

THE ORDNANCE SERGEANT

VOL. 5

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NO. 1



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Nov 42



Cover design by Tech. 5th Grade Alexander Nagy, Jr., of the Art Section of The Ordnance School.

HIGHLIGHTS

Although you will not find it mentioned further, this is the Second Anniversary Issue of THE ORDNANCE SERGEANT. Twenty-four issues have been prepared and distributed, and with this, the twenty-fifth issue, we begin our third year of publication. Much of the success of the publication has been due to the cooperation of its readers. All those who are taking part in its preparation hope that you, the readers, will continue to tell us what you want, and to send us the latest information on things you are learning in the field. Everything of value which you submit will be passed on to all our readers, and they now number an estimated 120,000.

The First Anniversary Issue of THE ORDNANCE SERGEANT told the full story of Ordnance Training as it existed at The Ordnance School at the close of 1941. This issue attempts to carry the story of the Ordnance Training Program much further. We tell you how a man is assigned to the Ordnance Department in the first place, and then describe all of the various things which may happen during the course of his training, both at the Ordnance Replacement Training Center and at The Ordnance School.

 "Undoubtedly the Highlight of this issue is the Editorial. Prepared by The Chief of Ordnance, it is a direct message from the Boss to every one of his assistants, which includes every member of the Ordnance Department, and therefore includes YOU. Read it carefully.

 Colonel Conway gives us the latest information regarding Air-Ground Support in the 1942 Maneuvers on page 52. This is a vital subject in modern warfare, and we study it through the eyes and mind of an experienced observer.

 Among the regular monthly departments don't overlook "M1 vs. M2 Height Finder" on page 63, "Inventories and Audits" on page 71, the first installment of "Practical Shop Math" on page 74, and "Procurement and Use of Training Films and Films by Ordnance Troops" on page 94.

Address all communications to: THE ORDNANCE SERGEANT, The Ordnance School, Aberdeen Proving Ground, Maryland.

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Editorial

The Ordnance Department is the Servant of The Line.

The Line bears the burden of battle.

The Ordnance Department relieves The Line of the complex problems of design, production, inspection, supply and maintenance of the fighting tools of The Line.

That is the only reason for our existence.

If an Ordnance officer or soldier fails, an officer or soldier of The Line, or many of them, may die as a direct or indirect result. This must not happen.

The minds of those who command in The Line and who fight in The Line must be free and clear for combat. The Ordnance Department must carry without question or complaint each and all of the manifold matters of supply and maintenance which range from the factories to the firing lines and back again.

These are not platitudes. Rather, they are plain statements of simple facts which each Ordnance officer, non-commissioned officer or enlisted man must keep in mind at all times, for they define our objective.

The armament program of the Ordnance Department amounts to around \$52,000,000,000. It is the world's biggest business; that is, individually, aside from the overall war program of the United States.

Only big men belong in a big program. Big men alone will survive in a big program, in peace or war. Private, Sergeant, Captain or Colonel — each has a big place, a big job, in this tremendous program. Your personal importance in the task is not determined by your rank. Rank determines the scope of certain responsibilities. Responsibilities of enlisted men and non-commissioned officers are greater today than ever before in warfare. In Ordnance, especially, each enlisted man and non-commissioned officer must be highly-trained and able to translate his training into effective and skillful performance in the field.

Now, whether you can mentally encompass the scope of a \$52,000,000,000 program, makes no difference. I can't, and I doubt if anybody can. Fifty-two billions of dollars has to be reduced to tangible terms before it can be handled.

We have to knock it down to fragments, which mean factories — factories across our forty-eight states which are producing armaments you are, or will, feed to the fighting fronts.

Ordnance, with its right-hand man, American Industry, has licked production. The flow to The Line, the servicing and maintenance, must likewise be licked. That is YOUR job!

Production of Ordnance came first because first jobs must come first in war, and in preparations for war. We had no Ordnance production in the United States beyond a sad trickle from our six manufacturing Arsenalns in the armament famine of peace.

Peace is very pleasant. We're going to win it back. That's the Army's job whenever the United States goes to war — To restore the peace as quickly as possible. Your contribution to the restoration of peace will be in direct ratio to your ability, skill and devotion to duty.

by

Major General LEVIN H. CAMPBELL, Jr.
CHIEF OF ORDNANCE

Today, the Ordnance Department concentrates on supply and maintenance of The Line. The Line has opened new fronts. Ordnance must service these fronts.

The Ordnance Department training program of officers, non-commissioned officers and enlisted men must develop troops worthy of every expectation of The Line. Further, The Line must be given no concern over whether Ordnance troops are trained properly, can carry on their field duties properly — or fight, if the occasion arises.

Besides the enemies we're fighting with shot, shell, tanks, and bombs, there's another enemy nearly as deadly — "Red Tape", the stumplebum enemy handyman lurking behind our lines. Individual headwork by members of all ranks can throttle that character.

Whenever a member of the Ordnance Department, regardless of rank, encounters "Red Tape" in conducting our business: Throw the "Red Tape" to hell out the window! If an abundance of paper work is involved in a matter of supply or maintenance, DELIVER first and fill out the forms when there's time! Accept that, please, as a definite General Order.

We're fighting a war. Nobody ever won a war by having a preponderance of paper-work. Nobody ever won a war by observing the social rules of Emily Post. Don't get bogged down by book-keeping, or we'll turn you into a military wallflower. Individual "social success" these days means military efficiency.

Never let me hear from The Line that an Ordnance outfit fumbled. If I hear it, something's going to happen — and fast! This is no threat. It's policy. Lives of good fighting men cannot be trifled with by delays in supply and maintenance of Ordnance.

Ordnance is honorable. Ordnance has traditions of service reaching back to the Revolution. In Ordnance, you are not serving among any Johnny-Come-Latelies. Our insignia is the oldest in the armies of the world. Our code of loyalty to the United States is long as it is solid. Ordnance outfits won combat honors in the last war. They will win them in this war.

Tarnish can come to the honor of Ordnance only in event that American soldiers die because an Ordnance man or unit was untrained, derelict or negligent in duty. No such stain shall ever disgrace the Ordnance Escutcheon if each Ordnance soldier takes full advantage of his training by utilizing it to the utmost in the field.

Rip up the "Red Tape" and rip into the fight to supply and maintain The Line!

Training is Our Task

by J. S. HATCHER

Brigadier General, U. S. Army
Chief, Military Training Division
Office of the Chief of Ordnance

This war is being fought by men with machines which must keep operating, and failure of a machine in battle often means the death of the man who is operating it and of many others besides; too many such failures would mean death for America.

The soldier who uses such a machine in battle has been trained in its use, but he has neither the tools nor the special skill needed to repair it when it is damaged by the enemy or gets out of order from any other cause. But, even though he himself cannot repair his damaged tank or truck or gun, he knows that nearby there is a group of soldiers who have the special knowledge and the special tools to do the job for him. These are the Ordnance soldiers — "Combat Ordnance" they should be called — fighting men, thoroughly educated in basic military subjects and armed with carbines, pistols, machine guns, and anti-tank weapons. The Ordnance man who has learned to be a first-class soldier has only started his education, for he must receive very special training in how each vehicle and weapon and instrument is constructed down to the last detail; how it functions, how to adjust and inspect it to keep it working; and, most difficult of all, how to get it going again when it is damaged or in need of adjustment or repair.

Such a technical subject as Ordnance is so absorbing that the normal human tendency is for the mechanic to give all of his attention to the mechanical end and to neglect the military part. Our modern Ordnance soldier has far too much pride and esprit de corps to be satisfied with such a condition. Thus the Ordnance man is up against the tough proposition of being just as fine a soldier, just as snappy-looking a military man, just as good a fighter as any one in the Army, while at the same time he must be a superb technician. He must know far more about military subjects than is learned during four years in the average military college and about as much science and engineering as is taught in the average college course.

This calls for a training job that would be extremely difficult even if we had plenty of time, but we do not have enough time and never will have until the war is won. But we must and will get the job done, operating in the spirit of the directive which says: "Difficult tasks will be accomplished at once; on impossible ones, a slight delay will be tolerated."

This training is directed by the Military Training Division of the Office of the Chief of Ordnance, and is carried on in one Replacement Training Center, seven Unit Training Centers, and forty-nine Ordnance schools, which have an aggregate capacity of more trained Ordnance men in a year than there were soldiers in the entire United States Army three years ago.

The formal schooling of the Ordnance soldier starts with the basic military course of four weeks given either (1) in the first unit to which he is assigned when he comes from the Reception Center, or (2) in a Replacement Training Center for men not assigned direct to an Ordnance unit.

The normal procedure is for all new Ordnance units to be activated with a cadre of a few trained men, approximately ten per cent of the total strength, who are drawn from the existing units. The remaining ninety per cent of the command consists of newly inducted and untrained men coming direct from the Reception Centers.

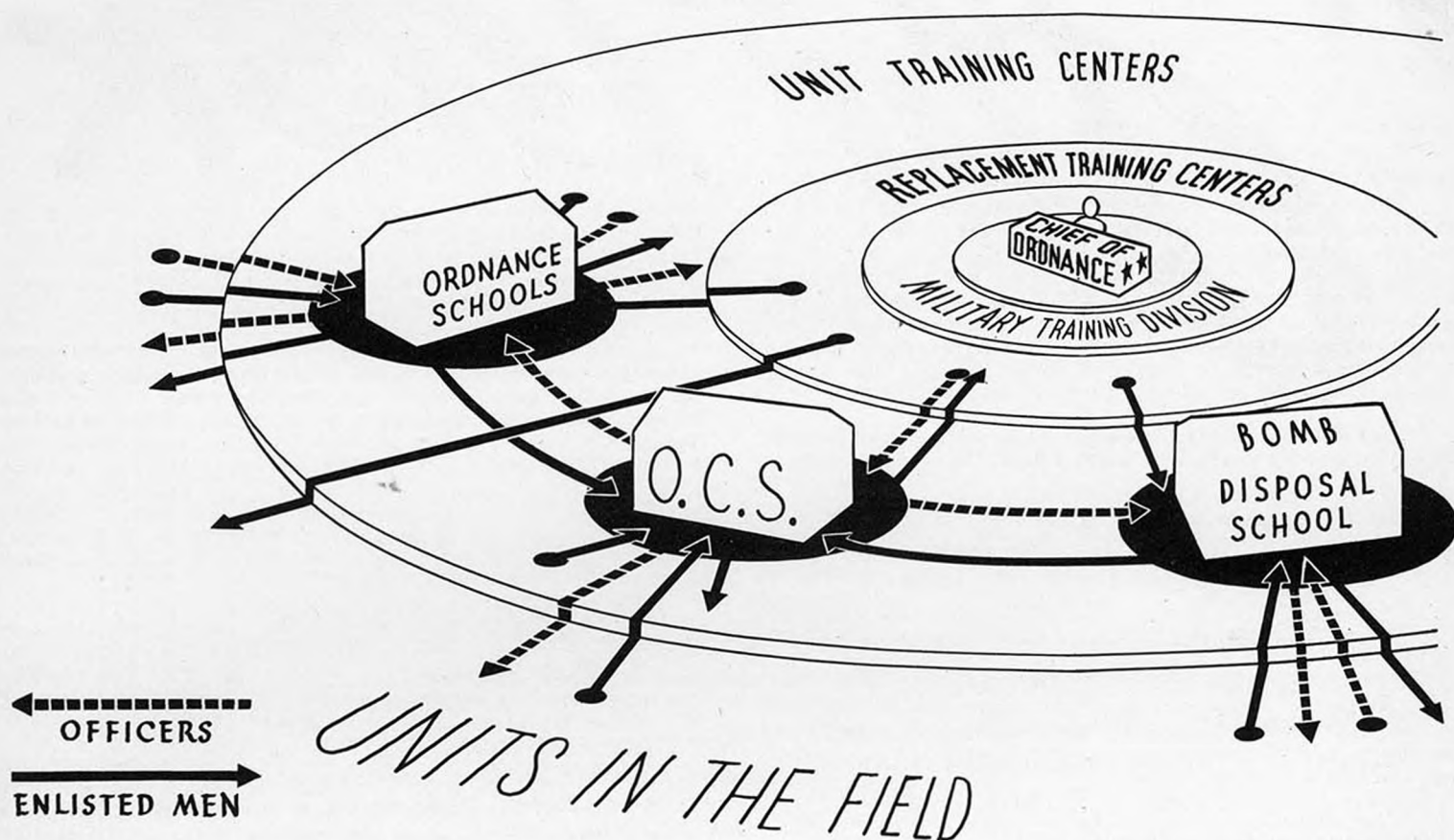
If possible, the unit is activated at one of the Ordnance Unit Training Centers, which are located at such stations as Aberdeen Proving Ground, Maryland; Raritan Arsenal, New Jersey; Camp Perry, Ohio; Camp Sutton, North Carolina; the Mississippi Ordnance Plant, Flora, Mississippi; the Red River Ordnance Depot, New Boston, Texas; or the Santa Anita Park, Pasadena, California. At these Unit Training Centers, the soldiers remain in the newly-formed units and receive their training as members of these commands, thus building up an organization spirit and the ability

to work together with other members of the unit as a coordinated team. At the same time, the company officers and the non-commissioned officers are receiving valuable training in handling their men. To repeat, the soldiers first receive their basic military training of four weeks, and after this they receive technical Ordnance training, either in the Unit Training Center itself or at some of the service schools to which certain individuals may be sent. At the end of three months, the unit is ready for the field, but its training has by no means been completed. The next thing is to obtain further proficiency and skill through actual work on Ordnance materiel in the field.

This is the way that the Ordnance fighting organizations are formed initially. But the problem does not end here. Men will drop out from one cause or another — even in peacetime, when discharges, accidents, transfers, or sickness take their toll. Thus there is always a certain turn-over of personnel which requires replacements. In time of war, on the fighting fronts, this turn-over will increase due to casualties inflicted by the enemy, and the demand for replacements becomes important.

Obviously, these units cannot give men their basic military training in the Theater of Operations in the face of the enemy. All the effort of the company officers, non-commissioned officers, and men must be given to the task of winning the campaign. For this reason, the replacements must be given their basic military training and a certain amount of technical training before they reach their organizations.

FLOW OF ORDNANCE PERSONNEL IN TRAINING



This is effected in Replacement Training Centers. The Ordnance Department has only one Replacement Training Center, and it is a very large one located at Aberdeen Proving Ground, Maryland.

The two types of training referred to above constitute, first a method of giving the soldier his basic military training and, second, a limited amount of technical information — that is, enough to enable him to be an understudy to a more highly trained specialist in the field.

For teaching these highly-trained specialists, the Ordnance Department has a number of large service schools; the largest one and the one in which every branch of Ordnance is taught is The Ordnance School at Aberdeen Proving Ground, Maryland, with a branch at Savanna, Illinois. A similar Ordnance School is located at the Ordnance Training Center, Santa Anita Park, California. Other service schools operated by the Ordnance Department are the Bomb Disposal School at Aberdeen Proving Ground, Maryland, and the Ordnance Automotive Schools at Camp Holabird, Maryland; Camp Normoyle, Texas; Atlanta, Georgia; Stockton, California; Fort Lewis, Washington; Fort Crook, Nebraska; Fort Sheridan, Illinois; Miller Field, New York, and Pomona, California.

Besides the large schools mentioned above, there are a number of smaller schools, many of which are in industrial plants. Here certain specialized subjects — such as, for example, the hydromatic transmission — are taught. The best understanding of the thousands of mechanical devices serviced by Ordnance is maintained by close liaison with the manufacturers.

In addition, there are the two Officer Candidate Schools, at Aberdeen Proving Ground, Maryland, and at Santa Anita, California, where soldiers who have served three months and who have shown the necessary qualities of leadership, may become commissioned officers in the Ordnance Department.

The Ordnance Department in the field is only what these training establishments make it and nothing more. The spirit of the leaders in the training effort will permeate the whole military structure of the Ordnance Department and will be reflected in the attitude of every Ordnance officer and every Ordnance soldier.

That is a heavy responsibility for the Military Training Division. It means that every member of the staff and training personnel of every Ordnance training center and school must be on the alert every moment to be a real leader and an aggressive go-getter with a spirit of "can-do", regardless of difficulties. He must impress this spirit on everyone with whom he comes in contact. He must be a team player — not an individual star. He must cooperate fully with higher authority and must be ready and willing to give up his key personnel when they are needed for expansion or for task forces. He must be able to improvise. Anyone can do a good job, given all the personnel and all the facilities and all the time that seems necessary, but the real leader is the man who can get results with too few men and no facilities except those he rustles for himself.

The spirit of the Military Training Division of the Office of the Chief of Ordnance is: "God helps the man who helps himself and God help the man who doesn't!"

Selecting Soldiers for Ordnance

by

ROBERT E. McQUISTON, Capt., A. G. D.
with
RICHARD L. SEGGER, Tech. Sgt., Ord. Dept.

Vivid in our minds is the picture of immense, mass armies of men and machines locked in mortal combat on modern battlefields, and of tremendous armadas engaged in vast air arenas. We are impressed with the technical character of present day warfare and the role the shipping lanes and the assembly lines play in the struggle. Less spectacular but no less significant is the all-out effort we must make to budget our manpower resources to meet the requirements of the services and of essential industry and agricultural production. Our human resources no less than our material resources must be utilized to the maximum to win this war.

Obviously, before we know how best to use our manpower, we must take and maintain an inventory of what we have. We must have such an

inventory as a basis for determining the most effective disposition of our labor supply as between the services and war industries and as among war industries. Further, the services themselves to meet their highly specialized requirements for waging technical war, have found it necessary to keep their own inventories of their supply of skills, training, and aptitudes.

As a modern Army needs the best equipment in the proper places at the right time, so does it need men trained according to their individual abilities in the right place at the right time. The modern Army's demand for specialists, technicians, leaders, men of combat, men for the several thousands of duties requiring particular aptitudes, temperaments, and training is inexhaustible. It can ill afford to waste the individual capabilities

DEPT. MND.		(10) CORPS AREA OF ENLISTMENT OR INDUCTION		THOUSANDS		HUNDREDS		TENS		ONES		MILITARY OCCUPATIONAL SPECIALIST	
(1) NAME		STERN MICHAEL VLADIMIR		12923327		5 10		165		W			
(2) BIRTHPLACE OF SOLDIER		New York, N.Y.		HOW LONG IN U.S.		8		YEARS AT IT		WKLY. WAGE		8 \$75.00	
(3) DATE OF BIRTH OF SOLDIER		Jan. 11, 1911		(4) CITIZEN		☒		TAKEN OUT FIRST PAPERS		☐		NON-CITIZEN	
(5) MARITAL STATUS		M		NUMBER OF DEPENDENTS		1		(6) BIRTHPLACE OF FATHER		Russia			
(7) BIRTHPLACE OF MOTHER		Russia		(8) EDUCATION		1931		NON-E.		L-7		ILLITERATE	
YEAR LEFT SCHOOL		1931		SCHOOL		Number of Years		GRAD. UATED		NAME AND LOCATIONS OF INSTITUTIONS ATTENDED		MAJOR SUBJECT OR SPECIALIZATION	
(1-1) GRAMMAR SCHOOL		8		☒		New York, N.Y.							
(1-2) HIGH SCHOOL		4		☒		New York, N.Y.		Academic		1928			
(1-3) COLLEGE OR UNIVERSITY		2 1/2		☒		Virginia Poly. Institute		Physics					
(1-4) POST GRADUATE				☐									
(1-5) TRADE NIGHT OR DAY SCHOOL		2		☒		Bedford Y.M.C.A. Brooklyn, N.Y.		Machine Shop		Cert. 1933			
(9) LANGUAGES		(CHECK APPROPRIATE SPACES) S-SPEAKS R-READS W-WRITES		OTHER LANGUAGES (B-38)		Russian							
FAIRLY WELL		S R W S R W S R W S R W S R W S R W											
FLUENTLY (B-39)		S R W S R W S R W S R W S R W S R W											
(10) CORPS AREA OR DEPARTMENT OF ENLISTMENT		II		(11) SPORTS IN WHICH QUALIFIED		EXCELS TRACK ☒ BASE BALL ☒ FOOT BALL ☒ BASKET BALL ☒ SOFT BALL ☒ TENNIS ☒ BOXING ☒ WRESTLING ☒ OTHER ☒							
(12) TALENT FOR FURNISHING PUBLIC ENTERTAINMENT		MUSICAL INSTRUMENT ☒ SINGING ☒ THEATRICAL ☒		Piano									
(13) MAIN OCCUPATION		Tool Maker		(14) SECOND BEST OCCUPATION		Truck Driver, Light		(15) ADDITIONAL OCCUPATIONS, HOBBIES, ETC.		Airplane Model Making			
(16) CLASSIFICATION TEST		FORM & DATE GRADE - SCORE		(17) APTITUDE TESTS		TEST NO. GRADE - SCORE		(18) OTHER TESTS		TEST GRADE - SCORE			
16 6/11/41 II 126				MA-1 132									
				CA-1 II 107									
(19) TRADE TEST RATINGS		SPEC. SER. NO. SCORE		114 W 14/15									
(20) HIGHEST POSITION OF LEADERSHIP (INCLUDING MILITARY)		President of H.S. (2000 Students)											

ties of the men in the ranks and of the thousands pouring into its ranks from our highly specialized civilian economy. The fact is that the Army has become an industry of global proportions, a diversified and far-flung organization to which the labor component is a critical factor.

The human raw materials are available, for our industry is the most highly developed and specialized in the world. The problem is to allocate them in such a way that with additional finishing and in many cases conversion with a minimum of cost in time and facilities to something more vitally needed, the finest possible final product will be accomplished.

To this end the Adjutant General's Department instituted the present personnel classification and assignment system.

By classifying and assigning soldiers according to their individual qualifications and by providing the machinery through which the soldier may be selected for training and finally placed in work for which he is fitted and in which he can take pride in accomplishment, the system facilitates the whole training program as well as contributes to the improvement of morale and efficiency in general.

Concern with personnel management as such is a comparatively recent development. Particularly is this so with respect to the Army. Prior to World War I, our Army had proceeded on the apprenticeship theory born of the days of individual artisanship and infant industry. That is to say, little or no attention was paid to the individual characteristics and abilities of the entering recruit in making assignments, and such training as was necessary was given on the job. So far as the Army was concerned, one man was very much like another. An Army was supposed to learn to fight as a unit and that was practically all there was to it, or so it was considered.

As Dr. Walker V. Bingham relates in his article, "How the Army Sorts Its Man Power" in the September issue of Harper's Magazine, "When the war was declared in 1917, we were not much further advanced with respect to personnel classification and assignment than the British

Colonel in the Boer War who stood at the gangplank of a troopship in Capetown and tapped each descending recruit with his riding crop, diagnosing by some process of occult divination: 'Infantry! Cavalry! Artillery! Er -- Medical Corps!'"

How outmoded and, in fact, how fatal was this conception of organizing an Army to fight a fairly technical type of warfare was tragically illustrated in World War I. The costly waste involved in initial failures in the assignment of men with special skills became increasingly apparent as the War progressed. Endless delays in training and disruptions of units already fully established and in the field caused by necessary transfers and reassignments were the penalties paid for the lack of a comprehensive classification and assignment system. One can only guess at the cost in human lives which resulted from the lack of the right men in the right places.

From this bitter experience the makings of the present personnel classification and assignment system emerged. By the time World War I ended, a fairly comprehensive classification and assignment service, including the development and the administering of the famous Army Alpha intelligence tests, and the maintenance of a very simple index of directly needed experts was in operation. The service was instituted in every cantonment and in the replacement pools of the Expeditionary Force.

It was perhaps natural that with the advent of peace and the drastic reduction of the Army the system should be all but forgotten. Nevertheless, the foundation had been laid; the experience gained.

While personnel practice in the Army languished, the increasing complexity of industrial and social conditions in general, and the rise of mass production industries in particular, gave great impetus in the twenties to the study and development of such subjects as personnel management, industrial psychology, vocational guidance, and employment practice. Thus, when the present emergency came upon us and we were confronted with a personnel problem of the greatest magnitude, the or-

NOTE: DO NOT ATTEMPT TO FILL OUT THIS CARD WITHOUT FIRST READING INSTRUCTIONS CONTAINED IN AR 615-25 VERY CAREFULLY

(21) - PREVIOUS MILITARY EXPERIENCE										(22) - RECORD OF CURRENT SERVICE			
ARM OR SERVICE	YEARS IN EACH	HIGHEST GRADE	CATEGORY R A N G C C G ETC	LAST DISCHARGE (YEAR)	SPECIAL TRAINING RECEIVED		DATE	ORGANIZATION	GRADE	PRINCIPAL DUTY	SURGEON'S ORDER (LIMITED SERVICE ONLY)		
					SPECIFIC NATURE	YEARS	MO'S						
G.E.	2 1/2	Corp.	R.R.C.	1931	Basic	2	6	1931	6/16/41 2nd Ord. Trg. Bn., APG, Md.	Pvt.	Basic Training		
									7/1/41 5th Ord. Trg. Bn., APG, Md.	Pvt.	Tech. Training		
									9/23/41 44th Ord. Co., APG, Md.	PFC	Machinist		
									6/15/42 Att. Ord. Sch., APG, Md.	T/5	Student		
									8/13/42 40th Ord. Co., APG, Md.	S/Sgt.	Instructor M4 & M7 Director		
(22) - SERVICE SCHOOLS, ARM. OR SERVICE				NUMBER OF WEEKS	COURSE		YEAR GRADUATED AND SCHOOL RATING						
1. The Ordnance School				8	M4 & M7 Director		Exc. - '42						
2.													
3.													
(23) - LIMITED SERVICE (TYPE)				CLASS A ☐	(24) SD	(25) PREFERRED							
				CLASS B ☐									
				CLASS C ☐									
(26) ASSIGNMENT RECOMMENDED BY RECEPTION CENTER													
Machinist - #114													
(27) - CLASSIFICATION IN MILITARY SPECIALTIES													
DESIGNATION		SPEC. SER. No.	Potential	SKILLED	DATE OF CLASSIFICATION								
Truck Driver, Heavy		245	✓	✓	7-15-'41								
Instrument Repairman		098	✓	✓	9-12-'41								
Machinist		114	✓	✓	11-2-'41								
Director Repairman, M4 & M7		917	✓	✓	8-12-'42								
(30) - DATE OF (CROSS OUT ONE) ENLISTMENT													
June 10, 1941													
DATE OF INTERVIEW													
June 11, 1941 STATION Camp Upton, N.Y.													
SIGNATURES													
INTERVIEWER Richard Harkness, PFC													
CLASSIFIER Thomas Grant, Sgt.													
SOLDIER Michael V. Stern													
(28) REMARKS (7) 3 hrs a night 3 nights per week. (13) up own work. Physically qualified for non-combatant service only - poor vision.													

ganization of a complex, mobile, mechanized Army, we had available an important body of knowledge and tested techniques, as well as the trained personnel. A number of the distinguished members of the new profession were gathered together in the Personnel Procedures Section of the Adjutant General's Department, and the present personnel classification and assignment system, adapted and streamlined from that developed in World War I, was the result.

General policy formulation relative to Army Personnel Management is a function of the War Department General Staff (G-1). The Adjutant General and particularly, the Assistant, The Adjutant General, who is Chief of the Personnel Bureau, participate in the preparation of policies, and through the Personnel Bureau control their execution and administration.

In all echelons below the War Department, personnel management is a function of command. The local Adjutant General or Adjutant is responsible to the local command for the administration and the technical details of personnel. The larger units have classification officers responsible to the local command usually through the Adjutant for personnel classification and assignment.

The personnel classification and assignment system operates in its initial stages principally through the reception centers operated by the Adjutant General's Department and the replacement training centers operated by the various arms and services.

Doubtless many a man in basic training at the Ordnance Replacement Training Center has paused to wonder as to what trick of fate or fortune directed his steps to Aberdeen. The process by which he was selected for training in the Ordnance Department begins in the classification section a day or two after his arrival in the Reception Center.

The first step in the classification process is the taking of two tests required of all entering recruits: the Army General Classification Test and the Mechanical Aptitude Test. By means of the first, the Army hopes to gain a rough idea of the recruit's ability to learn as well as his ability to think quickly, both important attributes of the soldier. With the aid of the mechanical aptitude test, the Army hopes to uncover the potential mechanics who perhaps in civilian life have been working in white collar jobs. The clerk or salesman may have been perfectly suited to his civilian occupation, but may also possess mechanical aptitudes which are more important to the Army than clerical or sales ability; or the man who enjoys working with machines may never have had an opportunity to do so as a means of earning a livelihood. The test does not seek to discover those men who have actually done mechanical work so much as it seeks to indicate a man's probable ability to learn and possibly succeed in mechanical work.

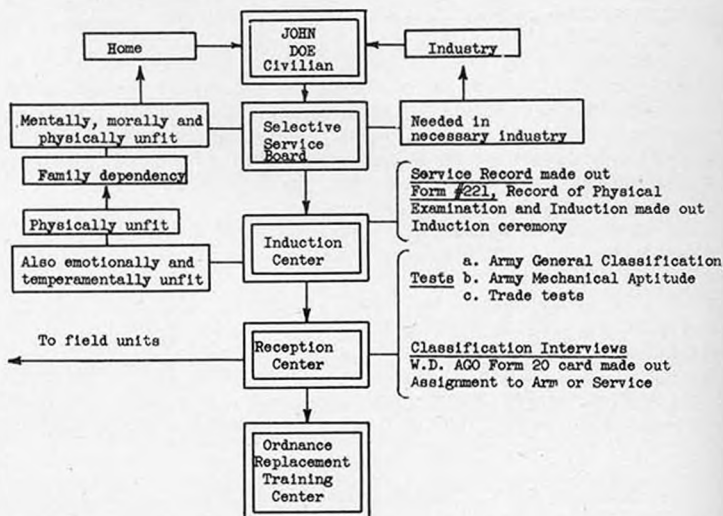
The second step in the Reception Center classification process is the interview. It is at this juncture that the basic classification record, the Soldier's Qualification Card (W.D., A.G.O. Form No. 20) is initiated. (See Figure 1.) A card with the soldier's name and serial number as well as his test results entered thereon, (see Items 16 and 17, Figure 1) is placed in an envelope and given to the soldier as he is directed to the classification specialist who conducts the interview. At the interview, the novice soldier is questioned concerning his education, knowledge of foreign language, ability to furnish public entertainment, sports, hobbies, leadership experience, previous military experience and civilian occupations. These facts are recorded in a uniform manner on the W.D., A.G.O. Form No. 20 according to Army Regulations (AR 615-25, July 13, 1942).

The most important phase of the interview is that pertaining to civilian occupations (see Items 13 and 14, Figure 1). The interviewer secures the complete work history of the soldier and then records his main and second best civilian occupation, considering such factors as length and recency of experience, the skill and responsibility involved and its bearing on assignment of Army work. This classification must be accomplished according to uniform nomenclature for occupations as set forth in an Army index of occupational specialists (AR 615-26, September 15, 1942), or the Dictionary of Occupational Titles prepared by the United States Employment Service. The former contains only those civilian occupations considered applicable to a specific Army assignment, as well as actual military occupations. The latter, on the other hand, comprises nearly all civilian occupations. If the soldier's work experience or any part of it substantially meets the specifications of an occupation set forth in AR 615-26, he is classified according to the appropriate occupational title and specification serial number listed therein (see Items 13 and 14, Figure 1.)* If it does not, the interviewer must refer to the United States Employment Service Dictionary for the appropriate title, in which case the recruit's occupational classification would not have an Army specification serial number indicating experience pertinent to Army assignment. Very often, a standardized oral or written

test will be administered to assist in evaluating or verifying the knowledge and skill claimed by the soldier. When the proper classification has been determined, the appropriate title and, if it is an occupation of specific value to the Army, the specification serial number, together with a precise description of the duties performed, are entered on the card by the interviewer.

FROM CIVILIAN TO SOLDIER

SCREENING AND TRAINING OF ORDNANCE ENLISTED PERSONNEL



Upon completion of the interview and of the trade test, if given, the card is forwarded to a chief interviewer for review as to accuracy and completeness. It is then routed to a classifier who recommends the soldier for the type of duty in which he will be of most use to the Army. The classifier reviews the Form No. 20, the information set forth thereon concerning his occupations, his education, his hobbies, his leadership potentialities, the nature of his previous military experience, if any, and the results of his tests. Generally, occupational experience will be the most significant factor. On the other hand, if this experience is not particularly useful to the Army, hobbies such as photography or previous military experience, for example, as a machine gunner, may be more important. Also there will be instances in which the classifier will feel that, although the soldier's main occupation does have some bearing on his military assignment, the skill indicated through the pursuit of a hobby is more urgently needed. For example, the carpenter with three years' experience may be recommended in his hobby as a radio operator, since radio operators are so much more urgently needed than carpenters. Always the classifier must have the needs of the Army in mind. Standards of occupational qualification must be constantly revised or lowered to meet the needs of the Army. The classifier's recommendation is the only flexible item on the card, the only item that is changed according to the changing needs of the Army. The other items such as main and second best occupation, etc., are objective facts and are unchanged, regardless of the particular duty for which the soldier may be recommended.

Recommendations are made in terms of the actual military occupations for which they are considered to have qualifications. For example watchmakers, jewelers, and refrigerator mechanics are not recommended as such but may be recommended for assignment as instrument repairmen, gunsmiths as armorers, stewards as mess sergeants, etc. To take a different illustration, the soldier classified as a "lawyer", may be recommended as an "armorer" because of his hobby of repairing guns. The civilian supply of occupational specialists falls short of Army demands

*For coding and reporting purposes, three digit specification serial numbers are listed with each civilian and military occupational title in AR 615-26. Specification serial numbers from 001 to 499 apply to occupations found in civilian life and are used by Reception Centers in classifying civilian experience pertinent to some specific Army assignment (see Items 13 and 14, Figure 1), and by training centers, service schools, and field units in classifying military training and experience (see Item 27, Figure 2) for which there is a direct counterpart in civilian life, such as a Machinist (114) or a Cook (060). On the other hand, specification serial numbers above 500 (with the single exception of 521, "Non-Specialists") are used in classifying military training and experience received in training centers, service schools, and field units for which there is no counterpart in civilian life such as a Gun Commander (602), or a Height Finder Repairman (921).

for certain skills. Furthermore, many Army specialists have no prototypes in the civilian economy. The differences must, therefore, be made up by locating and identifying related or potential skills which can most readily be converted into military specialties.

Many of the men entering the Army have no previous experiences or present skill for which there is a counterpart in the Army. This is not to say that they have no qualifications for which the Army has use. On the contrary, they may have demonstrated in civilian life qualities of leadership vital to the Army. They may be potential Ordnance Officers, non-commissioned officers, ammunition workers, or artillery mechanics, or they may possess combat ability to a rare degree. Nevertheless, they may not have specialized qualifications indicating that they should be assigned to any specified military duty. They will, therefore, be recommended by the classifier at the Reception Center as "Non-Specialists" (521).

When the classifier has determined upon the assignment recommendations, he enters the title and specification serial number of the military occupation in Item 26 of the Form No. 20 (see Figure 2). The card is then forwarded to the coding and punching section. Here the card is coded and punched on its perimeter, making possible quick mechanical sorting of a large number of cards according to any one or more of the facts on the card.

After coding and punching have been completed, the card is transmitted to the records and assignment section. Here tabulation is made of each man's classification in the Reception Center by specification serial number of the military specialty for which he is recommended. Each day a consolidated availability report is made over teletype to the Service Command Headquarters.

Constantly coming into the Service Command by teletype from the Classification and Enlisted Replacement Branch of the Adjutant General's Department in Washington are War Department requisitions designating the numbers of the types of specialists and of the non-specialists (by specification serial number) to be sent to a particular replacement training center of one of the arms or services. In the preparation of these requisitions, consideration is given not only to the specialized needs of a single arm or service but also to the necessity for making a propor-

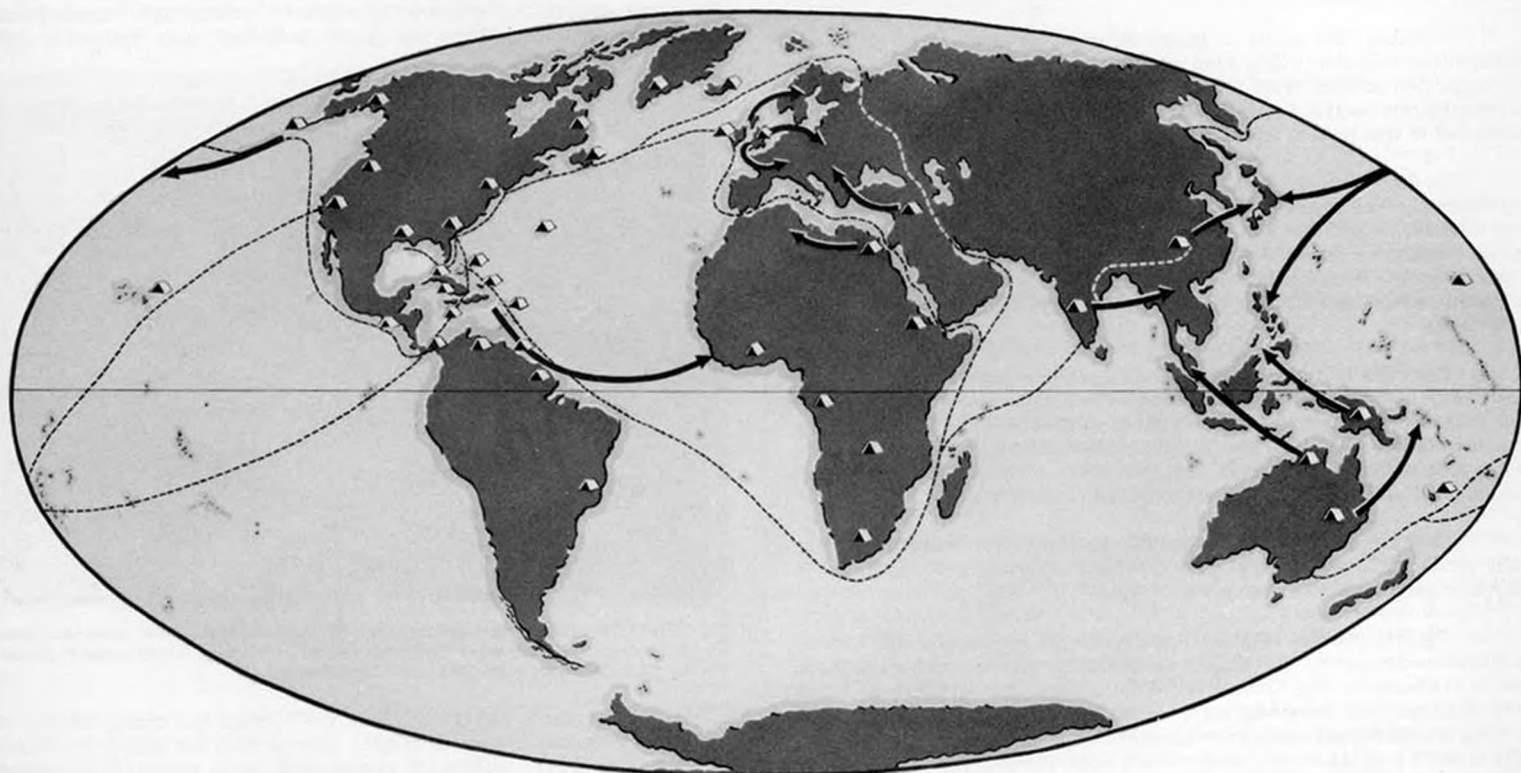
tionate distribution as between specialists and non-specialists to all arms and services. In other words, the ordinary Ordnance requisition will list a designated number of non-specialists as well as specialists of particular value to Ordnance such as instrument repairmen, mechanics and armorers and such specialists as cooks and clerks, needed by all arms and services. Effort is made to meet the particular needs of any arm or service within the limits of the available supply and with due regard to the requirements of the other arms and services.

As these requisitions arrive at the Service Command Headquarters, the Classification Officer matches them against the teletypes availability reports he receives from the Reception Centers of the Command and determines which one can most satisfactorily fulfill the requirements of the requisition. A directive is then teletyped to the Reception Center to transfer the men accordingly.

In filling the requisition the Reception Center naturally refers to the military duties for which men in the Reception Center have been classified. However, it is inevitable that in many instances it will be short on some specialties and long on others. To meet the immediate shortage, men of reasonable related specialties are substituted. It should be borne in mind that the capacities of reception Centers are limited. The egress of men must keep pace with their influx. Therefore, men with specialties seemingly qualifying them for a particular arm or service but of which the service command has an "overage" cannot be held over pending the arrival of a particular requisition. However, those men with specialties in which there is consistent shortage are earmarked and held over for the appropriate requisition. In selecting specialists and non-specialists alike, the Reception Center must follow a policy of distributing men of higher as well as the lower mental abilities on a roughly proportionate basis to each of the several arms and services. The whole Reception Center process of classification and assignment of the individual soldier is accomplished on the average within a period of from three to five days.

Thus, the individual soldier in basic training at the Ordnance Replacement Training Center may have come to Aberdeen as a result of a fortuitous set of circumstances. Nevertheless, he comes as a result of the process by which all available abilities are distributed with a minimum of delay to the best advantage of all the arms and services and therefore to the best advantage of the Army as a whole.

WHEREVER THE ARMY GOES, YOU WILL FIND ORDNANCE MEN



America's fighting men are now scattered throughout the world, and with them are Ordnance men, ready to serve day and night if need be, to keep every combat unit in fighting trim. These Ordnance men must be thoroughly qualified for this important task. This is the purpose of

the Ordnance Training Program. It is this program which makes it possible for us to truly say, WHEREVER THE ARMY GOES, YOU WILL FIND ORDNANCE MEN, ready and able to serve, anxious to do their most important "bit" for Victory.

ORDNANCE Classification OF ENLISTED MEN

by Captain W. E. THIESSEN

formerly Classification Officer
Ordnance Replacement Training Center
with Sergeant WENDELL LAWRENCE
and Corporal JACK HOWARD

Down from the turkey ridges of Arkansas, from the cow country of the Southwest and the high cotton of the Carolina, and from the cities of Atlanta, Chicago, and Seattle men pour into Aberdeen. Yesterday they were milkmen, mechanics, and clerks. Today they are on their way to become trained Ordnance men, soldiers whose weapons are tools and supplies. Already thousands of men, schooled at the Army's Ordnance Replacement Training Center at Aberdeen, Maryland, are carrying this war to its world scattered battlefronts.

Americans with their native mechanical ingenuity are fast becoming known as the world's best Ordnance soldiers. They are proof that today's Army Classification system is utilizing every soldier's background of experience, knowledge, skills, and aptitudes. By recognition of these factors it is today possible for the Army to quickly provide soldier specialists for specific jobs.

Civilian life needs a much different proportion of skills and occupations than Army life. Men who come to the Ordnance Replacement Training Center come from a wide variety of jobs. It is up to the O.R.T.C. Classification Section at Aberdeen to see that, within Ordnance, men are assigned to that type of training which they can most readily absorb.

In the O.R.T.C. Classification Section all men are reinterviewed by specially trained interviewers who understand the problems of training men for Ordnance. The Form 20 card is rechecked, and the man's qualifications for one of the 13 branches of Ordnance is discussed with the man himself. Because of the wide variations between the hundreds of civilian occupations and the 13 Ordnance occupations there must be adjustments.

Twenty-eight percent of the total number of men who are assigned to schools at the Ordnance Replacement Training Center go to the school for automotive mechanics. Yet only three percent have civilian experience as automobile mechanics. To fill this quota recruits must be taken from other skills. Since there is an excess of clerks, many of those with high mechanical ability will be trained to do mechanical work.

Only one half enough instrument repairmen are received, the other fifty percent are drawn from men who have experience or knowledge in physics, optics, engineering and mathematics.

Civilian life has very few armorers, artillery mechanics, or ammunition technicians. The American Ordnance soldier must learn these skills at Aberdeen. The Classification Section selects men for these fields with aptitudes and knowledge suitable for the work. Young America has proved itself adaptable, and each day men become more versatile as they add to their civilian skill Ordnance knowledge and occupations.

After judging each individual man, the interviewer recommends that he be sent to one of the 13 technical schools. This recommendation, based on a study of aptitudes, attitude, proficiency, skill, and preference, is followed by the Assignment Officer in making out the quotas for the

various schools. At the schools the soldier learns to convert his civilian skill and knowledge into a war productive military occupation.

Yesterday's jeweler, optician, or business machine repairman goes to the Instrument Repair School where he studies light refraction, prismatic principles, and the theory of optics. He learns to read blueprints, and he studies the geometric principles of light rays. His craftsmanship is utilized in the repair of fire control instruments such as the battery commander's telescope and the sighting mechanism of all artillery pieces.

A man who has been working with fine tools and instruments makes a good instrument repairman. A background of high school or college physics is good but not essential.

Armies are still traveling on their stomachs and good cooks are as essential to the Ordnance soldier as they were when Napoleon first mentioned the fact. Short order cooks, fry cooks, hotel stewards, restaurant managers, bakers and food inspectors; all of them fit into the school for cooks and bakers. A man must express a preference for cooking or have experience in foods before being assigned to this school.

If the man has native initiative and ingenuity, can think clearly and quickly and is familiar with loading, packing, supplies, transportation, or storage, he makes a good ammunition technician. Many blasters, powdermen, miners, and men who have had experience as oil field nitro-men, loggers, or construction workers make good in ammunition. Former chemical engineers and quarrymen find their places in this school.



CONCENTRATION. These men are typical of thousands who have come and gone at the Ordnance Replacement Training Center, finding their proper places in our fighting-servicing Ordnance Department.

At the Ammunition School the storage and transportation of shells, bombs, and powder is taught. How to keep the supply of ammunition flowing toward the front in a never diminishing quantity is presented with sand table problems. Camouflage and depot arrangement are taught. After four weeks fifty percent of the men go into the study of Aviation Ordnance, and the other fifty percent continue the study of Field Ordnance.

Carpenters, cabinetmakers, woodworkers, and men who have been

doing specialized work in the contracting and building trades find a school designed to train them in Ordnance carpentry. At the end of eight weeks of Carpenter's School, a man will have completed courses in the square, use of tools, the building of packing cases, and other work peculiar to the Army's problems.

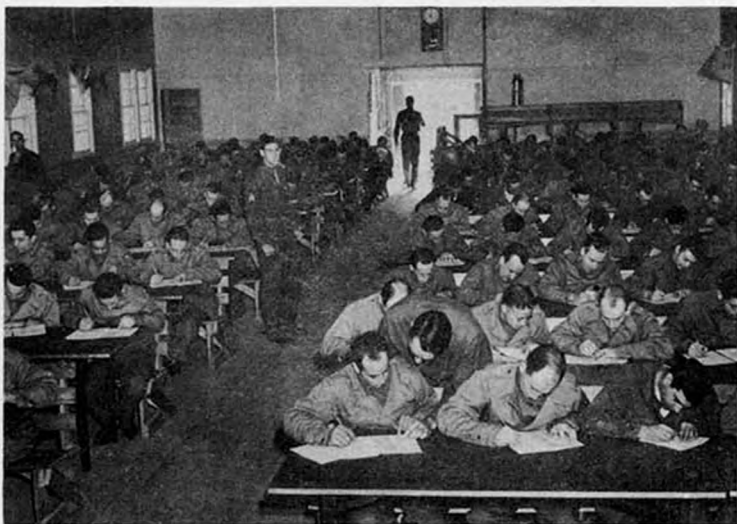
If the new soldier had formerly been handling a needle, sewing in an awning shop, working as a tailor, an upholsterer, a shoe repairman, or a sewing machine operator, he is assigned to the Leather and Canvas Worker's School. The training consists of learning and practicing various types of stitching, the study of hand needles, making and repairing instrument cases and pistol holsters, and, in the main, doing under supervision the type of work he will be doing in the field later.

Ordnance machinists handle many different types of machines, drill presses, and lathes under varying conditions. A man who has worked in small machine shops, doing many different types of work, meeting and adapting methods and tools to the situation confronting him, makes a good Army machinist. When he goes to the field he will meet similar problems and will have to produce results from the equipment provided in a mobile machine shop. The master machinist with varied experience is best adapted to Ordnance work after eight weeks of training at the Machinist's School.

Painters are used in Ordnance work for painting and stenciling ammunition cases and for painting and camouflaging mobile equipment, tanks, trucks, and artillery caissons. At the school for painters, former general painters, automobile painters, and spray gun specialists are taught mixing and brush techniques. Before leaving the O.R.T.C. a student painter receives actual experience in working on Army buildings and equipment. Ammunition painting problems are also worked out by the student.

The Artillerymen pull the lanyards and fire the pieces, the Ordnance men furnish the ammunition, the guns, and keep them firing. Ordnance artillery mechanics work on all guns from the 37mm antiaircraft gun to Coast Artillery railroad pieces. Any man who has handled heavy equipment such as a rigger or plumber, a student of mechanical engineering, or a man with some automotive experience or a maintenance man or general utility repairman goes to the Artillery School.

By working on some 14 different types of guns he will learn the fundamental units of operation and nomenclature of all artillery pieces. He gets a chance to specialize in light, heavy, or antiaircraft artillery. Students disassemble and assemble the pieces and study the function of each part, from the tube itself down to the brake linings in the wheels of the caisson. Replacement of tubes and heavy equipment requires a knowledge of rigging and the ability to use large tools such as Stilson wrenches, cables, and winches, with the gentle technique of a physician.

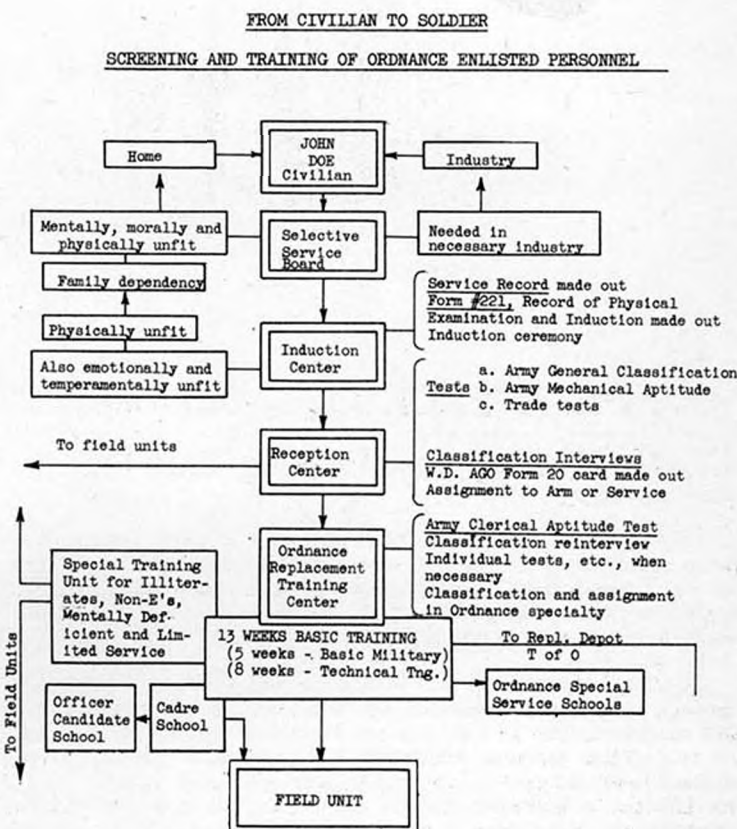


AMERICAN MANPOWER IN THE ROUGH. Here a classification expert conducts a test, one of several which may be given a man during his early days in the service, preparatory to classification.

If a man was a tinkerer or a kitchen mechanic, if tearing down small machines and putting them back together was his vocation, he'd enjoy and do a good job in the small arms section of Ordnance. If his civilian occupation resembled or was that of locksmith, bicycle repairman, gunsmith, or some occupation requiring the handling of small parts he could quickly learn to repair the hand and shoulder weapons of the Army.

Correction of malfunction through repair and replacement of broken parts is the job of small arms men. Apprentice machinists, student mechanics, toolmakers, and gadget repairmen learn to do this quickly and correctly.

To keep the trucks, tanks, and all motorized equipment of the Army rolling requires five large echelons of motor maintenance. Men manning these echelons are taken from the garages and service stations of the nation. They are the products of the automotive age, and they cut their teeth on piston rings. The better 20 percent get a chance to study the mysteries of the new General Motors' Diesel tank motor, or the radial Continental and Wright Whirlwind motors. The rest of the men specialize in pursuit cars, trucks, and service unit work. A man who comes from a motorized farm, from an airplane shop, from a carburetion or an auto-electrical school, or from the back end of Andy's garage will find a place somewhere in the huge field of Automotive Ordnance.



Supplies are moved by trucks, and drivers and their reliefs are required to keep them rolling. Many a man who has been driving trucks, chauffeuring, or wheeling a taxi goes to the Motor Pool's school for automotive drivers where he is taught Army driving practices. Tractor drivers and motorcyclists also find a place at the Motor Pool.

Army administration requires clerks, stenographers, checkers and typists. These men go to the Clerical School where they study a course in either depot and supply or administration. In this school the former clerical worker studies Army forms and methods. He learns Army regulations, morning reports, and payrolls. He practices filling out supply orders and requisitions. When he goes into the field he will work in a supply or an administration capacity.

A trainee who is assigned to small arms, artillery or automotive spends his first two weeks of technical training in elementary shop. This is an excellent aptitude test that actually indicates in two weeks time just what mechanical ability a man really has. Instruction and practice in using tools, mechanical equipment, and following blue prints is given each student.

The instructors for these various schools are graduates of Cadre School. The Classification Section makes recommendations for Cadre School to a board of officers. This board selects cadre men by an interview. Men who are thus selected go into a special training company for non-commissioned officers where for two weeks they study voice and command, principles of drill, physical education and field tactics. For one week they study educational principles and techniques. Then five

A Soldier First



by G. A. PACE, Capt., Ord. Dept.
Director Military Training, O.R.T.C.

The trainee reporting to the Ordnance Replacement Training Center is a member of the armed forces of the United States first and foremost and must learn to conduct himself as such, both in the environment of the barracks and in the face of the enemy in whatever foreign field the fortunes of war may take him.

The newly inducted trainee is a civilian, physically and psychologically, in spite of his uniform, serial number and service record. He will continue to think as a civilian and react as a civilian until his training as a soldier has been completed. The importance of Basic Training to these newly inducted men cannot be over-estimated. A great deal of the individual's future success and comfort as well as his efficiency as a fighting man will depend on the effectiveness of the training given him in his first few weeks at camp.

Perhaps the most important part of these first few weeks is the orientation given the man by his company officers and non-commissioned officers. By their encouragement and friendly instruction they develop in the trainee a sense of reliance and confidence in those about him, and instill in him the esprit-de-corps which will carry him through many a dark hour in days to come. He is given the rudiments of military courtesy and an understanding of the necessity for military discipline. He begins to look upon himself as an integral part of a very important fighting organization. He learns military sanitation, first aid, and individual security, to enable him to serve more efficiently in the position he is to take. Military bearing assumes a greater significance as the man begins to realize that he, together with his comrades, make up a military organ-

He participates in tactical marches.



ization. Pride in the appearance of that organization is a great deal stronger than any personal pride he may feel as an individual.

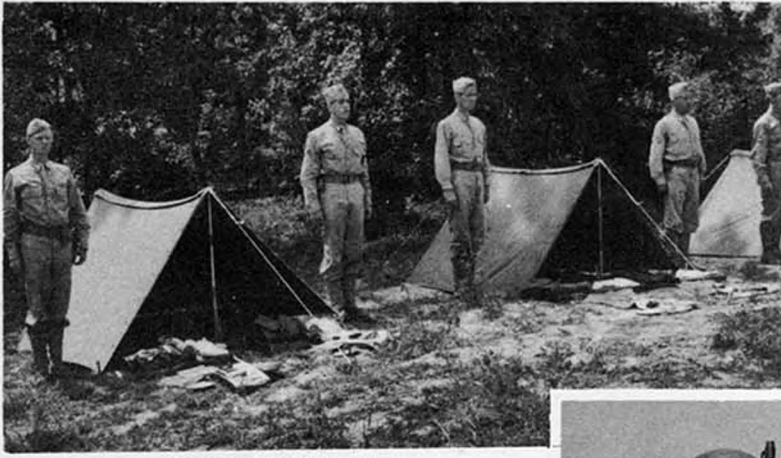
The formal basic training planned for the new recruit consists of four weeks of carefully scheduled lectures and demonstrations. The first week is devoted mainly to orientation. The trainee is taken on an orientation march consisting of a 5-mile walk, which acquaints him with the various features of an army post. After this, the terms "PX" and "Hdq." are a little less strange. He learns that on the post there are means of recreation which are distinctly military and that he may spend many profitable hours around the battalion area. Under the auspices of Centralized Training the trainee is instructed by experienced lecturers in the large War Department theatres available on the post. During such centralized instruction he is made acquainted with post regulations, military courtesy and customs of the service, and military discipline. Similarly, he learns about the war and the reason why he is fighting, in four well-planned lectures on various phases of the present war.

In the meantime, he has become acquainted with the chain of command in his training company and has taken his place in the military organization. He has a number in his platoon and the platoon in turn has a definite position in the company. He takes his place in the platoon for periods of close order drill and finally, after the first week of training, he becomes part of the review formation. As the blood surges in his veins and he keeps step with his platoon for the first time, he feels the joy of being an integral part of a great movement. He feels the confidence which springs from the knowledge that he is marching with comrades-in-arms and that he is joining his strength with theirs in a tremendous undertaking.

The soldier learns that the very clothes he wears are property of the people of the United States. For that reason he must care for them and keep them in good condition. Furthermore, that clothing and equipment is meant to protect him in time of battle and it must be kept clean and strong in order to do the job to the best advantage. He is given a formal course in care of clothing and equipment and in addition many hours are spent in barracks with his non-commissioned officers on the method of preserving his equipment and caring for the all-important rifle. Before much time has elapsed, the man is favored by a barracks inspection conducted by the company commander.

The physical condition of the soldier is a matter of prime importance to the army. During civilian life his muscles may have been adapted to a specialized job or he may have been occupied by merely sedentary work. Activity in the field of battle requires strong and supple muscles and complete coordination of mind and body. This is obtained through constant physical training. Ability to master physical difficulties is obtained through frequent trips to the obstacle course.

In the course of Motor Vehicle Operation the trainees are graded according to their ability to become drivers. Those who are found to have



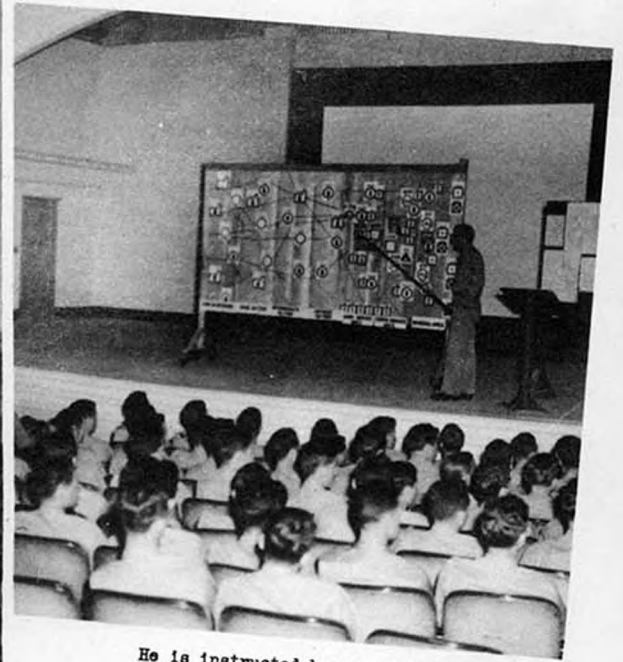
He camps in the open.



He takes his place in the platoon.



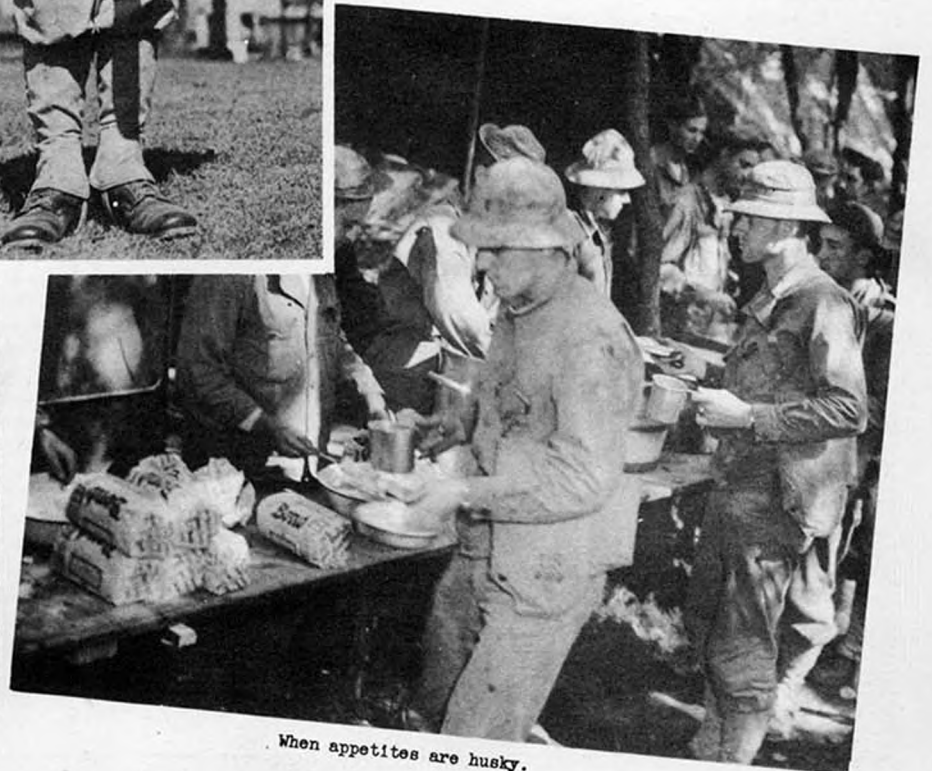
His entertainment and recreation are not neglected



He is instructed by expert lecturers.



He learns rythm, cadence, coordination



When appetites are husky.

particular aptitude are given a course in driving military vehicles.

No set of regulations could be more exacting than those given the new recruit for the disposition and display of his clothing and equipment in the barracks. He learns, perhaps for the first time in his life, how to sweep a floor, make a bed and fold a hand towel. In short, he learns to do all those little things which are necessary when a man must take care of himself. During these days of seemingly arbitrary exactitude he learns to discipline himself and learns by actual experience what precision really means. In days to come, perhaps in some lonely desert camp, the love of accuracy will help him as he carefully cleans and replaces the precious parts of guns or optical instruments.



Physical condition is a matter of importance.

The Replacement Center is a military camp, not simply a school. As such, it operates under a security plan and maintains a system of interior guard. The members of the guard are drawn from among the trainees just as soon as they have had sufficient training to participate in this duty. Centralized training is devoted to a study of the chain of command and details of operation of interior guard. The course of Rifle Marksman-

ship is completed early in training to enable the soldier to walk his post armed with a rifle. Field training for the ordnance soldier has taken on a new aspect with the advent of the dive bomber, parachute troops and mechanized equipment. In the old days of position warfare, the ordnance soldier was comparatively safe many miles behind the lines. But today, the increasing need for maintenance has brought him very close to the fighting troops. The concept of defense-in-depth places him virtually in "No Man's Land". He must work, eat and sleep almost in range of the guns and certainly within range of observation of the enemy. He must be a mechanic and a good one, but first of all he must be a soldier. He must dig his fox holes and slit trenches and camouflage himself as efficiently as any infantry man. He must be able to maneuver for position and set up new bivouac areas without being observed by the enemy. To this end is he given a course in Field Training consisting of centralized lectures on subjects such as Map Reading, Defense against chemical Attack, Camouflage, Individual Security, and Hasty Field Fortifications. He is taken on a three day bivouac where he camps in the open and participates in tactical marches, scouting and patrolling, and night operations. During this training he is encouraged to use his individuality and rely upon his own ingenuity to follow through various phases of the field work.

Expert rifle marksmanship has long been appreciated as one of the outstanding characteristics of the American soldier. It has always been a gratification to our leaders and a surprise to our enemies. The present methods of fighting have not minimized the importance of the fire power of the individual soldier. Rifle fire, moreover, is practically the security offered the ordnance company in the field. Armed with a rifle or a carbine, the ordnance soldier must pit himself against enemy scouting parties and parachute troops. It is desirable, therefore to make every ordnance soldier a sniper. Rifle marksmanship training is begun early in the training course. Many hours are spent in the study of care of the rifle, sighting and aiming, position exercises, and trigger squeeze. Finally, during the third week, the soldier participates in practice firing on the Cal. 30 range, where he fires the qualification course and receives a qualification medal upon successful completion of the instruction.

As a climax to the School of the Soldier, the trainee undergoes a final basic training examination. Together with the other members of his platoon, he is asked to demonstrate the principles learned during basic training. He has an opportunity to answer individually as pertinent questions are addressed to the platoon. Similarly he participates in demonstrations of proficiency at infantry drill, calisthenics, display of field equipment, and extended order drill. His company and his platoon are graded in this activity and before he leaves the basic phases of training he is told the score that his platoon has made. If the score is exceptionally high, his platoon is awarded an "E" pennant as a mark of efficiency in basic training.

We probably won't surprise anyone by saying out loud that war is a highly practical business and that the training of Ordnance men for war should be as practical as war itself. To say that we should teach things that are practical is to say that our emphasis must be constantly upon the "battle importance" of the thing we teach. There is an unfortunate tendency to forget that unless every hour spent in class room or shop is a representative sample of field conditions then the school is falling down on its job.

We realize that it isn't easy for an instructor to keep constantly in mind his heavy obligation to instill in his men the "life and death" nature of the thing he teaches but we can't help but think that frequently this failure is a result of the fact the instructor is not himself convinced that what he teaches possesses this "battle importance". He might, for example, wonder what there is of "life and death" about a Duty Roster. Well, if he stops to realize that there are few things more destructive of morale than a poorly run Duty Roster then perhaps he will be able to see the connection. The example we have just used is very simple and perhaps very obvious but nevertheless what we have said of the Duty Roster is just as true of everything that we teach Ordnance men here in the Ordnance School.

If you, as an instructor, aren't aware of the battle importance of the thing you teach then you are not doing the job you should be doing. Maybe it's your fault or maybe it isn't. At any rate, find out from someone, soon, what it is about your subject which makes it worth the teaching. Then make sure that your men become as much aware of it as you are yourself.

An extract from "The Ordnance School Training Methods Bulletin Number Two"



Men of Skill

By: Alvin C. Hope, Major, Ord. Dept.
Director Technical Training Ordnance Replacement Training Center

Ordnance technicians are men of skill, men specially trained for the task of supplying our fighting troops with the material of war and maintaining and repairing that materiel in the field. This is the first of a series of articles prepared by the technical training personnel of Ordnance Replacement Training Center, Aberdeen Proving Ground, Maryland, designed to outline, briefly, the scope and measure of technical training afforded "filler" or replacement Ordnance technicians for service in the field.

The purpose of the training program at the Ordnance Replacement Training Center is to qualify enlisted men as filler or loss replacements for Ordnance units. The objectives are two in number. The first is to train men as basic Ordnance replacements. The second is to train specialists needed to meet the demands of Ordnance units. Our concern is with the second or "technician" objective.

Technical training is conducted through the medium of ten independently organized sections which are coordinated under the supervision of the Director of Technical Training. Nine of these sections are concerned with the training of actual field technicians such as armorers, artillery repairmen and automotive mechanics. The tenth section is designed to facilitate the training program and has as its principal function the training of prospective instructors in the other nine sections in the technique of efficient teaching.

Prior to entrance into technical courses, all enlisted men, those who will go into the field as basic replacements as well as future technicians, receive four weeks of basic military training in which fundamental military and technical subjects are stressed. Knowledge of these subjects is essential to all Ordnance men irrespective of what may be their future duties and it is only when these subjects have been mastered that technical training may begin.

Based upon their showing during the basic training period, upon general and specialized aptitude tests and upon civilian training and experience, a selection is made of men qualified to enter the various technical training sections. Those selected undergo, in their respective sections, an intensive and rigorous training program during the ensuing nine weeks. Where feasible, the practical approach or the actual "doing" of the work is stressed. Lectures, general class room work and independent study, however, play an important part. In some sections, such as Clerical, resort is made largely to the class room. In others such as Automotive Drivers the work is primarily practical. In each instance the directors of technical training strive conscientiously to adapt the mode of training to the end objective of the maximum, most efficient training in the minimum of training time.

In this present world conflict depending, as it does, upon specialists operating intricate mechanized equipment, the success of the Army depends upon an uninterrupted flow of efficiently trained Ordnance Technicians — men of skill — to supply, service and maintain this materiel. The Technical Training Division of Ordnance Replacement Training Center, Aberdeen Proving Ground, Maryland, is the answer to the Army's man power needs in technical fields.



Elementary Shop

by ROBERT R. KING

Captain, Ordnance Department

Director Elementary Shop Section

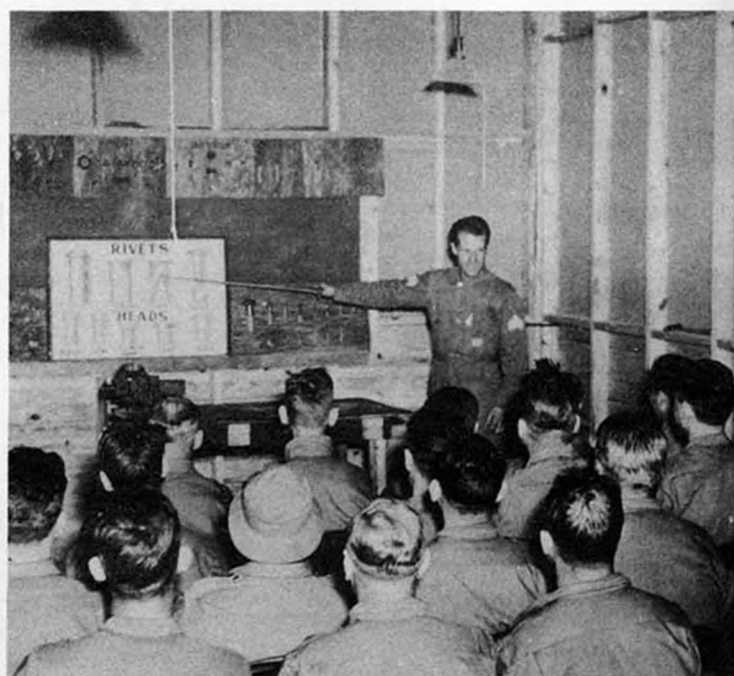
Ordnance Replacement Training Center



The Elementary Shop Section teaches prospective Ordnance mechanics to work with common hand-tools. The only pieces of machine equipment in the shop are vises, grinders, small drill presses, and portable electric drills. In the introductory lecture, the students are impressed with the value of a knowledge of hand tools. The organization of the shop is explained to the student, and he is told where he may expect to go from the shop. The first steps of the first shop project are explained, supplemented by slides flashed upon a screen.

Now the student begins to work in the shop. He listens to lectures on such subjects as Chisels and Chipping, Taps and Dies, Files and Filing, Elementary Mathematics, Blue Print Reading, Measuring Instruments, etc. He works on a cast iron project, as well as a steel project, and learns to use the proper tool in the proper manner. He learns to perform a rather difficult soldering job. He is taught a course in rigging. Indoors, he learns to tie various knots, hitches, and bends, learns to splice rope, and learns about mechanical advantage. Then he goes outdoors, into nearby woods, and applies his knowledge in constructing the "A" Frame, Gin Pole, Tripod, Transom, and Dead Man. He hoists an engine with the block and tackle. He learns the proper manner of setting upright an overturned truck.

All the foregoing is given to the general student in a two-week course. However, the Automotive Section has requested a shorter course for their students, so a one-week course for automotive students has been instituted. In this course, subjects not essential to the development of the automotive student are omitted, and such subjects as Flaring and Swedging, and Splicing and Soldering Stranded Wire are substituted. Some general subjects are condensed. Emphasis is placed upon the study and practical use of common wrenches, special wrenches, and special automotive tools.



The Artillery Training Section of the Ordnance Replacement Training Center prepares selected personnel to join both Medium and Heavy Maintenance Companies as apprentice artillery mechanics. These men may be either replacements or fillers in the organization and are trained with this objective in mind. They will require further experience and training in the field with the organization in which they are assigned, but will have a basic knowledge of most of the weapons with which they will come in contact.

Upon completion of Basic Military Training, men selected for artillery training are put through a course in Elementary Shop for two weeks before reporting to the artillery section. This develops facility in the use of ordinary hand tools and teaches basic shop practices before entering on specialized training.

The artillery course runs for seven weeks, the first of which is devoted to an introduction to artillery and fundamental rigging procedure as applied to artillery maintenance in the field. The introductory course deals, in general, with artillery material and its development, omitting any specific details of particular weapons. Some main differences between types of weapons are explained and illustrated by reference to the actual weapons. Main assemblies common to all types of weapons are briefly covered and the nomenclature learned. A general tour of all the shop buildings is taken and various types of weapons identified and briefly explained.

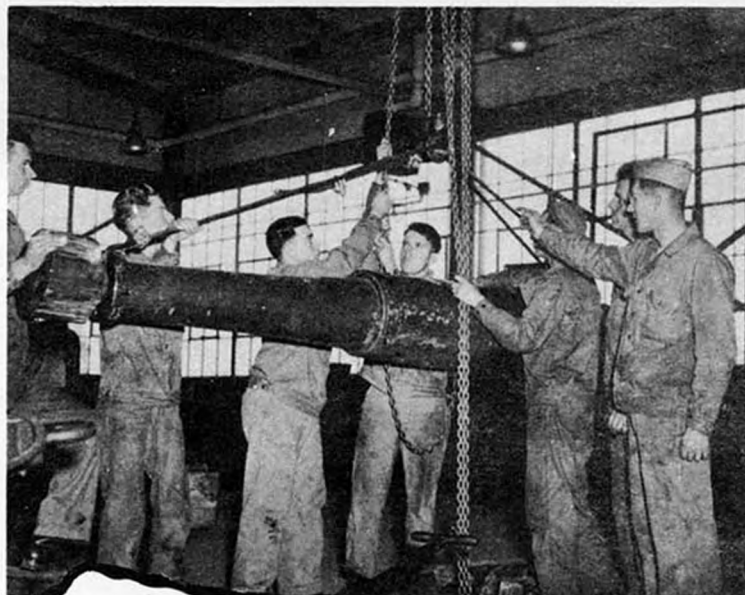


The course in rigging is a comprehensive coverage of simple knots and splices by demonstration and student participation, followed by field problems in rigging on artillery weapons. Tree climbing is also included.

Following this week of introduction, the trainee is assigned to one of three divisions within the Artillery Training Section. These divisions are Anti-Aircraft Artillery, Light Artillery, and Medium and Heavy Artillery. Assignment is based upon the trainee's expressed preference, plus recommendation of his instructor during the first week of training which he has just completed.

A student assigned to the Anti-Aircraft Section will study four principle weapons generally encountered in field service with a maintenance company, and in the case of certain guns may study two or more modifications of the weapon. Some time is devoted to the 37mm AA gun, M1A2, mounted on two modifications of carriage, the M3 and M3A1. A considerable part of the training time is spent on the 40mm AA, M1, gun, on carriage, M2 (generally known as the "Bofors" gun), because of the importance of this weapon. This completes his acquaintance with light anti-aircraft artillery and the remainder of his training period is devoted to heavier types, such as the 3", M2A2, and 90mm, M1A1, guns and other modifications of these weapons, plus special courses in brakes, lubrication, and preventive maintenance of the weapons he has studied.

In the Light Artillery Section, a wider variety of weapons is encountered, with slight overlapping into the Medium and Heavy Section.



Artillery

by

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Director of Artillery Section

Ordnance Replacement Training Center

Various modifications of the 37mm Anti-Tank Gun are studied with emphasis on the latest models available. The 75mm Gun, M2A3, is thoroughly covered, together with reference to some of the older models of this weapon likely to be encountered in the field. Both the 75mm Pack Howitzer and 75mm Field Howitzer are included in the program of training. One of the most important of the light artillery weapons is the 105mm Howitzer, M2. This weapon is given an important place in the schedule, and bore sighting and manometer test instruction are carried out on this weapon. Since the division between light and Medium artillery is very broad, the light artillery student is also required to take a brief course on the 155mm howitzer.

Probably the most important group of weapons, from a maintenance standpoint, in present day warfare, is the tank weapons group which also comes under the light artillery section. In cooperation with the Automotive Section of the ORTC, using their tank equipment, the trainee is taught to remove and install the various tank artillery weapons in all types of tanks available. He is given instruction and practice in the maintenance of the guns themselves as well as the various gun mounts used in tanks.

During the courses in all weapons, brakes and lubrication, as well as preventive maintenance, are taught. In addition, both the 60mm and 81mm mortars are covered in a brief course, and fuze setters are also taught.

Trainees who are selected for the Medium and Heavy Artillery Section do not find such a wide variety of weapons as in the anti-aircraft and light sections, but size and complexity of the heavier weapons make up for this, so that the total time of training is required for proficiency. The 155mm howitzer with its various modifications is thoroughly covered and a large portion of the training time is devoted to the 155mm gun, M1A1. Since the 155mm Gun, M1918, is also encountered in the field, some time

is spent becoming familiar with this weapon. Again an overlap is encountered, and the trainee receives instruction on the 105mm howitzer and the 75mm gun in order to round out his education on all types of weapons he may encounter in the field. A brief course in mortars and fuze setters is also included. Brakes, lubrication, and preventive maintenance are likewise included in the Medium and Heavy Artillery Section. The heavier pieces encountered in this section also give the student a chance to apply the knowledge of rigging gained during the first week of his training in artillery.

The method of instruction is the same for all divisions of the artillery section. Primarily, the object of all the courses is to familiarize the trainee with nomenclature and disassembly of weapons. Instruction takes the form of lectures and problems on each weapon; and for disassembly and assembly, a lesson plan and job sheet system is used. Emphasis is placed on practical experience with each weapon and classes are reduced to the minimum number of trainees required to handle the particular weapon so that each trainee must take an active part in the work on the weapon. Small classes also mean that the instructor is enabled to give each man individual attention and keep a close check on his progress.

Major assemblies are removed from the gun and complete disassembly of these subassemblies is covered. Since it is not the purpose of the training to turn out artillery specialists, all instruction is on a broad basis with the idea in mind that the trainee will complete his detailed training in the field, with his unit, after assignment. However, during the work on a weapon, certain details, and some of the more obvious and simple malfunctions, are brought to the attention of the

student. Naturally, certain questions occur to the trainees from time to time, and many of these do not have a direct bearing on the particular subject at hand. Regardless of this, every effort is made to satisfy the student by discussion of such questions, but not to the point of interference with the main purpose of the instruction.

Throughout the entire course, examinations and problems are given, and each instructor turns in progress reports on each trainee under his instruction. Inept students are weeded out and outstanding students are recommended for more advanced instruction.

Actual instruction is completed the middle of the seventh week, and the remainder of the seventh week is devoted to a field problem in conjunction with other sections of the O.R.T.C. The field problem takes the form of a bivouac setup for a medium maintenance company with artillery trainees operating the artillery repair section of the company. Problems and simulated defects of the weapons are presented to the student and repairs carried out under actual field conditions. All necessary functions of a medium maintenance company are represented and life under field conditions is strictly adhered to.

It is felt that upon successful completion of the program of training outlined above, any soldier sent into the field as a replacement artillery mechanic will be capable of fitting into the organization smoothly and with a basic knowledge of what is expected of him. He will have the necessary background to facilitate his final training in the unit as a full-fledged artillery mechanic and become another of the many men of skill required in the Ordnance Department.

Armorer's

by
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Director of Armorer Section
Ordnance Replacement Training Center



iron and steel. Students are then transferred to the Armorer's Section for a six-weeks course in the more common small arms in use by the Army today. Trainees specialize in either "Shoulder and Hand Weapons", or "Machine Guns".

The following table shows the weapons studied in each course:

<u>SHOULDER AND HAND WEAPONS</u>	<u>MACHINE GUNS</u>
1st Week. Rifle, U.S. Cal. 30 M1903A1 Rifle, U. S. Cal. .30 M1917 Pistol, Automatic, Cal. .45 M1911A1	(The first two weeks of this course are identical with the "Shoulder and Hand Weapon" course.)
2nd Week. Rifle, U. S. Cal. .30 M1 Carbine, U. S. Cal. .30 M1	
3rd Week. Rifle, Browning, Automatic Cal. .30, M1918A2 Revolver, Colt; Smith & Wesson Cal. .45, M1917	Gun, Machine, Browning, Cal. .30, M1917A1 & M1919A4 Gun, Machine, Browning, Cal. .50, M2, A.C.
4th Week. Shotgun, 12 ga., Remington, M1910 Shotgun, 12 ga., Remington, M31 Gun, Sub-machine, Thompson, M1928A1	Gun, Machine, Browning, Cal. .50, M2, H.B., W.C., A.C. Mounts — all types.
5th Week. Gun, Machine, Browning, M1917A1 & M1919A4 Mounts, all types	Gun, Automatic, 20mm, M1 & M2. Gun, Automatic, 37mm, M4.
6th Week. Field Maintenance & Inspection & Repairs.	Field Maintenance & Inspection & Repair.

For each weapon, the nomenclature, assembly and disassembly, inspection procedure, and functioning are taught, as well as the types of

The mission of the Armorer's Section, Training Department, Ordnance Replacement Training Center, is to qualify trainees who have received five weeks of basic military training as "filler" or "loss" replacements for Ordnance units.

Before reporting to the Armorer's Section, all trainees assigned as Armorer students complete a two weeks Elementary Shop course covering the identification, care and proper use of common hand tools used by Ordnance companies; elementary shop mathematics and blue print reading. This course includes the working of individual projects on cast

repair which are to be made by a maintenance company in the field. In most of the classes each student is provided with a weapon and proper publications so that he can follow the instructor in nomenclature, disassembly, and assembly. The actual weapons are also used to supplement instructions by charts and models. To aid in the assembly and disassembly of the weapons each student is given a set of tools, which will be used for a given number of weapons.

To save lost motion, due to working difficulties, specially designed tables are used for the 37mm gun, M4. When the gun is mounted on this table all parts are readily accessible and can be worked by a single student, if necessary.

It is of the greatest importance to use every available type of visual aids possible. The section at the present time is using three different types of visual aids, namely; charts, blackboard models, and sectionalized weapons. The charts used are 4' x 8' mounted on cloth. They are simplified but accurate functional drawings with the important parts blocked in contrasting colors. Such charts are used primarily to show the relation between various assembled parts in the weapon.



In many weapons there are small important parts that are inaccessible to the student because they are hidden within the weapons. Frequently they cannot be demonstrated easily by any of the other visual aids. Experience has shown that generally these points can be isolated from the weapon by the use of enlarged, wooden working models built to scale.

* The sectionalized weapons consist of actual weapons with surface parts cut away to expose the working parts underneath. They are used to

supplement functional instruction with the chart where it is difficult to understand the relative movements of the parts during operation.

Blackboards are used primarily for sketching parts not shown on charts, or models and for emphasizing words and sentences.

Instructors follow a "lesson plan" in teaching each weapon. This "lesson plan" is actually a detailed outline of all material covered in teaching a particular weapon. Carefully prepared "lesson plans" are an invaluable aid to the instructor and make for efficient instruction. They provide a means for presenting the material to be taught in an organized and logical manner, and, also, insure that each instructor presents the same material as any other instructor.

In order to keep a close check on the progress of the students, several oral check-up questions are asked each student at the close of each instruction period. These check-up questions are of real importance, selected for their definite bearing on the attainment of the objective of the lesson. They follow in a sequential order, as prescribed by the nature of the lesson. It is the individual instructor who frames these questions to suit the requirements of the lesson.

It is impossible for a student to properly learn all that is taught in so short a time, unless he does a certain amount of studying on his own time. To insure that he does this, questions are assigned daily for the student to study and answer.

As a last means of checking on the student's progress, a final examination is given at the conclusion of the instruction on each weapon. There are five independent sets of mimeographed examinations for each weapon. This permits the rotation of examinations so that the student cannot "catalog" the answers readily without learning the course thoroughly in the process. Examination papers are corrected, graded and returned to the students to be kept as a part of their permanent notes.

To supplement the class instruction and to apply the knowledge gained during the five previous weeks of the Small Arms course, the students are given as much practical field work as possible during the last week.

The first three days of this week are devoted to (1) the shop disassembly, assembly, inspection and repair of all the small arms mounts; (2) the shop repair of weapons including a minor amount of paper work; (3) field inspection and repair of weapons on the function firing range. Here malfunctions and stoppages are studied in detail during the firing of the weapons.

The students spend the last two days with members of other technical sections on a bivouac where a type Medium Maintenance Company has been set up and is in operation. During this period the students perform normal functions and duties of members of a small arms section of a Medium Maintenance Company in the field, including all details, on a 24-hour basis.

This is how the Armorers Section of the Ordnance Replacement Training Center transforms a recruit of five weeks into a man of skill.

by
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ORDNANCE REPLACEMENT TRAINING CENTER

Ammunition Technician

The Ammunition Technician Section, Training Department, Ordnance Replacement Training Center, was organized to qualify trainees who have received four weeks of basic military training as filler or loss replacements for Ordnance units.

The course covers nine weeks of instruction; four weeks of training in Ammunition Materiel and five weeks of training in either Ammunition Supply to the Ground Forces or Ammunition Supply to the Air Forces. The Ammunition Materiel course covers military explosives, small arms, artillery and trench warfare ammunition, pyrotechnics, and demolition or destruction of explosives. The courses in Ammunition Supply to the

Ground Forces and to the Air Forces consist of instruction in the organization of ammunition and aviation companies, and the problems of supplying ammunition to the various using arms.

A good share of the trainees' time is spent in the classroom. The type of instruction given here is the lecture method, supplemented with visual aids, instructional films, daily work sheets, and student participation. The instructor presents the material, lecturing from an outline.

The Ammunition Materiel outline is divided into subcourses, each subcourse dealing with a particular type of ammunition. Military



explosives are taught at the beginning of the course to acquaint the student with the characteristics of the explosives that are found in the various rounds. Rules for handling explosives safely are stressed, and proper methods of storing ammunition are taught both in the classroom, and in actual demonstrations in the field storage areas.

In order to make the classroom lecture procedure more interesting, and, at the same time, to present material through the sense of sight, visual aids are used by the instructors. These visual aids consist of wall charts, complete rounds of ammunition, and display boards. The wall charts consist of diagrammed cross sections of various calibers and types of rounds, showing all the components necessary to assemble the round for firing. Inert rounds of fixed and semi-fixed small arms and artillery ammunition are taken to the classroom so that the student can see and handle the actual shells. Rounds of trench warfare ammunition, pyrotechnics, anti-tank mines, and 100 pound bombs are also used in the classroom for demonstration. The display boards are used as visual aids wherever practical. These plywood boards hold inert rounds of small arms ammunition, hand grenades, and trench mortar ammunition with the component parts and containers for packing the rounds. The advantage of the display board is that all the parts used for demonstration purpose are attached to the board, and can be handled easily in the classroom.



Instructional films play an important part in the teaching of ammunition. In the Materiel course, the film on handling and packing of small arms ammunition gives the student an introduction to these phases of the subject, and prepares him for the actual work in the field. The films on loading shells with T.N.T. gives the trainee an appreciation of the type of materiel that he will be expected to handle when he becomes a member of an ammunition company.

Upon completion of the course in Ammunition Materiel, the classes are divided into two sections, one of which is assigned to a five-week course in Ammunition Supply to the Ground Forces, and the other to a course of equal duration in Ammunition Supply to the Air Forces.

The course of Ammunition Supply to the Ground Forces is presented in lectures and student participation in the class room, and through night field problems, which are so designed as to be representative of situations that may be encountered under combat conditions.

Classroom work is so outlined as to give the trainee a basic knowledge of Army Organization, and of the problems which will be met, and must be surmounted, by Ordnance personnel. Among these problems are those that must be overcome in the establishment and operation of ammunition depots and supply points, the importance of correctly gauging supply needs, and the necessity for maintaining an adequate record system that will facilitate the work of combat forces.

Students are also trained in the use of the record and report forms that are an integral part of a smoothly functioning organization, and, in the latter part of the course, use these forms in solving simulated problems, which closely approximate situations that will occur in the field.

The course is designed on a basis of flexibility, in order to allow for changes that, of necessity, occur in a subject of such scope and importance during a period of world-wide warfare.

The instructor for Ammunition Supply to the Air Forces follows a 150-page outline prepared for him. The broad aspects of this subject are broken down into their logical subdivisions for the five week course: organization of the Air Forces; Organization of Ordnance units servicing Air Forces; review of small arms ammunition, 20mm and 37mm ammunition; pyrotechnics; bombs; truck and trailer equipment; and forms used in supplying ammunition to the air forces.

A good supply of visual aids is available and used in all classes. These include various sizes and types of bombs, sample pyrotechnics, complete rounds of ammunition and illustrative charts. A film showing actual handling of bombs and the loading of bombs into planes aids in making the course practical. Naturally, the field work done by the classes, under guidance of the instructor, furnishes the best application for material learned in the class room. Schedules are planned to include a well-balanced program of field and class room work.

Work sheets are another aid to the student. These work sheets consist of diagrams of rounds and component parts for the student to identify, and completion questions to test the student's knowledge of the subject covered. He completes these with the help of his notes and technical manuals.

In addition to the class room and field instruction, an ammunition museum has been established as an aid to instruction. The museum consists of a complete display of all material covered in the ammunition course. In addition are four sand tables showing a railhead, a main supply depot, a roadside depot, and a bomb distributing point. Classes are conducted through the museum with special attention being given to that part of the display that pertains to the material being covered in classroom lecture.

Automotive Mechanics



by

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Director of Automotive Section

Ordnance Replacement Training Center

It is the mission of the Automotive Section, Ordnance Replacement Training Center, to qualify trainees as automotive mechanics for lss replacements in Ordnance Units.

After the automotive trainee completes his basic training period, he enters the Automotive Section for a 9-week training program. The first week is spent in the Elementary Shop where the potential mechanic is given a course on the use of tools particularly adaptable to automotive work. The second and third weeks are devoted to a study of automotive components, wherein the student is acquainted with the basic operating principles of the automotive engine and its accessories, and all the other units that make up the power train of an automotive vehicle. This course includes the following subjects:

Introduction	2 Hours
Inline engine principles	6 "
Inline engines, Shop Work (Dead Engines)	12 "
Fuel Systems	12 "
Electrical System	12 "
Final Drives	6 "
Transmissions	6 "
Brakes	12 "
Steering and wheel alignment	6 "
Inline engines, Shop Work (Live Engines)	12 "

During the fourth week, the trainee is taught preventive maintenance on both wheeled and track vehicles, combat vehicle driving and field recovery operations. In the latter course, the student is instructed in rigging, field expedients and the use of the M1 Heavy Wrecker. The subjects covered in this course are the following:

Preventive Maintenance, Wheeled Vehicles	16 Hours
Preventive Maintenance, Track Vehicles	6 "
Recovery Operations	12 "
Combat Vehicle Driving	6 "



At the end of the fourth week, 25% of the trainees are sent to the Ordnance School for advanced training. The selection of this group is based upon their grades on the various examinations given during these four weeks of training and on the individual's record in the shop. The remaining 75% is divided into two equal groups; one group to study wheeled vehicles and the other to study track vehicles. Each is a five week course, and the student will study all vehicles pertaining to his respective group. This study consists, briefly, of the unit removal and replacement of the engine sub-assemblies; engine tune-up and troubleshooting; unit removal and replacement of the vehicle components and the chassis electrical system. Every effort is made to avoid duplication of jobs in the different types of vehicles, thereby allowing more work to be covered in the allotted time.

The following vehicles are used for study:

Wheeled Vehicle Course

1/4 Ton, 4 x 4
1/2 ton, 4 x 4
3/4 ton, 4 x 4
1-1/2 ton, 4 x 4
2-1/2 ton, 6 x 6
Armored Car
Bomb service trailer
Wrecker, Heavy, M1
Half-Track, M3
Scout Car, M3A1

Track Vehicle Course

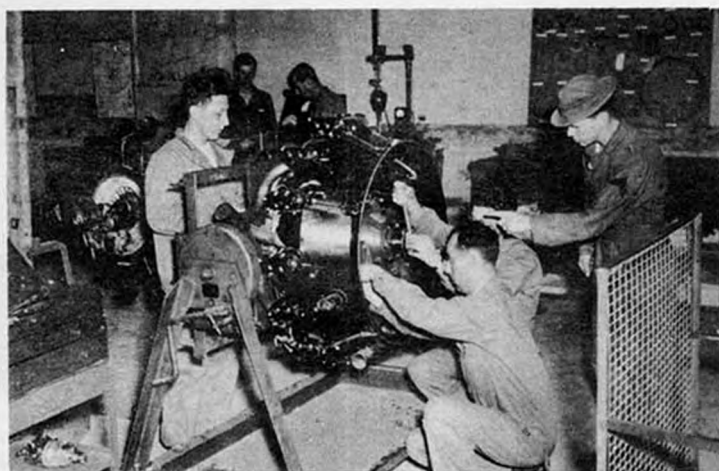
Light Tank:
Continental Engine (Radial)
Cadillac V-8 Engine
Medium Tank:
Wright Radial Engine
GM Twin Diesel Engine
Chrysler Multi-Bank Engine
Ford V-8 Engine
Tractor, TD - 18

During the last three days of technical training the automotive mechanic is assigned to the automotive section of the 1st Ordnance Company, Medium Maintenance Demonstration (several of the technical training sections participating) for a preview of field operations. Here, the students perform typical maintenance work under field conditions, working on a 24-hour basis, equipped with only those tools found in the automotive section of a maintenance company.

To insure the most efficient conduct of a course of instruction, the Automotive Section has established a system of instructor's lesson plans, job sheets, study questions and examinations. Each course is divided into instructional "units". An instructional unit is one lesson and may occupy from one to ten hours. The teaching sequence for each unit is:

1. Lecture by the instructor
2. Demonstration by instructor
3. Application, by student
4. Examinations

A lesson plan accompanies each instructional unit and is the instructor's guide for the four phases of instruction. The lesson plan sets forth the topics and object of the lesson, a list of necessary tools and equipment, training aids, i.e., charts, models, training film, a detailed time schedule, and other teaching aids that would help in simplifying the instruction.



The job sheet covers the "application" phase of the instruction. This is the student's guide, and each student receives a copy for his permanent use. The job sheet covers the objective of the lesson, the time allotted to perform the job, pertinent references, tools and equipment required, and a complete operating procedure. After the procedure is concluded, the student may check each step of the task with a job report and a set of pertinent questions.

When necessary to supplement the regular text, an information sheet is given to the students with the job sheet.

Home study questions are issued on Tuesday and Thursday to every student in the section. These are review questions covering the work which the student has just completed. Delinquent students are issued a special set of questions.

At the completion of each sub-course an examination is given. This is in accordance with the fourth step of training, i.e., "Examinations".

As a teaching aid to lectures and demonstrations the actual equipment under discussion is used whenever available. In lieu of this, cut-away and working models are used. When none of these are available or their use is impracticable large charts are used. Training films and film strips are incorporated into class room or lecture work whenever possible.

The application phase, which occupies the major portion of instruction time, is carried on out in the shop. Students remove and replace and study trouble shooting on the major items of automotive equipment.

Since its inauguration in June, 1941, the Automotive Section has grown into a large and efficient organization, capable of handling a load of 100 students per week. Constant effort is being made to improve programs and teaching methods and to increase the already large number of models and teaching aids.

Automotive Drivers

by

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Ordnance Replacement Training Center

You are the Commanding Officer of an Ordnance Ammunition Company. The troops which you serve are in the combat zone and engaged in a major offensive. Advance ammunition dumps have been maintained but the expenditure of ammunition has greatly exceeded the expected rate. You are called upon to furnish large quantities of ammunition immediately. Assuming that you have this ammunition on hand and that serviceable vehicles are at hand, you are then dependent only upon automotive drivers. They are at the moment your "Men of Skill".

Again, you may be the Commanding Officer of a Maintenance Company, perhaps serving the same troops. This time, your problem is that of transporting maintenance men and serviceable weapons to the troops on the line. Again, assuming these mechanics, and vehicles to transport them, are at hand, you are dependent upon the skill of your drivers. They are as important to you as the armorer or the artillery mechanic.

Your drivers must be capable of taking the vehicles anywhere at any time. The serviceability of those vehicles frequently rests with the driver and his first echelon maintenance responsibilities. He must be capable of driving not only on hard surface roads but across fields, through muddy terrain, over hills, through streams. Should his vehicle become mired, he must know the essentials of those field expedients which will enable him to extricate his truck.

The military driver is only remotely related to the well known "truck driver" in civil life. True, it is found during reclassification interviews, many of the men assigned for automotive driver training have previously been truck drivers or a part of the transportation industry. But the military truck driver depends more upon acquired technique and experience than does the "loud bellowing" and "hard road driving" truck driver of our civil motorways.



After four weeks of basic military training, the soldier is given two weeks of elementary shop training, where he is taught the proper use of hand tools and the working of wood and metals. Following this he receives seven weeks of training in the Automotive Drivers course. At the completion of this training he is sent to the field for filler and less replacements as an accomplished Automotive Driver and takes his place as a motor vehicle operator in an Ordnance Ammunition Company or in the Service Section of an Ordnance Maintenance Company.

This seven weeks of Automotive Driver training is broad and extensive. The student's time is roughly divided into one-fourth lecture and class room work, including training films and film strips, and three fourths practical work with the equipment, where the student is afforded an opportunity to put into practice what he has learned in the class room. The class room work is of the lecture and demonstration type and the instructor makes full use of available aids. The best visual aid is naturally the mechanism itself, and class room is arranged to permit the driving of any army vehicles, up to and including a 2-1/2 ton 6x6 cargo truck, into the class room. The instructor may then use the vehicle to illustrate the particular feature about which he may be lecturing.

The practical experience on the equipment itself is accomplished either in the class room, in the motor park, in adjacent fields, or over a net-work of roads used seldom for any but student driving and instruction.

The scope of the course is based on seven weeks of approximately thirty-six hours per week. The student is first given a drivers aptitude test in which his physical, mental and neurological fitness for driving is determined. Provided the requirements of this test have been met, the



student is given an orientation talk and an introduction into Motor Pool operations. He next spends several hours on each of the basic vehicles used in this section. These include the 1/2 ton 4x4 personnel carrier, 2-1/2 ton 6x6 cargo truck and the solo motorcycle. During this time, elementary instruction on these vehicles is given and it includes the nomenclature and the function of the major units thereof.

Basic motor vehicle operation is then given. First, the student is instructed in the stationary operation of the controls, aids and major units. He becomes accustomed to the positions of the gear shift lever, the front axle drive, the transfer case, and the power take-off. The operation of the winch is explained and demonstrated. The student is taught the proper pre-driving inspection, that inspection which each motor vehicle operator must make prior to operating his vehicle. Practice driving is next taught. The student takes his place at the controls of the vehicle and is required to drive over the practice driving roads which are assigned to this section. Essentially twenty hours are devoted to the driving of these vehicles. By this time, the student has become adept in the handling of all these vehicles and upon the satisfactory completion of both a written and a practical driving test is licensed as a Government Motor Vehicle Operator for the class of vehicles on which he has qualified. W. D.Q.M.C. Form Number 228 is his operators permit.

First echelon of maintenance, or "driver maintenance", is next taught the student. He is taught the nature of his responsibility with respect to his assigned vehicle and how this permissible "driver maintenance", together with its related preventative maintenance, will assure him that his vehicle will at all times be in a serviceable condition for military operations. Inspection of vehicles is taught as well as the prerequisites such as cleaning and washing. Tightening, emergency adjustments and repairs, which are a part of "driver maintenance", are taught. The driver, now qualified in the operation and maintenance of his vehicle,



is ready for instruction in military driving. Convoy driving, road discipline, and traffic control are taught and a course in map reading, typical road net-works, hand signals, and practical driving operations.

Approximately one week is spent in motorcycle instruction inasmuch as, for most students, the driving of a motorcycle is a new and difficult problem. An oval motorcycle track has been constructed for this purpose where the student, away from all other vehicular traffic, will not endanger himself or others.

The student now engages in his pioneer work where he learns the rudiments of field expedients and difficult terrain operation. He learns how to make impassable roads passable. He is given experience in driving over difficult terrains and taught the methods employed. Instruction is given in the use of special equipment and improvised aids such as the "A" frame, the use of the winch and snatch blocks (pulleys) for increasing the pulling power of his winch. There are few situations in which the driver may now find himself and his vehicle with which he would not be able to cope.

A short course in security and camouflage is taught. The driver learns what his responsibilities are, takes the necessary steps to secure his vehicle and properly camouflage it from observation.

Night driving under black-out conditions is finally considered. The student, in cooperation with other technical sections, is assigned as driver of a vehicle on a field problem for both night and day operations. There he is taught driving under practical field conditions.

Examinations and reclassifications finally determine the specific aptitude of our student and, upon the recommendations of the section, he is considered available for transfer to the field to take his place among his fellow "Men of Skill" as an accomplished automotive driver.

by WEYNANA J. FRIES

1ST LT., Ordnance Department

Director Instrument Repairmen Sec.

Ordnance Replacement Training Center

Instrument Repairmen

The mission of the Instrument Repairman Section, Training Department, Ordnance Replacement Training Center, is to qualify trainees who have received four weeks of basic military training as filler or loss replacements for Ordnance units, not to be experts, but capable assistants.

All trainees assigned to the Instrument Repairman Section take the same nine-weeks course. This course includes a two-week introduction consisting of elementary optics and its application to the repair of fire control instruments, elementary shop practice relating to use of special instrument repair tools and fixtures, and work on unit operations common to several instruments. Instruction during the next seven weeks is then given on the description, operation, inspection, adjustment, disassembly and assembly, and field maintenance of selected representative fire control instruments and sighting equipment. At the end of this training course, the students are formed into an instrument repair group of a type Medium Maintenance Company and given actual work in bivouac under field conditions.

The classroom procedure is a well balanced combination of lecture, demonstration and group performance. During these lectures, the instructor is aided by the use of two dimensional take-apart drawings, working models, plastic models of prisms, film strips and training films, which are classed as visual aids.

The first week is devoted to the theory of optics and the geometrical designs of practical optics. This course follows the same pattern as college courses on the same subjects. In the course on theoretical optics, the student is given comprehensive study of the nature of light and is taught the basic laws of reflection, refraction and the absorption of light, as they are applied to prisms and lenses. Image formations, simple telescopes, reticles, the mil system, the human eye and military optical instruments are included, in order to demonstrate the application of optical theory to the instruments in which this course is so vitally interested. Defects and maintenance of optical elements are covered in theory, and the lectures supplemented with actual practice in the cleaning, reconditioning and



sealing of lenses, prisms, and reticles.

An elementary course in shop practice is given to acquaint the student with the use and care of hand tools used in instrument repair such as common, jewelers, and spanner screwdrivers; tweezers, needle nose pliers, pin face spanner; teat, plate and other special wrenches; needle files, stones drifts and pin punches; measuring tools, micrometers, transfer and spring verniers, inside and outside calipers, dividers, combination set; squares; depth, center, thickness, tap and drill gauges; flexible and rigid rules; and dial indicators. Power tools, sensitive and all angle drills, precision and screw-cutting lathes are also taught plus the use of shapers, planers and milling machines; characteristics and uses of ferrous and nonferrous metals; blueprint reading and sketching; identification and measuring of screws and screw threads; types, heads, fits, points, special and standard hardware, tape and dies, and thread cutting on lathes.

An integral part of the introductory course is the use of reference material. The men are taught the contents and use of AR's, FM's, TM's, OFSMWO's, OFSC's, OFSTB's, SNL's, OPSI's and drawings.

The trainees are taught the performance of elementary unit operations encountered in complete instruments such as screws and clamping devices, magnetic needles, level vials, worms and worm wheels, and the cleaning, sealing and painting of metal components.

Upon completion of the preliminary phase of the course, the student is prepared for the practical phase consisting of description, operation, inspection and maintenance of the instruments most generally encountered in the field. Since the Field Glass accounts for approximately 50% of the work in the instrument section and is of simple optical and mechanical construction, it is the first instrument brought to the students attention.

Field Glasses. - Instruction consists of the elementary theory of the function of the instrument, description, operation, inspection and

maintenance, assisted by the use of take-apart models, skeleton models, and drawings. The use of the instrument in the field is fully explained, with each student operating the instrument as it is manipulated by the using arm. The complete inspection of the instrument is fully explained and demonstrated with the use of the proper fixtures and targets, then supervised group performance is undertaken. Adjustments are covered by lecture, by demonstration with the two dimensional take-apart drawings, and by adjustments on the instrument with and without the aid of the proper jigs and fixtures. The students then make adjustments for double vision and tilt and set the interpupillary scale and diopter scale. With the use of visual aids, the machining, interchanging and replacement of parts necessary to eliminate parallax are explained by the instructor.

Disassembly of the instrument is taught with the aid of the two dimensional take-apart drawings covering precautions, special techniques and order of operations. The students then perform these operations under strict supervision, assembling, inspecting, adjusting, lubricating, and sealing the instruments.

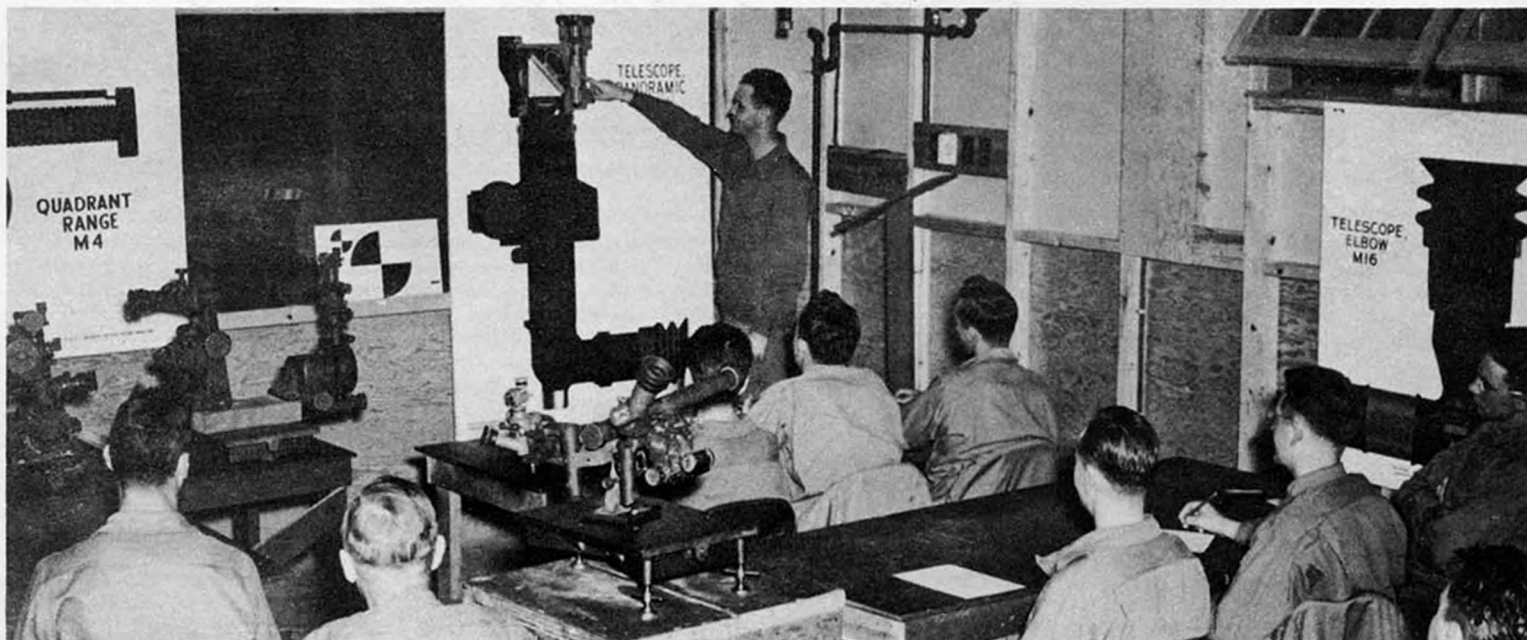
Job sheets are distributed as guides to the instrument repairmen. These job sheets are designed to give a man sufficient information to perform adjustments and repairs after he has been sent to the field.

Work sheets are used throughout the course to aid the student in compiling a systematic set of notes. Short tests in the form of check-up questions are held at the end of each lesson. A comprehensive objective type examination covering the instrument or group of instruments is given at the end of each week. These corrected examinations form a part of the students permanent notes.

This same general procedure is covered in all of the following instruments:

- Straight telescope - Telescopes M5A1, M6, and M15.
- Compasses - M2 and Prismatic compass M1918.
- Panoramic Telescopes - M1 and M12A1.
- Telescope Mounts M21 and M23.
- Elbow telescopes - M5 and M16.
- Range quadrants M3 and M4.
- Range Finders M1916 (1 meter base) & M1917M1 (80 cm base).
- B.C. Telescope M1915A1.
- Telescope Sight M1.
- Mortar Sight M4.
- Gunner's Quadrants M1 and M1918.

To supplement the class instruction and to apply the knowledge gained during the previous weeks of the Instrument Repair course, the students are given practical field work during the last week. The first two days of this week are devoted to normal instrument instruction; the third day is spent in studying the use of standard forms for field maintenance and inspection, and preparation of truck and equipment for bivouac. The students spend the last two days with members of other technical sections on a bivouac where a type Medium Maintenance Company has been set up and is in operation. During this period the students perform the normal functions and duties of members of an instrument repairman section of a Medium Maintenance Company in the field, including all details, on a 24-hour basis.



Service Training Section

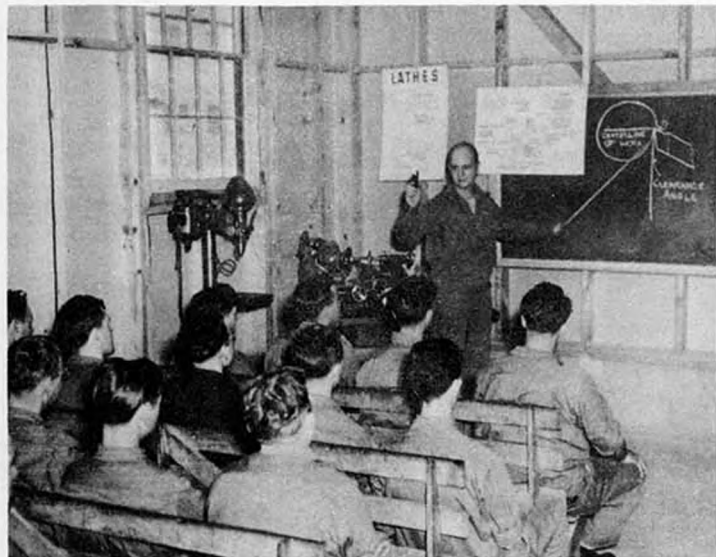
by JAMES G. HAWORTH
Lt. Col., Ordnance Department
Director Service Training Section
Ordnance Replacement Training Center

MACHINIST BRANCH

The Machinist Branch of the Service Training Section has developed in the past year from an eight-lathe workshop to a modern, well equipped military trade school. Its primary purpose is to adapt machinists to the problems and working conditions which they will encounter in the field. The new set-up is divided into two shifts to facilitate ample working space and equipment for the students, and also to permit the instructors to work more closely with their men. Lectures and demonstrations scheduled throughout the course permit the trainees to study and review the various operations before they actually perform them on the machines. The instructors use visual aids and the actual machines themselves to emphasize and clarify the more important points, and training films are shown as further aid in studying the theory and application of practical machine shop work. Class-sheets are also given to the students to be used as notetaking aids.

This course consists of a nine-week training period for experienced machinists, and a seven-week period for those men who require additional instruction and experience in layout and bench work. The first four weeks are devoted to learning the fundamental operations performed on the lathe. The next two weeks are spent on the shaper. Three days of work on the machine shop truck, and a three-day bivouac with a type Medium Maintenance Company in the field, terminate the course. While on this bivouac, the men work on the machine-shop truck and the tool and bench truck, repairing and replacing parts for equipment being serviced by the company.

Qualification examinations are given one evening each week to the trainees classified as machinists to determine those best suited for the course. These are objective type tests, covering bench and machine work. Trainees are also required to give a demonstration of their ability to operate the machines, and are given a personal rating and interview by the section leader. The men are graded and the most suited men selected. They begin the course at the completion of their basic military training.



Of the men selected, the ones showing a better than average knowledge of layout and bench work come directly to the shop, while the remainder are required to take a two-week course in the fundamentals and principles of elementary shop work. After reporting to the shop for duty on the first day the students are given an orientation lecture by the section chief. They are shown training films on measuring tools and the care observed in good machine shop practice. The rest of the first day is taken up by lectures on operations performed on the lathe and also a

lecture and demonstration on tool bit grinding. Following this the men grind practice tool bits, using low carbon steel. Practical work begins on the second day when the students start work on the first of the lathe projects, an arbor, designed to cover the more important operations performed on the lathe, namely, facing, straight turning, taper turning, internal and external threading, and knurling. This first project is followed by more lectures on lathe work and a group of training films made under the supervision of leading precision tool manufacturers. The student's second project is the making of ball peen hammers, which involves all the intricacies of the arbor as well as the cutting of radii and the use of the boring tool. In all, four weeks are spent on the lathes. The students have an opportunity to make a plumb bob, handles for a tap wrench, the clamping screws for a toolmakers clamp, and a "C" clamp. To complete these articles the students have the valuable experience of using the taper attachment, the milling attachment and the tool post grinding attachment.

Each group has two instructors who carefully supervise the student's progress and are eager to give helpful suggestions and advice. Grades are compiled from the work done in the shop, and from written tests. During the second and third weeks the instructors note the men who are making the best progress and allow them to do more difficult work. At the end of the third week the group has finished all of its projects for the lathe and the students are given practical jobs of a type which may be encountered in the field.

On the fifth week, the men leave the lathes and move to another part of the shop to study the shaper. The first part of the shaper instruction is held in the classroom, where the nomenclature, care and safety, use of tools, and various operations performed on this machine are discussed. Next the students commence their practical work with the first shaper project, the task of squaring a cast iron block. This familiarizes the students with the many working parts of the machine for the more intricate projects soon to come. Two weeks in all are spent on the shaper. During this time the men complete such projects as a "V" block, jaws for a tap wrench, and jaws for a toolmakers clamp. The shaper course is abbreviated for those students who have proven themselves more proficient, so that they may devote a portion of this time to more advanced maintenance work.

As a milling machine is not part of the equipment in the machine shop trucks used in the field, only one day, the last in the shop, is spent in the study of this tool. The instructor, through lecture and demonstration, shows the students all of the fundamental principles involved in the operation of this device.

The course is concluded with a three day bivouac during which the men, accompanied by their instructors, have an opportunity to demonstrate what they have learned, as part of a type Medium Maintenance Company.

Inasmuch as the outcome of our war effort is so dependent on what our soldiers learn during the period of their technical schooling, everything possible is being done here to make each man proficient in the work he will do in the field.

CARPENTRY BRANCH

As is true with all the other branches of the Service Training Section, the carpentry branch receives the students having a background of training and experience in their field. Since these men have been selected on the basis of past experience, the program might be considered as an advanced training course directed toward the integration of their trade to conform with accepted Army methods.

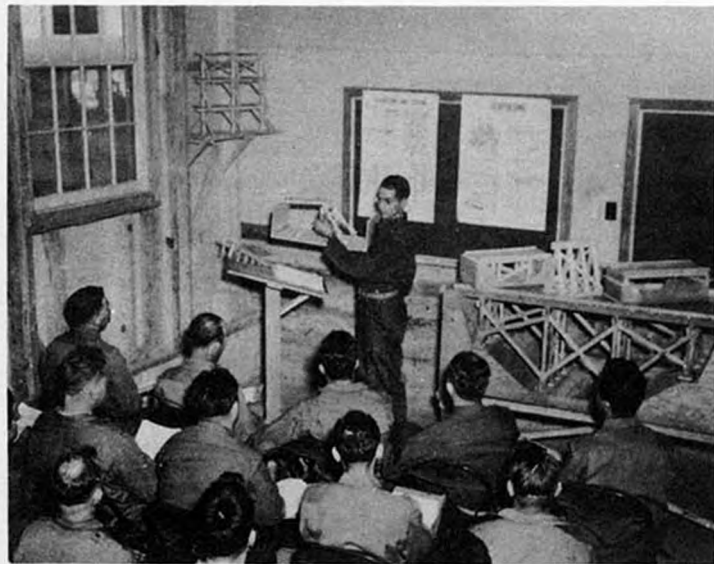
This course has two primary aims to accomplish; first, to supply the carpentry training needed by the men to round out their knowledge of the complete field; and second, to give them intensive training in the

phases of carpentry that are peculiar only to the Army. Trainees will often enter the course with a highly specialized training in only one phase of the trade; for instance, they may be form builders, cabinet makers, finish carpenters. It is necessary that they see the trade in its entirety to make them valuable carpenters in varied field conditions.

The training course has two major divisions with numerous subdivisions. The first five weeks of the training course are devoted to a series of technical lectures and assignments, supplemented where possible by demonstrations and practical work. The material covered during this period may be listed under the following headings: Shop Mathematics, Care and Use of Equipment, Woodworking and Shop Work, Specifications and Planning, Building Construction, and Field Construction.

Shop mathematics begins with an elementary review of simple addition, subtraction, multiplication and division, with emphasis on fractions, decimals and the combination of the two. Then follows a unit of instruction on area, volume, rectangles, triangles and circles as they are applied to carpentry. The next unit, square root, is in preparation for a lesson on the right triangle and its applications to the steel square. The latter enables the student to understand the functions and use of the steel square, so necessary to the carpenter. A final day is spent on the practical use of framing in which the students can actually apply the knowledge learned.

Care and use of equipment includes the nomenclature and use of the tools in the carpenter's and wheelwright's tool chest. Lessons and demonstrations are given on sharpening chisels, planes, saws and augers, after which the students are given an opportunity to develop practical skill in the shop. Early in the course a lecture is given on the care and uses of power equipment, and safety precautions to be observed. This enables the students to make use of the power equipment available in the shop.



A unit of woodworking is offered to enable those lacking in cabinet work to develop the necessary techniques. This includes lessons on wood joints, glues and their uses, woodfinishing and glazing.

Preceding the building construction work are lessons on specifications and planning. The student is taught to read blueprints, understand the materials, their uses and limitations, and to estimate the quality and quantity of the materials needed for a given job.

Actual building construction is the most important unit in the first major division, occupying over a week of the first five-week period. Lessons included in this unit are those on laying out foundations and building concrete forms; laying floors, erecting walls and framing roofs; exterior and interior finishing of the frame building; the installation of doors, windows and hardware and the construction of stairways. Many additional points are brought out in this unit as the students begin exchanging notes on the trade practices of their various localities. There is a final lesson on the erection of scaffolding and staging needed in work of this type. Supplementing the lectures is group participation in a project to lay out a foundation, and to construct model buildings, bringing out the points covered in the lessons.

Field construction as used here means jobs that are peculiar to the Army, in which the trainees have usually had little experience. Because this work is new to the carpenters, each unit is carefully covered by lecture and discussion, and followed immediately by practical

problems. The lecture subjects include packing and crating, blocking and anchoring shipments, temporary ramps and platforms, and light temporary bridges.

In the individual shop problems the students are aided by job sheets listing the tools and materials needed and the itemized steps of procedure.

The final four weeks of the students' training covers the duties of the service section in the field. Examples of these duties include such jobs as building desks, cabinets and tables; salvaging material from old buildings; pouring foundations; building forms; erecting temporary buildings; making building repairs; erecting flag poles; and doing any carpentry task that they may be called upon to do. These work details are so assigned that each man may have a maximum variety of experiences.

The test of the trainees' practical ability comes in the last three days of their training, when they go on a technical bivouac with a type Medium Maintenance Company. The duties they are called upon to perform on this bivouac are identical with those they might be called on to perform in the field. Particular emphasis is placed on the importance of doing the job with limited field equipment, and on improvising both with tools and with materials.

At the conclusion of the students' training they have the knowledge, training, and versatility to enable them to perform efficiently their job as Ordnance carpenters in the field.

WELDING BRANCH

Men selected for training as Ordnance welders are usually highly specialized welders of one kind or another. It is the object of the Service Training Section Welding Branch to make all-around welders and mechanics out of this already well trained group of men. The welding section is equipped to do and teach all types of electric arc and gas welding and brazing.

The method of training follows the same general lines as the training programs of schools. Special attention is given to the welding of Ordnance materiel. The program is set up to enable the student to start at a point in the course where he will receive maximum benefit. The schedule is designed to assist him to refresh his recollection and perfect his techniques, due to the fact that he has not been welding for the past few months. The men work under the personal supervision of highly trained instructors who direct their activities.

No student can be considered equipped for his work without some knowledge of the history of his art, the properties of the materials he uses and the practical applications of his profession in the Army. The problems involved in learning the art of welding while manifold, are not so difficult but that a conscientious student should have no trouble in acquiring a reasonable degree of proficiency by pursuing a well organized course of instruction.

As with any art or trade, the best that a course of instruction can do is to provide the fundamental knowledge upon which a student may build,



by diligent application and practice." It is impossible to place too much stress on the necessity for continued practice as the only means for developing the high degree of skill necessary to an Ordnance welder. A course of instruction should provide a two-fold approach to the problems. First, through the medium of lectures the student must be introduced to the elementary theories which will enable him to understand what is taking place in the process. Second, through practical shop exercises he must be taught the various manual operations involved. These principles have therefore provided the basis for making skilled welders and trained mechanics.

The course is divided into three units: 1. Welding theory, 2. Electric Arc Welding, 3. Oxy-acetylene Welding. A period of four weeks is devoted to Arc Welding and a period of four weeks to Oxy-Acetylene Welding. During this eight week period, welding theory is introduced in the course.

The first four weeks of training, referred to as the Electric Arc course, involves the use of different size electrodes and different thicknesses of metal, and the different positions. A man progresses through the different problems according to his ability. If he is an exceedingly skilled student he is given alternate problems. In the event he is a specialist in a certain phase of the work he is given the opportunity to assist other students in developing this specialty. Job sheets — step-by-step illustrations — are given the student and it is his responsibility to fulfill the requirements. Upon completion, his weld samples are examined and tested and he is given a brief written test.

The second four weeks are devoted to the Oxy-Acetylene process combined with machine and hand cutting. The ninth week of training is chiefly concerned with welding under field conditions including a three day bivouac with a demonstration Medium Maintenance Company to accustom the students to the welding truck, the art of camouflage, making and breaking of camp, and the setting up of a field work shop.

The bivouac affords the men an opportunity to work in the field simulating actual combat conditions. A continuous twenty-four hour shift is maintained. All shop welding work requested by other sections on "Inter-shop Work Orders" and other welding required in maintenance work is accomplished.

PAINTING BRANCH

The need for specialists skilled in the preservation and care of Ordnance materiel has led to the establishment of a Painting Branch within the Service Training Section.

The student who comes to the Painting Branch is first given a painter's qualification examination to determine his previous experience in this type of work. It is necessary for the student to have had previous experience, because the course of instruction to be covered is one that usually takes from two to four years in a civilian trade school. Bearing this in mind, a program of instruction was drawn up in which the student is allotted four weeks of class instruction and five weeks of practical work.

The first week of instruction covers general exterior painting and

stresses the care of painter's equipment. During the second week, interior painting and the chemistry of paints are taught. This course is not indispensable, but it is intended to broaden the trainees conception of the work required of the general painter and to enable him to visualize his work in relation to that of the Ordnance painter.

Spray painting and camouflage are taught the third week. Many men are entirely unfamiliar with spray coating and its possibilities in the Army. Further instruction in camouflage is taught to give the student a broader knowledge of the subject than was possible during his basic training period. Instructions are given in personal camouflage, camouflage of equipment, and other security measures necessary for the concealment of troops and materiel from ground and aerial observation by the enemy.

In the fourth week the student learns lettering and stencil cutting. The field for sign painters is a very broad one and cannot be thoroughly learned in a short time, but the object of the course is to teach the men to make neat, legible signs.

The final five weeks of the student's time is taken up with actual work projects in camp and on bivouac. The student-painter works under the direct supervision of an instructor who is required to report on his progress.

The Painters Branch of the Service Training Section is required to paint all repaired materiel including automotive equipment and signs used in field exercises.

BLACKSMITHS BRANCH

The work that is often thought of in connection with a blacksmith, shoeing horses, is not an Ordnance blacksmith's responsibility. That work belongs to the farrier and all horse outfits have their own farriers. The work done by the Ordnance blacksmith is mainly that of straightening bent pieces of machinery, forging odd wrenches, making parts not readily drawn from supply and doing emergency work on parts that may be needed immediately. Heat treating and tempering may be at times a very important part of an Ordnance blacksmith's job.



The lectures in this course are designed to cover the important points on forging operations, fires, fuels, the application of elementary theory and shop mathematics, which includes figuring stock pertaining to the blacksmith. All the lectures have study sheets and class sheets corresponding to the subject treated.

The job sheets are designed to instruct students in the actual operations of forging. Each of these sheets deals with one primary forge operation, and each operation leads progressively into another which is more difficult and more complicated. Every job sheet has specific measurements with which the student must comply. The amount and type of stock with which to start is designated and all measurements of the finished product are indicated. All projects must be checked and approved by an instructor before the student proceeds on to the next job sheet.

When the entire course is covered the trainee has a knowledge of fuels, fires, elementary metallurgy, shop mathematics, measuring and



figuring stock, and a little historical background on the development of iron and steel manufacturing. He can identify iron, steel, and fuels. He knows hand welding and brazing, and has had some practice in most of the operations involved in any forge job.

During the last portion of the course the student has the chance to fill genuine work orders under the supervision of the instructors. Emphasis throughout the course is placed upon the judging of a good forge job in comparison with a poor one.

LEATHER & CANVAS BRANCH

The Leather and Canvas Branch of the Service Training Section at the Ordnance Replacement Training Center attempts in an eight-weeks training program to orient the soldier in army methods of maintenance, so that he will be able to service all forms and types of army canvas and leather material under field and combat conditions. Since the great majority of men selected for this training have had some previous background and experience in leather, canvas, and allied branches, the task of instructing them in army procedure is not a difficult one.



After a trainee has been given a preliminary lecture on the functions of the Service Training Section in the field of Medium Maintenance Ordnance, of which leather and canvas is but one phase, he is then assigned for further orientation and training. As an introduction to "Leather and Canvas", he is given a short lecture explaining the purpose of the course, the duties of a trainee here at the post and in the field, the training time allotment and a brief description of each phase of his training. An interchange of questions and answers completes this period.

A Classification Examination is given to determine the trainee's civilian background, his potentialities as a trainee, and his group standing. This examination embraces the fundamentals of leather, canvas, upholstery and rope splicing.

Next he is issued a set of reference books and Technical manuals from which he is given study assignments, demonstrations, lectures and quizzes in such topics as Classification, Tanning of Leather, Glossary of Leather Terms, Inspection and Grading of Leather. The use of classroom visual aids and demonstration materials are also included. He is next issued a Saddler's Tool Kit, and in a short time becomes familiar with the nomenclature, care and uses of tools. A practical test and examination is given to prove his knowledge. The trainee is now ready for a series of practical sewing and stitching problems demonstrating the techniques of leather. As a first step, he must know how to prepare and wax thread. Among the numerous projects the trainee is asked to make and service after he has mastered the preliminary problems are the Caliber .45 Pistol Holster; 60mm, 75mm, 37mm, gun covers; instrument repair cases; bags; dispatch cases; straps; machine belts; etc. This period of application and instruction lasts three weeks.

For the next two weeks he is taught the fundamentals of the cleaning, preserving, care, sewing and repairing of canvas. Reference reading assignments are correlated with a series of practical problems, such as making a waxed end on a thread, flat seam stitching, cat stitching, sewing of tears, rips, holes, grommets, etc. These lessons and problems will aid him in the service and repair of truck covers, tarpaulins, tents, bags,



cots, and other articles made from canvas.

One week is devoted to each of the following: upholstery, rope splicing and knot tying, field problems and maintenance work with a type Medium Maintenance Company.

In the one week of upholstery, the trainee learns how to service, repair, and replace parts of truck and personnel seat covers. Only the fundamentals of upholstery are taught, since a detailed study is not necessary for army purposes. In the lecture demonstration on the "Introduction to Upholstery", the trainee is instructed in the work of the upholsterer in the field and training center, and the use of tools, materials and various accessories. Lesson No. 2, "Springing and Construction", concerns the proper method of tying and constructing springs. Finally the padding, cutting and finishing processes are taught. Repair and maintenance work is given as a test of the trainees' knowledge and skill.

In the one week of rope splicing and knot tying the trainee is given instruction in the proper care, use and types of ropes. Charts and visual aids accompany each lecture, with demonstrations of the making of splices and knots necessary in the maintenance of leather and canvas. Instructors follow each operation with the trainee step by step until satisfactory results are obtained.

The final week of the trainee's course emphasizes field work on the post and on bivouac. In the short space of two months the transition of an individual from his civilian status to that of a trained Army Ordnance Specialist has taken place.

CLERICAL SECTION

Due to the fact that we are a nation at war, there has been an ever increasing expansion of the activities of the Ordnance Department. To accommodate an increased demand for Ordnance clerical specialists, the Clerical School has both modified and improved its course of study and training methods; this has been done with the primary thought in mind of training the right man for the right job.

The Clerical School is divided into two main sections, the Depot and Supply Section and the Administration Section. Upon entering the Clerical School the experienced typists are assigned to the Depot and Supply course and the beginning typists are placed in the Administration course. With this in mind, the students in Administration are given a half day of typing instruction and a half day of instruction in Administration for the duration of the course. Men in the Depot and Supply course, being experienced typists, are assigned a lesser amount of time for typing. Inasmuch as Depot and Supply is a longer and more complex course than Administration, this allows the men to devote more time to the various subjects on Supply.

The foremost aim of the Clerical School is to provide the basic or general training in Supply and Administration that will enable men to better perform their duties in the field.

Examples of these positions are:

- (1) Clerks, chief
- (2) Clerks, general
- (3) Clerks, stock control
- (4) Clerks, stock record
- (5) Clerks, file
- (6) Clerks, typists
- (7) Storekeepers, Warehousemen, etc.
- (8) Clerks, company
- (9) Clerks, personnel
- (10) Clerks, supply
- (11) Supply Sergeant (company)
- (12) First Sergeant

The first step in accomplishing this aim is the selection and arrangement of the subjects to be taught. A well-rounded knowledge of the subject of Supply may be obtained from the following courses:

- (1) Sources of Information
- (2) Procurement of Property
- (3) Receipt, Issue & Shipment of Property
- (4) Lost, Damaged, and Unserviceable Property
- (5) Storage and Safekeeping of Property
- (6) Transfers, Inventories, and Audits
- (7) Company Supply
- (8) Correspondence and Filing
- (9) Ordnance Field Maintenance Units
- (10) Ordnance Depot Company
- (11) Typing

The course in Administration consists of:

- (1) Sources of Information
- (2) Correspondence and Filing
- (3) Company Supply
- (4) Company and Regimental Personnel Administration
- (5) Typing

The most important step is now encountered in the presentation of these subjects. Instruction must be accomplished in a logical, clear, and concise manner. The instruction system in use at the present time is called the "Block System", wherein one instructor is assigned to each of the nine weeks of training. Inasmuch as only one or two subjects are dealt with in any one week, the instructor attains a high degree of proficiency in dealing with his respective week's subject or subjects.

Depot and Supply and Administration, being academic courses by nature, are taught in classrooms. The presentation of a typical subject in Depot and Supply, or Administration, generally consists of the following phases:

- (1) Lecture on subject by instructor
- (2) Answering by the class of pertinent questions
- (3) General class discussion of subject
- (4) Working practical problems
- (5) Discussion, review, and examination

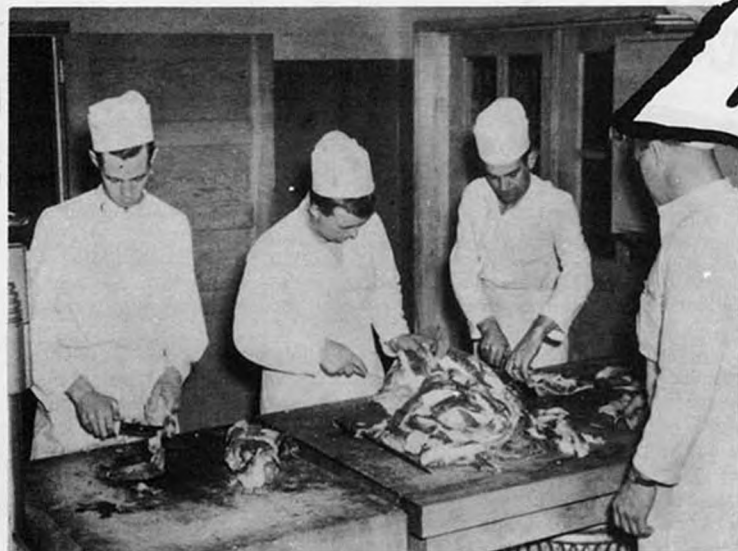


To insure uniformity of presentation by different instructors, the Clerical School has prepared lesson plans covering every hour prescribed for the various subjects. These lesson plans, in Administration as well as in Depot and Supply, assure a logical sequence in the flow of instruction with a minimum of wasted time. This is accomplished by carefully allotting a certain amount of time to each of the phases of presentation, conforming, of course, to the total amount of time assigned to each subject.

Visual aids are used by the instructor in each subject in order to present a more vivid picture of the important parts of the subject being taught.

The most important result of the student's schooling is in his ability to skillfully apply his newly acquired knowledge. Problems have been set up for all parts of the courses in Depot and Supply and in Administration. Standard War Department forms are used for the solution of most of these problems. The working of the problems is, of course, under the supervision of the instructors, and general class discussions are held to clarify any particularly difficult points that might puzzle the students. After the pupils have completed their problems, the instructors will always place the approved solutions before them so that they can actually see the correct manner of solving the problems.

Both the Depot and Supply and Administration courses have been formed around four main principles of teaching — telling, showing, doing, and testing, with the goal in view of giving the students a practical working knowledge that may be applied to the various jobs to which they will eventually be assigned in the field.



Bakers AND Cooks

by

DORSEY H. CULLEN, Captain, QMC

Assistant Commandant, School for Bakers and Cooks

Ordnance Replacement Training Center

One of the Technical Training sections established at the Ordnance Replacement Training Center is the School for Bakers and Cooks. This unit operates in conjunction with the Parent School at Fort Geo. G. Meade, Maryland, and under control of the Third Service Command.

The objectives of this School are:

(1) Officers:

- a. To instruct in the theory and practice of —
Handling the ration.
Conducting and supervising messes.
Inspection of mess activities.

(2) Enlisted Men:

- a. To train in the duties of —
Pastry bakers.
Cooks.
Meat cutters.
Mess sergeants.

Here at the Ordnance Replacement Training Center emphasis has been placed on the training of selected enlisted men to efficiently perform the duties of Army cooks under all conditions of garrison, and field. In order to accomplish this end the student cook is required to successfully complete a nine-weeks course composed of both theoretical and practical training. The training in theory is conducted in the classrooms of the School under supervision by permanent instructors. The



training in practice is conducted through assignment of students to work in operating messes of the Replacement Center under control and supervision by the School personnel, and the permanent mess personnel of that particular mess. The student is assigned to a shift (first or second) and alternates daily between classroom and work in the kitchen. Classroom instruction is conducted five days per week, Monday through Friday, for a minimum of two hours a day. Practical instruction in the kitchen is



conducted seven days per week, for a minimum of eight hours a day. This schedule of training may appear to be rather rigorous, but it has proven necessary in order to accomplish the desired objectives.

The basic text used in conducting the student cooks course is TM 10-405, the Army Cook. However, many other training manuals and commercial pamphlets, together with appropriate motion picture films are employed to broaden the scope of the course. Throughout the period of practical training the student cook receives constant, and thorough, supervision in cooking, meat cutting, and pastry baking. He learns to actually prepare meals on the gasoline field range, and through actually participating in a five-day field bivouac he learns to prepare meals under field conditions. He is schooled in personal hygiene, sanitation, and the principles of mess cleanliness. He is taught the administrative procedure in connection with the handling of the garrison ration, and takes part in the daily operation of the field ration. Instruction is given in the proper methods of handling, storing, and preserving items of subsistence.

In order to qualify for admittance to a mess sergeants course the student must have previously graduated as a first cook. In other words, with an average of 85% or better. The mess sergeants course is of four weeks duration and combines, in a manner similar to that of the cooks course, theoretical and practical training for the accomplishment of the objective — the training of especially selected enlisted men in the duties of mess sergeants for military units.

Upon completion of the mess sergeants' course, the student is ready for assignment in accordance with the manner of his graduation. In certain instances where vacancies exist within messes on the Post he may be assigned to such an organization. Or, he may be immediately ordered elsewhere for duty with an Ordnance Unit.

Training Methods Section

by

WILLIAM GOLDSCHLAGER

2nd Lt., Ord. Dept.

Director Training Methods Section

Ordnance Replacement Training Center

Efficient instruction is the core of an efficient army. In February 1942, tri-weekly lectures were begun, to instruct commissioned officers in the most efficient teaching methods for the Army. From this grew the present Training Methods Section. The course was soon changed, and given to non-commissioned officers instructing in the technical sections. Later, all cadre trainees attended a half-week course in principles and practices of instruction. Today, Training Methods has become a full week course for all cadre trainees.

Within seven months, the section, originally consisting of only one commissioned officer, has grown into an organization numbering two commissioned officers and thirty-six enlisted men. Every instructor

in the Training Methods Section was a teacher in civilian life, and in the Army he is continuing the work for which he was so carefully trained.

Men who are skilled in technical subjects are given the teacher training course to better enable them to transfer their skill to others. As the final part of his week's training, each cadre trainee presents a fifteen-minute lesson on a subject taught in the technical section to which he has been assigned, and in which he is expected to teach. These lessons are observed and graded by an officer from that particular technical section, and a non-commissioned officer from Training Methods Section. A library of visual aids and technical manuals is maintained for the benefit of the cadre trainees in preparing their lessons. Facilities are also



Practice teaching

provided for the individual trainee to prepare his own instructional aids, assisted by members of the staff.

However, training men in instructional methods is not the only function of this section. New and important tasks have been assigned to it. Written materials — examinations, lesson plans, job sheets, work sheets and charts — are of invaluable assistance to technical instructors. The technical sections submit their materials to the Training Methods Section's editorial department for examination, review and improvement. Here the materials are corrected, revised, standardized and sometimes re-written for clarity and simplicity, to provide present and future instructors in the technical sections with good written guides with which to teach. This work is done by a staff of editors who were formerly newspaper men, magazine writers, and attorneys. Skillful typists are an integral part of this department which works to put the teaching material in good form and to make it rapidly available.



Skillful typists

The third phase of the work of the Training Methods Section has been the institution of a guidance counselling program. This is a logical development of the effort to raise the quality of instruction. Training Methods Section does not graduate its men and then forget them completely. Trained instructors, many with vocational teaching experience, observe the instructors in the technical sections. After carefully observing a lesson, the guidance counselor examines the lesson plan, work sheets, job sheets and visual aids, and confers with the instructor. In the discussion with the instructor, constructive suggestions are advanced, to improve the instructional techniques.

The Training Methods Section has thus combined a system of teaching the principles of instruction, observing and counselling instructors in the technical sections, and editing and revising instructional aids for them. Its aim has been and will be to improve the quality of instruction and to increase the efficiency of training at the Ordnance Replacement Training Center.

The development and molding of the Ordnance soldier into non-commissioned officer material is the task of the cadre-training organization of the Ordnance Replacement Training Center. This organization is the Eighth Ordnance Training Battalion consisting of four companies, A, B, C, and D.

Cadre-trainees are normally selected while they are still undergoing basic military training. The selections are made by a cadre selection board and are based on the individual's previous experience, civilian or military, education, leadership abilities and other qualifications. If accepted by the board, he is transferred, upon completion of four weeks of basic training, to one of the four cadre companies, where he goes through a rigorous nine-weeks course.

Shortly after reporting to his company, the cadre-trainee is addressed by his company commander and informed of his new duties and responsibilities. He learns that the red circle which he will wear on his garrison cap is symbolic of the leadership and prowess of the cadre-trainee. By the end of the orientation talk the cadre-trainee realizes that he will be required to speak, dress and act like a model soldier, and that to do otherwise would bring discredit upon the unit of which he is a member.

The first week of training stresses military drill. This drill is conducted for the most part by the trainees themselves. It is designed to give them practical experience in voice and command, practice instruction and close-order drill. The officers and non-commissioned officers of the cadre companies supervise and grade the men on their leadership and commanding abilities. Trainees whose performance is unsatisfactory are transferred out of cadre training at the close of the first week.

Guard duty is also emphasized in this week. The Cadre Training Battalion has a permanent guard assignment which is coordinated with the training program. There is a guard mount within the Battalion daily and the trainees themselves act as sergeants and corporals of the guard. Each trainee has ample opportunity to become proficient in this important phase of military life.

Cadre-trainees must learn the duties of a charge-of-quarters. A lecture is given on the nature of these duties, after which all trainees are subject to charge-of-quarters assignment. Preparation for this duty is important inasmuch as the C. Q. is acting for the company commander during non-duty hours and is, therefore, responsible for the proper functioning of the company. The charge-of-quarters is subject to examination by the Battalion Officer of the Day at any time during his period of duty.

THE Training of Cadre

by W. J. BARNES, Capt., Ord. Dept.
Ordnance Replacement Training Center

During this first week, the cadre-trainee is interviewed by the Technical Training Department for assignment to that type of Ordnance work for which he is best fitted.

During the second week of his cadre training the trainee is given a course in teacher-training. Four days of this week are devoted to a study of the principles of demonstration and instruction. In this time the trainee also prepares a lesson plan and visual aids for a fifteen minute practice lesson which he gives on the fifth day of the course. The subject of this lesson must concern some phase of the special technical course to which he was assigned the week before. An officer in the technical section and an instructor of the teacher-training course, are present during this lecture to evaluate the teaching abilities of the man. Failure in this course means transfer from the cadre-training company.

The cadre-trainee in his third week again goes through a rigorous military training program. The fourth, fifth, sixth and seventh weeks are devoted to technical training in the technical section to which he has been assigned. The eighth week is a final week of military training during which the trainee is given many responsibilities such as supervising the instruction of newer trainees and handling the duties of a sergeant of the guard.

The ninth and last week of training is for the purpose of giving the trainee self-assurance in teaching the technical specialty to which he is assigned. He instructs technical training classes under the supervision of regular instructors.

The cadre-trainee having completed his nine weeks of training, is transferred from his Cadre company, ordinarily to one of the basic or technical companies of the Ordnance Replacement Training Center, where he must prove himself in order to win his stripes. The intensive training which he received in the cadre battalion has fitted him for the duties of a non-commissioned officer.

Special Training Section

O.R.T.C.

The mission of the Special Training Section is to provide for the training of individuals who, by reason of mental attitude or capacity, lack of ability to understand or speak the English language, inability to read or write, lack of common knowledge, speech defects, or other deficiency, are not immediately suited to undertake the regular course of instruction conducted by the Ordnance Replacement Training Center. This type of training is given to the trainees in Company "A" of the 6th Battalion and Company "D" of the 7th Battalion, more frequently referred to as the school companies.

In addition, the purpose of this program is to train those men who, because of minor physical defects, lack of coordination, age, or questionable stamina indicate that they require special attention. This type of training is given in Company "C" of the 7th Battalion, commonly referred to as the physical company.

The basis for the selection of men for the school companies is lack of education or mental deficiency as indicated by A.G.O. Classification Tests and interviews conducted by the Personnel Consultant and his assistants in the Classification Section. The basis for selection of men for the physical company is physical deficiency as determined by observation of the various company commanders and non-commissioned officers in their respective companies and their subsequent recommendations to the Personnel Consultant.

To meet the special needs of the trainees and to fit them for some type of military service, the instruction program is divided into three phases. These are the academic, the military, and the physical conditioning phases.

Trainees are kept in the school companies of the Special Training Section for a period of 12 to 16 weeks. The academic program consists of reading, writing, spelling, arithmetic, and English or expression. Emphasis is placed upon comprehension of what is read, accuracy and clearness in writing and speaking, the development of an understanding of the spoken word, and the ability to perform at least the four fundamental operations in mathematics. Three hours a day are devoted to the subjects mentioned above, and two hours each week are spent in the discussion of Modern Military History and Current Events.

The second phase of the training program in the school companies is basic military training. The military phase of the program is divided into instruction periods and field problems. In the instruction periods the basic training lectures are modified and given in the form of class discussions or conferences which are led by the instructors. In the field problems the men practice what they have learned in the basic instruction periods. In both the academic and military training visual aids are advantageously used.

The third phase of the program concerns itself with the development of physical fitness. The physical training program is designed and presented to improve the general vigor, coordination, and muscular control of the men. Each man is given a physical fitness test in the first or second week after he joins the Special Training Section. Those men who qualify are permitted to follow a supervised program of intramural games during physical training periods. Those who do not qualify are given a closely supervised program of special corrective and remedial exercises. At the close of each week they are permitted to try the physical fitness tests again. If they qualify, they are transferred to the groups participating in intramural sports, and, if they fail, the process of conditioning is continued.

Physical fitness as demonstrated by mastery of field problems, endurance on hikes, and in drill, and the ability to participate and qualify in the physical training program, are essentials for the Class V trainees, as many of them are placed in basic soldiering jobs upon completion of Special Training.

Trainees are kept in the physical company for a period of 9 weeks for basic training and for the time required to complete technical training. Five periods a week are devoted to special academic classes, in which the trainees are allowed to make an exploration into the technical fields offered in Ordnance Technical Training. In addition, in some instances a rapid review of fundamental academic subjects is provided for. Those men excused from all physical activity employ their free time in the library making more advanced surveys of technical training. Two hours each week are devoted to the discussion of Modern Military History and Current Events.

The military phase of the program is divided into instruction periods and field problems. The instructors conduct basic training classes and lead class discussions. During the conduct of field problems provision is made for the physical deficiencies of the trainees.

The third phase of the program is concerned with improving the general physical vigor of the men. Close observation is given to the amount of physical exercise the men can endure. The physical program is largely remedial and corrective in nature.

All of the cadremen in the Special Training Section have had previous experience in teaching, psychology, or supervision of men. Therefore, insofar as possible, each instructor in the Special Training Section carries his own group through the entire Special Training Program — academic, military, and physical. In this way it is felt that each instructor can challenge every man to his highest achievement.

Upon completion of the course, or during it when necessary, the Director of Special Training makes recommendations to the Commanding Officer through the Classification Section of the disposition to be made of each trainee. The ability of the trainee to adjust himself to Military life, his aptitude in particular fields, and his progress and achievement as indicated by test grades and interviews are taken into consideration. To assist in formulating recommendations, the Special Training Classification Test is given at the end of 8 weeks of training, and the Army General Classification Test is given again to each man at the end of Special Training.

In the order of ability or skill shown the following recommendations for the disposition of trainees are made:

- Assignment to technical sections for advanced training.
- Duty on the post as building supervisors, carpenters, painters, truck drivers, firemen, company mechanics, and so forth. These placements are made directly by the Special Training Section.
- Basic-soldiering duties in Ordnance Field Units involving work of a manual or non-technical nature.
- Recommendations for discharge, should it be determined that an individual cannot be trained for any type of service.

As the leader of your men do you know they are ready — or do you simply THINK they are? Or HOPE they are? Is your unit one of those in which inspections revealed there were men who had never seen a first-aid kit opened? Who did not know how to set their rifle sights?

Who knows little or nothing about scouting, cover and concealment? Whose gas masks had broken eyepieces? Whose bayonets would not fit the studs on their rifles? Do you think the bayonet of the Japanese soldier is not going to fit when he needs it?

Medium Maintenance Company Field Problem



The purpose of the Medium Maintenance Company field problem is to give the trainee in the Ordnance Replacement Training Center some idea of the actual setup and operation of an Ordnance maintenance company in the field.

Trainees from the Automotive, Artillery, Armorers, Motor Vehicle Operation, Service Training, and Instrument Repair sections who are in their last week of technical training make up the largest part of the simulated company. Some trainees from Depot and Supply and Bakers and Cooks Schools are obtained to perform the duties not directly related to the technical sections. Noncommissioned and commissioned officers for the problem are furnished by the various technical sections. Shop trucks, equipment, and all necessary materiel for the proper conduct of the problem are also drawn from the technical sections.

On Thursday morning of each week the simulated Medium Maintenance Company moves out from the O.R.T.C. to a bivouac area which is generally located within a radius of 25 miles from the post. In order to prevent the field problem from becoming too much of a standard set-up, new bivouac sites are selected at frequent intervals. An alternate bivouac site is selected each week and is sometimes used after setting up in the regular area when it is found that an evacuation is necessary due to "enemy" action. These evacuations are at night under blackout conditions.

In setting up the field shop, care is taken that sections are properly located for best operation. Security of the individual and the organization are stressed by the use of camouflage where necessary and the setting up of a practical security plan. Each trainee is required to dig his own slit trench for protection in the event of air attack. The security plan is tested by gas attacks and simulated enemy attacks by small patrols.

Operation of the field shop is continuous night and day, each section setting up a system whereby the men operate in shifts. Actual problems are worked out by the trainees by the use of "problem" vehicles and other materiel which is brought out with the convoy (e.g., tanks, artillery, small arms). The actual paper work of a maintenance company is carried out in the Field Shop Office, work orders being issued as the materiel to be repaired is brought into the Field Shop and followed through to completion of the particular job.

The field problem is completed on Saturday morning and the company returns to the O.R.T.C. where it is "in-activated" until the following week, when an entirely new group of trainees will make up the new company.



THE Personnel Section O.R.T.C.

by CARLTON A. JOHNSON, Jr.
M. Sgt., Ordnance Department
Personnel Sergeant Major

On February 1, 1941, The Ordnance Replacement Training Center was activated and upon its activation a Personnel Section was set up, composed of three officers and eight enlisted men.

Shortly thereafter, a division was made which more or less separated the Personnel Section into two sub-sections, viz.; The Personnel Section and The Classification Section. One officer was detailed from the Personnel Section to act as Classification Officer and under him were five enlisted men. At that time both sections were in the top floor of a regular barracks building in what is now the Provisional Company area.

The rapid expansion of The Ordnance Replacement Training Center during its first and ensuing months naturally placed many additional duties on our shoulders and necessitated many changes in the Personnel Section.

Four distinct sub-sections were formed within the Personnel Section alone, the Classification Section having been separated and formed, more or less, into a unit of its own.

These four sub-sections were designated: The Reports Section, The Special Order and Filing Section, The Reproduction Section, and the Battalion Personnel Section.

The duties of these sections follow:

The Reports Section is charged with (1) The checking of Morning Reports; (2) The preparation of Strength Returns; (3) The preparation of Ration Returns; (4) The preparation, checking and submission of Reports of Change; (5) The checking and correcting of Machine Record Rosters which are submitted monthly by the Third Service Command; (6) The preparation and submission of weekly reports to The Adjutant General and the Chief of Ordnance on activities concerning arrival and departure of trainees; (7) The maintenance of Flow Charts on arrival and departure of trainees; and (8) The checking on strength of sections by grade, prior to the forwarding of recommendations for promotion to the Special Order Section for publication. The present strength of the Reports Section numbers seven men.

The Special Order and Filing Section is charged with (1) The cutting of stencils for Special Orders and Assignment Memoranda from information furnished by the Classification and Assignment Section and other authoritative sources; (2) The filing of Special Orders, Memoranda, correspondence, Service Record Extracts, decisions, etc.; (3) The maintenance of 200 files; (4) The inter-office distribution of Special and General Orders, Assignment Memoranda, Memoranda, and other stencils for Personnel; (5) The preparation of Charge Sheets from information furnished by company Commanders; (6) The requisitioning, storage, and issuance of forms and office supplies used in the Personnel Office; (7) The filing and posting of Army Regulations, Circulars, Bulletins, General Orders, and Changes to the above; and (8) The handling of restricted and non-routine correspondence. The present strength of the Special Order and Filing Section numbers ten men.

The Reproduction Section is charged with (1) The preparation of addressograph plates for use in preparing rosters used in the Personnel Section and the companies, Blood Type Cards, Good Conduct Passes, and various other forms for the companies; (2) The reproduction, by mimeograph, of Special and General Orders, Memoranda, Assignment Memoranda, and other forms and letters for use by the Personnel Section; (3) The inter-office distribution of items outlined in (2) above; (4) The filing of extra copies of items outlined in (2) above; and (5) The distribution to the companies of prepared passes, rosters, etc. The present strength of the Reproduction Section numbers ten men.

The Battalion Personnel Sections make up the greater part of the Personnel Section, there being one clerk for each company and one Personnel Sergeant who performs the work of the Detachment in addition to supervising the work of the company clerks.

The Battalion Personnel Sections are charged with (1) The receipt and checking of Service Records and allied papers of all enlisted men; (2) The posting in the Service Records of all changes in the status of enlisted men; (3) The preparation of payrolls, paycards, allotments, deductions, etc.; (4) The submission to companies of pertinent information regarding payments of enlisted men, names of men due for lectures and Articles of War, immunization shots, etc.; (5) The checking of Special Orders and Assignment Memoranda for accuracy in names, serial numbers, and status of enlisted men; (6) The compilation and shipment of Service Records and allied papers of transferred enlisted men; (7) The handling of all routine correspondence; (8) The preparation of Warrants, Discharge Certificates, and all other forms pertinent to enlisted men; (9) The submission of weekly reports of bond sales to the Personnel Sergeant Major; and (10) all other matters which come up with respect to enlisted men. At present the strength of the Battalion Personnel Sections numbers 45 regularly assigned enlisted men.

In addition to the duties outlined above, the sections are charged with the training of Student Personnel Clerks (men assigned to the Personnel Section for Technical Training) for shipment to the field as qualified clerks, and, in numerous cases, to take over the jobs of regular clerks who are used to fill cadre shipments to the field. The number of Student Clerks in the Personnel Section varies from ten to thirty, according to the contemplated requirements of the field.

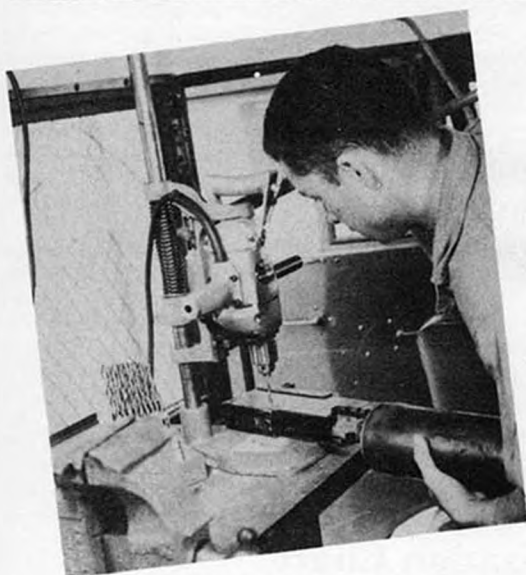
Each section has at its head a Chief of Section, who is directly responsible to the Personnel Officer for all work performed by his respective section.

In addition to the Sections outlined above, there is a Personnel Sergeant Major and an Assistant Personnel Sergeant Major. Their duties are: (1) Supervision of all work performed by the Personnel Section; (2) The breaking down and forwarding to proper sections of all incoming correspondence; (3) The handling of all non-routine matters; (4) The securing, and dissemination by memoranda, of all pertinent information and changes in personnel procedure to the various sections; (5) The keeping of a Memoranda Receipt account on all property charged to the Personnel Section; (6) The submission of weekly reports, to the Adjutant, on the activities of the Personnel Section; (7) The submission of semi-monthly reports to the Post War Bond Officer on War Bond Sales; (8) The selection of Student Clerks; (9) The assignment of men to various duties in the Personnel Section; and (10) The location of men, for various reasons, by means of the 200 and Extract files.

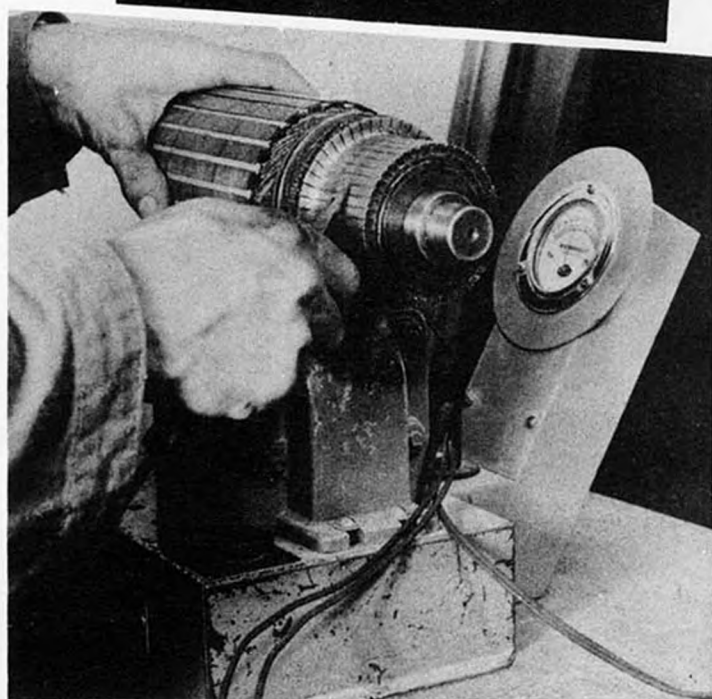
As the enlisted strength of the Personnel Section increased in size, new officers were assigned to duty with it so as to have one officer in charge of signing correspondence and reports for a certain number of battalions.

Thus, in a little less than two years, the Personnel Section has grown in size from an humble strength of two officers (the third one having been assigned to the Classification Section upon the arrival of the first group of Selective Service Trainees) and eight enlisted men to a total strength of four officers and 68 enlisted men.

The Personnel Section now occupies the entire upper and lower floors of the east wing of the Headquarters Building, and as The Ordnance Replacement Training Center expands and increases in strength, so must and will the Personnel Section expand and increase in direct proportion.



TRAINED
FOR
TASKS
LIKE
THESE



THE MAN BEHIND THE

The concept of a Replacement Training Center is something entirely new and peculiar to the present war effort. It is a highly specialized military organization designed and equipped to transform the untrained selectee into a replacement ready to take his place with a military unit in the field. Replacement Training Centers, as such, did not exist at the time of the last war. In those days the important function of recruit training was divided between an organization known as the Depot Brigade and the Division to which the man was assigned. The Depot Brigade was attached to the Division and served to equip the recruit and give him what was then considered Basic Training. The rest of the training job fell upon the Division.

There are several reasons why so rudimentary a system would be impractical in our present mobilization plan. In the first place, the number of men mobilized is much greater than it was during the last war. Many civilians, nowadays, are already trained and educated in various branches of knowledge and careful classification is necessary to make the best possible use of their civilian talents. Most important of all, the army itself has changed. The increased amount of mechanized equipment now in use requires that the soldier be especially trained to fill the particular job.

This training mission has been allocated to what we now call a replacement training center. These organizations exist for the sole purpose of starting the soldier on his army career in the best possible manner and giving him the greatest possible amount of knowledge in the short time available.

The Ordnance Department has a particular need for specially trained personnel, dealing as it does with technical equipment, which is the very backbone of modern warfare. This need was anticipated when, early in the emergency, on January 1, 1941, the Ordnance Replacement Training Center was established at Aberdeen, Maryland.

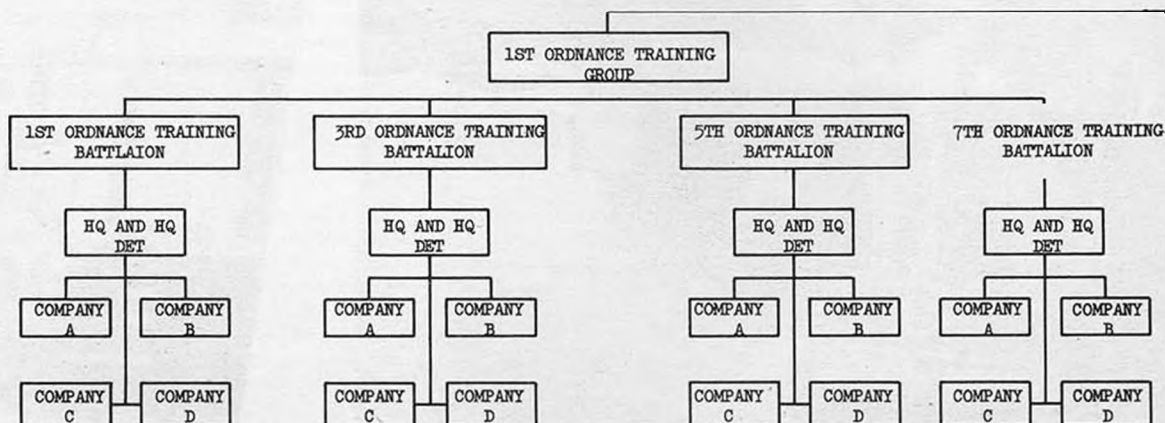
by **RICHARD N. ATWELL**
Executive Officer

Along with technical developments in fighting, equipment methods of training have also changed. The army has borrowed liberally from colleges and universities, as well as industry, and the result has been more thorough and complete application of training principles, with the resulting increased efficiency of training.

At the time the actual training began, the Ordnance Replacement Training Center was still very new. However, even at that time there were evidences of sweeping changes in training methods which would adapt this training center to the particular job confronting it. In the first place, a system of centralized training was established. This method of training was planned so as to utilize the services of a few trained instructors to teach a large group of students. In this way it was possible to insure high quality instruction for the trainees even though few trained instructors were available.

As time went on, other changes and innovations took place. The advent of training aids into the course of instruction constituted one of the major steps. The principle of training aids is by no means new. However, its application to large scale training was one of the necessary developments that had to take place at Aberdeen before training could be effective.

A Typical Organization Chart of the ORDNANCE REPLACEMENT TRAINING CENTER (April 14, 1942)



MAN BEHIND THE GUN

Lt. Col., Ord. Dept.
Ord. Repl. Tng. Center

Perhaps the most important group of training aids are those which appeal to the visual senses. These have been developed to a great extent and are especially designed to fit in with the centralized training lectures. Other important training aids have been developed in a like manner, such as the Note Taking Aids, which assist the student in the lecture classes and make it possible for him to listen to the lecture and, by the addition of a few key-words and notes to his prepared Note Taking Aid, to retain a complete and accurate set of notes for future study. To supplement lecture in cases where this type of instruction is necessary, the Note Taking Aid, now known as the Ordnance Soldiers Guide, and various forms of Work Sheets, were developed. Along with these, the Job Sheet came to be used in conjunction with practical work done in the shops. The Job Sheet is especially designed to assist the student in such jobs as assembly and disassembly of weapons and vehicles and their various sub-assemblies.

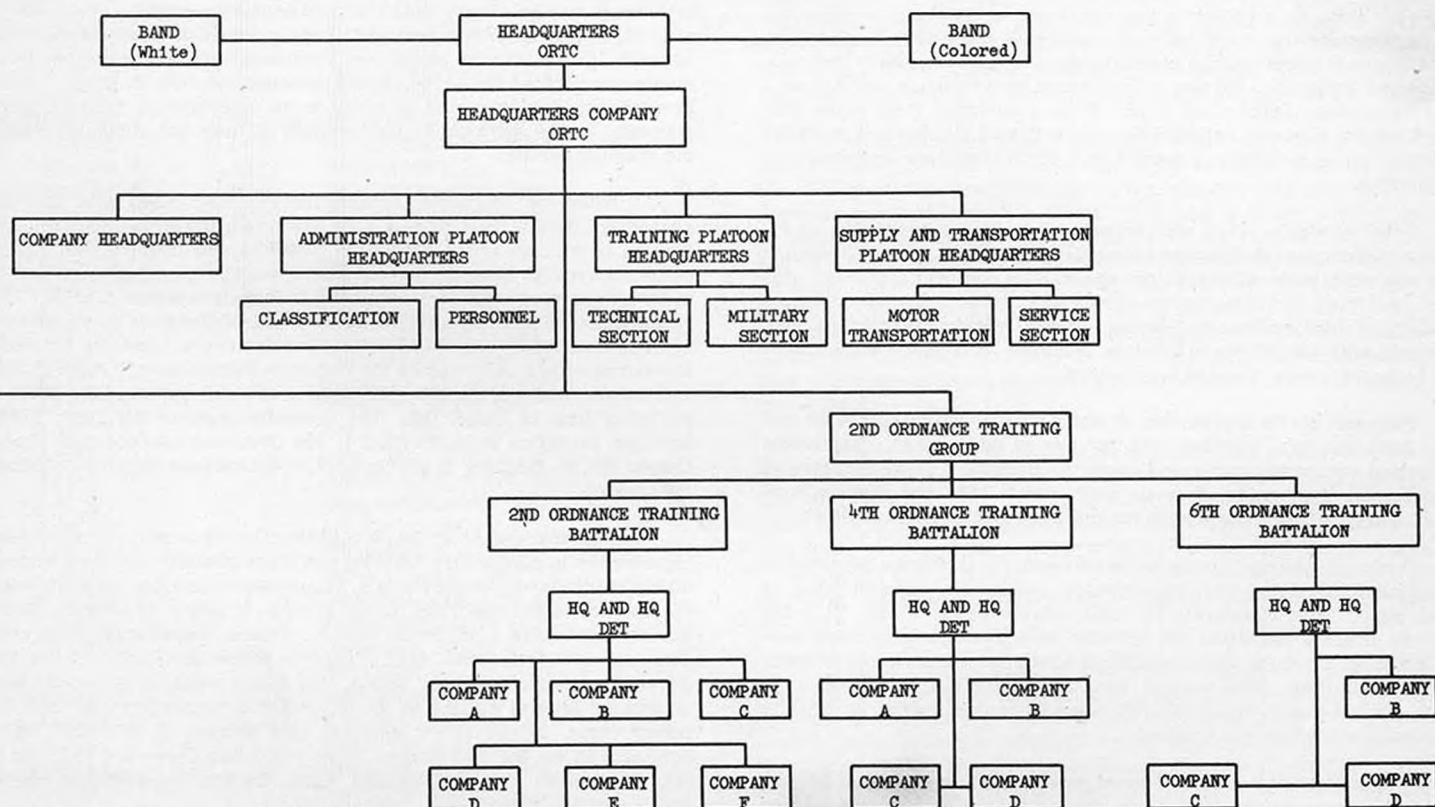
Although lecture, as such, may be improved on immeasurably by the use of training aids, it is still the least effective method of training. For this reason the Replacement Center has always followed the principle that, wherever possible, demonstration and application must be used, to the extent that more than 75% of the training time is devoted to these types of instruction.

Considerable change has taken place in our understanding of what is meant by an ordnance replacement. At the inception of the Replacement Training Center it was decided that the ordnance replacement would have Basic Training plus the rudiments of some specialty, so that he could take his place in an organization in the field as a helper, and later become a technician. Force of circumstances has, from time to time, altered this ideal. On many occasions, men are sent from the Ordnance Replacement Training Center into newly activated organizations. In this way they serve both as cadre and replacements. Very often graduates of the Replacement Training Center are used as cadre in newly activated organizations formed mostly of basic recruits. These conditions have caused an intensification of specialist training in the Ordnance Replacement Training Center.

The ordnance replacement, therefore, must be considerably more than merely a helper when he is graduated from the course of training. He must have a well-grounded knowledge of some technical specialty and a certain degree of leadership.

In addition, he must have something which does not pertain directly to ordnance technical knowledge but will certainly be an important factor during combat — the ordnance replacement must be a well-trained soldier. Since the days of the last war, the entire method of combat has changed, with the result that the ordnance soldier is no longer a non-combatant. He must do his share of scouting, sniping, camouflage, and furnish much of his own individual security. To this end the replacement is given a very thorough Basic Training, which begins as soon as he enters camp and continues even during his period of technical training.

It is the mission of the Replacement Center, then, to produce the very timber and fibre of ordnance troops, and to do it in a period of thirteen weeks. The task is a tremendous one and its importance to the army is immediately evident. The task is being accomplished and the results, represented by the thousands of trained men, will speak for themselves.



The Ordnance School

WHAT IT MEANS TO THE ENLISTED MAN

by GEORGE W. OUTLAND

Colonel, Ordnance Department

FORMERLY COMMANDANT, THE ORDNANCE SCHOOL

The Ordnance soldier is a member of one of the oldest professions in the military service. Long before the advent of gunpowder he played an important part in supplying and maintaining such equipment as crossbows, ballistas and catapults. He was a craftsman, an artisan, a smithy, or a worker in metals, leather and wood. When gunpowder first came into military use the men who supplied the ammunition and made and serviced the weapons were members of a guild who preserved their knowledge as trade secrets.

Prior to World War I maintenance of Ordnance equipment in the hands of combat organizations was accomplished by small units of Ordnance specialists, supplemented by civilians and enlisted company or battery mechanics. All work of a complicated nature was performed at an Ordnance arsenal, by civilian craftsmen. During the war Ordnance companies were formed and, with operations in foreign countries, base shops were established using Ordnance enlisted technicians.

This was the first great war in which mechanization played an important part and this, together with the use of much more complicated weapons and equipment, made necessary the training of large numbers of skilled soldier mechanics. Schools were established and thousands of soldiers were trained in Ordnance maintenance and supply activities.

During the years of peace which followed, the Ordnance Department used ammunition, depot and maintenance companies, supplemented by civilian technicians, to operate its field service installations. In order to provide training facilities for enlisted men to supplement organizational training, a school was established where men were given courses in many specialties. The normal courses of training required nine months, and students graduated with a considerable degree of skill in the subjects which they had studied.

The present war has introduced many added complications to the training program. In the first place, the student is no longer a soldier

with from one to twenty years of active service behind him. He is a recruit, received from a reception center, with but a few days of active service. In the second place, our implements of war have become so highly complicated that technicians are needed not only in proportionately greater numbers, but also in many more specialties than heretofore planned. In the third place, the element of time has seriously reduced the training period.

When the Ordnance Department was confronted with the added responsibilities of training men to be soldiers in the large numbers necessary to service an army of millions of men, a new training technique became necessary. Many of the "old guard" might remark that the training of Ordnance personnel to be soldiers is largely a waste of time. Those responsible for training policies, however, wisely foresaw the vulnerability of Ordnance supply and maintenance installations to attack by aircraft or air-borne troops. As a result, the Ordnance Replacement Training Center was established to train men during their first thirteen weeks. Since this period of time is longer than that normally required for basic military training, facilities were provided in the Ordnance Replacement Training Center for the training of apprentices in the various technical Ordnance specialties.

This training program released the Ordnance school from conducting courses in elementary training and made possible the development of highly specialized courses for men who possess some limited knowledge of the subject before reporting to the school. In order to provide courses that would require a minimum amount of time, the courses were broken down into several parts, each complete within the limits of the items covered. A man may thus spend only a few weeks in a special engine course, or several months on the various courses covering all tank component parts. Where there were but nine courses of specialist training available to the enlisted student three years ago, there are today no less than fifty-seven courses available within the training activities operated under the direction of The Ordnance School.



In order to avoid expanding the training facilities at Aberdeen Proving Ground beyond the twenty-six thousand capacity now provided, and also to utilize many existing training facilities at manufacturing plants and civilian institutions, a number of branch schools were established. These branch and affiliated schools are discussed in another article in this issue.

While the Ordnance School conducts ten different courses of training for officers, the supply of available officers from the National Guard and Organized Reserves was too small to meet our mobilization needs. The Officer Candidate School was consequently established with a training capacity of about thirty-five hundred students. Two hundred and seventy specially selected enlisted men enter this school each week and those graduating at the end of the thirteen-week course are commissioned as second lieutenants in the Ordnance Department.

The additional courses of instruction available for enlisted men at the Ordnance School are as follows:

Course No.	Course
Arty 101	Light Artillery
Arty 201	AA Artillery
Arty 301	Heavy Artillery
Shop 101	Advanced Machinists
Shop 201 A	Welding (Gas)
Shop 201 B	Welding (Electric Arc)
Shop 201 C	Welding (Armor Plate)
Shop 301	Blacksmiths
Auto 211	Radiator Repair
Auto 310	Tank Accessories
Auto 401	Tractors, General
Auto 335	Tank Engines (Diesel)
Auto 330	Tank Engines (Gasoline)
AAFC 110	Directors, M4 & M7
AAFC 210	Directors, M5 & M6
AAFC 310	Remote Control M2
AAFC 410	Data Transmission System M4
AAFC 510	Remote Control System M1
S.A. 101	Hand and Shoulder Weapons
Auto 130	Air Fuel Systems
Auto 220	Wheel Veh & 1/2 Track C & P.T.
Auto 301	Tanks, General Adv.
Auto 320	Tank Hull, Susp Sys. & P.T.
I.R. 100	Instrument Repair A
I.R. 200	Instrument Repair B
Mun. 101	Munitions, N.C.O.
Auto 120	Auto Electricity
Auto 110	Wrecker Operation
Auto 201	Wheel Veh & 1/2 Track Adv.
Auto 210	Wheel Veh & 1/2 Track Eng. Int.
S.A. 201	Machine Guns

The term mechanized warfare has come into popular use during the past few years. It is only natural that a nation with our tremendous industrial resources would develop the most highly mechanized army that has ever been mobilized in the history of the world. Hand in hand with this mechanization there must be supplied the skilled mechanics necessary to keep this complicated equipment in condition for combat. Our Ordnance companies must have the most highly skilled soldier mechanics who have ever been assembled together and trained for duty with combat forces.

The Ordnance School is today the fountain head of Ordnance training technique. Hand in hand with the other institutions of learning under the direction of the Military Training Division it is processing men through its courses at the maximum rate possible. Unfortunately about fifteen per cent of the students are unable to complete the prescribed courses of training in a satisfactory manner. This is more often due to the fact that the student does not possess the necessary educational background rather than a lack of interest on the part of the student.

Through the medium of THE ORDNANCE SERGEANT the school disseminates to the field the latest doctrines and technique applied to maintenance and supply problems. By a careful reading of the articles appearing therein the enlisted man may not only gain new knowledge, but also keep in touch with the constantly changing problems we will face as our combat technique is modified as a result of experience.

The Ordnance soldiers who become the mainstays of this maintenance enterprise will be those who possess the greater knowledge and the ability to use it effectively. They are the ones who will reap the greatest rewards for their efforts. The aim of every soldier mechanic or Ordnance specialist must therefore be the acquisition of as much knowledge as possible. This can be obtained only by training and experience. The soldier who is given the privilege of taking a course of training at The Ordnance School is therefore indeed fortunate. He should take advantage of this opportunity by applying himself to the utmost. That this is the rule is illustrated by the fact that a large percentage of students take advantage of the arrangements provided for additional voluntary training at night.

There is another advantage obtained by such training that is not being overlooked by students, and that is the value of such training after the war is won and they return to civilian occupations. Not only are many men learning trades who have never before been skilled mechanics, but also many who have been working at skilled trades find that the instruction available at The Ordnance School provides knowledge far beyond that normally obtained while employed on production work in commercial plants.

The Ordnance School is thus an institution of specialization, designed to provide training wherever specialized knowledge is needed in meeting the supply and maintenance responsibilities of the Ordnance Department. Whenever changes can be made to further improve this training program, The Ordnance School, like its publication THE ORDNANCE SERGEANT, is not only willing but eager to find the better way.

Classification

-ITS IMPORTANCE TO THE ORDNANCE TRAINING PROGRAM

by **ROBERT E. McQUISTON, Capt., A.G.D.**
with
RICHARD SEGCEL, Tech. Sgt., Ord. Dept.

The management of a modern army involves a continuous process of selection, placement, and replacement of manpower. Classification at reception and training centers constitutes merely the initial stages of this process.

For example when a group of Ordnance soldiers from the Ordnance Replacement Training Center arrive at their field posts, they must be assigned to specific military duties. This should, of course, be done with careful consideration given to individual qualifications of each man, particularly the military specialties for which they were trained at O.R.T.C. In the case of Ordnance requirements and battalions, the process also requires assignments in accordance with the specialized needs of constituent units, with due regard for the general desirability of a roughly proportionate distribution of mental abilities. All of this involves the interpretation of classification data on the Soldier's Qualification Card WD, AGO (Form 20). (See pages 4 and 5 of this issue.)

WD, AGO forms No. 20 are available at all times to unit commanders for their information concerning the individual qualifications of the soldiers of their command. Men must be selected for officer training, cadre and for special service schools. On occasion they will be chosen for special missions, and to perform special services. Perhaps a photolithographer or someone who can operate a radio and speak Russian will be needed. Or perhaps some prisoners will be captured requiring the services of an interpreter. Possibly in some post far away from organized forms of recreation, the commander will want to arrange an entertainment program and therefore casts about for talent to put on a show. These are some of the needs which can be supplied quickly and comprehensively by recourse to a simple sorting and examination of the Form 20's.

Now let us suppose that the table of organization calls for certain additional specialists not on hand. They must therefore be requisitioned from the Office of Chief of Ordnance. This should be done according to the specification serial numbers established for each specialty by classification regulations (AR 615-26). Consider the grim problem in the combat zone of determining the casualties and the resulting loss in skills. Suitable filler replacements must then be requisitioned by specification serial number of the special training required. The fate of modern armies often depends upon the caliber of its replacements and the ability to obtain them in the right place at the right time. Classification, through its qualification record system, is designed to facilitate this process.

However, to be of use the qualification record must be properly maintained, for it is designed to be a cumulative record of the individual soldier's progress in his military career and, as such, to afford a composite picture of both his civilian and military qualifications. It follows the individual soldier wherever he goes, and, in addition, it should follow him in whatever he does. For example, the Classification Section of the

Ordnance School is charged with the responsibility of following the careers of some 7,000 enlisted men at the School, including students, officer candidates, members of the staff and faculty, and replacement pool men. It is the Section's job to make the training and grades, the experience and skills they acquire at the School a matter of record, to set forth this training and experience as part of their qualifications for the information of all commands to which they may be assigned.

In order to simplify this information, to make it easily understood and readily sortable, each course the enlisted man may take and each principal duty to which he may be assigned is analyzed to determine the proper classification and specification serial number for entry on the Form 20. For instance, upon successful completion of courses in the Ordnance School, men are transferred to their next station as "Instrument Repairmen, Fire Control" (Spec. Serial Number 922), "Tank Mechanic, Suspension and Power Train" (Spec. Serial Number 908), "Ammunition-Noncommissioned Officer" (Spec. Ser. No. 505) and etc. In the same way after 3 months on the job, the Noncommissioned Officer in charge of the morning reports Section of the personnel section becomes a "Personnel Noncommissioned Officer" (Spec. Ser. No. 816), and the soldier who is in charge of the tool room at the Machine Shop becomes a "Toolroom Keeper" (Spec. Ser. No. 242). This is noted on the Form 20 of each and is punched in the military specialty code field on its perimeter, according to the specification serial number, thus permitting ready selection of those trained in any given specialty at a moment's notice.

The classification data set forth on the Form 20's of those at the Ordnance School is continually being revised by the Classification Section. In some cases re-interviews or retests, or both, are found necessary to obtain more accurate and comprehensive information, often resulting in a reclassification. At present stock inventories are being taken of the Ordnance School enlisted staff and faculty as well as the School Colored Detachment by main occupation, military specialty, education, classification and aptitude test grades, and other classification data as compared to current assignments. This affords a composite picture of abilities as compared to the way in which these abilities are being utilized. Through such inventories, important hidden talent has been uncovered from the obscurity of a "bull gang", and put to work in sections or units in which such talent is badly needed. It is the job of classification to assist in discovering the misassignments, the "occupational casualties" which frequently occur in the processing of large numbers of men. Continual vigilance should be exercised in order to insure that the most is being obtained from available human resources through full utilization of their skills and aptitudes.

Of utmost importance is the caliber of men selected to attend enlisted or officer training courses at the Ordnance School. Men should be selected for these courses according to their individual abilities to absorb the instruction for which they are selected. The Form 20, in addition to a personal interview and actual supervision on the job, is invaluable for this purpose. To ascertain the quality of the selection job being done by individual units, the Form 20 of each entering student is studied with reference to the academic and practical requirements of the particular course for which he has been selected. As a direct corollary to this activity, statistical analyses are being made of the successful as against

NOTE: DO NOT ATTEMPT TO FILL OUT THIS CARD WITHOUT FIRST BECOMING FAMILIAR WITH AR 605-90

(18) - (c) MARITAL STATUS AND DEPENDENTS:		SINGLE		MARRIED		DIVORCED		WIDOWER		NUMBER OF DEPENDENTS (OTHER THAN WIFE)		None	
(20) LEGAL RESIDENCE:		No. & STREET		26 Hayworth Place		CITY		Portland		STATE		Oregon	
(21) EMERGENCY ADDRESS:		NAME		Mrs. Mary S. Quinn		STREET ADDRESS		26 Hayworth Place		CITY		Portland	
(22) SCHOOL		NAME OF INSTITUTION		Portland, Oregon		CITY		Portland		STATE		Oregon	
(23) COLLEGE OR UNIVERSITY		NAME OF INSTITUTION		San Jose State Coll., Calif.		CITY		San Jose		STATE		California	
(24) POST GRADUATE		NAME OF INSTITUTION				CITY				STATE			
(25) TESTS		DATE		SCORE		TEST		DATE		SCORE		TEST	
H-1		9-3-42		F.131									
(26) PARTICIPATING SPORTS		DATE		SCORE		TEST		DATE		SCORE		TEST	
1. BOXING													
2. SOFT BALL													
(27) HOBIES		DATE		SCORE		TEST		DATE		SCORE		TEST	
1. MAP MAKING													
2. FOREMAN, WAREHOUSE													
(28) - (c) PRIMARY		NAME		R.E. McQuiston, 1st Lt. AGO		CITY		Portland		STATE		Oregon	
(29) - (c) SECONDARY		NAME		J. E. McQuiston		CITY		Portland		STATE		Oregon	
(30) REMARKS:		(a) Records and dealt with express and freight bus. Was in, Ord, 14 yrs. Steer record clerk Tmcs, Chief storekeeper & mgr. (T/56) in Hawaiian Dept. Was grad. Ord. A.G.S., A.G.S., MA, 4-5-42.											

AR 605-90 (Rev. 10-1-41)

IMPORTANT - UNDER NO CIRCUMSTANCES WILL THIS CARD BE FOLDED, ROLLED OR CREASED

PRINT NAME AND ADDRESS OF INTERVIEWING OFFICER

[illegible]

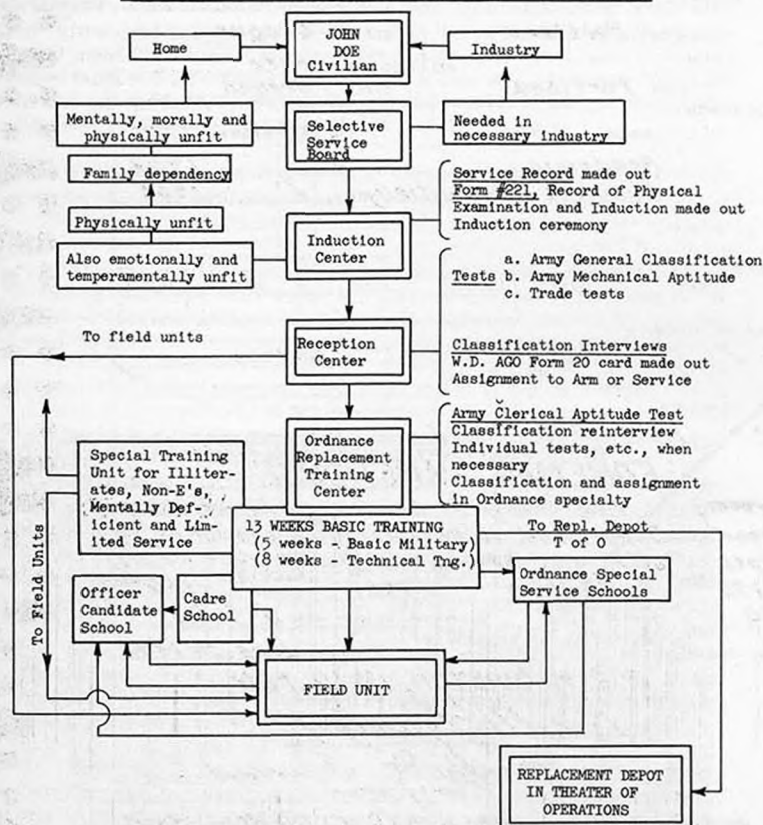
the unsuccessful students and officer candidates in order to determine what, if any, minimum admission standards may be established which, if established, would eliminate most of those who fail and yet not eliminate any appreciable number of those who would otherwise pass. Through such analyses of past experience, the possession or lack of certain qualifications are being found to indicate for the students probable success or failure in the courses at The Ordnance School. The idea is to establish definite standards by which the field may be guided in selecting future Ordnance N.C.O.'s and officers.

But personnel classification is not alone concerned with the classification of men for specialist training and assignments. It is also concerned, and in an increasing degree, with the ever growing number of men now entering the Army who are fit only for limited service because of physical, mental, or emotional limitations. The Army's need for manpower is urgent. It will not discharge anyone who can be trained to become more of a help than a burden to the service. In order to make maximum use of the large numbers of limited service men now entering the Ordnance Department, a special training unit has been established in the O.R.T.C. at Aberdeen. It has as its object the individual development and, in some cases, the actual rehabilitation of the limited service soldier to a point of military usefulness. The training, conducted by a specially trained group of officers and cadre is adapted to the characteristics of the individual case. In general, four broad categories of men are referred to the special training unit - namely: those who because of physical handicaps cannot take part in the activities of the regular training companies, those who are mentally deficient, those of satisfactory mental intelligence versed in the English language, and those who are emotionally or psychologically maladjusted. Accurate classification is essential to the determination of the particular training methods applicable in the individual case and the type of work in which the individual may be placed to advantage.

Classification for limited service because of physical handicaps is, of course, the function of the medical authorities. However, it is the job of the personnel classification unit to make sure that such men are placed in work of a type consonant with their limited physical capacities. Usually they will be assigned to the special training unit for limited military training and then to duties at an overhead installation not requiring much physical exertion. They can thus be used to release the able bodied now doing such work for active duty in the field.

FROM CIVILIAN TO SOLDIER

SCREENING AND TRAINING OF ORDNANCE ENLISTED PERSONNEL



On the basis of Army General Classification Test results, 8 to 10 percent of those now entering the Army are determined to be mentally inferior, illiterate or unable to read the English language. Ordnance is receiving a proportionate share of this group. It is the function of the O.R.

T.C. Classification Section to screen out these and non-English cases for special training. Men coming into the O.R.T.C. who tested in the lowest group on the Army General Classification Test, with the exception of the non-English cases, are given an individual general aptitude test to identify further their mental capacity. At the same time they are re-interviewed and, in some cases, are also given a simple identification and memory test. Upon the basis of these individual tests and reinterviews, recommendations are made for assignment to the special training unit. Those in the non-English category are given a group non-language classification test to establish their actual native ability to learn. These are recommended to the special training unit for instruction in the English language.

Those in the mentally deficient classification constitute a difficult placement problem. However, it has been found that, after a period of special training sufficient to enable them to understand simple orders and to instill in them a certain amount of self-confidence, they will work well in routine, repetitive work of a type likely to irritate the more imaginative soldier. Some may even be assigned to the field, although care must be taken not to place too many in any one unit. Such cases should be brought to the attention of unit commanders. Commanders should know what, if any, of the men of their commands are in this category, in order to place them in work commensurate with their strictly limited abilities.

It is to be expected that among the masses of men now entering the Army there will be some with tendencies to emotional instability, inner conflict, strong inferiority complex, etc. Particularly are such tendencies likely to be accentuated in the process of attempting to make adjustment from civilian to military life. The Classification Officers of all headquarters with the aid of personal consultants, who are specially trained in psychology, must be ever on the alert for the occurrence of any case in which abnormal psychological factors are operating or any case involving unusual personality traits. These cases must be singled out for special consideration, testing, and study.

In some cases the solution may be found in reassignment to a different job or to different surroundings, or possibly to special training. In others the trouble may be found to arise as result of some soluble private problem. Still others may admit of no ready solution, but will require close supervision and follow-up. At all times in the assignment of men to training and duties an effort is made to take a sympathetic view of the individual. Always it is directed toward making him the best soldier possible. In the abnormal as well as the normal case, the Army recognizes through its classification system the importance of the individuality of the soldier in molding a winning combination.

An interesting new development was the inauguration in May, 1942, of a system of officers and warrant officers classification (See AR 605-90, issued May 21, 1942). The uniform record instituted for the purpose was the Officer's and Warrant Officer's Qualification Card (W.D., A.G.O. Form No. 66-1) a record very similar to the W.D., A.G.O. Form No. 20. However it also provides for information concerning promotions, entry on extended active duty, World War and C.C.C. military service, and each principal duty together with an efficiency rating by superior officers. It is designed to be a service rating record as well as a general qualification card.

W.D., A.G.O. Forms No. 66-1 are prepared by the classification Section of the Ordnance School, for all School Staff and Faculty Officers and Company Officers, Officers reporting for active duty either to the Officers Replacement Pool or the Ordnance School, and all officer candidates upon graduation. Classification is accomplished by means of interviews or questionnaires or both and, in the case of officer candidates, with reference to Form No. 20 already completed for them as enlisted men. The interview and classification procedure as well as that prescribed for making the entries on and punching the form are very similar to that prescribed for the Form No. 20.

The Warrant Officers and Officers qualification card (Form No. 66-1) represents a substantial advance in the management of officer personnel in the field. Prior to its institution, the only records worthy of the name were temporary forms completed by the officers themselves and sent in to the Corps Area or the War Department. The only source of information for the commanding officer in the field with regard to officers of his command was the 201 file, which started anew at each post. No experience and education, his dates of promotion, his previous military experience, the type and quality of the work he did at previous posts, etc. was available. The Form No. 66-1 is designed to meet this need. Not only will it facilitate sound selection and assignments but it will constitute a basis for promotions based on merit as determined by service ratings, thus enhancing general efficiency and esprit de corps.

The extension of classification procedure to apply to officers is indicative of the growing recognition throughout the army of the fact

(Continued on page 54)



Under adverse conditions

Two years is not a long time under ordinary conditions and the changes which they bring are not dramatic, but when the years cover a period of transition such as the world is undergoing at the present time, they produce changes which even those who have a hand in them find amazing. The Ordnance School has undergone such changes, and the growth has not been painless, but instead has been accompanied by an appropriate number of growing pains.

In September, 1940, the Ordnance School was just getting settled after having moved from Raritan Arsenal late in July. Three stone buildings housed its personnel, classrooms, and administrative offices, but even then plans were under way to erect a shop building to accommodate students within the School Area, rather than up on the Proving Ground. The first signs of expansion were beginning to show themselves.

During this time of gradual awakening, there was born an idea, based on the chaotic state of world conditions, which soon blossomed as the Ordnance Replacement Training Center, and having as one of its prime objectives an enlarged Ordnance School. Now the scenery changed rapidly. First the surveyors, tramping through the mud and slush, laying out the areas that had been planned under the direction of Colonel George W. Outland. Then the bull-dozer clearing the land, scraping, leveling, and working under adverse winter conditions. And then finally, the forms for the concrete piles suddenly dotted the barren ground like mushrooms. Floors, sidewalks, and roofs appeared over-night, and the appearance was that of a "Boom-Town". No longer were all the classrooms in one central building. The Machine Shop was finished, and down from the Proving Ground came the Artillery Section, the Machine and Carpenter Shops. The Ordnance School had reached the toddling stage in its physical growth; it was looking for farther horizons — that time when it would be training thousands of students, not a few hundred. But more buildings were needed. No sooner did a section move into a new area when more students arrived and the facilities immediately became too small. It was a vicious circle — students, more buildings; more buildings, more students — war looked closer, training had to be expanded, and another one-thousand-man area had to be constructed. Developments showed that not only was expansion of present training necessary, but new courses must be added. The answer? More buildings to handle the new courses; new shops, more classrooms. The Automotive Shop had long since outgrown its space, a new building was necessary. Tanks were playing a major part in the war? All right, that means we'll have to repair more of them. Welding course must be expanded? We can't handle them in that small space. And another shop is added. The war was showing new trends? The Ordnance School must not only follow but anticipate such trends. A huge army of many millions? They'll have more weapons, new weapons — that means we need a small arms building to teach more men to repair them. Always there must be expansion, and time is short.

But by October, 1941, the big surge was passed. Barracks to house the expected quotas of students were available; shops, while not as extensive as desired, were sufficient to carry out the mission, and it appeared that the physical organization of the School was almost completed. But December 7 was still in the offing when that conjecture was made. When war was declared, the whole process started over again. However, the quantity was less and the organization of the school was functioning

TO MEET Increased Demands

by R. B. BRAID, Capt., Ord. Dept.

smoothly enough to assimilate the new demands more efficiently. The personnel of the School, by this time well versed in the art of moving, settled down into new quarters with little loss of time.

At the present writing, the three stone buildings are still standing, but filling the once-vacant land behind them are more than 100 barracks, and 50 shops and classroom buildings. This has been the answer of The Ordnance Department to the demand for increased training facilities.

Expansion of housing, however, was done with only one objective in mind — to accommodate the students, and it wasn't long before they arrived. In September of 1940, enlisted students approximated the grand total of 200, officer students numbered about 50, and Officer Candidates were still a figment of someone's imagination. On the first of February, 1941, the First Provisional Ordnance Training Company was formed as a School company to administer to the new quota of enlisted students arriving on that date. During the following months, more Provisional Companies were formed as the need arose, which was frequently, until the total rose to 7. Since these companies numbered 250 men, the aggregate total of students was a far cry from the 200 of a few short months before. True, the courses were shortened, thus allowing the entrance of more men, but the number was far in excess of the normal expectation.

In such a manner then, did the Ordnance Department and the Ordnance School accept their responsibilities toward training this increased army.

Officer students, too, showed a large percentage increase. From the original 50 in September 1940, the figure rose gradually to approximately 300. New courses were added as reports showed them to be needed — a Basic Military Course for officers commissioned directly

The Ordnance School early in 1941





The Ordnance School about the middle of 1942

from civilian life — special courses for officers in particular jobs — and many others as the need arose.

But the group showing the largest increase — the Ordnance Officers' Candidate Course — dwarfed all others by comparison. In July 1941, the first class of 50 arrived at the Ordnance School. Rumor had it then that this figure was to be greatly enlarged — possibly 150 taking the three months' course at one time — somebody said he heard there would be one thousand! But contrary to usual procedure, rumor under-estimated the situation. The next class was 100 strong, but from then on the figure rose rapidly. Past 1,000, past 2,000, past 3,000, and there it staggered to a puffing halt. Now it can be seen why shop and housing facilities had to be expanded so greatly — the 6000% increase in Officer Candidates alone would have necessitated considerable expansion.

But if enlarging the physical components of the school was a difficult job, training of instructor personnel and overhead was equally difficult. To instruct hundreds of students is a far cry from instructing thousands, and to indoctrinate instructors is a tremendous job. To further complicate the situation, the expansion occurred so quickly that new instructors often were put in charge of classes immediately upon their graduation from the course, and they found themselves in the unenviable position of struggling to keep one day ahead of their students. But the process of weeding out instructors was facilitated by this handicap, oddly enough, for those who couldn't stand the pace were quickly weeded out.

However, it was still necessary to properly train instructors for the vital position which they held, so, a course in Instructional Methods was instituted to train all officer and enlisted instructor personnel.

This, undoubtedly, was responsible for a great advancement in the quality of instruction at the School, and at the present time is not only given to all instructors but also included as an integral part of the Officer Candidate Course. With this assistance, however, it was still necessary for instructors to spend many of their "leisure" hours assimilating as much knowledge of their subject as possible, in an effort to keep the quality of their instruction on a high level.

In keeping with the increase in instructor personnel was the necessity for training staff personnel such as company commanders, company officers, administrative officers, and the like. With men coming from civilian life directly into the Army, and their consequent lack of military background, a company commander had a job which required delicate, yet firm handling. With a basis of one permanent company, the 40th Ordnance Company (Tng.) the Ordnance School has expanded to the point where it now numbers 22 companies, and a colored detachment, and the 40th Ordnance Company alone has a strength of approximately 1400 enlisted men. First sergeant, supply sergeants, and clerks all had to be found and trained, and many were the company commanders and supply sergeants who stayed up late trying to find a shortage in blankets or footlockers, and many were the company commanders and first ser-

geants who searched for that missing ration. But, as in the case of the instructors, the experience came the hard way, and only the best survived.

The administration personnel such as personnel clerks, cooks, and supply personnel all had to be trained from the ground up and, for the former, there was no such thing as a 6-day week.

The turn-over in a school is so great and so continuous that personnel work is one of the largest jobs, and here, as in other spots the number of trained personnel was sadly inadequate to handle the situation. The same situation existed with regard to cooks. From one mess, which fed as high as 500 men, it was necessary to expand to 7 messes feeding 8,000. The number of cooks had to be increased from 5 to 175, and experienced cooks are not the easiest men in the world to find. Some came from the Bakers & Cooks School, but experienced cooks who can satisfy Private Jones' tastes are not made in a few weeks, or even a few months — and Private Jones doesn't hide his reactions toward a poorly cooked meal. But Private Jones survived and the cooks gained experience, and the mess situation was settled.

The supply men faced similar difficulties with the added responsibility of possible payment for loss of any of their equipment. This may have been the reason for their gaining experience so quickly, because the volume of materiel coming into the school was tremendous and mistakes were costly.

And so we come to January of 1943, a new year with new problems and great events. The products of the school will continue to make their weight felt on the Axis, and the Ordnance School personnel who faced such difficulties in instructing students will find their reward for accomplishment in the efforts of these students. The worst part of the initial struggle in expanding the school is passed; the long hours of trying to learn the basic fundamentals of a job are a thing of the past. Now we can concentrate on teaching and doing the myriad number of jobs with a certain assurance that they are being done correctly. While the personnel of the school is ever-changing, still the process is slow compared with the tremendous influx that once occurred. Now new instructors can be indoctrinated in a more orderly manner; new administrative personnel can learn the rudiments of their job before such time as they must take over the responsibilities. Cadres of the various companies, supply personnel, and personnel clerks have gained the experience so necessary to enable them to do their tremendous job, and this is fortunate, because the amount of work is ever-increasing. Knowledge is power, and together with experience derived from painstaking hardship, makes a combination that cannot be beaten, whether it be in battle or in organizing a school.

Those are the two years of the Ordnance School — two years of effort, trial and disappointing reversals. But the two years were easy years if their results are good — and the records of the thousands of students, officers, officer candidates, and enlisted men, give credit to the excellence of its training. From the performances of these students the Staff and Faculty of the Ordnance School derive satisfaction as a reward for their two concentrated years of endeavor.

TRADES *Adapted to* DEFENSE

American industry is contributing a major share toward eventual victory. All of us are familiar with the tremendous production that industry has shouldered. Newspapers and magazines portray the mass of material that is turned out daily -- tanks, armored cars, guns, ammunition, and a multitude of other major items.

On another and less publicized front, Industry is also contributing its facilities and experienced personnel. Ordnance troops are being trained at the factories and trade schools for the important task of maintenance and repair of Industry's products. This training program is no small scale affair -- thousands of soldiers are being and have been trained. During 1942, the number of courses offered and the number of schools were increased many times. The addition of all these schools and the addition of all the instructing staffs has made the Ordnance School one of the largest educational institutions in the Army.

Why has industry undertaken to teach the Ordnance soldier? There are several reasons. First of all Industry felt that time could be saved by using its plant facilities. Essentially there is little difference between a course of instruction offered at Aberdeen and one offered at Detroit, or other industrial areas. However, to handle a large group of men, new construction would have to be instituted at Aberdeen, while at Industrial organizations satisfactory facilities are on hand. The Army saw the sound reasoning in this plan and agreed to the idea.

Secondly, Industry felt that having the materiel on hand would save time and money. There would be no need of shipping tanks, guns,

or half-tracks to Aberdeen. Furthermore, those plants having proving facilities could provide the schools with typical maintenance problems.

Thirdly, Industry felt that Ordnance personnel could derive advantage from the experience of its skilled mechanics. In many cases this was true; in others, where the plant's peacetime product was altogether different from its wartime product, it was not immediately applicable. But a skilled mechanic is capable of applying certain knowledge and methods to any process, no matter how unfamiliar, and this application may be taught to Ordnance personnel.

Fourthly, Industry felt that having soldiers in its plants was a good morale factor and an incentive to increased production. This has been generally true and it is also true that there has been a beneficial effect on the Army personnel.

What are the courses like? In general, each plant in its school teaches the maintenance of its own product. Some schools teach only basic methods applicable to all products, but in general the schools are specialized. One industrial organization teaches maintenance of its guns; another, of its tanks. In all the schools the students are adequately housed and fed, usually by arrangement with hotels, YMCA's or the factories. Drill and calisthenics keep the men fit and soldierly.

Like all other projects undertaken by a rapidly expanding Army there have been difficulties inherent in the expansion. These are ironed out and the system is constantly being improved. Much valuable time has been saved, much valuable information has been disseminated, and many men have been well trained in a short time. This war is one of maintenance. When this war is won, American Industry will have contributed more than its share.

Affiliated Schools

by WILLIAM L. ROSSIE, Major, Ord. Dept.
Director of Training, Enlisted Division

The operation of these schools is authorized by the Chief of Ordnance. The Commandant of The Ordnance School is responsible for the coordination, conduct and supervision of the training program of each school. Principally, the courses offered at these schools are designed to train enlisted specialists for The Ordnance Department. However, many officers attend some of the schools. These schools, hereinafter briefly described, are known as Branch and Affiliated Sections of The Ordnance School and they function under the Enlisted Division of The Ordnance School.

The instructors in the Trade Schools are regularly employed by the State Departments of Education in the States where the schools are located. The Instructors at Factory Schools are regular employees of the factory and are trained especially for this type of instruction, and

these usually have been men who have had considerable experience with the Service and Maintenance Department of their respective firms.

On November 6, 1942, we had 2,294 students in Branch and Affiliated schools. Factory and Trade Schools are not new. Practically all large manufacturers have for years maintained a small school for training their own personnel on new equipment. The Trade Schools merely adapted the use of their training equipment and personnel to our training needs. The Factory Schools, in practically every case, are conducting training upon the Ordnance materiel that their factory is producing for The Ordnance Department. The advantages of these schools are many. First, instructors are rather permanent as they are older men and not likely to be inducted in active service. Second, these schools have on hand permanently or a flow of equipment or materiel with which to carry out the training program.

Third, the Factory Schools usually have access to use of spare parts, and new materiel, at all times. Fourth, the students have a chance at factory schools to come into contact with the engineers and technicians who are producing the material and are able to keep up with engineering changes, laboratory, field tests and other data. Fifth, the factories are vitally interested in doing their part to train soldiers in the proper use, care and maintenance of their product.

It is desired that the remainder of this article tell the story of training at the various sections of The Ordnance School by means of photographs showing students at work in their various shops on a variety of materiel. In addition, it is desirable to point out briefly the various sections of the schools and their location:

AKRON SECTION

Located at Firestone Rubber Company, Akron Ohio

Capacity of 50 students

2-week course on 40mm AA Gun & Carriage

Akron Section

Y.M.C.A. Building, 80 West Center Street, Akron, Ohio

Students should report to Officer-in-Charge

No Government Quarters and Messing are available.

Students must be paid IN ADVANCE the monetary allowances in lieu of rations and quarters in accordance with Paragraph 2a, Table II, AR 35-4520, as amended by WD Bul. #41 dated August 7, 1942.

Service records and allied papers should NOT be forwarded.

Round-trip tickets should be furnished IN ADVANCE to each student.

BLOOMINGTON SECTION

Located at Mid-West Motive Trade School, Bloomington, Illinois

Capacity 600 students

8-week course of instruction in Auto Mechanics

Bloomington Section

Midwest Motives Trades Institute, 220 East Grove Street, Bloomington, Illinois

Students should report to the Commanding Officer at the above address.

No Government Quarters and Messing are available.

Students must be paid IN ADVANCE the monetary allowances in lieu of rations and quarters in accordance with paragraph 2a, Table II, AR 35-4520, as amended by WD Bulletin #41, dated August 7, 1942.

Service Records and allied papers should be forwarded.

CLEVELAND SECTION

Located at White Motor Company, Cleveland, Ohio

Capacity 50 students

5-week course of instruction upon Half Track & Schut Cars

Cleveland Section

Quad Hall, 7500 Euclid Avenue, Cleveland, Ohio

Students should report to Officer-in-Charge at the above address.

No Government Quarters and Messing are available.

Students must be paid IN ADVANCE the monetary allowances in lieu of rations and quarters in accordance with paragraph 2a, Table II, AR 35-4520 as amended by WD Bulletin #41 dated August 7, 1942.

Service records and allied papers should not be forwarded.

Round-trip tickets should be furnished IN ADVANCE to each student.

DETROIT SECTION

Located at Chrysler and General Motors Corporation, Detroit, Michigan

Capacity 120 students

2-week course of instruction upon each of the following:

Chrysler Multibank Tank Engine

GMC Hydramatic Transmission

GMC 6 x 6 Truck

Chrysler Hull, Suspension & Power Train

Detroit Section

Headquarters, Detroit Tank Arsenal, Center Line, Michigan.

Students will report to Detroit Tank Arsenal or Hotel Detroit or as designated by special orders.

Students taking the Tank Arsenal courses will be furnished Government Quarters and Rations.

The provisions of AR 35-4520 which require indorsement on travel orders to show date last rationed, date of departure from old station and fact of payment of monetary allowance by disbursing officers will be strictly complied with by all concerned.

Letter, The Adjutant General's Office
December 9, 1942

Students taking the course at Continental, Ford, Hydramatic Transmission, 6 x 6 Truck course will not be furnished Government Quarters and Rations. Payment shall be made by the designated Finance Officer for the Detroit Section, in accordance with Paragraph 2a; AR 35-4520 as amended by WD Bulletin #41 dated August 7, 1942.

Service records and allied papers should be forwarded.

Round-trip tickets should be furnished IN ADVANCE to each student.

FLINT SECTION

Located at General Motors Institute, Flint, Michigan

Capacity 220 students

3-week course on Armor Plate Welding

5-week course on M-5 Tank Engine

3-week course on Diesel Twin Unit Tank Engine

2-week course on Diesel Series "71" Marine Engine

Flint Section

State Armory Building, 1101 Lewis Street, Flint, Michigan

Students should report to the Officer-in-Charge at the above address.

No Government Quarters and Messing are available.

Students must be paid IN ADVANCE the monetary allowances in lieu of rations and quarters in accordance with paragraph 2a, Table II, AR 35-4520, as amended by WD Bulletin #41, dated August 7, 1942.

Service records and allied papers should not be forwarded.

Round-trip tickets should be furnished IN ADVANCE to each student.

LANSING SECTION

Located at Oldsmobile Division of General Motors, Lansing, Michigan

Capacity 450 students

4-week course in Aircraft Armament

Lansing Section

Wells Hall, Michigan State College, East Lansing, Michigan

Students should report to the Officer-in-Charge at the above address.

No Government Quarters and Messing are available.

Students must be paid IN ADVANCE the monetary allowances in lieu of rations and quarters in accordance with paragraph 2a, Table II, AR 35-4520, as amended by WD Bulletin #41 dated August 7, 1942.

Service records and allied papers should not be forwarded.

Round-trip tickets should be furnished IN ADVANCE to each student.

PONTIAC SECTION

Located at Pontiac Division of General Motors, Pontiac, Michigan.

Capacity 50 students.

4-week course on 20mm AA (Oerlikon) Gun & Mount and 40mm AA Gun & Carriage

Pontiac Section

Oakland County Welfare Building, 1260 West Blvd., Pontiac Michigan

Students should report to the Officer-in-Charge at the above address.

No Government Quarters and Messing are available.

Students must be paid IN ADVANCE the monetary allowances in lieu of rations and quarters in accordance with paragraph 2a, Table II, AR 35-4520, as amended by WD Bulletin #41 dated August 7, 1942.

Service records and allied papers should not be forwarded.

Round-trip tickets should be furnished IN ADVANCE to each student.

SPRINGFIELD SECTION

Located at Springfield Trade School, Springfield, Mass.

Capacity 175 students

12-week course Machinists.

2-week course 37mm Remote Control System M1, Conducted at Gilbert & Parker Manufacturing Company

2-week course on Gyro Stabilizer & Power Turret Control conducted at Westinghouse Manufacturing Company.

Springfield Section

Y.M.C.A., 122 Chestnut Street, Springfield, Mass.

Students should report to the Commanding Officer at the above address.

No Government Quarters and Messing are available.

Gyro-stabilizer and Oil Gear students must be paid IN ADVANCE the monetary allowances in lieu of rations and quarters in accordance with paragraph 2a, Table II, AR 35-4520, as amended by WD Bulletin #41 dated August 7, 1942.

Machinist students will be authorized payment of monetary allowances in lieu of Quarters and Rations in accordance with Paragraph 2a, AR 35-4520, as amended; by Finance Officer, Springfield Armory, Springfield, Mass.

Service records and allied papers should not be forwarded for Gyro-stabilizer and Oil Gear students.

Service records and allied papers should be forwarded for Machinist students.

Round-trip tickets should be furnished IN ADVANCE to each Gyro-stabilizer and Oil Gear student.

Round-trip tickets should not be furnished to Machinist students.

There are other courses conducted at manufacturers' plants for a few men, also on Ordnance materiel, such as the Bell Laboratories, New York, N. Y.; Delco Remy Co., Anderson Indiana; Otis Elevator Company; Yonkers, New York; and Bausch & Lomb, Rochester, New York.



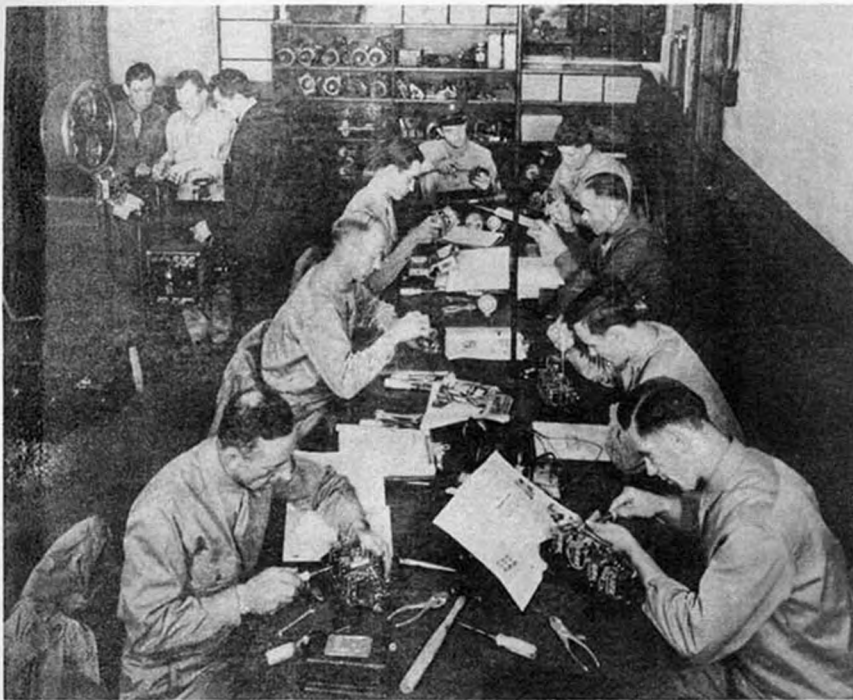
Students at the Cleveland Section receiving some interesting points on the White Transmission used in Army Scout Cars and Half Tracks



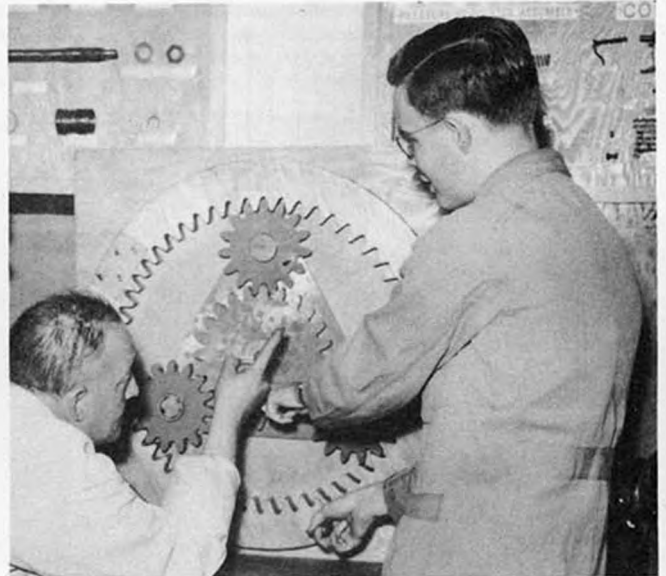
The day room at the Pontiac Section is furnished by patriotic organizations of Pontiac, Michigan

A Lansing Section shop scene showing students working on 37mm Automatic Guns at Oldsmobile Gun School at Lansing, Michigan





Shop scene at the Delco-Remy Electrical Equipment School at Anderson, Indiana. Students receive instruction on the many different types of electrical equipment manufactured by this establishment.



A large scale wooden model of a planetary gear train simplifies instruction at the Hydra-Matic Transmission School conducted by the Detroit Transmission Division, Detroit, Michigan.



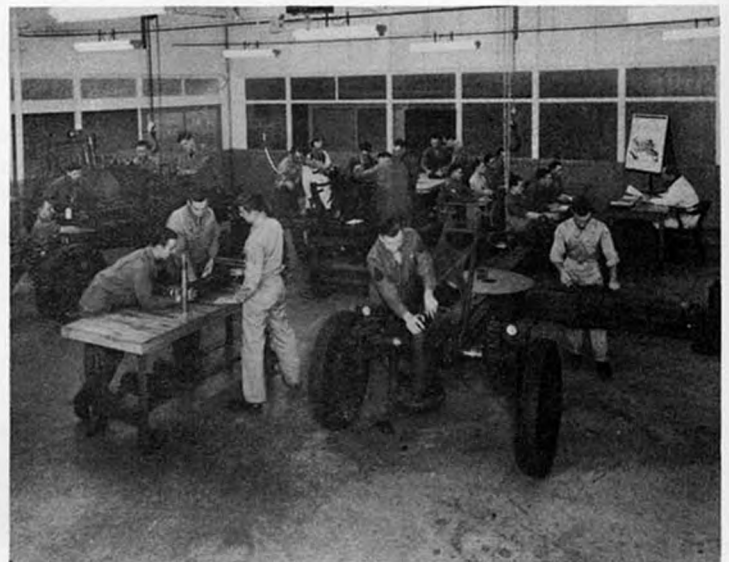
Students assembling engines and installing them in tank hulls at the Detroit Diesel Engine Division's Tank School held at General Motors Institute, Flint, Michigan

Students receive special instruction in assembly, alignment, and adjustment of front wheels at the Cleveland Section.



Students receive instruction on wheel alignment at the General Motors Truck School, Detroit, Michigan.

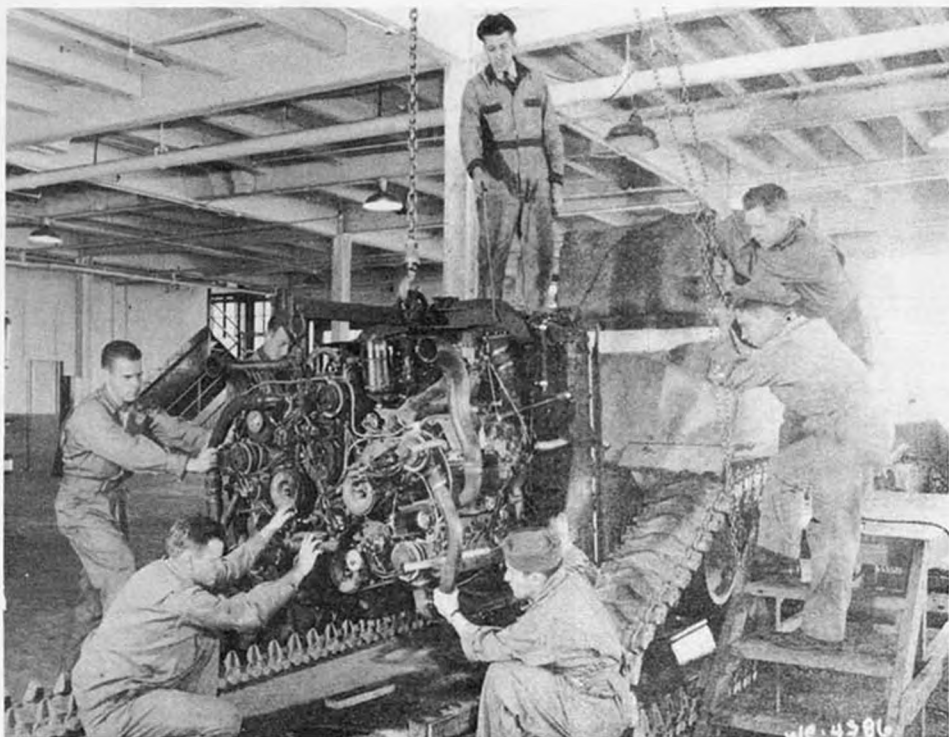
At the Pontiac Section it has been proven that plenty of equipment, working space and good lighting are essential to good work.





Above: At the Pontiac Section quarters like these are available for 150 students.

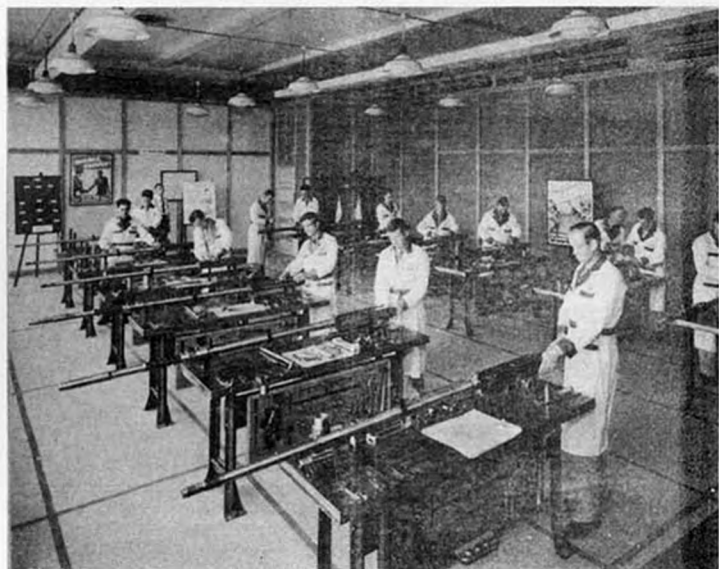
Right: At the Detroit Section students learn by actual experience the assembly, disassembly and adjustment of the Chrysler Multibank Tank Engine, in a school operated by the Chrysler Motor Company.



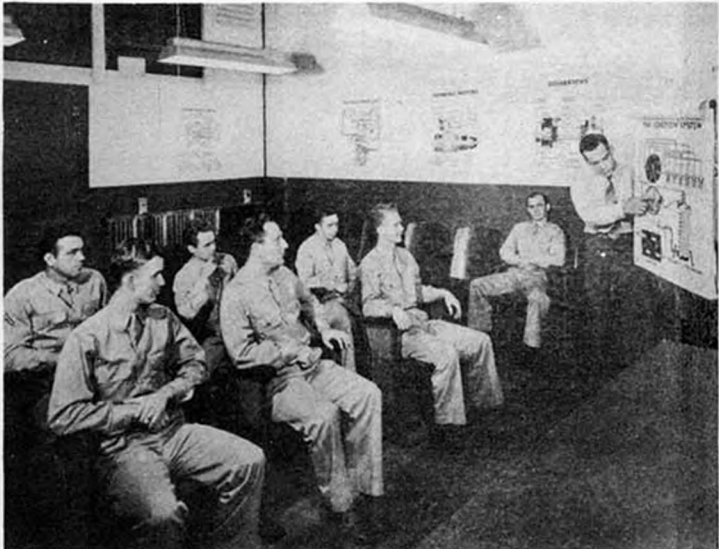
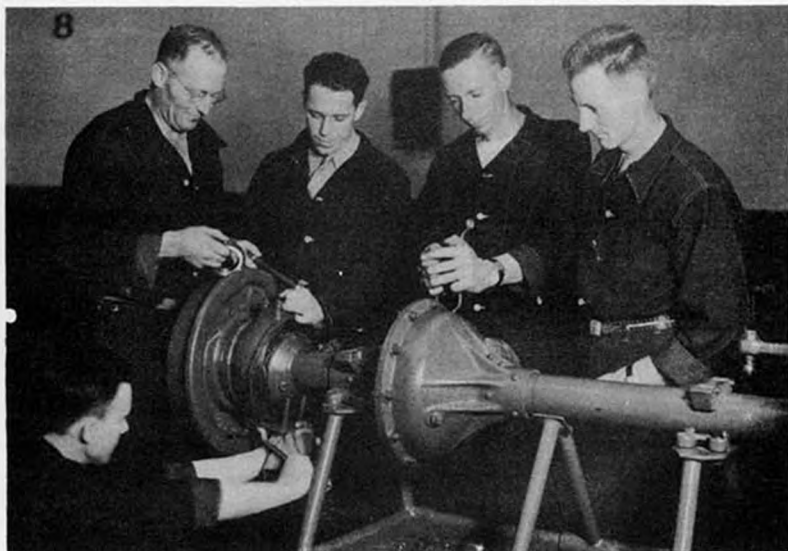
Above: At the Pontiac Section students assemble the Bofors AA Gun.

Right: At the Lansing Section every student has a gun to work on in the well equipped Oldsmobile Gun School. This scene shows students disassembling the 20mm automatic guns.

Below: At the Cleveland Section students learn to do the job correctly through the proper use of the proper tool for the job. They must get the "feeling" of doing the job right.



Below: Class room scene at Delco-Remy's Electrical Equipment School at Anderson, Indiana.



PHYSICAL FITNESS

ALL IMPORTANT IN AN ALL-OUT WAR

by G. H. STANTON, 2nd Lt., Ord. Dept.

Athletic Officer, The Ordnance School

People all over the world train intensively for all types of games and contests requiring physical fitness. We are now in the most important contest of all, another total World War. In this contest the score is kept with human lives and the number of homes confiscated and burned.

This is a highly mechanized and rapidly moving war. Our machines can out-maneuver, out-shoot, and over-run the enemy. Machines, in themselves, are useless unless we have the men who are equipped physically as well as technically to use and maintain them. I say physically equipped first, because a man must have a healthy mind and body before his technical knowledge is of any use.

Who are the men that the army and the nation are banking on for the maintenance and repair of their machines? They are the men of the Ordnance Department. Therefore, it is our duty to see to it that these Ordnance men are given the training to cope with the serious problems of a total machine war.

The Ordnance Department, with the rest of the army, has gone through, and is still going through, an enormous expansion program. Our training program has been forced to expand and speed up in order to get the men into the field to join newly forming organizations. These organizations will see action a few short months after activation. Are the men equipped technically for the job? We hope so, and we believe so. But has our training been so concentrated and rapid that we have overlooked his physical equipment? Is he strong enough to stand the strain of long hours at work with no sleep and short rations? In too many cases I am afraid that he is not. When the combat unit is engaging the enemy, the Ordnance man is repairing its worn out or broken equipment. When the combat unit is catching a little shut-eye, the Ordnance man is going out and getting its over-heated and damaged weapons. A normal question would be "When does the Ordnance man sleep?" A normal answer might be "He doesn't".

We have put the wrench into the man's hand, and we have shown him how to use it, but we have neglected to put the muscles into the arm that holds that wrench.

If we are to win this war, which we surely must, we must be able to crush the enemy in every field of encounter. When the enemy is forced to rest and sleep, we must be able to attack. Technical knowledge and courage are not sufficient. William L. Shirer who wrote "Berlin Diary" tells of a conversation with some British lads just after they had encountered a Nazi unit. One lad said "We didn't have a chance. We were simply overwhelmed." We must see that our men are never "overwhelmed".

At the Ordnance School we have facilities at our disposal with which to equip our men physically. We have an expensive "Trainasium" designed to toughen them and give them exercises which will strengthen muscles needed in action. The candidates in the Officer Candidate School are given an opportunity to use this apparatus twice during their training. Through this activity they get an understanding of the type of conditioning necessary to strengthen men for action. The enlisted men in the school are also given instruction on the Trainasium. Their technical training in the school is very intensive and this work gives them a chance to get much needed physical exercise. We also encourage the officers of the



school to participate in Trainasium activities and they are beginning to realize great benefit through this type of exercise.

The "Obstacle Course" presents obstacles to the men that will be encountered in the field. It is our plan to make the conditions of running the course as near combat conditions as possible.

The Ordnance School also has a gymnasium for the use of its men in competitive activities. At present there is a basketball league operating with seven provisional company teams and six 40th Ordnance Company teams. A gymnastic team has been organized and is preparing for exhibitions to be given at future dates. The officers of the post obtain recreation and exercise by using the gymnasium for athletic games and contests. Other organizations using the gymnasium facilities are the Station Hospital Medical Detachment and the Ordnance School Colored Detachment. The Post Basketball Team which ranks as one of the nation's best service teams also holds its practice sessions and home games in the gymnasium. The facilities are available so there should be excuse for our sending a man into the field physically inadequate.

Let us continue our technical training at its present high standard and never lose sight of the importance of the "Physical Fitness" of our men. We've got to be damn sure no man's ghost will ever say "If your training program had only done its job!"

LEADERS of MEN

by E. H. KIBLER

Lt. Col., Ord. Dept.

Director, Ordnance Officer Candidate School

Just as the Biblical scapegoat stood as a symbol of man's release from past offenses, so the leader carries man's burdens of present responsibility, thought, and action. Man is a gregarious creature. The herd instinct predominates in the masses where, as in all forms of life, the precipitation of the leader is inevitable and indispensable. It is with this precipitation within the life stream of our fighting forces that this article deals, and more particularly with the catalytic effect of the Ordnance Officer Candidate School in this process.

Many designs of leadership have been set down during the passing of the centuries, most of them with more particular attention to a man, but all of them indicating a definite reflection of the times. So, in our definition must we be guided in our objective by an appreciation of the essential characteristics and personalities of those who must be leaders today. Leadership to meet our needs is, assuming physical fitness and health, an integration of moral integrity, responsibility, rationality, intellectual curiosity, and forcefulness of purpose. It is as much to the determining of these characteristics as to the dissemination of military and Ordnance information that the Ordnance Officer Candidate School owes its existence.

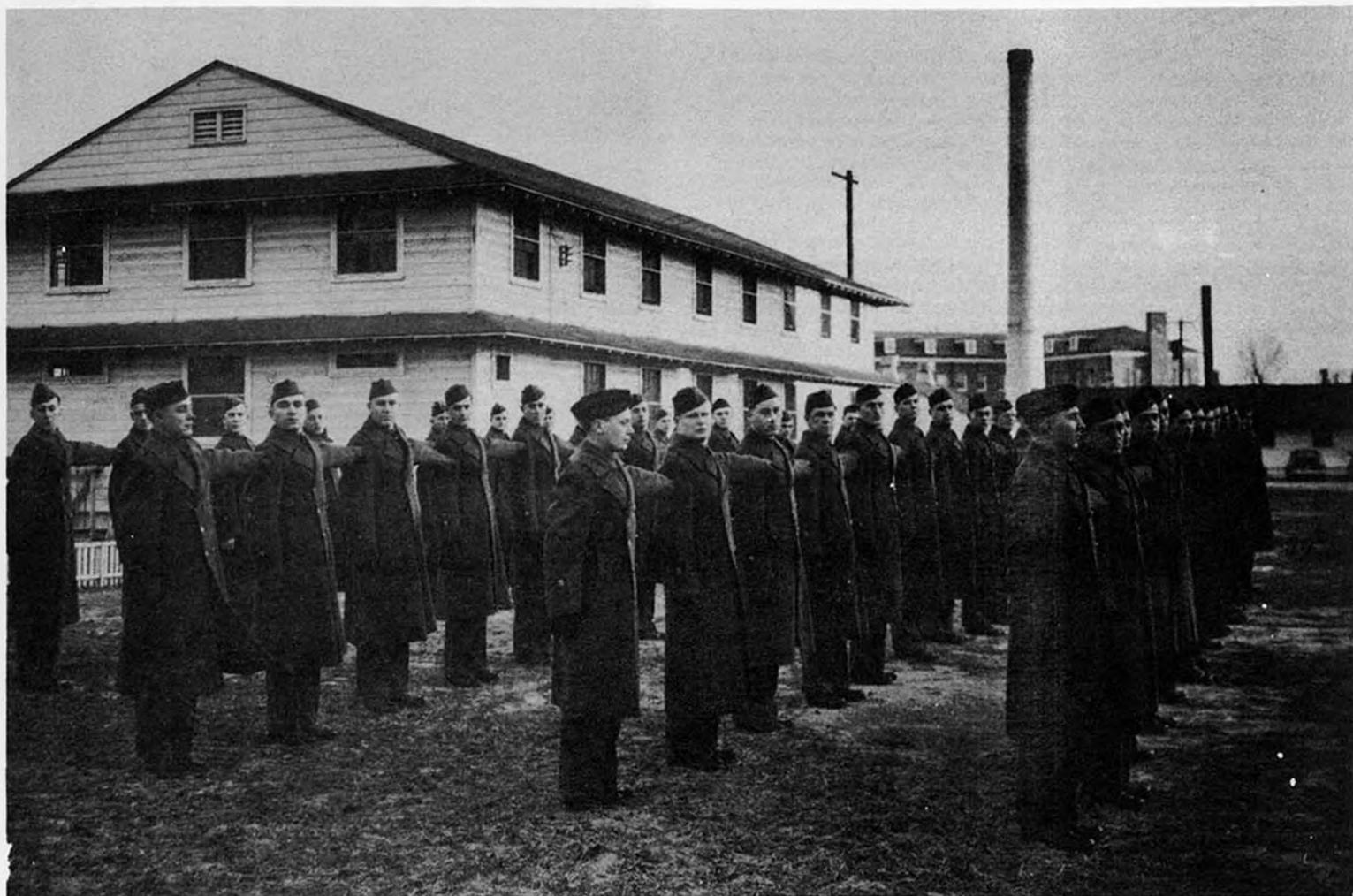
Drill

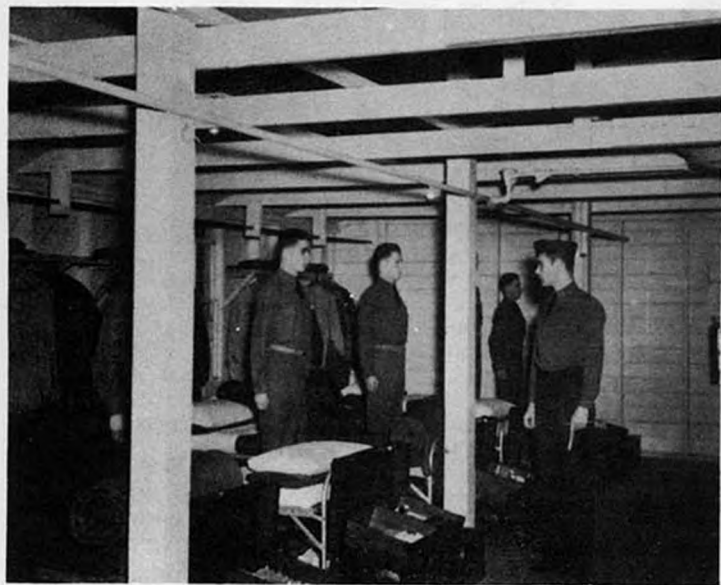
Men are ordered to this school from the four points of the compass, within and beyond this hemisphere. Theoretically, the existence of the previously mentioned characteristics should have been determined by application boards in the field, and the Officer Candidate School should serve as little more than the polisher and pedagogue. Practically, however, an alarming percentage of Officer Candidates are ordered into this school ill-equipped to establish their attainment of the integral of leadership heretofore mentioned. This is less because of indifference than because of the failure of field application boards to appreciate the essential requirements.

The various functions of the Ordnance Officer Candidate School are not of arbitrary innovation, but are the result of tedious and studied consideration of the most practicable yet reliable tests of the candidate's attainment of the leadership integral, and his ability to develop latest characteristics included therein.

Of course, it goes without saying that during the course, or the test, and as a concomitant thereof, the candidate is exposed to a wealth of academic and technical instruction. The Officer Candidate Course lasts for a brief thirteen weeks. During the first eight weeks all candidates receive academic classroom instruction in Company Administration, Depot and Supply, Ordnance Service, and Military Subjects, with equal emphasis on each.

Company Administration briefly, as the name implies, deals with the internal management of the company as a unit, covering such matters as Morning Reports, Service Records, Sick Books, Company Fund, Appointments and Promotions, Furloughs, etc.





Inspection

Depot and Supply, properly named, deals with the storage and supply of, and accountability and responsibility for, property in general as well as Ordnance materiel.

Ordnance Service gives a composite picture of the function of Ordnance field service. The candidate learns essential Army organization and the why and wherefore of Ordnance service therein. Map reading and the problem of ammunition supply in the field are also included in this section of the course.

Military Subjects is a conglomerate of Military Law, First Aid, Sanitation, Customs of the Service, Interior Guard Duty, Protective Measures, Identification of Foreign Aircraft and Vehicles, Defense against Chemical Warfare, Bomb Reconnaissance and Disposal, etc.

On Saturday afternoons during this eight weeks' period, candidates visit all of the technical facilities of the school so that they become well oriented with Ordnance materiel. These visits include lectures from the various sections describing their individual technical responsibility in the field so that the candidate is able to judge, in the light of his own experience and capabilities, the particular technical subject in which he would care to specialize.

Where field demands permit, deference is given to the candidate's desire in specializing in one of the following during the last five weeks of the course: Ammunition, Artillery, Automotive-Wheeled Vehicles, Automotive-Tanks, Aviation Ordnance, Fire Control, Shop Officer, and Small Arms.



Graduation

Through the first eight weeks of the course all candidates are subjected to a rigorous training in infantry drill, covering field performance, one hour a day other than Saturdays and Sundays. During this same period the candidate receives instruction in Training Methods every Saturday morning, where he is required to exhibit and develop his ability as a public speaker.

As was stated heretofore, this article's objective is to describe the manner in which the course discovers and/or develops the leadership integral.

The self-appointed, self-governing, and self-purging honor system here existing, stands as guardian and delineator of the candidate's moral integrity. Boards of candidates, elected by candidates in each class, meet when occasion requires to hear evidence of breaches of honor and to make findings of fact incident thereto, which findings are solemnly respected and acted upon by school headquarters. Candidates of culpable character are soon discovered and usually relieved by action of their more righteous and tougher fibered classmates. The "white lie" and "half-truth" are within the province and obligation of an Honor Board's investigation so that even these apparently normal civilian proclivities are, by their abstention for three months, removed from the candidate's personal traits; he ultimately emerging a man who can meet the world eye to eye, holding himself above deceit.

The highest sense of responsibility is imperative in an officer; that is, a self-compelling accountability for minute detail in the accomplishment



Instruction

of the delegated mission. The superior need only outline the general plan; the subordinate recognizes no excuse for other than its complete accomplishment. Candidates throughout the course act in turn as Officer of the Day, Charge of Quarters, Section Marcher, etc. On the drill field they perform the functions of squad leaders, platoon leaders, and company commanders. The responsibilities imposed on the candidate are not simulated, but are quite real. Those who cannot assume them are usually relieved. It has been said that responsibilities gravitate to those who can shoulder them. Many falter under the load, but many more prove their worth.

Nowhere in the vicissitudes of life is clear, logical, and coherent thought of greater importance than in modern warfare. The Staff and Faculty of The Ordnance School is constantly alert to discern and weed out faulty thought habits and to occasion the relief of those candidates whose learning ability, by either misfortune or choice, is not up to standard. The influence of emotion and environment are carefully observed; formally by several boards of officers before whom the candidate must appear during his course, and informally by company officers, instructors, and classmates. At this point it is appropriate to discuss a system of leadership rating by the candidates themselves which has been used most effectively and successfully for some time at this school. It is obvious, when men have to live, day in and day out, in the close association of the highly regimented officer candidate company, that the relative weakness and strength of the candidates become apparent to each other. Periodically during the course candidates, in strictest confidence are required to rate their classmates from a leadership standpoint, expressing appropriate remarks warranting the excellent and the deficient. This is not a "popularity" contest, but is an analysis of leader-

(Continued on page 100)

BOOKS IN SUPPORT OF GUNS

by B. B. ABRAMS, Captain, Ordnance Department
Executive Assistant to the Chief of Military Training

"I call, therefore, a complete and generous education that which fits a man to perform justly, skillfully and magnanimously all the offices, both private and public, of peace and war." -----JOHN MILTON.

The idea of presenting military training in civil educational institutions in the United States was originated by Captain Alden Partridge, when he founded the "American Literary, Scientific and Military Academy" (now Norwich University) at Norwich, Vermont, in 1819. A graduate and former superintendent of the U. S. Military Academy, Captain Partridge believed that military training should be added to the regular course of instruction in civil schools in order that educated men might also serve as efficient soldiers at times when their services were required by the country.

Passage of the Morrill Act in 1862 was next in the chain of events to further military education in our schools and colleges. Sponsored by Senator Justin S. Morrill of Vermont, this bill provided for the donation of public lands to all states establishing agricultural and mechanical colleges. The act specifically required that military education be included in the curriculum of these land-grant colleges.

With the gathering of war clouds in 1916, the Reserve Officers Training Corps was established at schools and colleges by an Act of Congress. The National Defense Act of 1920 permanently established the R.O.T.C. The object of this training is to qualify students for positions of leadership during times of national emergency, and has proven to be the "Keystone of our National Defense". Now that we are engaged in war, from this point on our greatest source of junior officers will be the Officer Candidate Schools. But in peace time we are dependent upon the college students enrolled in R.O.T.C. The inception of our present emergency found an Officers' Reserve Corps numbering almost 120,000 men, the majority of whom were R.O.T.C. graduates. With officers of the Regular Army as a nucleus, the present wartime army has been built largely around the O.R.C. as may be seen by the fact that in December, 1941, over two-thirds of the officers on duty with Regular Army units were reserve officers. On that date they were also serving on the General Staff, in the various administrative headquarters, and as instructors at West Point and R.O.T.C. colleges.

During the 1919-1920 school year, an Ordnance Unit of the R.O.T.C. was established at Massachusetts Institute of Technology, Cambridge, a land-grant institution where all regularly registered students who meet the citizenship and physical requirements must complete the Basic Course in Military Science and Tactics. In order to be selected for Ordnance training at M.I.T., a student must be enrolled in one of the following academic courses: Mechanical, Chemical, or Aeronautical Engineering; Metallurgy, Business and Engineering Administration; Chemistry, or Physics. The quota, at present, for Advanced Course students is set at 54.

Faculty members of the Sibley School of Engineering imparted most of the instruction in the first year of Ordnance R.O.T.C. at Cornell University in 1920. Today basic instruction is received in either Field Artillery or Signal Corps with a quota of 37 students allotted to Ordnance for the Advanced Course. Enrollment in this course is limited to engineering students.

The University of Michigan Ordnance Unit was authorized by the War Department in 1921, and has always been popular with engineering students. This unit is fortunate in having access to an Ordnance De-

partment Gage Laboratory located at the university, as well as the Ordnance shops and materiel at nearby Fort Custer. Second Year Advanced Cadets are utilized as instructors for an Ordnance Inspectors' Course offered by the university.

Ordnance training was established at Georgia School of Technology, Atlanta, in the fall of 1921. Unlike most of the other Ordnance R.O.T.C. schools, Ordnance instruction at Georgia Tech begins in the freshman year. Since 1935 enrollment in the Ordnance Unit has been limited to Cooperative Engineering students. Due to the fact that part of each student's time is devoted to outside work, a period of five years is required to complete the requisite courses for a degree and reserve commission. The quota for Ordnance is 200 students.

The 1922-1923 school year brought the establishment of an Ordnance Unit at the University of Cincinnati, a municipal school. Basic cadets take their work in Coast Artillery, and then students enrolled in Mechanical and Chemical Engineering are permitted to transfer to the Advanced Ordnance Course within limits of the quota of 56. Students at the university are afforded opportunities for instructive inspection trips through the cooperation of the Cincinnati Ordnance District.

At the request of the University of California, San Francisco, an Ordnance R.O.T.C. unit was authorized by the War Department in 1923. The first graduating class of Ordnance cadets consisted of three men. At present the enrollment in Ordnance is limited to 45 students, selected from those enrolled in engineering, chemistry, mining, mathematics, physics or optometry.

Since the inception of an Ordnance unit of the R.O.T.C. in 1925, 178 graduates of Stanford University have been commissioned second lieutenants in the Ordnance Reserve. Ordnance cadets at Stanford are selected from those who have completed the Basic Course in Field Artillery, and are regularly enrolled in engineering, chemistry or physics. Facilities of the San Francisco Ordnance District Gage Laboratory are available to Stanford students.

Next on the list of institutions to be granted an Ordnance unit is Lehigh University of Bethlehem, Penn. This unit was established in 1925. All freshman and sophomore students at Lehigh who meet qualifications are required to take Basic R.O.T.C. in infantry. 27 juniors are selected each year for the First Year Advanced Course in Ordnance. Inspection trips are made annually to nearby arsenals and commercial manufacturers.

As early as 1930, authorities at the University of Oklahoma, Norman, had taken steps for the establishment of an Ordnance Unit. With the discontinuance of Ordnance R.O.T.C. at the University of Washington in 1934, the unit was immediately transferred to Oklahoma. This was the first Ordnance unit of the R.O.T.C. to be established in the 8th Service Command, and has been in successful operation for eight years.

To meet the demands of a war-time army for technically trained officers four new Ordnance Units were established during the summer and fall of 1942 at colleges already maintaining other branches of the R.O.T.C. The institutions selected were: The Citadel, Texas A. & M. College, Louisiana State University, and Purdue University.

At the thirteen institutions listed above, there is no Basic Ordnance Course, but an Advanced Course for juniors and seniors who have

(Continued from page 54)

Observations on AIR-GROUND SUPPORT in 1942 Maneuvers

by

HAROLD J. CONWAY

Colonel, Ord. Dept.

Deputy Chief, Military Div.

With every official, radio and newspaper report speaking glowingly of the battle success of properly coordinated air-ground operations, the importance of properly trained Aviation Ordnance officers and men has finally come to the forefront and is recognized by all in authority. It gave this observer a great deal of personal satisfaction to note the unusual and splendid cooperation between the using customer, the Air Force, and the men who reflect only in the glory of an overall job well done — the Ordnance soldier. As representative of the Chief, Ordnance Military Training Division, Office Chief of Ordnance, the following is part of my report at the conclusion of the Seventh Corps maneuvers held in the vicinity of the Civil War battlefields near Lebanon, Tennessee, during the period October 5 - 18, 1942. The troops involved consisted of three mechanized divisions supported by an Air Support Command whose physical makeup is described in the report.

The report as concerns the Air-Ground operations is as follows:

The organization of the normal Air Support Command for an Army of three Corps is as follows:

- 4 Observation Groups - 1 per corps and 1 per Army
- 1 Photographic Group
- 4 Dive Bombardment Group - 1 per each Corps, 1 per Army
- 4 Light Bombardment Group - 1 per each Corps, 1 per Army
- 13 Groups total per Field Army

Certain reinforcing attachments to this Air Support Command of medium bombardment, or other types of aviation, are unusually made by the higher echelon Air Force Commander as the situation warrants.

To supply this Air Support Command, the procedure as laid down in Army Air Forces Regulations No. 65-1, August 14, 1942, would be followed. This regulation on the Supply and Maintenance of Air Force Units differentiates logically between operations in the Continental limits of the United States and in Task Force operations. The problem of the Air Forces utilizing existing Ground Forces Supply installations and Zone of Communications installations should be seriously considered. It would appear that in view of the fact that the S.O.S. of a Task Force would have limited means available in terms of water, rail and motor transportation, plus the fact that supplies must be forwarded through a regulating point for all branches, that the utmost effort should be made to prevent duplication of supply facilities in those air installations which are superimposed and adjacent to already existing S.O.S. or Zone of Communication Supply installations: This statement is made with the provision that the Air Force's flexibility must be maintained. For instance, considering Ammunition Supply, if an Ordnance Ammunition Depot can handle ammunition for Infantry, Field Artillery, and Armored Forces, and as the Ordnance Department manufactures Aircraft Ammunition — that type ammunition could be issued by an Ordnance Ammunition Depot — of course if the Air Corps' flexibility is reduced materially by this procedure, separate installations must of course be maintained for that branch of the service. From the viewpoint of economy of personnel and materiel, duplication of organizations and facilities must be avoided in the rear areas back of the Normal Ground Force Combat Zone.

For the supply of ammunition from the Ammunition Depot and Air Force General Depots forward, the use of the Air Service Group is definitely recommended. These Air Service Groups are furnished at the rate of one Air Service Group per two Air Combat Groups, (each two Combat Groups normally occupy eight (8) dispersed airdromes.)

This Air Service Group, combines all 3rd echelon service agencies normally coordinated by G-4, including Air Corps Supply and Maintenance, under a single commander. It fills the supply gap between the Air Force General Depot and other type Air Depots and the squadron airdrome. It is a definite progressive step in the handling of Air Corps Supply. The Air Service Group operates what is known as an Air Service Center.

The Air Service Center provides the following services for Air Force units in its area.

- (1) Administrative supervision of all service elements and air force supply points other than squadron distributing points.

- (2) Third echelon of aircraft maintenance, supply, and reclamation.
- (3) Motor transport supply service.
- (4) Third echelon of motor vehicle maintenance, supply, and salvage.
- (5) Third echelon signal maintenance, supply, and salvage.
- (6) Third echelon Ordnance maintenance, supply, and salvage.
- (7) Instrument landing service for airdromes designated.
- (8) The required number of Class I and III supply refilling points.
- (9) A refilling point for camouflage and construction material.
- (10) Quartermaster salvage service.
- (11) A purchasing and contracting service.
- (12) Photographic laboratory and ground photographic service.
- (13) Finance service, including payment of troops in the area.
- (14) Engineer maintenance service.

Ground Force refilling points for material common to both air and ground forces are used when available and suitably located.

The organization of the Air Service Group which operates the Air Service Center is as follows:

- (1) Headquarters and Headquarters Squadron Service Group T/O 1-413.
- (2) 2 Service Squadrons T/O 1-412.
- (3) 2 Quartermaster Truck Companies T/O 10-57.
- (4) 1 Quartermaster Company Service Group T/O 10-437.
- (5) 2 Quartermaster Medium Maintenance Companies T/O 10-487 (Now Ordnance)
- (6) 1 Signal Company Service Group T/O 11-237.
- (7) 1 Military Police Company T/O 19-217 - guards among other service center activities, Ordnance ammunition and bomb dumps.
- (8) Engineer Construction and Maintenance Troops (Number and type dependent on local conditions).
- (9) Medical Section, Chemical Section.
- (10) Ordnance Company Service Group.

Thus the Ordnance means available in this service group operating a service center are -

The two Ordnance Medium Maintenance Companies, T/O 10-407, above, formerly Quartermaster organizations capable of performing 3rd Echelon repair for four and six wheeled maintenance, and one Ordnance



Colonel Harold J. Conway,
Deputy Chief, Ordnance Military Training Division

Company Air Base, T/O 9-167, whose name is now being changed to Ordnance Company Service Group.

The duties of Ordnance Company Service Group are as follows:

- (1) Procure, store, and issue class II and IV Ordnance materiel for all units in the service center area.
- (2) Operate a reserve supply dump of class V supplies for emergency use in the service center area.
- (3) Operate the required Ordnance Class V RP's in the service center area.
- (4) Operate an Ordnance repair shop for the third echelon repair of Ordnance equipment.

The writer visited the headquarters and all organizations of the 40th Air Support Service Group at its Service Center. This Service Group was efficiently commanded by Major W. H. Worley, Air Corps, an officer of unusual leadership capabilities. The Ordnance companies, although short of bomb handling equipment, were efficiently organized and commanded. The Service Group Commander complained that the lack of an Ordnance Section in the Headquarters and Headquarters Squadron Group T/O 1-413, which should include an Ordnance Officer as a special staff officer, handicapped his activities. He stated he was forced to run down the Ordnance Company Commander for advice on Ordnance matters which took that officer away from his command duties. One Ordnance Officer and five enlisted men as part of the Headquarters of the 40th Air Service Group

were recommended by the group commander as the Ordnance personnel necessary to properly perform Ordnance ammunition and Maintenance Supply duties for his headquarters.

Two discussions of interest took place which will require some action:

(a) First, the question as to how the Ordnance companies of the Service Group could deliver the ammunition from the Air Force Ordnance Ammunition Depot to the eight (8) dispersed airdromes. Considering the tonnages involved to be transported as well as handled, it appears that the two QM truck companies T/O 10-57, the only transportation available for all purposes in the Air Service Group, might not be adequate. Also, means of carrying the bombs in the 2-1/2 ton standard quartermaster truck to prevent damage enroute of bomb fins and other bomb parts, would have to be provided for these companies if this type of transportation is to be used for air ammunition supply.

(b) The second problem was who would furnish those parts formerly handled by Quartermaster now necessary for Ordnance 3rd Echelon four and six wheeled motor maintenance. The answer logically was, at present, whoever had the parts. Recommend steps be taken by the Ordnance Service Company to take over, procure and issue those parts as rapidly as possible; that the Ordnance Company Service Group now handle those parts now necessary for Ordnance maintenance in the Air Service Group.

The only ammunition supply simulated for training purposes by the Air Support Command was the provision of ammunition for the Air Base Security Battalion T/O 7-415. This is an Air-Ground unit organized and trained to provide the required airdrome defense against attack via ground, parachute troops, airborne troops, or air attack. This unit protected the airdrome of the Observation Group operating out of Gallatin

Airdrome and is normally a unit furnished for the protection of airdromes used by the Air Force General or Branch Depots. An ammunition allocation was made for this unit by Army to the Red Forces, 8th Motorized Division. This unit then drew their ammunition through the 8th Division Ammunition Office. As this Air Base Security Battalion has rifles, .30 and .50 caliber machine guns, ground and aircraft, and 75mm self-propelled mounts, their ammunition problem was one of ammunition, all classes.

In the next problem or future air-ground maneuvers it is hoped that the Air Support Command participating, will attempt to test their plan of ammunition supply in order that the Ordnance Department, as well as they, may properly prepare and lay plans for solving this problem in terms of organizations, transportation, and equipment.

Commendable improvement was observed in Air-Ground relationship in working out their problem of joint defense. Concealment, rapid movement, and the placing of minimum amounts of dispersed supplies on the ground must be stressed in all training of Service Units due to the threat of capture or destruction by mechanized or air attack.

ORDNANCE CLASSIFICATION OF ENLISTED MEN

(Continued from page 9)

weeks of intensive technical training is given the future non-com in the specialists' school to which he has been assigned. At the end of eight weeks the student is graduated and takes his place among the instructors at the Replacement Center. The Classification Section has in its recommendations attempted to pick men with teaching experience, and is responsible for individual assignment to the various schools.

At all times the problem of the Classifier is to recommend that each individual be placed in a technical school where his former civilian knowledge and skill will be of the most value to the Army. In all cases the man is oriented and shown that he has something to offer, and that his contribution is an important one.

A man who enters one of the Ordnance schools with such an attitude becomes a good soldier. He studies hard, and his morale is good. After five weeks of basic and eight weeks of technical training he is ready for field service.

At this point the man again comes in contact with the Classification Section, whose shipping department handles all shipments of men from the Ordnance Replacement Training Center.

Previously the shipping department had reported to The Adjutant General's Department the number that would be available at a specific time. These reports are submitted regularly four weeks in advance of the completion of the man's technical training.

From The Adjutant General's Department comes a replacement transfer order requesting that a certain number of skills be assigned to specific units. It is up to the shipping department to select these skills from its files of available men. Men were shipped from the O.R.T.C. to all units of the Army which use ammunition, automotive equipment, instruments, guns or tanks. An armored division has an entire battalion of Ordnance men attached to it and a railway artillery unit is supplied and maintained by one complete Ordnance company. It is the responsibility of the shipping department to select replacements, fillers, and men to establish new units.

The Classification Section has seen to it that men are trained in that type of Ordnance work in which they will do the most good, and that they are assigned to the units which need their skills. By fulfilling that responsibility they are helping to make today's American soldier the world's best fighting technician.

R.O.T.C. TRAINING

(Continued from page 51)

completed Basic training in some other branch of R.O.T.C. and who have been selected because their academic course and training especially fits them for Ordnance work. Instruction in the Advanced Ordnance Course

consists of Ordnance subjects, certain technical subjects, and some military subjects common to all branches. Following is a list of subjects prescribed for the two year period: Ammunition, Ordnance Materiel, Ordnance Provision System and Property Accounting, Ordnance District Organization and Administration, Ordnance Supply Operations in War, Organization of the Ordnance Department, Company Administration, Aerial Photograph Reading, Defense Against Chemical Warfare, Interior Guard Duty, Leadership, Mess Management, Military Law, Military History and Policy, and Care and Operation of Motor Vehicles. Technical subjects, such as powder, explosives, and optical instruments, are selected by the Professor of Military Science and Tactics from those regularly offered by the institution as academic courses.

Until 1942, Ordnance R.O.T.C. students who had completed the First Year Advanced Course attended a summer camp of six weeks duration. Those attending schools in the eastern section of the country were sent to Aberdeen Proving Ground, Maryland, those in the west have been attached to the 2nd Ordnance Company (MM) at Fort Sam Houston Texas, while those on the West Coast were sent to Fort Lewis, Washington. For the duration of the war, in lieu of camp, R.O.T.C. men will be sent, upon graduation from the four year course, to The Ordnance School, or one of the other Ordnance Training installations, to undergo training. Upon successful completion of the prescribed course of instruction, they will be commissioned second lieutenants in the Ordnance Reserve and ordered to extended active duty.

The primary object of instruction at Ordnance R.O.T.C. units is to prepare the students for duties with a Maintenance, Depot, or Ammunition Company, or as Ordnance Officers on the staff of a tactical unit or installation. This policy pertains in particular to recent R.O.T.C. graduates who are called to active duty. Those who have been out of school for a number of years and have gained considerable civilian experience in a technical specialty may be assigned to arsenals and Ordnance Districts.

General Charles P. Summerall, former Chief of Staff, U. S. Army, once said: "The country expects the college man to become a leader in business, statescraft, the ministry, the professions, and in the sciences and arts. The nation has the right to expect him to accept the responsibilities of citizenship and leadership when the clouds of war loom darkly on the horizon. Our past history shows ample evidence that the trust placed in our college man has not been in vain — he has always been among the first to volunteer his services and he has borne the responsibilities placed on him cheerfully and well, in peace and in war. Success in a crisis does not come by inspiration. It comes as a result of preparation and capacity carefully developed by experience and habit. The college man has a decided advantage over the uneducated man because of his broader vision, wider perspective, and greater adaptability which he derives from his studies and experience; and as a result of his opportunities more is demanded of him, and rightly so."

Through their leadership and deeds on Bataan, in Libya, and on other far-flung battlefields of the world. Ordnance R.O.T.C. graduates have demonstrated their patriotism, and have fulfilled their obligations as citizens. During the years of peace to come, they will continue, in their quiet way, to prepare themselves for future times when the country will require their services.

CLASSIFICATION IN THE ORDNANCE TRAINING PROGRAM

(Continued from page 40)

that individual differences are the keynote of proper assignments. Men come into the Army with a wide variety of skills and aptitudes. A technical Ordnance course is wasted upon the man who has no inclination along mechanical lines. Only most careful process of classification, selection and assignment can supply the quality of human raw material necessary to the fashioning of the Ordnance Technician. Only the most careful process of continued classification, selection and placement can insure that the training and abilities of the Ordnance technician will be actually utilized to the fullest.

Potential Ordnance men are scarce. Efforts to make the most of what we have must be carried on unrelentingly. It is the goal of the classification system to make the most of what every officer and enlisted man individually can contribute in the service of his country. How close we can come to this goal will depend in large measure upon the extent to which field commanders utilize the proven advantages of the classification system.



Conducted by: E. E. Jones, M. Sgt., Ord. Dept.

MARK IV TRIPOD

by

Pvt. CHARLES E. DuCHARME, Ord. Dept.

The principle parts of the Mark IV Tripod are:

- (1) cross head with joint pin and chain
- (2) socket with jamming screw
- (3) elevating gear with elevating joint pin and chains
- (4) rear leg with clamp
- (5) front legs with clamps

With the pivot of the cross head vertical, thirteen degrees elevation and twenty-five degrees depression can be obtained. Greater elevation and depression can be obtained by adjustment of the legs of the tripod. However, the pivot will not, then, be vertical.

An all around traverse is obtainable.

At the leg joints, numbers are stamped at regular intervals so that the relative position of the legs, to the zero mark and to the vertical can be ascertained.

A chain is provided which secures the inner screw of the elevating gear to the cross head to prevent its loss when traveling.

An elevating stop riveted inside the left arm of the cross head limits the elevation of the gun so that the recoil spring box cannot be damaged.

NOTE: When firing from the Vickers Adjustable Tripod, Mark J, a special joint pin, permitting quick mounting and dismounting is used. This joint pin is inserted first in the trunnion hole of the weapon, from the left hand side. The sliding bushing is then put on and the nut is tightened. The split pin is not inserted until the correct position of the adjusting nut has been determined, by trial, in the mounting. When this is once determined, the trunnion pin is not to be removed from the weapon while it is used in conjunction with this tripod.

NOMENCLATURE

(Mark IV, Tripod)

Alphabetical list of the component parts of the

MARK IV TRIPOD

Crosshead
Chain, loop and eye for securing cross head pin
Chain for securing elevating gear pin
Chain for elevating screw
Cotter pin for front leg joint stud
Cotter pin for tumbler pin
Elevating nut
Elevating gear joint pin stop
Elevating stop bracket
Front leg tube
Front leg shoe (right)
Front leg shoe (left)
Front clutch plate
Front leg joint
Front leg joint stud
Front leg joint stud pin
Front and rear clutch plate screw
Handle, jamming front leg
Hand wheel
Hand wheel bushing
Hand wheel bushing feather
Handle washer for jamming rear leg
Inner elevating screw
Inscription plate screw
Joint pin for elevating gear
Joint pin for crosshead
Jamming bolt
Jamming bolt nut



Jamming pivot handle
Jamming pivot handle washer
Jamming pivot screw
Jamming pivot block
Key for rear leg joint pin
Nut for hand wheel bushing
Nut for jamming rear leg
Nut handle for jamming rear leg
Nut for jamming pivot screw
Nut pin for jamming pivot screw
Outer elevating screw
Pin securing nut for jamming rear leg
Pin for securing legs
Pin for rear leg serrated joint
Rear leg tube
Rear shoe
Rear leg serrated joint (Part 1)
Rear leg serrated joint (Part 2)
Rear clutch plate (right)
Rear clutch plate (left)
Rear leg joint pin
Socket
Spring disc
Short pin for rear clutch plate
Stud for elevating gear joint pin
Stud for cross head joint pin
Securing strap
Tumbler
Tumbler pin
Tumbler nut
Washer for front leg joint stud
Washer for elevating gear pin chain
Washer for securing cross head pin chain



Artillery

Conducted by: N. M. BLACKWELL, M. Sgt., Ord. Dept.

FUNDAMENTALS OF ARTILLERY WEAPONS

by D. A. WERBLIN, 2nd Lt., Ord. Dept.

PART IV

EQUILIBRATORS

In modern artillery weapons, the horizontal axis about which a cannon revolves in elevation is located well to the rear of the center of gravity of the cannon. The cannon thus is unbalanced and tends to tip forward. An equilibrator is a device which overcomes this unbalanced weight and keeps the cannon in balance at all angles of elevation. There are three general types of equilibrators: namely, spring, pneumatic, and pneumatic-spring.

ACTION. - An equilibrator may act to balance an artillery weapon in either of two ways:

By pulling downward on the breech end of the cradle, rearward of the trunnions. This type of equilibrator is known as a "puller". (See Figure 43).

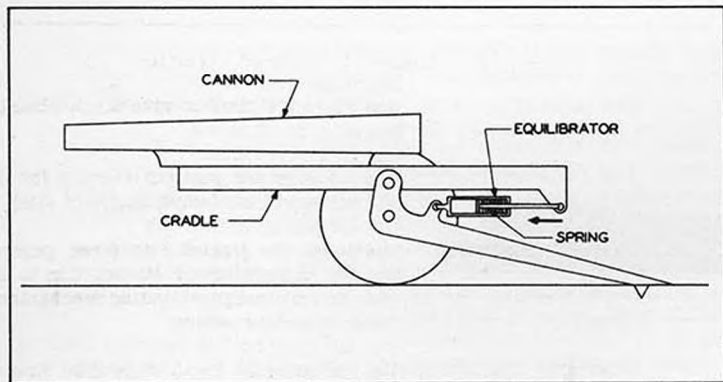


Fig. 43 -- Spring equilibrator (puller)

By pushing upward on the tipping part, or cradle, of the cannon, forward of the axis of revolution (trunnions). This type of equilibrator is referred to as a "pusher".

SPRING EQUILIBRATOR. - One type of spring equilibrator (pusher type) is illustrated in Figure 44. Two such units are provided, one on each side of the carriage. Essentially, the mechanism consists of two telescoping sleeves forming a housing for a spring which is under initial compression. With the cannon in its horizontal position, the telescoping sleeves are pushed together, compressing the spring, and the resultant pressure upward against the cradle balances the cannon. As the cannon is elevated, less force is required to hold it in balance. The outer sleeve moves upward, allowing the spring to expand, and thereby reducing the upward force, which is always just great enough to hold the cannon in balance.

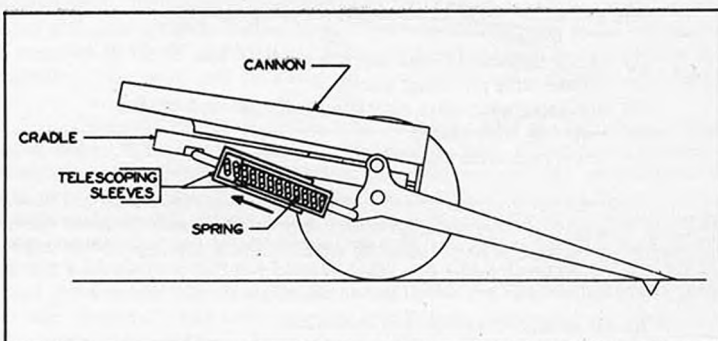


Fig. 44 -- Spring equilibrator (pusher)

PNEUMATIC EQUILIBRATOR. - A pneumatic equilibrator operates similarly to a spring equilibrator, as outlined above. The system consists essentially of two gas-filled telescoping cylinders, with suitable packing to confine the compressed gas. The compressed gas stores up the energy necessary to balance the cannon in the same manner as does the spring in the spring equilibrator.

PNEUMATIC-SPRING EQUILIBRATOR. - A pneumatic-spring equilibrator is a variation of, and functions essentially the same as, the pneumatic equilibrator. The main difference between the two is that the former has a retarding spring which comes into action at extremely high angles of elevation. At high angles of elevation, the unbalanced force of a cannon may be reduced so much that the initial pressure in the equilibrator would prevent the cannon from being depressed. Before this condition occurs, the retarding spring counteracts the air pressure in the equilibrator, thus keeping the cannon in balance.

SUPPORTING MEMBERS OF THE CANNON

The main cannon-supporting members of a carriage are: the sleigh, cradle, top carriage, and bottom carriage. Depending upon the design of the carriage, certain of these components may or may not be used.

SLEIGH. (Fig. 45.) - The sleigh is that part of a carriage which forms the immediate support of a cannon. In practically all of our cannon, the sleigh houses the recoil mechanism and recoils with the barrel on the cradle. In some cases, the recoil cylinders are bored directly into the sleigh; in others, the cylinders are separate tubes which are rigidly attached to the sleigh. The cannon is firmly secured to the sleigh which, in turn, slides on the cradle in recoil and counterrecoil.

CRADLE. (Figure 46.) - The cradle is that part of the carriage which supports the cannon and sleigh. Where no sleigh is used, the cradle houses the recoil mechanism. In general, the cradle is a U-shaped trough

which has slides or roller paths along which the gun recoils in firing. It provides means of securing the recoil piston rod or rods where a sleigh is used, and provides mountings for the recoil cylinders if no sleigh is used. It has trunnions which furnish an axis about which the cradle, and hence the cannon, rotates in elevation. The trunnions rest in trunnion bearings on the lower part of the carriage. Runways on the cradle form surfaces upon which the cannon or sleigh recoils directly to the rear.

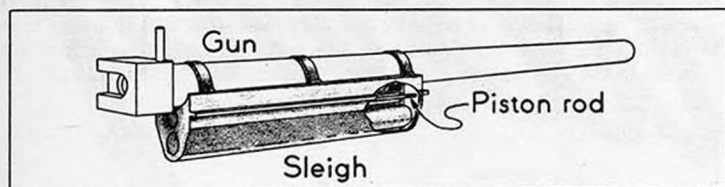


Fig. 45 -- Sleigh

TOP CARRIAGE. (Figure 47). - The top carriage, when present, supports the cradle in its trunnion bearings and carries the elevating mechanism. It moves with the cradle in traversing, but not in changes

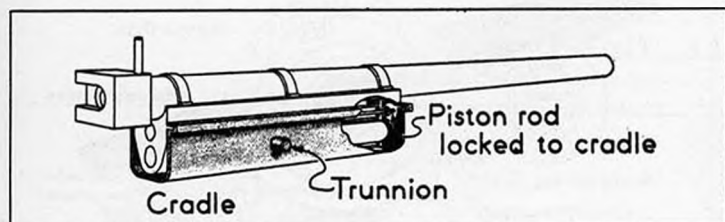


Fig. 46 -- Cradle

of elevation. In traversing (rotating in a horizontal plane), it pivots on the axle or bottom carriage. In cases where a top carriage is not used, its function is performed by the upper front part of the trail. In general, a top carriage is required when pintle traverse is desired.

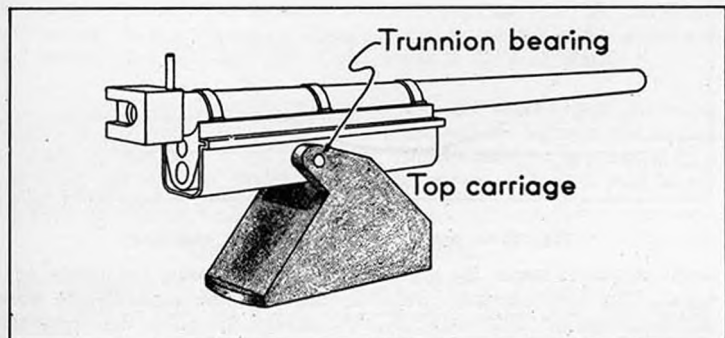


Fig. 47 -- Top carriage

BOTTOM CARRIAGE. (Figure 48.) - The bottom carriage is that part of the carriage assembly which supports the top carriage and has attached to it portions of the mechanism for rotating the top carriage with respect to the bottom carriage. The pintle may consist of a vertical pin or bolt. In mobile mounts, the bottom carriage may have the trail end (or ends) attached, and sometimes a firing jack may also be attached: the

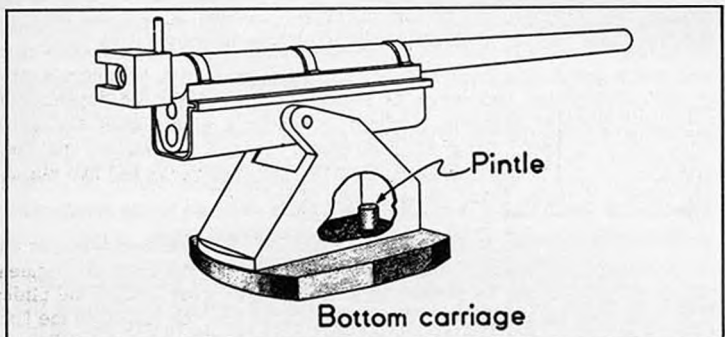


Fig. 48 -- Bottom carriage

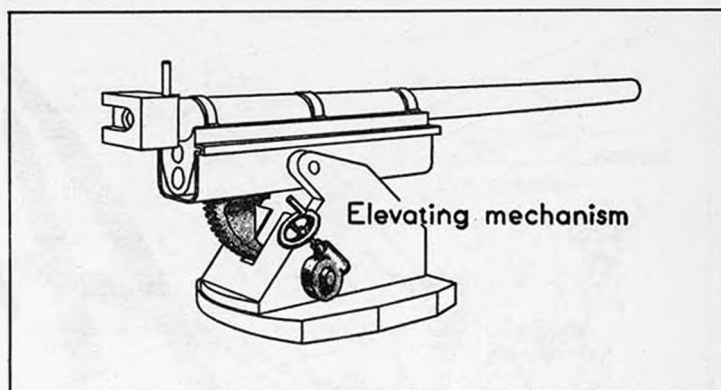


Fig. 49 -- Elevating mechanism

bottom carriage may be fixed to the axle, or it may replace the axle and carry the wheels.

ELEVATING MECHANISMS

GENERAL. - An elevating mechanism (Figure 49) consists of devices for placing and holding the axis of the bore at a desired inclination to a horizontal plane.

In order that a projectile fired from a cannon may reach a given target, the cannon must be laid, or aimed, with a predetermined angle of elevation (Quadrant elevation). This angle is composed of two elements (See Figure 50.)

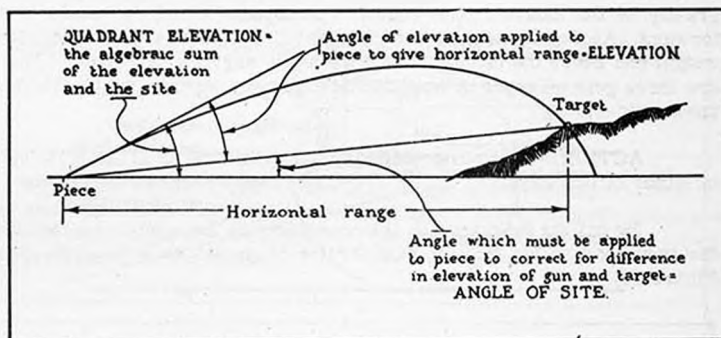


Fig. 50 -- Elements of quadrant elevation

The angle of elevation applied to the piece to give the horizontal range to the target (range elevation)

The angle which must be applied to the piece to correct for the difference in altitude between the cannon and the target (angle of site).

TYPES. - Elevating mechanisms are divided into three general types of systems according to the line of sighting and its relation to the angle-of-site elevating mechanism and the range elevating mechanism: namely, dependent, independent, and semi-independent.

Dependent line of sighting. (Figure 51.) - A dependent line of sighting is one in which the weapon is laid for angle of site and for range by a single elevating mechanism; any movement of the elevating mechanism moves the cannon and the line of sighting simultaneously. On the particular design illustrated, the angle-of-site level and the telescope are attached to the moveable part of the range or elevation scale. Hence, any setting on the range scale will result in a corresponding movement of the angle-of-site level. The angle-of-site level is provided with a site scale on which the angle-of-site can be set. Movement of the site scale moves the axis of the level with relation to the line of sighting; while movement of the range scale moves both the axis of the level and the line of sighting simultaneously. Thus, the elevating mechanism hand-wheel moves the following parts as a unit through a vertical arc: cannon telescope (line of sighting), angle-of-site level and scale, and range or elevation scale. The proper elevation is set as follows: the angle of site is set on the site scale and the range is set on the range or elevation scale. The elevating hand-wheel is then turned until the bubble is centered in the level. The cannon is now properly laid for elevation.

Independent line of sighting. (Figure 52.) - An independent line of sighting is one in which the weapon is laid for angle of site and for range

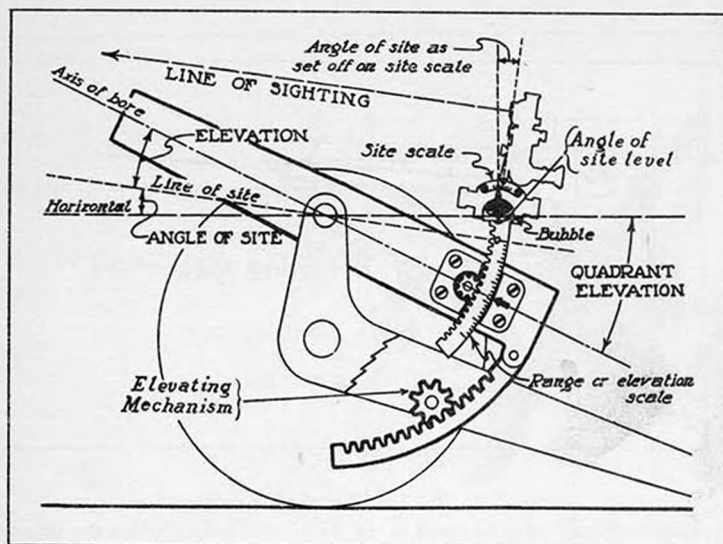


Fig. 51 -- Dependent line of sighting

by two distinct and independent elevating mechanisms; a change in laying for range does not affect the laying for angle of site, and vice versa. This type of elevation-laying mechanism requires an additional part for the carriage, which is known as a rocker and is interposed between the cradle and the bottom carriage or trail. The telescope and angle-of-site level are attached to, and move with, the rocker. Movement of the angle-of-site handwheel thus moves the cannon, rocker, site scale and bubble, and

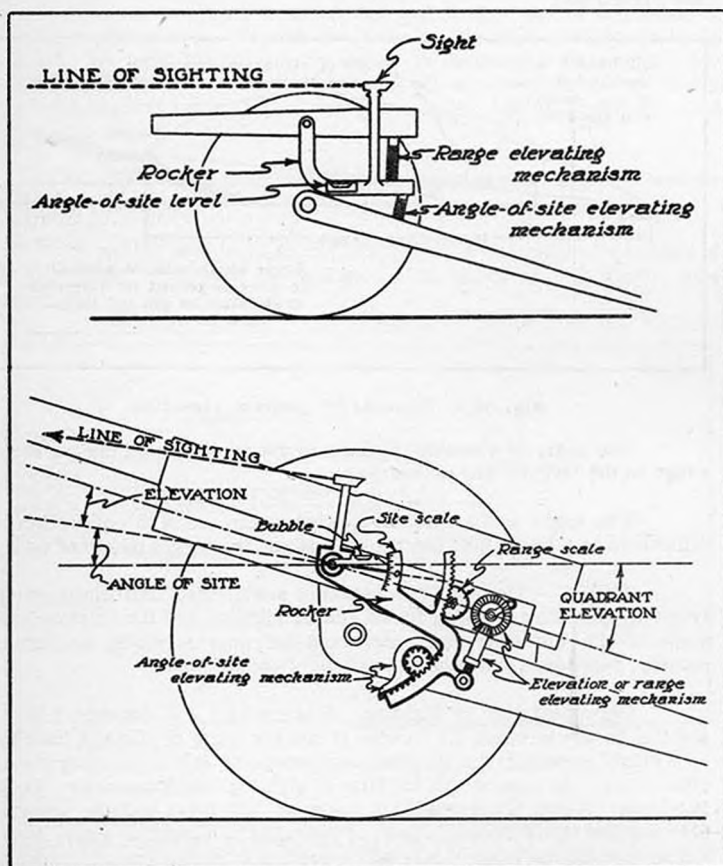


Fig. 52 -- Independent line of sighting

telescope; movement of the range elevating handwheel moves only the cannon with respect to the rocker, without moving the other parts. The proper elevation is set as follows: The angle of site is set on the angle-of-site scale, and the bubble is centered by turning the angle-of-site handwheel. The range elevation is then set off by means of the range elevating handwheel which moves the cannon with respect to the rocker. To attain the same result, these two operations may be made in the reverse order; i.e., range elevation set first and angle of site set next.

Semi-independent line of sighting. (Figure 53.) A semi-independent line of sighting is one in which the cannon is elevated for both

site and range by a single elevating mechanism, as in the dependent type. It is similar to the independent type in that a change in setting for range does not affect the setting for site, and vice versa. On the design shown, the angle-of-site mechanism, the telescope, the range disk, and the elevation micrometer worm are mounted on the same bracket. Hence, any movement of this bracket (to level the angle-of-site level) results in a corresponding movement of these parts. Thus, when the angle-of-site leveling worm is moved, the adjustable index is moved away from the fixed index. Also, a setting on the elevation or range scale further moves the adjustable index out of alignment with the fixed index. The fixed index, which is on the cannon, is brought into alignment with the adjustable index by turning the elevating handwheel which moves only the cannon with respect to the other parts. The proper elevation is set as follows: The

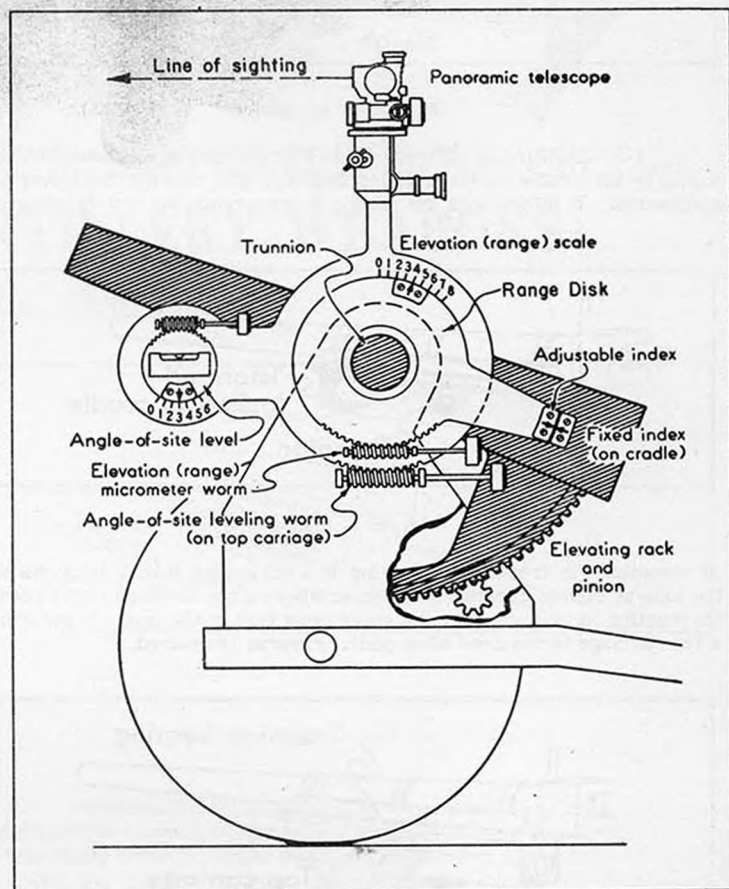
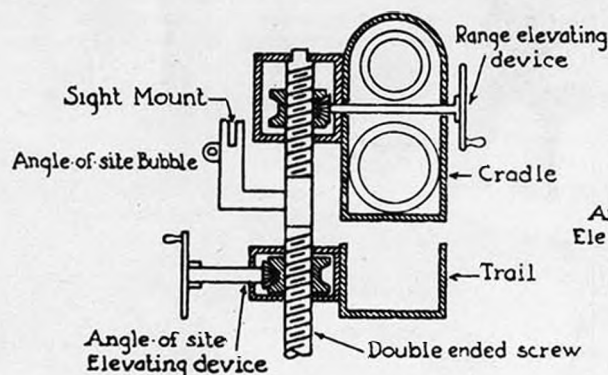


Fig. 53 -- Semi-independent line of sighting

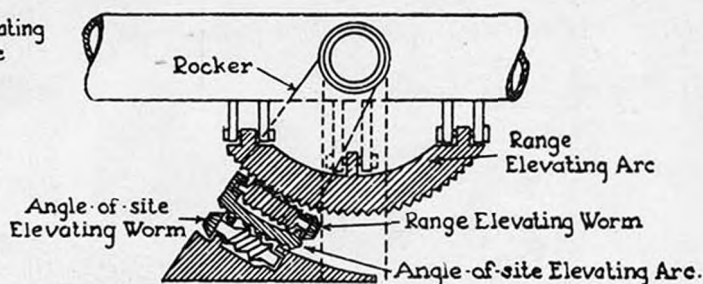
angle of site is set on the angle-of-site scale, moving the bubble out of level. The bubble is then leveled by means of the angle-of-site worm, which moves the entire bracket, thus moving the adjustable index away from the fixed index. The range is then set off by turning the elevation-micrometer knob, again moving the adjustable index with respect to the fixed index. This last operation does not affect the setting of the line of sighting, the angle of site, or the level bubble. Finally, the cannon is moved by means of the elevating handwheel until the fixed index coincides with the adjustable index, and the cannon is properly laid for elevation. This latter movement does not affect the setting of the telescope or bracket, nor do these parts move when the cannon is elevated or depressed. The fixed index is the only element which moves with the cannon.

CONSTRUCTION. (Figure 54.) - The mechanical means of elevating a cannon may be one of two main types: namely, rack-and-pinion, or screw. Generally, for the independent line of sighting, a double rack-and-pinion (or double rack-and-worm), a double-screw, or a combination of rack-and-pinion and screw is required. For either the dependent or semi-independent systems, a single screw or a single rack-and-pinion with worm is used. For greater strength, many of the heavier carriages and some of our newer carriages have two parallel racks and two pinions, one rack and pinion being on each side of the gun.

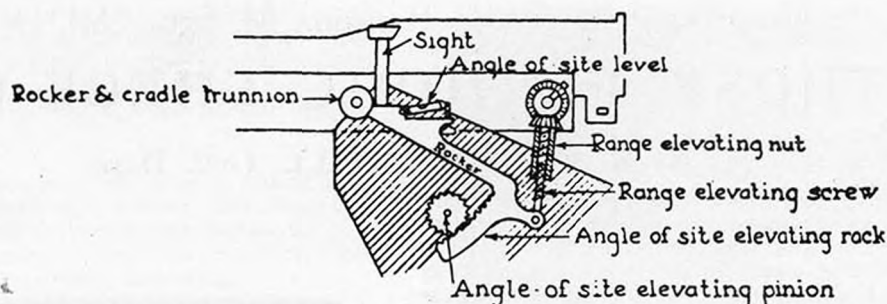
Rack-and-pinion elevating mechanism. - The rack-and-pinion type of elevating mechanism consists of an arc, called the rack or segment, which moves or can be moved by a small spur gear, called the pinion. The rack may be attached to the tipping parts and the pinion to the fixed part of the carriage, or vice versa. Whenever a rack-and-pinion is used, a worm and a worm wheel must be placed in the gear train to make the



DOUBLE SCREW ELEVATING MECHANISM



DOUBLE RACK & WORM ELEVATING MECHANISM



COMBINATION SCREW, WORM, AND RACK ELEVATING MECHANISM

Fig. 54 -- Construction of elevating mechanisms

system irreversible, that is, make it hold its position when the handwheel is released. In some cases, a worm and a segment of a worm wheel are used instead of a rack-and-pinion with worm in the gear train.

Screw-type elevating mechanism. - The screw-type elevating mechanism consists essentially of a screw and nut between the tipping parts and a fixed part of the carriage. The mechanism is actuated by a handwheel and suitable gears. Either the screw or the nut may be attached to the tipping parts.

TRAVERSING MECHANISMS

GENERAL. - A traversing mechanism (Figure 55) is a device for making internal changes in the direction of the axis of a cannon bore. The

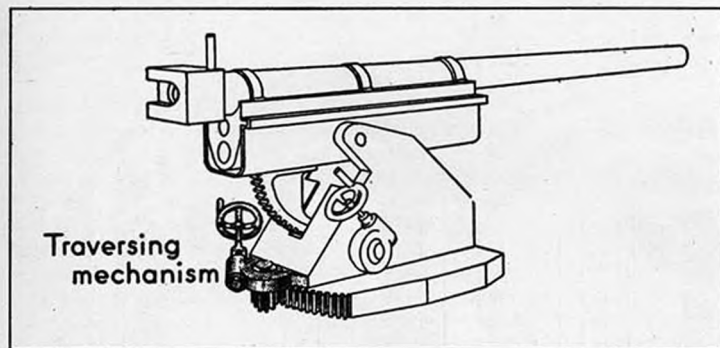


Fig. 55 -- Traversing mechanism

moving parts may consist of only the cannon and the upper part of the carriage, or in some cases, the moving parts may consist of the entire cannon and carriage except the axle. In the case of self-propelled artillery and certain types of railway artillery, the entire vehicle or railway car may be moved to traverse the cannon.

Traversing mechanisms are of three general types: axle, pintle, and base ring and racer.

AXLE TYPE. (Figure 56.) - In this type of traversing mechanism, the upper part of the carriage and the cannon are moved laterally along the axle, pivoting about the trail spade. This arrangement is applicable only to carriages with box trails.

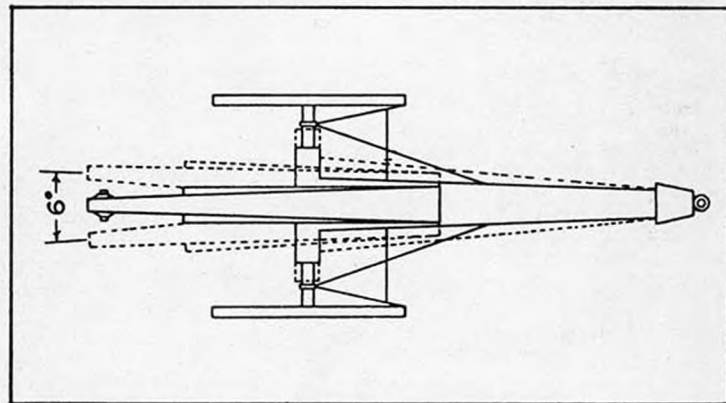


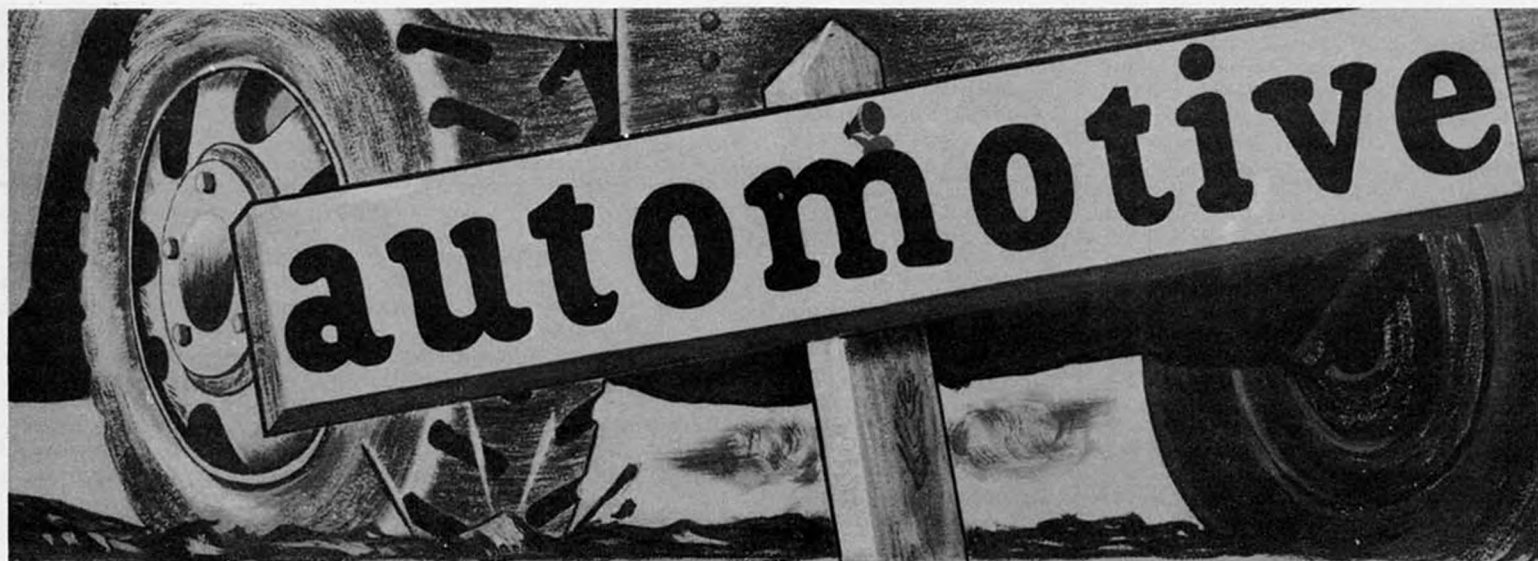
Fig. 56 -- Axle traverse (schematic drawing)

Construction. - The mechanism may consist of a threaded axle and traversing nut (Figure 57) or of a separate traversing screw and nut (Figure 58), together with the necessary gear train and handwheel. Either system is irreversible, so that the only purpose of additional gears is to change the power ratio or the direction of the power applied at the handwheel. The threaded-axle type is simpler than the threaded-screw-and-nut type, but is suitable only to light carriages.

PINTLE TYPE. - In the pintle type of traversing mechanism, the cannon is moved about a vertical pivot fixed on the axle or on the underpart of the carriage (Figure 59). It can be used with all types of trails, and it is the only type suitable for use with the split trail carriage.

Construction. - The mechanism consists of a handwheel and a shaft which operate, directly or through a train of gears, a worm and rack, or a pinion and rack (see Figure 60). As with the elevating mechanism, some

(Continued on page 99)



Conducted by: W. E. Ransom, M. Sgt., Ord. Dept.

THOSE PERIODIC CHECK-UPS

by R. E. PACE, 2nd Lt., Ord. Dept.

Future engine breakdown can be prevented if periodic checks are properly carried out. That burned valve you have today did not materialize suddenly. It developed over a period of time from some minor misadjustment or trouble; such as improper valve clearance, weak valves or sticky valves. That battery which has failed after a short life was probably due to a voltage regulator that was improperly adjusted. If periodic checks had

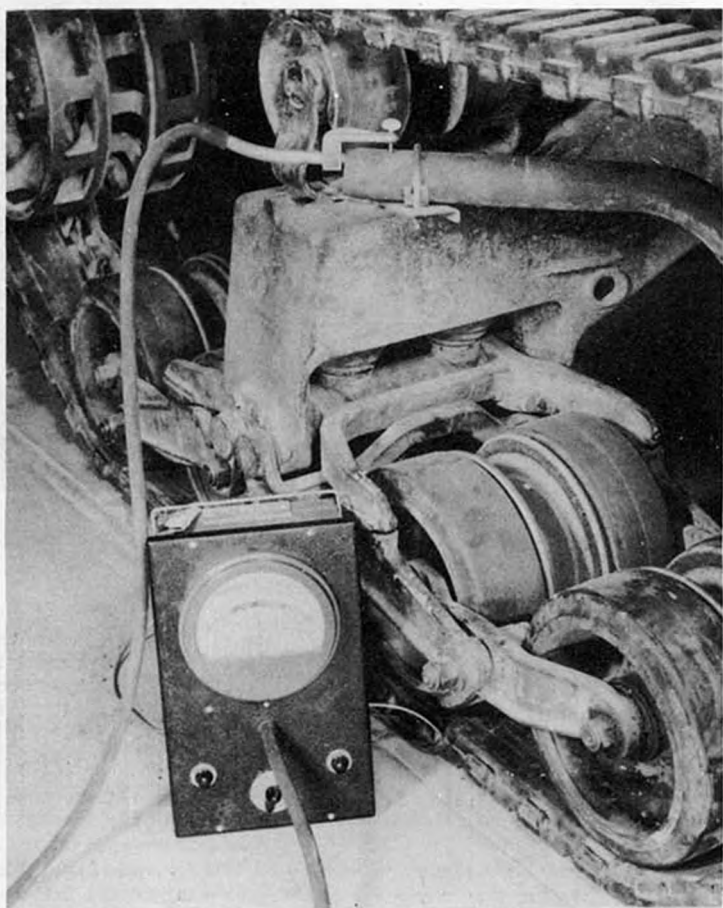


Fig. 1 -- Exhaust gas analyzer

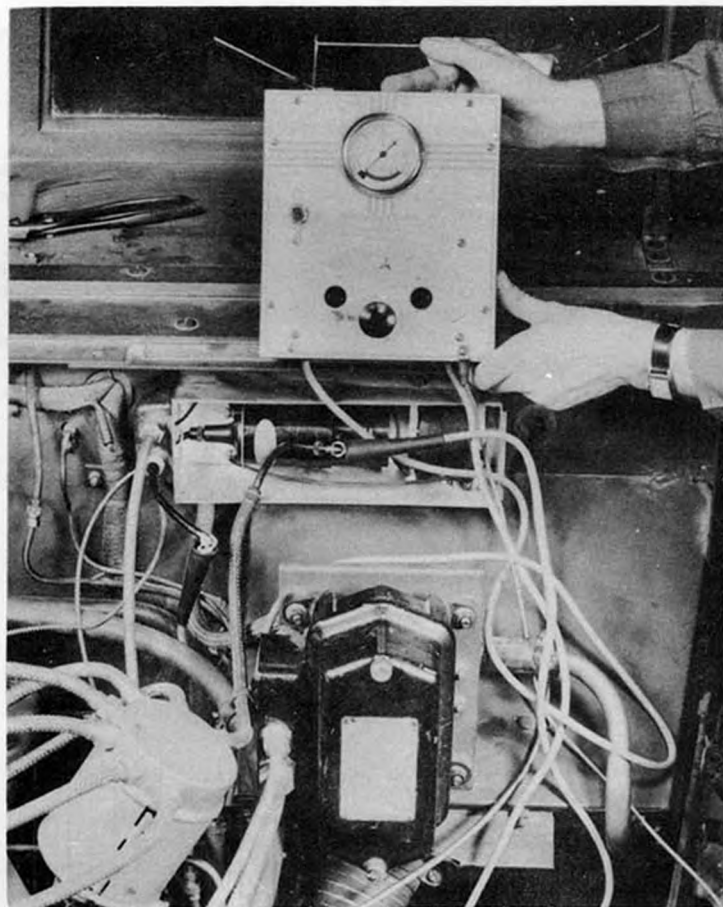


Fig. 2 -- Spark meter test
been performed the improper adjustment would have been corrected and the battery would still be in service.

Small troubles gradually appear due to wear of the moving parts of the engine. The practice of giving these minor troubles no attention

until complete failure results is very unwise and sometimes very costly. A gradual falling off in gas mileage and power can be due to ignition timing that gradually becomes later as moving parts wear. Your carburetor mixture will gradually change due to various causes, such as wear on the float mechanism, plugged air bleeds, leaky by-pass valves on accelerating devices, or defective power jets. By periodic use of the proper test instruments these minor defects can be detected and corrected.

Low gas mileage, poor get-away and loss of power can usually be attributed to one or more of the following factors: defective carburetion, timing, valves, or ignition.

Figure 1 above shows an exhaust gas analyzer connected to the exhaust pipe of a Half Track, M2. This instrument will show us our carburetor condition at idle, intermediate speed and high speeds, besides indicating excessive accelerating charges. The reason unsatisfactory results are sometimes obtained is because the mechanic expects too much from the analyzer. One must expect to get only carburetion condition; not ignition and valve conditions. Some belief exists that the exhaust gas analyzer will show a rich reading if ignition trouble is present. This can be proven by setting the throttle for a definite speed with the analyzer hooked up. By shorting out one or more plugs very little change in reading will be noted. But notice that what change does occur is on the lean side. On some analyzers this test will move the needle toward the zero. As for valve timing the engine may range as far as 12 to 15 degrees variation in valve timing without making any noticeable change on the analyzer. Of course, an extreme condition in valve or ignition timing would cause a marked change, but then the engine would perform so poorly it would be useless to make a test with the analyzer until the trouble was remedied.

There are two important points to remember in making a gas analysis. First, in bringing the engine up to a faster speed, bring it up with a slow, steady movement, without accelerating beyond the point desired. Do not pump the accelerator. Second, after changing engine speed wait at least half a minute before taking the reading.

With the engine idling the analyzer should read between 11 to 1 and 12 to 1. Now bring the engine up to a point corresponding to a speed of about 25 to 30 miles per hour. The reading now should be "12 to 1" to "13 to 1". Now bring the engine up to a high speed of about 50 miles per hour. The reading should be between "13 to 1" and "14 to 1". Letting the engine return to idle the reading should be the same as before at idling. If the reading is not the same you have indications of erratic fuel pump pressure or a leaky float valve. Now, upon accelerating quickly, the needle should go over slightly to the rich side before going over to the reading you had previously at high speed. If an excessive rich reading is obtained you are probably getting an excessive accelerating charge. When making floor tests avoid making readings between 10 and 20 miles per hour speed, as both the high speed and idling jets may be in operation, giving a false reading.

A variable spark gap may be inserted in the high tension ignition circuit to determine the high tension output of the coil. This unit should be placed in series with the secondary circuit between the high tension terminal of the coil and the center terminal of the distributor cap. Figure 2 shows the spark meter connected at the high tension terminal of the coil.

A handy adapter for this test can be made by taking a length of secondary ignition wire, about six or seven inches long, and putting a coil secondary terminal, which screws into the coil, on one end and an ordinary high tension terminal on the other. This adapter is illustrated in Figure 3-B.

Now by clipping one lead from the spark meter to the wire leading to the center distributor cap terminal and the other to the short lead

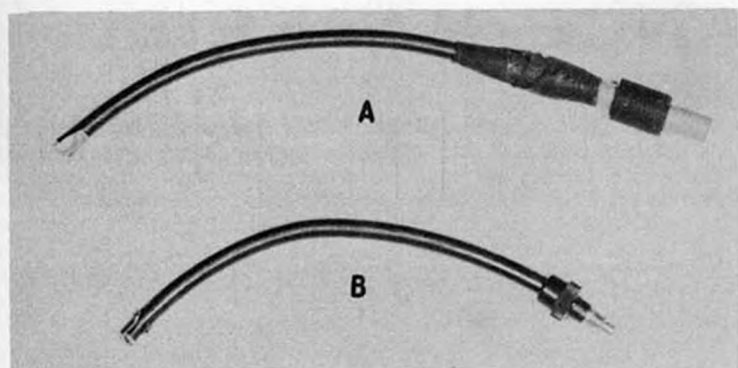


Fig. 3 -- Adapters for spark meter test

screwed into the coil terminal we have the variable spark gap in series with the secondary ignition circuit. A warm engine should start on a 5 millimeter gap and should run steady without a miss with the gap set at 7 millimeters. This indicates the coil secondary output is sufficient to take care of the load that may be placed upon it. However, should a miss occur it does not mean the trouble is definitely in the coil. Since the voltage in the secondary is dependent upon the proper functioning of the entire primary circuit the trouble could be in the coil, condenser, breaker-points or elsewhere in the primary. Further check would be necessary.

Sometimes a further check to the secondary is necessary to see if the secondary spark is getting to the plugs. A handy adapter to be used for this purpose is illustrated in Figure 3-A. On vehicles without ignition shielding no adapter is necessary. This adapter consists of a piece of secondary ignition wiring about eight inches long. On one end is taped two of the cylindrical, fiber insulators found within the cone shielding that fits over each plug. The wire extends about halfway through the first insulator, leaving the outer insulator and half the other still empty. On the other end of the wire is an ordinary high tension terminal. Push the end with the insulators up into the cone shaped shielding so the in-

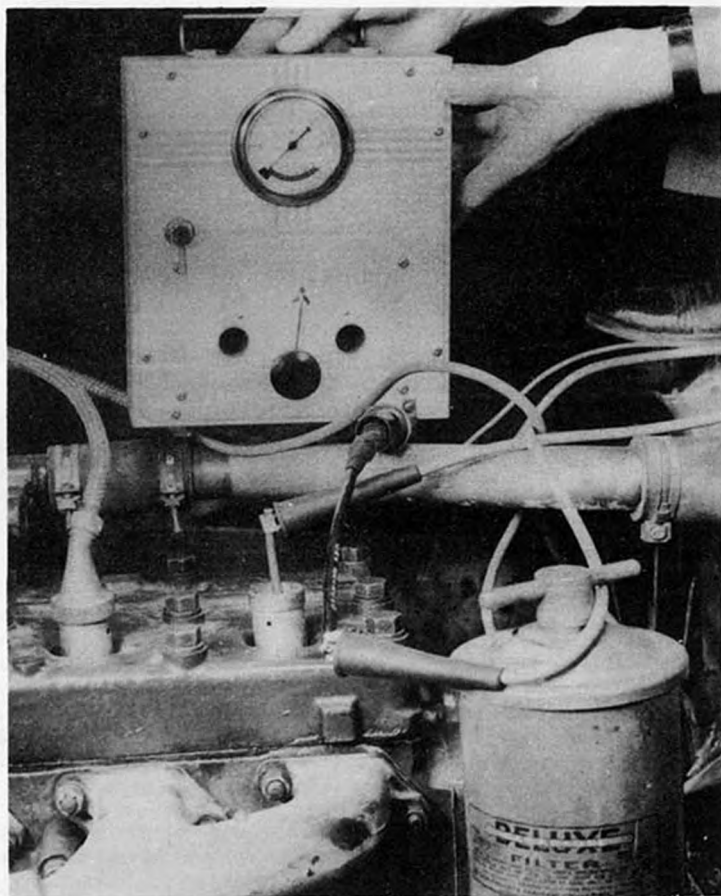


Fig. 4 -- Copper tubing in place

insulator will fit over the coil spring on the end of the high tension lead coming from the distributor. Clip one lead of the spark meter to the exposed end of the adapter. Instead of clipping the other spark meter lead direct to the plug it is better to place a three or four inch piece of copper tubing down over the plug terminal and clip onto the tubing, as illustrated in Figure 4.

This prevents shorting out between the clip and the shielding around the plug.

The third instrument to be covered is the vacuum gage. Figure 5 shows a vacuum gage connected to the intake manifold of a Half track, M2. Normal reading with the engine running should be between 19 and 21 inches at sea level. The reading will be about 1/2" lower for each 1000 feet of elevation. At any speed above idling the needle on the gage should be absolutely steady. On some engines an ignition miss will cause the needle to jump. This can be tested by shorting out one or more of the

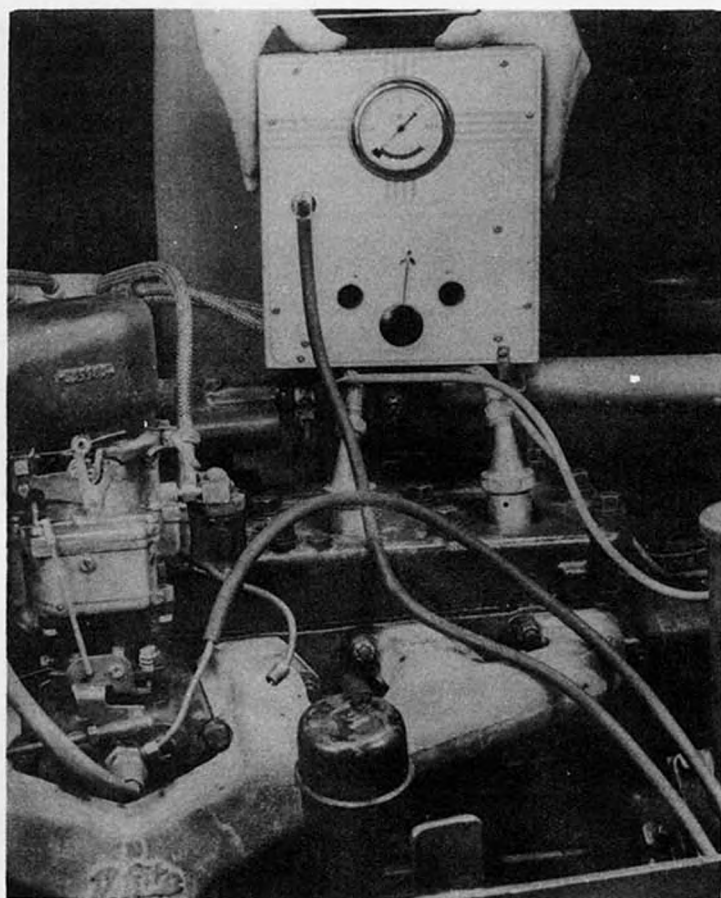


Fig. 5 -- Vacuum gage test

plugs in turn and seeing if it causes any action on the gage. If not, then you know definitely any unsteadiness is due to a valve condition. A low reading can be the result of late timing, either ignition or valves, a constant manifold leak, poor rings, or perhaps certain carburetor conditions. The carburetor condition, however, would be detected on the exhaust analyzer.

It will be noticed that upon deceleration from a high speed the needle will increase to 25 or 28 inches before decreasing again. This is a normal condition. If a bad ring condition, or blow-by, exists, the increase upon deceleration will not be as great. If a bad exhaust valve is present and is not closing properly the reading on the gage will take a perceptible drop while the intake valve on that particular cylinder is open. Also, if a leak in one of the combustion chambers exists the needle will drop when that particular cylinder has its intake valve open. If leaks exist in several combustion chambers it will cause wide fluctuations of the needle.

A low-reading voltmeter (one that will read in tenths of a volt) is a very useful instrument for locating excessive resistance in any electrical circuit. Wherever we have resistance in a circuit we will have "Voltage loss", or "Voltage drop". The greater the resistance the greater the voltage drop will be. Figure 6 shows a voltmeter and ammeter connected at the

battery terminal of the voltage regulator on a Half Track, M2. Remember that the voltmeter is always connected in parallel with the circuit to be tested. If only one point in the circuit is to be tested the voltmeter leads can be connected one on each side of the point and then with current flowing through the circuit the reading on the meter will be the voltage drop.

For a quick check on the ignition primary, connect one voltmeter lead to the live side of the ignition coil and the other lead to ground. With

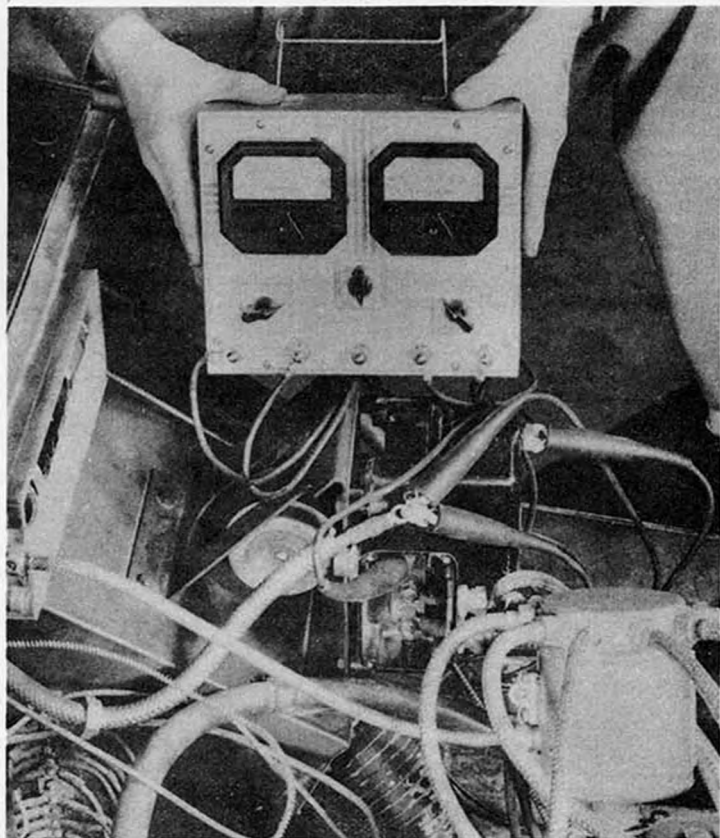


Fig. 6 -- Voltmeter and ammeter

the ignition switch on, the reading should be slightly over 12 volts (on a 12-volt system). This is full battery voltage as there should be scarcely no noticeable resistance between the battery and coil. A reading of less than 12 volts indicates a low battery or a loose or dirty connection. Watch the voltmeter while the starter is turning the engine over. A reading below 10 volts indicates battery trouble or resistance in the starter or starting circuit. After the engine is running the voltmeter will indicate if high voltage exists which would shorten the life of breaker points, condenser or the coil.

Best results can be obtained on periodic checks if the four units covered above are connected to the engine at one time. Every time a vehicle comes into the shop for repair or overhaul, if time is available, these checks will be found profitable. The mechanic will find that every defect will not be glaringly noticeable to him the first time he uses these instruments. Only through continued use will he be able to detect troubles quickly and accurately.

NOTES ON ORDNANCE MATERIEL

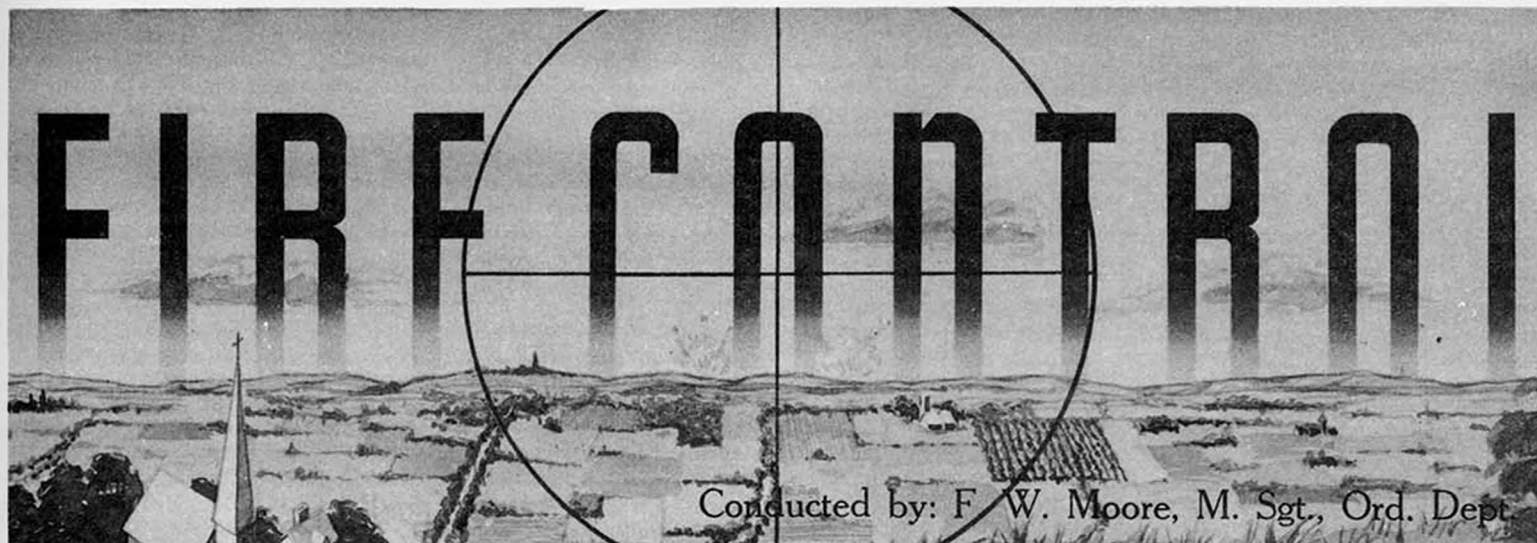
GUN, MACHINE, CALIBER .50, BROWNING, M2, A/C BASIC PAINTING OF BARREL JACKETS TO PREVENT RUSTING

It has been reported that barrel jackets for Browning Machine Gun, Caliber .50, M2, Aircraft, Basic, are rusting when, after long service, the parkerizing has worn. This has been noted especially when guns have been fired over salt water. The complaint has arisen that upon removing the rust spots, shiny surfaces appear which quickly rust again, and that if a coating of oil is placed over these shiny spots, deposits of dust will form.

Barrel jackets encountered with shiny or rusty spots should be

thoroughly cleaned and coated with Primer, Synthetic, Rust-Inhibiting, Paint Specification AXS-750. This specification covers a grade of quick drying primer, rust-inhibiting, capable of being brushed or sprayed for general use as the first coat on bare metal surfaces. Paint Specification AXS-750 should be used in conjunction with Enamel, Synthetic, Stenciling, Lustreless, Specification AXS-753. This specification is intended as a finish coat for unfinished metals, in which specification AXS-750 has been used as a primer coat. When the above are not available, any good commercial paint or paints having similar characteristics of the above specified paints may be used.

This information is published pending revision of TM 9-1225.



M1 vs. M2 HEIGHT FINDER

by C. L. DUKE, 1st Lt., Ord. Dept.

Personnel unfamiliar with height finders would assume that the M1 and M2 models of this instrument were similar on casual observation, but upon closer examination several differences are apparent; the most noticeable is the cradle.

The cradle of the M2 height finder is a very solidly built, compact casting, which houses the traversing mechanism and receiver, friction clutch, and altitude transmitter. On the M1 the traversing mechanism and the friction clutch are housed in the tripod. A comparison of the weights of these two components shows the M2 model to be 25 pounds heavier. The M2 cradle weighs 255 pounds, the tripod 115, whereas the respective weights for the M1 are 160 and 185 pounds.

It is readily noticeable that the tripod of the M2 is lower; the top surface being just one foot lower than that of the M1. The area of the tripod head on the M2 is greater, resulting in better distribution of weight.

Another variation in structure is that the tube proper of the M2 has an undercarriage which rests on the cradle, whereas on the M1 the tube is supported directly by the cradle at the main bearing supports. This feature of the M2 again gives better distribution of weight. The tube proper of the M2, however, is 94 pounds heavier than the M1; the respective weights are 669 and 575 pounds.

The undercarriage mentioned above supports the tube proper at the main bearing supports, these being spaced twenty inches from the center. The main bearing supports on the M1 are slightly nearer the center.

The supports on the cradle of the M2 are spaced seventeen inches from the center, while on the M1 they are spaced twenty-eight inches from the center. The support bars which form the undercarriage of the M2 are incorporated right in the cradle of the M1.

Another important change is that the M2 has the elevation mechanism and elevation repeater attached to the undercarriage and main bearing support on the left, thereby divorcing it from the cradle where it is attached on the M1. This feature eliminates the necessity of orienting the elevation receiver prior to placing the tube on the cradle.

An observer is aware immediately that the height of image adjustment, fire elevation, and internal adjuster correction knobs are all located differently on the M2 as compared with the M1. There is also an additional knob on the M2 for a side adjustment of the collimator (internal adjuster) targetline. It replaces the internal adjuster centering plate of the M1, and allows one to make the adjustment without breaking the seal of the instrument.

Other differences of a less noticeable nature are as follows: the porter bars are longer; the diameter of the end windows is less by about 1-1/2 inches; the diameter of the outer tube is slightly smaller; the bearings supporting the inner tube are spaced about one foot farther out; the 13-conductor cable is connected first to the undercarriage, and then to the

junction box; the cradle has four handles for carrying purposes; and there are six rather than four locking screws between the tripod and cradle.

The above is a general description of the two instruments with little attention paid to the technical details of the subassemblies. However, in the following paragraphs there will be discussed in detail the differing features of the major assemblies.

Tracking Telescopes

When comparing the tracking telescopes of the M1 and M2 height finders several factors must be taken into consideration. First to be considered are the component parts, mounts, magnification and fields of view.

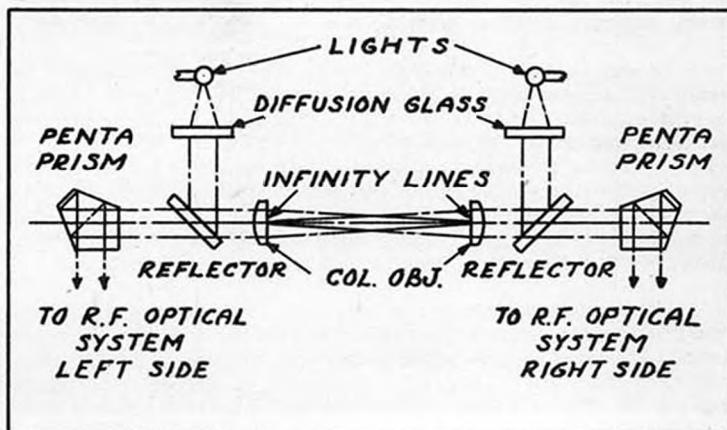


Fig. 1 -- Internal adjuster system

The magnification of the telescopes on both instruments is the same (8-power), as well as the fields of view (6 degrees). The tracking telescope used with the M1 is the M7 elbow telescope, while the elbow telescope used with the M2 height finder is the M13. Both carry the necessary components of a terrestrial telescope; i.e., objectives, erecting systems, reticles, and eyepieces. There are, however, important differences in design. The M13 telescope has a porro prism while the M7 does not. The M13 telescope provides a means for tilting the reticles by readily accessible jack-straws, while the same adjustment on the M7 is difficult to perform because of a lack of this provision. The M13 has a knob conveniently located for moving the reticle horizontally across the field of view. There is no such feature in the M7.

One outstanding characteristic of the M13 telescope is the incorporation of an open sight. On the M7 there is used a tube-like collimator for approximately positioning the target prior to tracking. This same

act may be performed more quickly by sighting through a sight which is similar to an ordinary gun-sight.

Another variation is found in the manner in which the telescopes are mounted on the height finder. On the M1 the tracking telescopes are mounted so they may be adjusted for orienting purposes. This adjustment is accomplished by turning three jack-screws of the mount until the telescope is accurately aligned. On the M2 there is no such provision. The mounts in this case have three points of support which are bearing surfaces, and are so machined during manufacture that the telescopes are aligned with the main telescopic system when the instrument is sighted on a target at 4000 or 5000 yards. Once aligned the scopes are pinned in place. If for some reason the tracking telescopes must be removed in the field it may result in their disalignment, and unless an experienced instrument repairman is present, great difficulty may result in attempting to correct this defect. When necessity does demand their removal, extreme care should be observed and the operation performed by an expert repairman.

Internal Adjuster System

Since the M1 and M2 height finders both employ the stereoscopic principle to measure slant range and altitude, it is necessary that some reference point be selected from which to make these calculations. With both instruments point (or distance) is infinity. Consequently it is possible to sight on some star, planet or other celestial body since they are at an infinite distance. Furthermore, the light from any of these sources is parallel. Early height finders used a "measuring lath" which is a low coefficient metal strip with two marks separated the exact distance as the two end windows. By sighting first on one mark and then on the other the same result was obtained as by sighting on a star. With this means of adjusting the instrument, however, there was no assurance that weather conditions would be suitable or that time would permit the operation. In addition it was difficult to manufacture a suitable lath, to say nothing of accurately setting it up. To remedy this a system was devised and built into the instrument itself. The sole purpose of this system is to create

an artificial target at infinity. An instrument possessing such a system is said to be "self-contained".

Both the M1 and M2 height finders obtain these parallel rays by having a reticle at the principle focus of an objective. With this arrangement in duplicate, as shown in Figure 1, parallel rays of light can be introduced in each end of the tube.

While the end result accomplished in both height finders is the same, the optical parts of these internal adjuster systems are mounted and arranged differently. In the M1 height finder two separate identical mounts are attached to the inner tube with their reticles facing each other. The light for the system, arising from a bulb mounted on the outer tube, passes through a diffusing lens and then strikes a reflecting plate whence it is reflected 45° and illuminates the reticle. This reticle lies in the focal plane of the objective in the opposite mount, which picks up the image of the reticle and passes parallel rays of light. After leaving the objective the now parallel rays strike an alignment wedge and pass on to the end of the tube. Here they are reflected to the end reflectors by means of a pentaprism. (See A and B, Figure 4.) The end reflectors then transmit the light to the main telescopic system of the height finder. This same action takes place in the other internal adjuster mount. A centering plate is located midway between the mounts and it is adjusted so the target line as seen in the observer's field of view will be conveniently located with respect to the height finder reticles.

This same function is accomplished in the M2 height finder by a somewhat similar arrangement. In the case of this instrument, however, the main optical components of the internal adjuster system, or the "collimator", as it is referred to in this case, are differently housed, although they still maintain their same relative positions. In the M2 there is but one alignment wedge. This does not hamper the efficiency of the instrument; as a matter of fact we could easily do away with one of the alignment wedges in the M1 and it still would function properly — with a few minor changes to the correction wedge. Also missing on the M2 collimator tube is the centering plate, but to compensate for this absence there has been attached an adjusting device which will move the right side of the tube laterally; the left side pivoting at its attached joint. This movement gives the same effect to the target line; i.e., moves it laterally across the observer's field of view. Another difference is that on the M2 the collimator target line is double line instead of the single line that is found on the M1.

A knob is located on the outer tube to the left of the stereoscopic observer's station. This knob is the correction knob, a motion of which moves a wedge and causes the target line seen in the left field of view to move across the field. When the instrument is in adjustment and the range is set at infinity, a motion of this knob will enable the observer to bring the line into stereo-contact at which point he has applied the correct internal adjustment to the instrument for changes that might have occurred due to temperature differences or due to variations between his stereoscopic sense and the stereoscopic sense of a previous observer.

Measuring Wedges

The so-called "compensator", or more commonly known "measuring wedges", are of a distinctly different design in the M2 height finder as compared with the M1. This change in design has introduced new problems heretofore not encountered by the Ordnance repairman. While the M2 wedge unit is essentially of more simple design, complications arise because ample adjusting facilities are lacking.

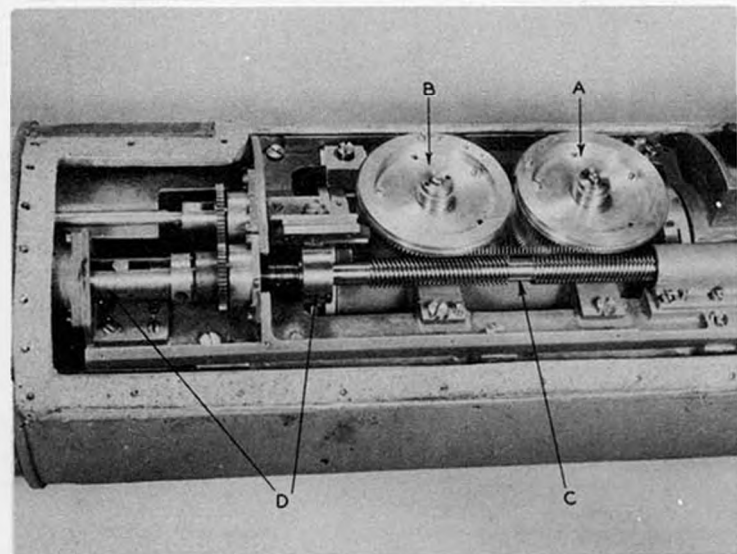
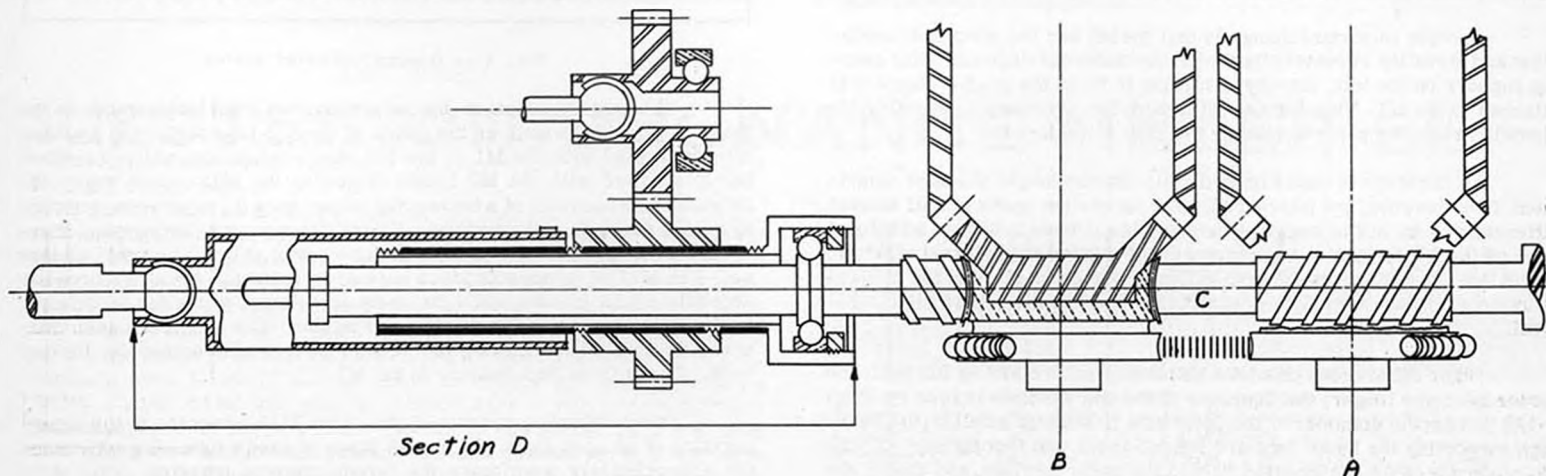


Fig. 2a -- Measuring wedges (compensator)

Fig. 2b -- Details of Section D indicated on Fig. 2a.



The M1 wedges contain the familiar differential which has presented a constant maintenance problem. The M2 wedge unit has done away with this differential as such. Generally speaking, the entire unit consists of one large differential, but the gear-train is so simply designed and arranged that its operation is obvious after a few minutes' observation. (See Figure 2.) The principle of operation of this differential is as follows:

Overlying wedges 1 and 2 is a bevel gear that engages with the gear attached to each of these wedges. Similarly, overlying wedges 3 and 4 there is another bevel gear that engages with the gears of these respective wedges. These two overlying bevel gears, A and B, are geared to a common worm and rack arrangement, C. This gear (C) acts as both a worm and a rack depending upon the motion put into it at D (see Figure 2 (b); i.e., either elevation or range motions. When the range-height lever is in the "height" position and the instrument is elevated it causes a motion to be put into the worm and rack; this motion is a rotation, thereby causing wedges 1 and 4 to move together and in the same direction, and at the same time it causes wedges 2 and 3 to move together and in the opposite direction from wedges 1 and 4. Whether the range-height lever is in the "range" position or the "height" position makes no difference insofar as range input is concerned. This motion (range) is put in by rotating the range knob and it causes the worm and rack to be translated, thereby causing wedges 1 and 3 to move together and in the same direction; at the same time wedges 2 and 4 move together but in the opposite direction. These motions of range and elevation have the same effect as in the M1 Height Finder, but, as has been illustrated, the means of accomplishing them is entirely different.

To eliminate backlash from the M1 unit there is a system of four springs attached to the wedges. In the M2 unit there is but one spring used. This spring is attached, under tension, to both of the overlying bevel gears so that regardless of the direction or the amount of rotation there will be a constant pressure in one direction on the gear-train of the unit.

On instruments numbered 1 to 12 (inclusive) there is no means provided for adjusting the measuring wedges without complete disassembly of the inner tube from the outer tube. A very small correction may be made for range on these instruments by removing the range drum cover plate and disconnecting the drive to the wedges, but as far as working on instruments 13 and above there is provided a cover plate over the unit which may be easily removed and considerable work accomplished without disassembly. It must be remembered that for any adjustment of the measuring wedges experienced and trained men only should be used.

Eye-piece Assemblies

The eye-piece assemblies of the M1 and M2 height finders differ greatly in their optical setup and general construction. (See Figure 3.) The main differences lie in the fact that the M2 unit contains the erecting system and the change of power (magnification) mechanism. In the M1 the erecting system and change of magnification systems were incorporated into the optical bar. In the M1 the erecting system may be shifted from one position to another (which is the means for changing magnification) by turning a lever located on the rear center of the outer tube. But in the M2 this lever is located on the front right corner of the eye-piece mount. It drives through shafts and gears to the underneath portion of the eye-piece. Here the erecting lenses are mounted in tubes and provisions are made whereby they can slide up and down in their respective tubes; i.e., toward or away from the eye-piece. In both instruments this erecting system performs the same function as (1) giving the proper erection to the image, and (2) providing a means for changing the power of the instrument. Making the erecting system a part of the eye-piece has greatly facilitated the ease with which maintenance may be performed over the system used in the M1 where the erecting unit was in the optical tube, disassembly of which required complete disassembly of the tubes.

Optically the two systems differ in that a greater variety of optics are used in the M2 eye-piece. Here there are two pairs of four lenses each; two double convex; one double concave; and one meniscus concave in each set. The total movement is much shorter and the system is exceedingly compact.

The eye-piece assemblies are so designed that they may be separated into two complete units; one containing the erecting system and the ray filters, the other containing the eye-piece optics. Removal of these two subassemblies as a unit entails breaking the seal of the instrument, while the upper section or the eye-piece itself may be removed without effecting the seal since there is a sealing glass on the lower section.

As a precaution against dust and scratching, the optical elements are very well concealed and effectively covered. The M1 will be found to be of simpler construction with most of the optics exposed. The rhomboids of the M2 are housed so that only the portions through which light must pass

are exposed. This design makes them more stable and less apt to become defective.

A slight change may be noted in the arrangement of the filters. In the M2 the filters are contained in a single disc with corresponding color pieces opposite each other, while on the M1 the filters are contained on matched discs which must be aligned so corresponding colors are visible at the same time.

The headrest used on the M2 is larger than that of the M1, which presents advantages as well as disadvantages. It is more comfortable, but because of its size handicaps the repairman when attempting to make adjustments. Its removal, however, is a simple operation and should not be considered an obstacle.

Objective Mounts

Upon inspection and comparison of the M1 and M2 objectives and their mounts, it can be seen immediately that there are several major variations. They differ in size in that the M2 is much smaller than the M1. The lenses themselves are different; the M1 employs a compound lens composed of a double convex and a plano concave, while the M2 employs a double convex and a meniscus concave.

When it is desired to move the entire mount of the M1 objective it is necessary to loosen a locking screw on top of the optical bar and then move the single adjusting ring. Since there is only one ring which can be moved it is difficult to obtain an exact adjustment, but it must be accomplished by a series of "hit-or-miss" adjustments. On the M2 there are two adjusting rings provided. By loosening one of these rings and tightening the other the objective mount may be moved to any desired position.

On the M1 height finder there is no provision for changing the air space between objective elements. This is a vital adjustment in that it is the only means whereby the magnification may be equalized if a cross-field check is negative. On the M2 there is an arrangement that provides for this adjustment, and hence gives the mount one great advantage over the M1.

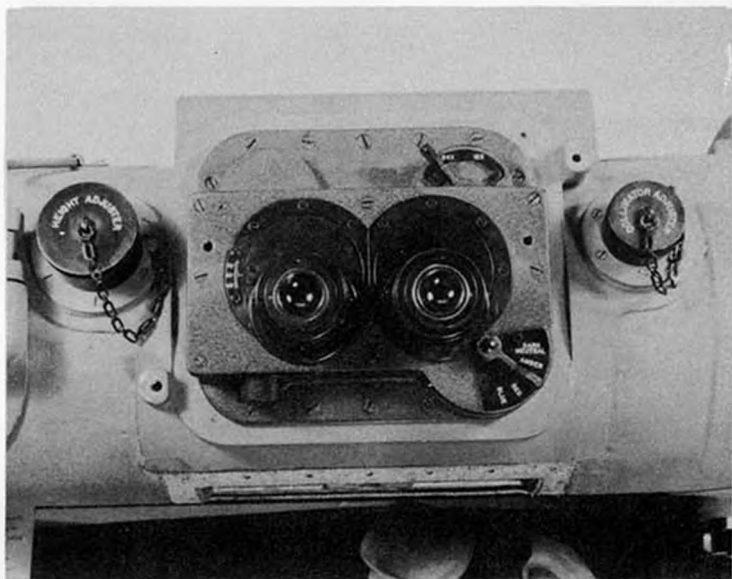


Fig. 3 -- Eye-piece assembly

End Reflectors

A decided change is found when comparing the end reflectors of the two instruments. Instead of having the old built-up reflecting mirror type of end reflector, the M2 has the trapeziform type which employs two front surface aluminized reflectors placed at 45° to each other. Figure 4 shows the reflector complete with pentaprism. With the front surface doing the reflecting it means that the glass backing up the mirrored surface does not have to be perfect as it does in a rear surfaced mirror. This is one advantage to the manufacturer, and also helps keep the cost of the instrument to a minimum. It has been found that the aluminized end reflectors are extremely delicate and difficult to clean. Care should be taken that no coarse material strikes their surface and that no cleaning agent such as alcohol, ether or acetone is used. Instead of one of these standard cleaning agents, use a weak solution of soap and warm water. Better still, use a dry clean piece of medical cotton wrapped on a splint, making sure that it is not handled with the fingers. By rubbing very gently over the aluminum surface the end reflector may be cleaned sufficiently.

Each piece (optical) at the end reflector is held firmly in the end reflector mount at two places. The mount itself is secured to an adapter which fastens to the inner tube, and this mount is secured to the adapter at three points. Three points are used because it affords the minimum amount of scraping in the event one needs adjusting.

There is no adjustment that may be performed on the end reflectors except scraping, stoning and/or filing the three points of support of the mount. This, of course, should be attempted only by an height finder repairman. Serious damage will result if this precaution is violated.

Pentaprisms

The pentaprisms used on the M2 are practically the same as those of the M1 except they are slightly smaller and mounted to move into position in a different manner (see Figure 4.) Instead of swinging in an arc by means of a yoke, the M2 pentaprisms slide back and forth when the positioning knob is turned. This knob is located on the rear of the outer tube slightly to the right of center, and it is geared to rods in the same manner as the M1. These rods in turn carry the motion out to the pentaprisms and cause them to slide into position.

Like the end reflectors there is no provision for adjusting the pentaprisms. They are fixed in place and may only be adjusted by filing, scraping and/or stoning. On the M1 there is an eccentric screw which provides adequate adjusting facilities.

Correction Wedge

In the M2 height finder an internal adjuster correction wedge is employed for the same purpose as in the M1; to allow for adjustments which will compensate for the optical disalignment due to variations in temperature, or to compensate for errors in stereoscopic effect caused by differences in observers. While the M2 correction wedge is in the same relative position in the telescopic system as the M1 wedge, its general construction and manner of mounting is somewhat different.

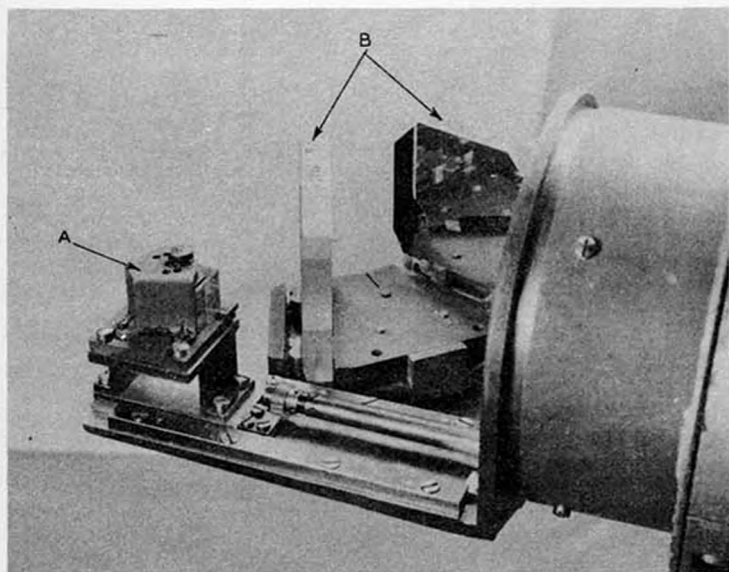


Fig. 4 -- End reflector assembly

The M2 correction wedge is of sturdier structure, having a cast mount into which fits a machined cell. This mount is attached to the inner tube and may be removed only after the inner tube has been removed from the outer tube. However, there is a cover plate located under the left tracking telescope mount which provides a means for getting at the connection between the correction knob shaft and the wedge. The over-all metallic structure of the wedge mount and cell makes it far more resistant to shock than the half-metal, half-plastic mount and cell assembly of the M1.

Fine Elevation Adjustment

An adjustment for fine elevation is also provided on the M2 height finder to allow the observer some freedom of motion in a vertical sense. This adjustment actually moves the inner tube in such a manner that the total movement as seen in the observer's field of view is 1°. The one degree movement is equally divided above and below the horizontal when the instrument is properly leveled.

In the M1 instrument the elevation motion is introduced by an eccentric motion which is created by turning the elevation knob. This knob is attached to a shaft which engages a cam and drives the inner tube with respect to the outer tube. But in the M2 this elevation movement is introduced by a camming action. The elevation knob, via shafts and gears, turns a threaded shaft which causes the slide into which it is threaded to move right and left in a line parallel to the axis of the tube. To this slide is attached a cam follower. The right and left movements cause the cam follower to ride against the cam itself. This cam is simply a slot which is attached to the inner tube and is set at an angle to the axis of the instrument.

In the M1 the movement of the knob is approximately 45°, while in the M2 the movement is almost 360°. There is an arrangement on the M2 that provides a detent at the center of the knob's motion. This setting is important when adjusting the instrument for height conversion and an exact level is desired. The M1 does not have any such provision.

Tripod and Cradle

The tripod of the M2 height finder is shorter than that of the M1. It consists of three legs with their leveling plates, a column, and a metal plate upon which rests the cradle. Unlike the M1 tripod, there is no traversing mechanism contained herein; it is all in the cradle.

The cradles of the M1 and M2 instruments differ widely in appearance. Whereas the cradle of the M1 is made of several parts, the M2 cradle is a single steel casting. The two long steel tubes that were the framework of the M1 cradle are now an integral part of the height finder proper and form the undercarriage of this assembly. The friction drive and ring gear mechanisms which were in the tripod head of the M1 are now incorporated in the cradle of the M2.

The cradle of the M1 had three selsyn motors — the azimuth and elevation receivers, and the altitude transmitter. The M2 cradle has only two selsyn motors. The elevation receiver is part of the height finder proper and is located on the undercarriage mentioned above. This feature eliminates the necessity of zeroing the elevation receiver when assembling the instrument, since the elevation mechanisms are entirely contained in the height finder proper.

There are four small handles for carrying the M2 cradle which weighs approximately 255 pounds. They are located near the corners to allow plenty of foot space for the men carrying it. To insure greater stability there are six bolts holding the cradle to the tripod and four clamping screws fastening the height finder tube to the cradle.

The height transmitter is set at more of an angle to enable easier reading by the operator, and the dials are larger and more legible than those of the M1. The azimuth handwheel is set at an angle increasing the facility and the adjustments made by scraping, filing and/or stoning. However, due to the sturdy construction of the levels it will be unlikely that they will need much attention.

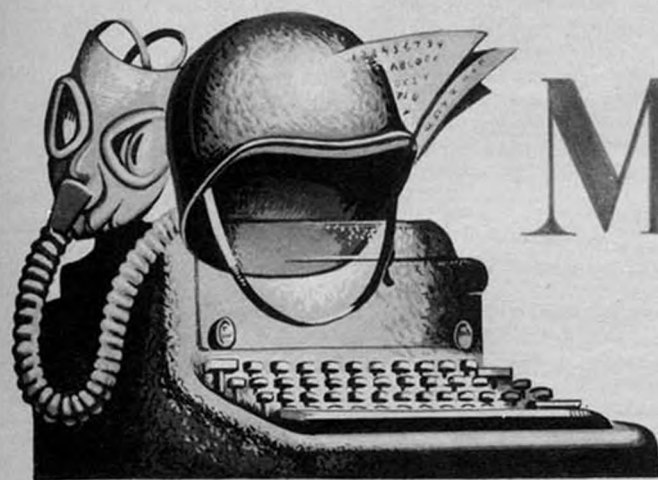
To adjust the friction clutch unscrew the wrench hole cap in the center top of the cradle. Insert the socket wrench (found in the accessory case of the cradle carrying case) in the opening, and rotate the height finder by means of the azimuth handwheel until the friction bolts are in position for adjusting. Tighten each bolt one-half turn; if this does not provide sufficient friction, repeat the procedure tightening each bolt another half-turn.

If a rotation of the height finder does not produce a corresponding rotation of the azimuth indicator index, the azimuth receiver friction clamp is slipping. Remove the plug on the right side of the receiver housing, and rotate the height finder in azimuth until the screw in the azimuth receiver friction clutch is visible through the opening in the receiver housing. Insert a screwdriver and tighten the screw until no slipping of the index occurs when the instrument is traversed through 360°.

Optical Bar and Components

Although the optical bar of the M2 height finder is approximately the same size and shape as that of the M1, there are several differences that make these units worth mentioning. In their manner of mounting within the inner tube there is a difference, in that the M1 bar is held firmly in place on the left side by means of a gimbal joint. This feature allows for expansion in both a lateral and horizontal sense. Also attached to the optical bar are a series of counterweights used for correcting twists during elevation of the instrument. These weights are located on either end of the bar as well as at the center. They may be observed at the ends

(Continued on page 100)



MILITARY ADMINISTRATION CLERKS

Conducted by: G. D. Brand, M. Sgt., Ord. Dept.

THE SERVICE RECORD

by GUSTAV L. KREISCHER
S. Sgt., Ord. Dept.

One of the most frequently referred to of the individual records for enlisted men is the Service Record (W.D., A.G.O. Form No. 24). In this record is gathered together the story of the soldier's military career from the day he enters the service until his final separation therefrom. In order that the record may be readily accessible at all times for reference and for the timely entry of data, it accompanies the soldier whenever it becomes necessary for him to make a change of station. When the service record is closed out at the expiration of the enlisted man's term of service, it is filed with the Adjutant General in the archives of the War Department, where it is permanently preserved. Once filed under these conditions, no further entries or corrections may be made without the approval of the Secretary of War.

Service records are maintained for each enlisted man on active service with the Army, and in addition, are opened upon enlistment in the Enlisted Reserve Corps. The following persons are charged with the responsibility of opening the service record for the several components of the Army:

- For original enlistment or reenlistment in the Regular Army: by the recruiting officer who accepts the enlistment.
- For members of National Guard organizations of the several states when called up for active Federal service: by the commanding officer of the National Guard organization concerned.
- For retired enlisted men called to active duty: by the Finance Officer, U. S. Army, Washington, D. C.
- For Selective Service Trainees: by the officer to whom the selectee first reports for military duty.
- For members of the Regular Army Reserve, upon mobilization for active service: by the commanding officer to whom the reservist is directed to report for duty.

Upon completion of the opening entries, the responsibility for keeping the service record up to date passes to the official custodian of the record. In the case of separate battalions and higher administrative units, the custodian of the service record is the Unit Personnel Officer, while the organization commander of separate or detached companies assumes this duty for the service records of the men under his command. The unit personnel officer or the company commander, as the case may be, upon assuming custody of the service record is responsible for the proper posting of all entries to the record with the exception of those relative to the soldier's character and his efficiency rating as a soldier. These latter entries are made by the organization commander in his own handwriting and are initialed by him. Whenever the custodian of the service record initials an entry, by way of authentication, for the first time,

he will place his initials, together with his full name, grade and organization on the last page of the record in order that his initials may be identified at some future time.

In order that the service record may contain all necessary entries, the custodian must place at the disposal of the clerk in charge of making postings, all pertinent source material. The morning report or extracts therefrom should reach his desk daily, and the sick report must be brought to his notice whenever an entry of "No. AR 35-1440" appears in the "Line of Duty" column for the first time, and also when a soldier in this status is finally returned to duty. Orders, Special Orders, General Orders, Court-Martial Orders, and Charge Sheets should be routed through the service record clerk. In addition, certain information which is not supplied by one of the above sources, but which is normally furnished by the soldier's organization commander, should be furnished this clerk. Some of the data which fall within this category are the man's Army specialty ratings, the dates when the Articles of War were read, and the dates of completion of the sex morality course.

AR 345-125 prescribes certain rules for making entries in the service record which must be observed by the service record clerk. First, in order to insure the permanence of the record and to make reproduction by photographic process possible, all entries should be made with black ink. Temporary entries made on page seven pending the final decision as to the result of a trial may be made in pencil. If the trial results in conviction, the entry is made in ink, but if the soldier is acquitted, the entry is erased. Second, final entries may not be erased, or eradicated by other means. If an item has been incorrectly posted, a correction should be made by crossing out the incorrect material with a thin line and inserting the correct information directly above. The entry should then be initialed by the officer making the correction. Third, when there is no information to be entered under any heading in the record, the space for that entry should be left blank; i.e., a negative entry should not be made. There are two exceptions to this rule. On page two, the enlistment record calls for the home address of the soldier and the addresses of his beneficiaries. If any of these does not contain a house number and/or a street or rural route number, the word "None" may be placed in the appropriate space. Again in the endorsements, beginning on page sixteen, information regarding amounts due the United States and the soldier is required. If nothing is owed under one or both of these headings, the word "Nothing" should be entered.

Oftentimes entries under one or several of the printed headings in the service record will completely fill the spaces provided. In the event that additional entries must be made in such a case, the posting may be accomplished by making an insert to the record. W.D., A.G.O. Forms No. 24-1 to 24-7, inclusive, are provided for this purpose. The insert should be pasted securely above the original page in such a manner that all entries on that page remain visible. While accompanying the soldier on his tour of service, the insert may be lost, and to place persons concerned on notice that entries have been made on an insert, a notation is made on the margin of the original page to the effect that data under that particular heading have been entered on an insert. (See Figure 1.)

With these preliminary remarks in mind, let us page through the service record in order to examine certain of the less obvious headings contained, with a view to making clear the information required thereunder, and the method of making the entries.

On page two, under the heading "Designation of Beneficiary" is provided spaces for entering the names and addresses of the soldier's beneficiary and alternate beneficiaries. If the soldier has designated a

Fig. 1

beneficiary and subsequently wishes to name another person in place of the one previously indicated, the name, address, and degree of relationship of the new beneficiary will be entered under "Remarks-Administrative", and the Adjutant General will be notified of the change by preparing and forwarding to him W.D., A.G.O. Form No. 41 (Designation of Beneficiary). To provide a cross-reference in these cases, it is a good plan to make a notation "See Remarks-Administrative" in the border of page two beside the name of the beneficiary which has been changed. In the event no beneficiary has been named by the enlisted man, the custodian of his service record will interview the man to determine whether in fact he has or has not a beneficiary. If the former is the case, the name of the beneficiary will be entered in the space provided on page two, and the Adjutant General will be notified on W.D., A.G.O. Form No. 41. If the latter, the word "Verified", together with the officer's signature and the date will be entered in the margin opposite the heading "Designation of Beneficiary". (See Fig. 2.)

The provisions of AR 35-2380 have been suspended for the duration of the War, and all data which would ordinarily have been entered under the heading "Qualification in Arms" on page four, will be posted under "Remarks-Administrative".

A record of furloughs granted the soldier will be maintained on page six under the heading "Furloughs". Delays while travelling under official orders will also be entered here. The inclusive dates of the furlough will be shown with the authority therefor. For the authority, it is normally sufficient to cite AR 615-275, but in the event a furlough is granted in excess of the limit specified in these regulations, the specific authority must be stated. If an extension is granted, the number of days extended will be entered, together with the authority therefor. Finally, the date the soldier rejoined his organization will be shown. If the soldier

Fig. 2

on furlough does not return on or before the day after the last day of furlough, the reason for the absence will be indicated. (See Fig. 3.)

The making of entries on page seven under the headings "Time Lost Prior to the Normal Date of Expiration of Term of Enlistment to be Made Good under 107th Article of War" and "Absence Subsequent to the Normal Date of Expiration of Term of Enlistment" may cause some difficulty if a few simple rules are not understood. First, all entries of dates on this page must be inclusive. Second, the date of departure in any of the categories listed is a day of absence, and the day of return is a day of duty. For example, if a soldier departed from his organization without leave at 6 AM on October 22, 1942, and returned to military control at 3 PM on October 26, 1942, he would be carried as AWOL for four days from October 22, 1942 to October 25, 1942, inclusive, and the appropriate entries would be made under the subheading "(a)" on page seven. If an enlisted man is placed in confinement awaiting trial by court-martial, a pencil notation will be made showing the first day of confinement, under the subheading "(b)". Upon final disposition of the case (i.e., after the findings and sentence of the court have been reviewed), if the soldier has been found guilty, the pencil notation will be made in ink, and the remainder of the entry will be made when the man is returned to duty. If the verdict announces the acquittal of the accused, the pencil notation will be erased and no further entry will be made. Entries reflecting absence in the hands of civil authorities are made in a similar manner under "(b)", except that some additional entries are required. A pencil notation will be made indicating the first day of absence, and at that time, an entry in ink will be made under "Remarks-Administrative" showing the soldier's status: e.g., "Sol Abs in hands C/Auth, Chicago, Ill., held for trial on charge of Drunk and Disorderly conduct - 4/22". If the trial results in conviction or if the soldier is released because of reparation made, the pencil entry on page seven will be made in ink, and a notation made under that entry: "See Remarks-Administrative". The entry on this page will be completed upon the soldier's return to duty. Under "Remarks-Administrative", a further entry will be made showing the result of the trial: e.g., "Sol tried by C/Auth on above charge, found guilty,

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therefor. Below this entry on the old service record will be noted "New service record prepared" and it will then be returned to the Adjutant General for filing. On the cover of the new service record the words "Honorably Restored to Duty" will be placed, and it will be forwarded to the personnel officer or organization commander at the soldier's new station.

It seems appropriate at this point to mention some of the auxiliary steps necessary to effect the transfer of a service record. Whenever a soldier's service record is transmitted incident to his change of station, transfer, death, discharge, etc., an additional form must be accomplished by the custodian of the service record. This is W.D., A.G.O. Form No. 25 (Extract from Service Record). An extract need not be prepared by the recruiting officer when forwarding a recruit to his first station providing no issues of clothing or equipment have been made, and no money is owed the United States. If a soldier, assigned to one organization, is serving with another for the time being, and is subsequently placed on detached service, transferred, etc., from the organization to which he is temporarily attached, the extract must be prepared in duplicate. The original is retained by the command with which serving, and the duplicate is forwarded to the custodian of the service records for the organization to which the soldier belongs. Certain of the more important information is transcribed from the service record to the extract including the data contained in the indorsement filled out by the officer transferring the record. The extract is often referred to after the soldier has departed in order to answer inquiries from the enlisted man's relatives and others, and to reconstruct a new service record in the event the original is lost.

After the extract has been properly prepared and filed, certain of the soldier's individual records must be obtained for transmittal with the service record. Normally the following forms will accompany the service record: W.D., A.G.O. Form No. 20 (Soldier's Qualification Card); W.D., A.G.O. Form No. 32 (Individual Clothing and Equipment Record); W.D., A.G.O. Form No. 33 (Individual Equipment Record); and a copy of W.D., A.G.O. Form No. 35 (Individual Clothing Slip), where applicable. In addition it is the general practice to enclose a copy of the orders, or an extract therefrom, directing the transfer of the soldier. A form of letter of transmittal which may be used to forward these records is included as Fig. 6.

HEADQUARTERS FORT BLANK,
Office of the Commanding Officer,
Fort Blank, Illinois.

302.36-Records.
201.36-Records.

March 20, 1942.

SUBJECT: Transmittal of Records.

TO : The Commanding Officer,
Fort Blank, Illinois.

1. Transmitted herewith Service Record and allied papers pertaining to Private JAMES J. WILSON, 12443657, 150th Ordnance Co (MM), placed on detached service, your command, per paragraph 4, SO #25, Hq. Fort Blank, Illinois, dated March 19, 1942.

2. Acknowledgement of receipt is requested by indorsement hereon.

For the Commanding Officer:

H. L. Sims

H. L. SIMS,
Captain, Infantry,
Personnel Officer.

- 5 Incls-
Incl 1 - WD AGO Form 20
Incl 2 - WD AGO Form 24
Incl 3 - WD AGO Form 32
Incl 4 - WD AGO Form 33
Incl 5 - Copy SO 25, Hq. Ft. Blank.

Fig. 6

When the enlisted man is to proceed alone to his new station, the service record and allied papers will be forwarded by mail to the commanding officer of the station to which the man is to report, unless the mail service between the two places is not dependable, in which case, the service record and other papers will be placed in a sealed envelope and entrusted to the soldier for delivery. If a group of men is being transferred, the records will be sealed in an envelope and given to the officer or enlisted man in charge of the group for delivery to the commanding officer at the new station.

Upon receipt of the service record of a soldier newly transferred, the personnel officer will immediately forward the record, with-

out indorsement, to the enlisted man's organization commander, who may review the record and make note of any information contained therein which he believes will aid him in assigning the man to duty, etc. Upon return of the service record from the organization commander, the personnel officer will inspect it for completeness and accuracy. If he discovers any omission or error, he will take immediate steps to supply the missing information or to make the necessary corrections.

In connection with the transfer of an enlisted man, it sometimes happens that his service record is delayed in arriving at the station to which the man has been transferred. If the record has not arrived before the date of the next regular pay day, that fact alone should not prevent payment of the soldier. A temporary service record should be opened by the personnel officer from information secured from the enlisted man, and from any other sources available. This service record (the regular form 24 is used) should be marked "Temporary" on the cover. When the original service record arrives, the information entered in the temporary record and not contained in the original, should be transcribed to the original service record. The temporary service record may then be canceled and filed by the officer originating it.

In the event a service record is lost, immediate action should be initiated by the custodian of the record to secure a replacement. A thorough search should be made in the personnel office or orderly room, and if the record is not found after every effort has been made to locate it, a report stating the fact of the loss, and the circumstances under which it was lost, if known, should be made to the Adjutant General. The Adjutant General will open a new service record for the soldier from data filed in his office, and will forward it to the station to which the man first reported for duty. The custodian of service records for the organization with which the man was serving at that time will have on file an Extract from Service Record which he had prepared at the time the soldier was transferred from that organization. He will copy into the new service record the indorsement shown on the extract and other information not already entered by the Adjutant General. He will then forward the record to the next station at which the man had served. The same process of transcribing information and forwarding will continue until the service record reaches the command with which the soldier is currently serving. While awaiting the new service record, the information necessary to obtain payment of the man may be obtained from prior payrolls filed with disbursing officer.

DISPOSITION OF USED AMMUNITION COMPONENTS

In this war, we have to make everything we have count.

That means that we must try to make it count not only once, but as many times as we can.

It's true that once a bullet is fired, there's nothing much that can be done about using the bullet itself or its propelling charge over again. But the cartridge cases, clips, metallic belt links, and the boxes with their metal liners, lids, and wing nuts can be reclaimed and used again and again. And if they can be reclaimed, we cannot afford to throw them away.

It's in the regulations, and has been for some time. Look at your OFSB 3-5 (change 3, paragraph 9). Look at your AR 775-10 (paragraph 115, on page 45). And the AR not only says that the stuff must be turned in, but also shows how much there should be.

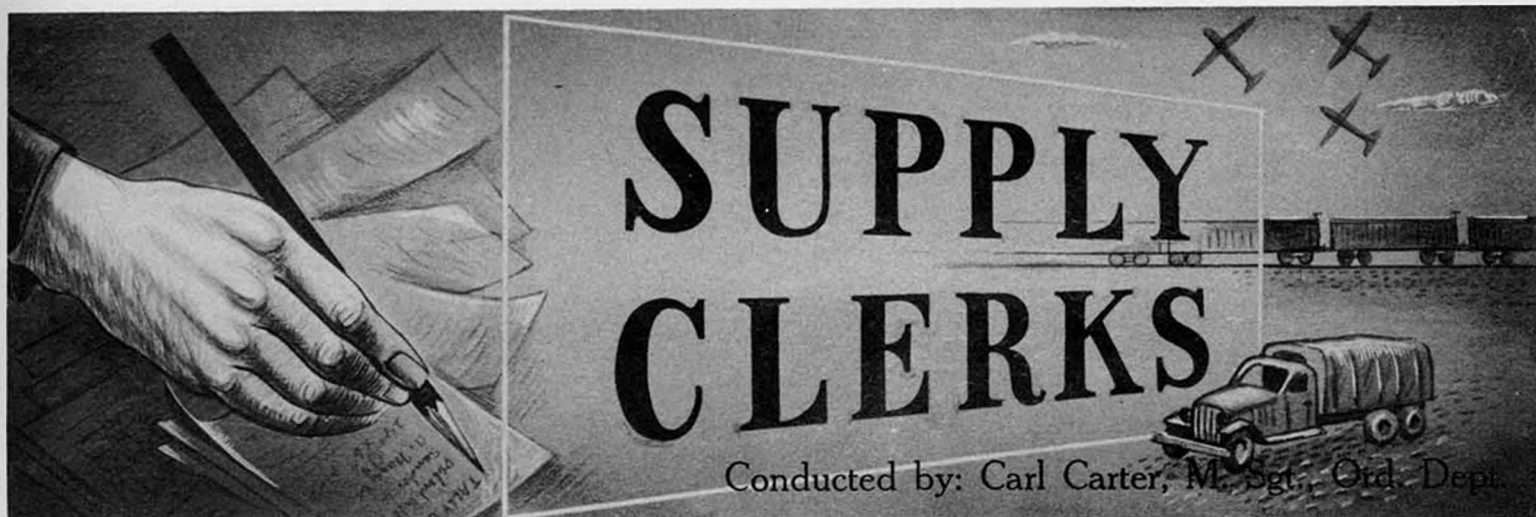
In returning used ammunition components, remember that each piece has to be all there. Nobody (it is hoped) opens ammunition boxes with an ax. There is no reason why boxes should be turned in without lids, and wing nuts missing or minus the metal liner. Yet one depot reports that 50 percent of the used ammunition boxes it gets arrive with the liner missing.

So send back all you can, and send it whole, to the best of your ability.

Make sure that this message gets to the units that use the ammunition. AR 775-10 applies to them, too.

This bulletin is, of course, directed primarily to Ordnance men in the zone of the interior. In the combat and communications zones it should be applied as conditions permit.

So remember — pass the ammunition, and pass back the used components.



INVENTORIES AND AUDITS

by

WESLEY F. KERN

Tech. Sgt., Ord. Dept.

A stock record account of property is generally referred to as a perpetual inventory record or book inventory. That is, the balances shown in the stock record account — the excess of the received entries over the issued entries — represents the actual balance that should be on hand. This stock record account is supposed to represent a true inventory of property that is actually on hand. See Figure 1.

Notice that the heading on this page and that on page 67 are strangers to the pages of THE ORDNANCE SERGEANT.

"Military Administration Clerks" replaces the old "Administration" heading, and "Supply Clerks" replaces the old "Depot and Supply" heading.

These changes are in accordance with organizational changes made in the Savanna Section, of The Ordnance School, the agency which regularly supplies the material found under these two headings. As explained elsewhere in this issue, it was thought that "Depot and Supply" was a misnomer which did not fully portray the scope of instruction provided by the section."

STOCK RECORD

DATE	Vol. No.	RECEIVED	ISSUED	BALANCE
7/1/41	1	750		750
7/24/41	22		250	500
8/2/41	29		75	425
8/26/41	37	100		525
9/15/41	49		50	475
10/7/41	60		50	425
11/2/41	74	150		575
12/6/41	92		25	550
2/13/42	121		200	350
3/8/42	142	200		550
5/1/42	163		53	497

Article PISTOL
Description Auto., Cal. 45, M1911
Unit each Unit cost \$26.42
Maximum _____ Minimum _____
Stock No. _____
Sheet No. 1

WAR DEPARTMENT
Q. M. C. FORM NO. 484
Revised April 6, 1941

Fig. 1

STOCK RECORD

DATE	Vol. No.	RECEIVED	ISSUED	BALANCE
7/1/41	1	750		750
7/24/41	22		250	500
8/2/41	29		75	425
8/26/41	37	100		525
9/15/41	49		50	475
10/7/41	60		50	425
11/2/41	74	150		575
12/6/41	92		25	550
2/13/42	121		200	350
3/8/42	142	200		550
5/1/42	163		53	497
6/23/42		As per Inventory		497

This entry
in RED

Article PISTOL
Description Auto., Cal. 45, M1911
Unit each Unit cost \$26.42
Maximum _____ Minimum _____
Stock No. 1
Sheet No. _____

WAR DEPARTMENT
Q. M. C. FORM NO. 484
Revised April 6, 1941

Fig. 2

STOCK RECORD

DATE	Vol. No.	RECEIVED	ISSUED	BALANCE
7/1/41	1	750		750
7/24/41	22		250	500
8/2/41	29		75	425
8/26/41	37	100		525
9/15/41	49		50	475
10/7/41	60		50	425
11/2/41	74	150		575
12/6/41	92		25	550
2/13/42	121		200	350
3/8/42	142	200		550
5/1/42	163		53	497
6/23/42		As per Inventory		497
		AUDITED 6/28/42		J.C.B.

This entry
in RED

Article PISTOL
Description Auto., Cal. 45, M1911
Unit each Unit cost \$26.42
Maximum _____ Minimum _____
Stock No. 1
Sheet No. 1

WAR DEPARTMENT
Q. M. C. FORM NO. 484
Revised April 6, 1941

Fig. 3

In order to verify the authenticity of the stock record account, a property officer is compelled to take a physical inventory of property at least once each fiscal year and oftener if circumstances warrant it. In general and branch depots where large quantities of property and supplies are stored, a continuous and progressive physical inventory will be made, so that a complete check of all property will be accomplished within each fiscal year. This physical inventory should coincide with the balances as shown in the stock record account. Regardless of whether the physical inventory agrees with the balances as shown in the stock record account, the result of the inventory will be entered on the stock record card immediately below the last entry on the card. The inventory balance is entered on the stock record card in red ink. In the "Date" column of the stock record card, the date on which the inventory was taken is entered. No entry is made in the "Voucher Number" column as it may be necessary to accomplish vouchers to correct a discrepancy. When this is done, the serial voucher number that is given to these vouchers is entered in the voucher number column of the stock record on the same line as the inventory entry. In the columns headed "Received" and "Issued", enter the notation "As per Inventory" and place the result of the inventory in the balance column. See Figure 2.

Responsibility for seeing that a physical inventory is taken rests with the commanding officer of the post, camp, or station.

The accountable officer is responsible for the balances shown in the stock record account and must be able to account for discrepancies between his physical inventory and the balances shown in the stock record account. Should discrepancies between the physical inventory and the stock record account occur, this would necessitate a complete check of all debit and credit vouchers that have gone to make up the balances in the stock record account. A common error in posting that may occur is a transposition of figures - that is - posting 68 as 86. Another frequent clerical error is a mistake in addition or subtraction. All computations in determining the balances in a stock record account (additions and subtractions) should be checked. When stock record accounts are being checked for errors in additions and subtractions, it is recommended that an independent calculation be made. That is, the received column and issued column should be added and the total of each column indicated by a "pencil foot". The excess of the received "pencil foot" over the issued "pencil foot" should represent the balance. This method is recommended for the purposes of check in that a previous error that has been made will not be overlooked and compounded again on a recheck.

Discrepancies which still remain unadjusted after a thorough check has been made must be accounted for by the accountable officer. In case there is an excess of property, this overage must be taken up by means of an Over, Short, and Damaged Report (W.D., Q.M.C. Form No. 445) and posted to the stock record account. Shortages to the stock record account are accounted for by means of a report of survey or a statement of charges which will fix responsibility for these shortages. Vouchers used to correct a discrepancy in a stock record account are given the same serial voucher number, whether it be one or more vouchers, and filed together in proper serial number order with the other vouchers to the account.

In the preceding paragraph, it has been indicated that in the event of an unaccounted for overage, an OS&D Report should be prepared to reflect this excess. At this time, it is desired to direct attention to a common practice and erroneous impression by some clerks as to the use of an OS&D Report to adjust shortages. At no time, with the exception of a change in nomenclature should an OS&D Report be used for this purpose.

In order to expedite the inventory of property and supplies, the following procedure may normally be observed. Original packages and packages that have been assembled, verified, marked, and sealed locally need not be opened for inventory if there is no evidence indicating that they have been tampered with. An effort should be made to keep as large an amount as possible of the supplies and property to be inventoried in packages. The contents listed on such packages may be taken as correct for inventory purposes. There are certain small items of minor value such as cleaning patches, springs, screws, and the like in which a physical count of each item is impracticable. In such a case, a count by weights should be made. That is, a certain number of these items would be weighed and then the figure would be divided into the total weight of all such items on hand. If the amount determined under this method does not vary more than 2% with the stock record account, the balance shown on the stock record account can then be accepted as correct.

The taking of the actual inventory is generally supervised by the accountable officer. The inventorying clerk will record the physical inventory in indelible pencil or ink on inventory slips. Upon completion, the clerk should turn the inventory slips over to the accountable officer, who, in view of its importance, should compare these balances with the stock record account. The inventory slips will be carefully assembled and made

available for use by inspectors and auditors. After having served the purpose of the inspector and auditor and after all discrepancies have been adjusted, these slips may be destroyed.

AUDITS

An accountable officer is compelled to maintain a stock record account and therefore all his records are audited by a property auditor from the Finance Department of the service command at least once each year. However, where accountability for items issued has been dropped from accountability on issue by the property officer and picked up by the company on a company property book, no stock record account would be maintained by the company. The company property book of a company is not subject to an audit by a property auditor. Instead, the regimental or similar commander will make periodic inspections to ascertain that the items listed in the company property book are accounted for properly.

The responsibility for seeing that audits are performed rests with the commanders of service commands, Services of Supply, and similar administrative areas.

The actual audit of a property account is performed by officers of the Finance Department or by some person acting under the supervision of a finance officer. Circumstances may arise whereby a shortage of commissioned personnel exists. Under these conditions, warrant officers, master and technical sergeants or qualified civilian employees of the Finance Department may be used for the detail work. However, when this occurs, it is the responsibility of the commissioned officer in charge to see that the audit is complete and correct in every detail and to sign all official papers in connection with the audit. In order to prevent any possible mishandling of public property, the accountable officer or the commanding officer of a post, camp or station is not permitted to act as an auditor for the audit of a property account.

Before going into the details of an audit, let us first consider the reasons for subjecting a property account to an audit. The general purpose of an audit is to determine the actual condition of an account. It is also necessary to ascertain by this audit, whether regulations governing property accountability have been complied with, whether any irregularities in vouchers, posting, or handling of property have occurred, and whether the stock record account reflects a true accounting of all property.

In order to determine that the above conditions have been complied with, the auditor checks the stock record account and sees that the balances shown by previous audits have been properly carried forward, that additions and subtractions have been accurately recorded and that each debit and credit entry to the stock record account is supported by a valid voucher, and that balances shown at the date of the current audit are arrived at through a correct system of accounting.

It is the duty of a property officer to have his accounts in proper condition for audit at the time of the auditor's arrival. When a property account is not in readiness for auditing, an informal report of this is made by the auditor to the post commander. Under the surveillance of the post commander, the property officer should endeavor to straighten out his records. A sufficient amount of time is allotted him to do so. If, however, the property officer fails to take action or takes insufficient action to correct his account during the allotted period, the auditor will make a written report of this to the commander of the service command, who will take the proper steps to see that the account in question is put in condition for auditing.

As previously mentioned, it is the work of the auditor to see that each entry to the stock record account is supported by a validated voucher. After an auditor has checked a voucher, he indicates his approval on the voucher by stamping "AUDITED" on it and adding the date and his initials. This procedure is also done to stock record cards, the stamp being placed immediately after the last entry on that particular card. It may be necessary for the auditor to make changes in entries on the stock record cards to correct minor discrepancies. When this is necessary, the changes must be initialed by him. See Figure 3.

Upon completion of an audit of a property account, the auditor prepares and signs a Certificate of Audit (W.D.F.D., Form #50). At general depots where the large volume of the property accounting records requires a full year's time of the permanently assigned auditing force to complete the audit of all the accounts, the accounts of the several sections (e.g. quartermaster, medical) and of the several sections (e.g. quartermaster, clothing and equipage division) will be audited completely and in turn for a definite period of time. This period will be from the date of the last audit to the date of the current audit. Upon completion of an audit of one of the above mentioned sections, a certificate of audit is prepared showing the results. See Figure 4.

CERTIFICATE OF AUDIT

Certificate No. 27

Headquarters Sixth Service Command, SOS, Chicago, Ill.

Date June 30, 1942.

Account and station ORDNANCE PROPERTY OFFICER, Fort Blank, Illinois
Acct. officer VERNON GREEN, 1st Lieut., Ordnance Department
Period covered 7/1/41 to 6/30/42 No. S. R. C. 325 No. Vouchers 2261
Last voucher considered JUNE 23, 1942, Credit Voucher No. 2261
Auditor 1st Lt. John C. Barlow, FD Asst. Auditor T/Sgt. William Jones, FD
Last C/A No. 52 dated 9/10/41 issued to Vernon Green, 1st Lt., Ord. Dept.
RESULTS OF AUDIT: Audit disclosed that the records are accurate and well kept, and that the pertinent Army Regulations covering property and property accounts are being complied with. Examination was made of all physical inventory records taken as of June 30, 1942, and compared with the balances indicated on the Stock Record and found to be in agreement. The provisions of paragraph 5c, AR 35-6740 were complied with by the auditor, and no discrepancies were found.

John C. Barlow
JOHN C. BARLOW
1st Lieut., Fin. Dept.,
Property Auditor

Fig. 4

A certificate of audit is executed in triplicate, all three copies being forwarded to the commander of the service command in which the audit has been performed. The certificate of audit is submitted by the service command commander to the finance officer on his staff for review. If it shows that the property account was found to be correct or that any discrepancies which had been discovered during the course of the audit had been corrected before completion of the audit, the triplicate copy of the certificate will be sent to the accountable officer through his commanding officer, the duplicate copy will be filed in the auditor's file, and the original copy will be forwarded direct to the Chief of Finance. When a Certificate of Audit shows discrepancies which remain unadjusted at the time of the completion of the audit, the original copy of the certificate is forwarded to the Chief of Finance, the duplicate copy is filed and the triplicate copy is sent by letter to the commanding officer of the post, camp, or station, who in turn forwards this copy to the accountable officer. The letter is then returned by the post commander to the commanding officer of the service command with an indorsement placed thereon stating that the discrepancies noted on the Certificate of Audit were adjusted or just what action was being taken by the accountable officer to correct them. Upon receipt of this information at the service command, a new and superseding certificate of audit is issued which makes reference to the date and serial number of the original certificate and states that all discrepancies previously reported have been adjusted. Distribution of this superseding certificate is made in the same way as that of the original certificate.

Failure of the accountable officer to make the necessary adjustments to correct discrepancies in his account will result in a stoppage being placed against his pay for the full amount of the property short.

If the audit shows no discrepancies in the property account and the auditor has certified that the property account in question is without fault, stock record cards which are completely filled up and vouchers to the date of audit may be withdrawn from the current files and placed in a dead file. These records must be kept in this dead file for a period of not less than eight years before they can be disposed of. After this period of time has elapsed, the officer then responsible for the files will forward a report, giving a detailed description and the quantity of the records to the Adjutant General, who will advise as to their proper disposition.

When an enlisted man is transferred, his service record and allied papers will accompany him.

When travelling in a detachment, the service record and allied papers will be turned over to the detachment commander for delivery.

When travelling alone, the service record and allied papers will be carefully sealed, addressed to the commanding officer of the station, and entrusted to the individual concerned for delivery. The service record will be forwarded by mail only under exceptional circumstances.

In the event an enlisted man is separated from his service record, the most expedient means will be used in forwarding the service record and allied paper to the proper destination.

Change 9
AR 345-125
November 28, 1942

A "NEW YEAR" MESSAGE WORTH READING

Although the New Year will be well begun before this issue of THE ORDNANCE SERGEANT reaches its readers, the New Year message of the Commandant of The Ordnance School will still be worthy of consideration. Although addressed to personnel of The Ordnance School, it will be found to contain good advice for all Ordnance personnel.

THE ORDNANCE SCHOOL
Aberdeen Proving Ground, Maryland

SUBJECT: New Years Message.

December 30, 1942

TO : All Personnel and Organizations, The Ordnance School.

1. As we enter our second year of training for War, it is desired to express sincere appreciation to the members of our staff and our civilian employees for the wholehearted cooperation manifested in our training activities for the past year. I am fully aware of all the conditions that have confronted us, and only the untiring efforts of our entire staff account for the largest training program in the history of the Ordnance School. It appears that the training effort for the second year will be even greater than the first. The requirements are many-fold and such will require each member of our staff to spur himself on to greater and more effective service. To meet our training requirements will require closer cooperation of personnel, closer coordination of all training facilities; more clearly defined training mission and more effective instruction.

2. The ultimate purpose of all our training effort is its direct effectiveness in war and under active war circumstances. To accomplish this purpose it is necessary to train personnel to become capable of coordinated and sustained action, as a member of a unit or as an individual, in accomplishing a given mission under actual battle conditions. Also, we must develop, if possible, leadership and command qualifications in those whom we select as leaders.

3. More specifically, our training mission is to develop the quality of technical proficiency in the maintenance of weapons, in the hands of individuals and units, that will sustain tactical proficiency in battle. This means that the man we train must be taught the exact knowledge that his duties will require as well as the responsibility of his grade and assignment, together with the determination to perform his duties correctly, even under the fire of the enemy. Briefly, this is the training mission — yours and mine.

4. Let us make an estimate of the training situation. This must be done for each and every course in order to determine whether the standard of our training is sufficient to maintain tactical proficiency. This requires much study and planning, promulgation, and finally, execution in an efficient and effective manner. All training should be so planned and conducted that the objective is reached in the minimum time, without sacrificing thoroughness, and so varied as to stimulate interest and thus insure effective results.

5. Any officer who plans, supervises, or actually conducts the training of military personnel should bear in mind that military training is but the application of common sense to military ends. That, as a rule, those under instruction come to the instructor with an open mind ready to accept instruction and to interest themselves in the new field of activity. Should an instructor fail to arouse and hold interest, he should ask himself what is wrong. A good instructor can simplify learning by presenting his subject in a clear, logical manner, and by constantly giving it the appearance of being easy. Men usually remain interested in their work so long as they are learning things of practical value and are making satisfactory progress.

6. It is desired, in the future, that we of the staff and faculty devote our untiring efforts to increasing the efficiency of our training efforts with respect to the training program ahead. Let no one say that we did not do our best to develop the quality of technical proficiency that will sustain the tactical proficiency required to overcome the enemy under any circumstances, or battle conditions. This I must entrust to your hands as we enter the biggest training program ever delegated to the Ordnance School. I place complete confidence in your ability to perform the duties necessary to accomplish our training mission.

WE WILL NOT FAIL!

/s/ John D. Billingsley

JOHN D. BILLINGSLEY
Lt. Col., Ord. Dept.
Commandant.

THE MACHINE SHOP

Conducted by: F. P. Bingert, M. Sgt., Ord. Dept.

PRACTICAL SHOP MATH

by M. R. KRAUSE, 2nd Lt., Ord. Dept.

PART I

Introduction to Shop Math

At some time or another, every person has heard someone say "I'm no good at Math." That is precisely what makes it so difficult for some people to learn mathematics.

There is nothing mysterious about Math, especially Shop Math, which deals with measuring and calculating, and calls for application of simple arithmetic, fractions and decimals. Also used, are simple time saving formulas, which are not hard to learn.

These articles will show that certain important practical phases of math, despite their high sounding names, are easily understood by persons of average intelligence.

Measurements made in a machine shop are usually taken in inches or fractional parts of an inch. The two most common instruments for measuring are the steel rule and the micrometer. The steel rule gives us fractional measurements in 64ths, 32nds, 16ths, and 8ths of an inch. The micrometer gives us decimal measurements in thousandths of an inch. Therefore, we must be able to convert fractions to decimals and decimals to fractions.

To do precision machine work, we must understand simple arithmetic, square root, and some geometry. We should also learn some of the time saving formulas, such as: how to find Revolutions per Minute, commonly known as R.P.M.'s; how to find the dimensions of a Thread; how to figure Tapers. Also needed is some knowledge of ratios, gears and gear trains.

These articles, which have been divided into three parts, begin with a refresher course in arithmetic, and lead up to various Machine Shop formulas and their use in machine work. This first part deals with fractions, decimals, square root and such simple geometry as pertains to the right angle. The second, deals with the formulas for finding R.P.M.'s, thread measurements, tapers and their application. The last article concerns itself with ratios, gears and gear trains as applied to the Dividing Head.

Each point brought out in these articles is followed by actual problems which serve to illustrate its practical application. After reading the article carefully, the reader is urged to go back and work out these problems and check his answers against the key. Doing this will take some of the mystery out of Math, and prove that anyone who applies himself to a moderate degree is able to master it. The solutions to all problems given will be found on page 79.

INTRODUCTION TO FRACTIONS

The dimensions of ordinary items we deal with in everyday life, makes it apparent that the use of whole numbers alone is not sufficient to represent such information.

For example, we see such measurements as 24-1/2 lbs. on a sack of flour, and 3-3/8" stroke in a gasoline engine, or a Savings Bank offers interest of 1-1/2% on deposits. All of these are dimensions and in fractions. Therefore, understanding fractions helps one in everyday life and in the machine shop too. It is especially important that machinists thoroughly understand fractional numbers, because, in the shop, very fine distinctions are made. In civilian life 1/8" is a small measurement - in the Machine Shop 1/8" is quite large because most measurements are in thousandths of an inch.

Therefore let us begin with a review of common fractions and lead up to their decimal equivalents and the application of both to Machine Shop problems.

DEFINITIONS OF COMMON FRACTIONS

An INTEGER is a whole number.

A FRACTION is a number which denotes a certain number of the equal parts of a unit. For example, the fraction "3/4" denotes three of the four equal parts of a unit. "7/32" denotes seven of the thirty-two equal parts of a unit.

A fraction is composed of both a NUMERATOR and a DENOMINATOR. The DENOMINATOR is the number which shows into how many equal parts the unit has been divided. The denominator is written below the line. The NUMERATOR is the number which shows how many equal parts of the unit have been taken to make a fraction. The numerator is written above the line. The denominator and the numerator are referred to as the TERM of the fraction.

A COMMON FRACTION is a fraction which has both terms expressed.

A PROPER FRACTION is one whose numerator is less than its denominator, as 3/8, 5/16.

An IMPROPER FRACTION is one whose numerator is a larger number than its denominator, as 16/5, 11/10.

A UNIT FRACTION is one whose numerator is one, as 1/4, 1/6, 1/8, 1/11.

A MIXED NUMBER is a number composed of an integer and a fraction together, as 3-3/4, 7-1/2.

REDUCTION OF COMMON FRACTIONS

Fundamental rule: The value of a fraction is not changed by multiplying the numerator and denominator by the same number. The value of a fraction is not changed by dividing the numerator and denominator by the same number.

Reduce the following to their lowest term:

(In each case find a number that divides evenly into both numerator and denominator.)

- | | | |
|----------|----------|------------------|
| 1. 2/4 | 5. 25/45 | 9. 199/597 |
| 2. 12/44 | 6. 50/52 | 10. 27/36 |
| 3. 35/70 | 7. 14/32 | 11. 77/121 |
| 4. 9/12 | 8. 18/30 | 12. 89475/125250 |

METHOD FOR SELECTION OF THE LEAST COMMON DENOMINATOR FOR ADDITION AND SUBTRACTION

Fractions cannot be added or subtracted unless they have a common denominator. You cannot add 7/9, 3/6, 2/7, and 4/5. Their denominators are unlike. When the denominators of the fractions are the same, they are said to have a common denominator as: 5/9, 7/9, and 12/9.

In adding or subtracting fractions first, reduce all fractions to be added or subtracted to their lowest term, then select the least common denominator (the smallest number into which all the denominators will divide evenly.)

EXAMPLE:

Fractions to be added These fractions reduced to lowest terms

$\frac{4}{8}$	$\frac{4}{8} = \frac{1}{2}$
$\frac{14}{32}$	$\frac{14}{32} = \frac{7}{16}$
$\frac{27}{36}$	$\frac{27}{36} = \frac{3}{4}$
$\frac{14}{8}$	$\frac{14}{8} = \frac{7}{4}$
$\frac{16}{5}$	$\frac{16}{5} = \frac{16}{5}$

Then place all denominators in a line, separating them by commas.

2, 16, 4, 4, 5,

Select a number that will exactly divide two or more of the denominators. In the following example we have selected the number 2. Divide, and write the quotients below and bring down any numbers which are not divisible by this divisor.

$$\begin{array}{r} 2 \overline{) 2, 16, 4, 4, 5} \\ 1, 8, 2, 2, 5 \end{array}$$

Proceed as before, and continue this process until no two of the remaining numbers can be divided by any other number except 1.

$$\begin{array}{r} 2 \overline{) 1, 8, 2, 2, 5} \\ 1, 4, 1, 1, 5 \end{array}$$

The product of all the divisors (which was the number 2 in each case) and all the numbers left in the last line (1, 4, 1, 1, 5) is the least Common Denominator.

$$2 \times 2 \times 1 \times 4 \times 1 \times 1 \times 5 = 80$$

Since multiplying by the Figure 1 does not effect the answer we can drop all 1's simplifying the process of multiplication.

$$2 \times 2 \times 4 \times 5 = 80$$

After finding the Least Common Denominator, which in this case is 80, we then rewrite each of the fractions to be added showing its representative value of 80.

$$\begin{array}{r} \frac{4}{8} = \frac{1}{2} = \frac{40}{80} \\ \frac{14}{32} = \frac{7}{16} = \frac{35}{80} \\ \frac{27}{36} = \frac{3}{4} = \frac{60}{80} \\ \frac{14}{5} = \frac{7}{4} = \frac{140}{80} \\ \frac{16}{5} = \frac{16}{5} = \frac{256}{80} \end{array}$$

$$531/80 = 6-51/80$$

Now we add all of the numerators of the fraction and we get an answer of 531. This figure represents the number of parts of a unit divided into 80 parts. We then convert this fraction to a Mixed number and get an answer of 6-51/80.

APPLICATION OF ADDITION AND SUBTRACTION OF COMMON FRACTIONS

Find the sum of

13. $\frac{1}{2} + \frac{2}{3} =$	17. $\frac{5}{12} + \frac{3}{8} =$
14. $\frac{3}{4} + \frac{1}{5} =$	18. $\frac{7}{20} + \frac{3}{16} =$
15. $\frac{5}{6} + \frac{3}{8} =$	19. $\frac{17}{50} + \frac{3}{10} =$
16. $\frac{9}{10} + \frac{7}{8} =$	20. $\frac{89}{100} + \frac{31}{50} =$

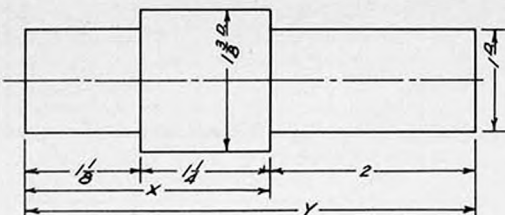


Fig. 1

21. In the drawing above:

- Find dimension "X".
- Find overall dimension "Y".
- If $\frac{1}{32}$ " must be allowed on each end for facing, to what length must the stock be cut?
- The width of the sawblade with which the stock is cut is $\frac{3}{32}$ ".

How much material is needed if two parts are required?

Find the difference in each of the following problems.

22. $\frac{1}{2} - \frac{1}{6} =$	26. $\frac{5}{12} - \frac{3}{8} =$
23. $\frac{3}{4} - \frac{5}{16} =$	27. $\frac{15}{16} - \frac{1}{12} =$
24. $\frac{5}{6} - \frac{3}{8} =$	28. $\frac{17}{50} - \frac{3}{10} =$
25. $\frac{9}{10} - \frac{7}{8} =$	29. $\frac{89}{100} - \frac{31}{50} =$

MULTIPLICATION OF COMMON FRACTIONS

Rule: To multiply two or more fractions together, multiply the numerators together and multiply the denominators together.

Write the answer of the numerators over the answer of the denominators. Reduce the resulting fraction to lowest terms. For example, to multiply $\frac{5}{6} \times \frac{3}{10}$

Multiply the numerators together
Multiply the denominators together

$$\frac{5 \times 3}{6 \times 10} = \frac{15}{60}$$

Therefore $\frac{5}{6} \times \frac{3}{10} = \frac{15}{60}$. Reducing this answer to its lowest terms by dividing both numerator and denominator by 15, we get

$$\frac{15}{60} = \frac{15 \div 15}{60 \div 15} = \frac{1}{4}$$

This answer could have been obtained more easily by the use of cancellation. Cancellation consists of dividing both numerator and the denominator by any given number.

For example, the same problem can be solved by using cancellation.

By this method, both numerator and denominator can be divided by 5 to get 1 in the numerator and 2 in the denominator.

$$\frac{1}{6} \times \frac{3}{10} = \frac{1}{2} \times \frac{3}{10}$$

By dividing by 3, we get 1 in the numerator and 2 in the denominator.

$$\frac{1}{6} \times \frac{3}{10} = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

Multiplying the new numerators (1 x 1) together we get 1.

Multiplying the new denominators (2 x 2) together we get 4.

This gives us an answer of $\frac{1}{4}$

APPLICATION OF THE MULTIPLICATION OF COMMON FRACTIONS

30. $\frac{3}{8} \times \frac{8}{1} =$	33. $\frac{5}{8} \times \frac{13}{64} =$
31. $\frac{16}{1} \times \frac{7}{10} =$	34. $\frac{16}{25} \times \frac{5}{16} =$
32. $\frac{1}{3} \times \frac{1}{2} =$	35. $\frac{11}{16} \times \frac{48}{55} =$

36. If a standard barrel contains 31-1/2 gallons, what is the weight of such a barrel, 3/4 full of oil? This oil weighs 7-5/8 lbs. per gallon.

DIVISION OF COMMON FRACTIONS

Problem: Divide $\frac{7}{9}$ by $\frac{5}{6}$.

Rule: 1. Invert the divisor $\frac{5}{6}$. When a fraction is inverted, the numerator becomes the denominator, and the denominator becomes the numerator. Therefore, the divisor $\frac{5}{6}$ becomes $\frac{6}{5}$ when inverted.

2. After inverting the divisor, change the division sign to multiplication and work the problem.

$$\text{Original problem } \frac{7}{9} \div \frac{5}{6} =$$

Inverting the divisor and multiplying

$$\frac{7}{9} \times \frac{6}{5} = \frac{42}{45} = \frac{14}{15}$$

APPLICATION OF DIVISION OF COMMON FRACTIONS

37. Divide $\frac{1}{16}$ by $\frac{2}{3}$
38. Divide $\frac{2}{3}$ by $\frac{5}{8}$
39. Divide $\frac{5}{1}$ by $\frac{7}{8}$
40. Divide $\frac{14-3}{8}$ by $\frac{5-b}{8}$
41. Divide $\frac{5-3}{16}$ by $\frac{5-1}{8}$
42. Divide $\frac{4-1}{2}$ by $\frac{6}{7}$

INTRODUCTION TO DECIMAL FRACTIONS

A DECIMAL FRACTION is a fraction whose denominator is 10 or some power of ten, as 100 (10×10), 1000 ($10 \times 10 \times 10$).

We call $\frac{9}{10}$, $\frac{53}{100}$, $\frac{941}{1000}$, decimal fractions.

The denominator of a decimal fraction is always ten or a power of ten, and may be expressed as 1 with ciphers attached. Therefore we can write a decimal fraction by omitting the denominator entirely and substituting instead a decimal point.

Hence $\frac{9}{10}$ may be written as .9.

$\frac{53}{100}$ may be written as .53.

$\frac{941}{1000}$ may be written as .941.

The period or decimal point, therefore, distinguishes the decimal fraction .9 from the whole number 9.

Any number, therefore, with a decimal point in front of it (.9), is a fraction and is known as a decimal fraction. The numerator is the number after the point (.9), and the denominator is a 1 with as many ciphers after it as there are figures in the number to the right of this point.

Thus .9 means $\frac{9}{10}$, .53 means $\frac{53}{100}$, .09 means $\frac{9}{100}$, .009 means $\frac{9}{1000}$, etc.

The following table indicates the relative value of three digits when the decimal point is

placed in different positions. Note how the value changes.

900.	Nine hundred
90.0	Ninety
9.00	Nine
.900	Nine-tenths
.090	Nine-hundredths
.009	Nine-thousandths

ADDITION OF DECIMALS

Problem: Add: 5.75, 42.0975, 741.006, 551, and 0.625.

1. Write the numbers as shown below, arranging them so that the decimal points are in a column.

```

5.75
42.0975
741.006
551.
.625

```

2. To avoid errors, add ciphers to the numbers with the fewer decimal places, so that all the numbers will have an equal number of places after the decimal point. We then have,

```

5.7500
42.0975
741.0060
551.0000
.6250
1340.4785

```

3. Proceed as in addition of ordinary whole numbers, and place the decimal point in the sum, directly underneath the other decimal points.

```

5.7500
42.0975
741.0060
551.0000
.6250
1340.4785

```

SUBTRACTION OF DECIMALS

Problem: From 53.71 take 13.875.

1. Write the numbers so that the decimal points are beneath each other. Be sure that the subtrahend is under the minuend. This gives us;

```

53.710 (called the minuend)
13.875 (called the subtrahend)

```

2. If one of the numbers has less figures after the decimal point than the other, add ciphers to it. In the minuend of the problem, we add a cipher after the 1 to get 53.710.

3. Proceed the same as in the subtraction of whole numbers. Place the decimal point in the difference below the other decimal points.

```

53.710
13.875
39.835 (difference)

```

APPLICATION OF THE ADDITION AND SUBTRACTION OF DECIMALS

Solve the following problems:

43. $346.7 + 42.9 =$
44. $3.742 + 0.0093 + 5.61 =$
45. $0.093 + 39.851 + 5.1112 =$
46. From 873.59 take 138.
47. Take 0.6537 from 0.9124

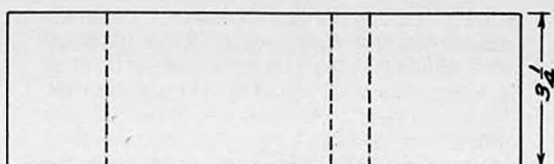


Fig. 2

48. Determine the distance "D".

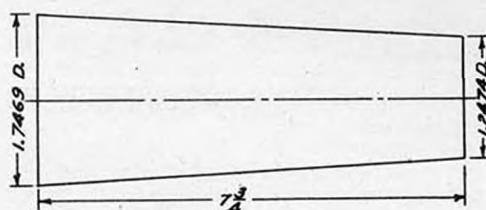


Fig. 3

49. Find the difference in diameters of the tapered pin.

HOW TO MULTIPLY DECIMALS

Problem: Multiply 43.413 by 9.06.

1. Multiply the same as you would with whole numbers.

2. Multiplying gives us:

```

43.413 (Multiplicand)
9.06 (Multiplier)
280478
3907170
39332178 (Product or answer)

```

3. This answer is incorrect because the decimal point has not been located. To locate the decimal point in the product, proceed as follows:

Beginning at the right, point off, in the product, as many decimal places as there are decimal places in both the multiplier and the multiplicand.

In the problem the multiplicand has 3 decimal places, while the multiplier has 2, making a total of 5 places. Therefore, the product must have five decimal places.

4. Multiplying and locating the decimal point, we get

```

43.413
9.06
280478
3907170
393.32178

```

APPLICATION OF THE MULTIPLICATION OF DECIMALS

Solve the following problems:

50. $2 \times 3.5 =$
51. $11.4 \times 8.2 =$
52. $.55 \times .81 =$
53. $.245 \times .83 =$
54. $.3875 \times 3.9375 =$
55. $3.0414 \times .875 =$

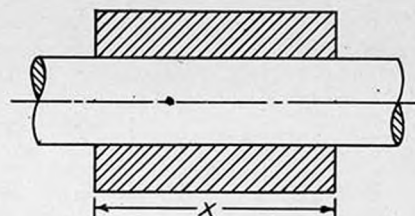


Fig. 4

56. Find the length of material required to make 12 rollers, allowing .09375 for cut-off, if

- a. $X = 1.250$
- b. $X = .8625$
- c. $X = 1.625$
- d. $X = 2.25$

HOW TO DIVIDE DECIMALS

Problem: Divide 0.78 by 0.964

1. Place the dividend and divisor as shown.

Divisor .964) .78 Dividend

2. Convert the divisor into a whole number by moving the decimal to the right 3 places, as shown:

964.) .78

3. Move the decimal point in the dividend an equal number of places to the right. If, as in this case, the dividend has fewer figures than the divisor, add ciphers.

964.) 780.

4. Divide as whole numbers. Place the decimal point in the quotient directly above the decimal point in the dividend. Since the quotient is not an even whole number, add ciphers after the decimal point in the dividend and continue the division to as many decimal places as is required.

```

.809
964.) 780.000
771 2
8 800
8 676
124

```

APPLICATION OF THE DIVISION OF DECIMALS

Solve the following problems:

57. $36 \div 4.5 =$
58. $78 \div .06 =$
59. $.558 \div .018 =$
61. $146.2 \div .043 =$
62. $24.642 \div 1.11 =$
63. $24.642 \div 5.43 =$

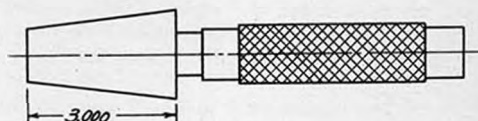


Fig. 5

64. The large diameter of the taper gauge shown is .875". If the taper per foot is .500", find the small diameter.

HOW TO CHANGE A COMMON FRACTION TO A DECIMAL FRACTION

Problem: Change $\frac{5}{8}$ to a decimal fraction.

In a fraction, the line between the 5 and 8 indicates division.

1. Divide 5 by 8.

$$8 \overline{) 5}$$

2. Since 8 does not go into 5, we place the decimal point after the 5, add ciphers and carry out the division.

$$\begin{array}{r} .625 \\ 8 \overline{) 5.000} \\ \underline{48} \\ 200 \\ \underline{160} \\ 40 \\ \underline{40} \end{array}$$

3. Place the decimal point in the answer directly above the decimal point in the dividend.

Therefore, in changing a fraction to a decimal fraction, the rule is:

Divide the denominator of the fraction into the numerator, adding ciphers after the decimal point when necessary.

HOW TO CHANGE A DECIMAL FRACTION TO A COMMON FRACTION

Problem: Change .625 to a common fraction.

1. The number after the decimal point is the numerator of the fraction. Therefore, the numerator in this problem is .625.

2. The denominator of the fraction is a 1 with three ciphers, because there are three figures to the right of the decimal point. Therefore, the denominator in this problem is 1000.

$$.625 = 625/1000$$

3. Reduce to lowest terms. Divide by 125.

$$\frac{625}{1000} \div \frac{125}{125} = \frac{5}{8}$$

4. Therefore, to change a decimal fraction to a common fraction, the rule is:

The number after the decimal point is the numerator of the fraction, and the denominator is a 1 with the same number of ciphers after it as there are figures to the right of the decimal point.

POWERS OF NUMBERS

The product obtained by multiplying numbers by themselves one or more times is known as the "power" of that number. The second power of 7 equals 7 multiplied by itself, or $7 \times 7 = 49$, and the third power of 7 equals $7 \times 7 \times 7 = 343$. The second power is commonly called the square of the number, and the third power, the cube.

The square of 3 is $3 \times 3 = 9$, and the square of 15 is $15 \times 15 = 225$, similarly the square of 169 is $169 \times 169 = 28,561$. Instead of writing 3×3 for the square of 3, it is often written 3^2 , which is read "three squared" and means that 3 is multiplied by 3. In the same way, 157^2 means 157×157 . The small figure (²) in the expressions is called the exponent.

ROOTS OF NUMBERS

The square root of a number is that number which, when multiplied by itself, will give a

product equal to the given number. Thus, the square root of 9 is 3, because 3 multiplied by itself equals 9. The square root of 49 is 7; of 64, 8, etc. The square root is the reverse of the square, so that if the square of 25 is 625, the square root of 625 is 25. The mathematical sign for the square is $\sqrt{}$, and is known as the radical, but the index figure (²) is generally left out, leaving the radical simply $\sqrt{}$, thus

$$\sqrt{9} = 3 \text{ (the square root of nine equals three)}$$

$$\sqrt{625} = 25 \text{ (the square root of six hundred twenty-five equals twenty-five)}$$

EXTRACTING SQUARE ROOT

In solving certain shop and toolroom problems, it is necessary to find either the square root or cube root of a number, and these values should be obtained directly from tables such as are found in practically all engineering handbooks (See AMERICAN MACHINIST HANDBOOK, pages 1131 to 1142, Seventh Edition.) The use of such tables saves time and insures accurate results. The method of extracting the roots of numbers should be understood.

The process of finding the square root of a given number is called extracting the square root. Let us find the square root of 729,316. Write the number as follows, leaving space for the figures of the root as shown. Beginning at the unit figure (the figure at the right of the whole number), point off the number into periods of two figures each. If there are an odd number of figures in the given number, the last period to the left will, have only one figure.

$$72'93'16 \quad | \quad \text{Space for root}$$

Find the largest number the square of which does not exceed the value of the figures in first period (72), and write this number as the first figure of the root. In the example this number is 8, the square of which is 64. Subtract the square from the first period, and move down the next period and annex it to the remainder, thus

$$\begin{array}{r} 72'93'16 \quad | \quad 8 \\ 8 \times 8 = 64 \\ \hline 893 \end{array}$$

Now multiply the figure in the root obtained by the constant 20 which is always used when extracting the square root by this method ($8 \times 20 = 160$), and find how many times this product is contained in the number 893. This gives a trial divisor for the second figure of the root; 160 is contained 5 times in 893 and 5 is placed as the next figure of the root.

$$\begin{array}{r} 72'93'16 \quad | \quad 85 \\ 8 \times 8 = 64 \\ \hline 893 \\ 8 \times 20 = 160 \end{array}$$

Now subtract from 893 the product 160 plus the figure of the root just obtained (5), multiplied by the same figure (5); $(160+5) \times 5 = 825$. If this product were larger than 893 it would indicate that the trial divisor was too large, and a figure one unit smaller should be used.

Then move down the next period of two figures and annex it to the remainder.

$$\begin{array}{r} 72'93'16 \quad | \quad 85 \\ 8 \times 8 = 64 \\ 8 \times 20 = 160 \\ (160+5) \times 5 = 825 \\ \hline 6816 \end{array}$$

Now multiply the figures of the root thus far obtained by 20; ($85 \times 20 = 1700$), and find how many times this product is contained in 6816. This gives a trial divisor for the third figure of the root; 1700 is contained 4 times in 6816, and 4 is placed as the third figure of the root. Then subtract from 6816 the product 1700 plus the figure of the root just obtained (4), multiplied by the same figure (4).

$$\begin{array}{r} 72'93'16 \quad | \quad 854 \\ 8 \times 8 = 64 \\ 8 \times 20 = 160 \\ (160+5) \times 5 = 825 \\ 85 \times 20 = 1700 \\ (1700+4) \times 4 = 6816 \end{array}$$

If as in this case, this last subtraction leaves no remainder, and if there are no more periods of figures to move down from the given number, the obtained root 854 is the exact square root of 729,316.

If there is a remainder when the last period of figures has been moved down, place the decimal point after the figures already obtained in the root, annex two ciphers (00) to the remainder, multiply the number so far obtained in the root by 20, and proceed as before until a sufficient number of decimal places have been obtained to give the root with the desired accuracy.

Example:

$$\begin{array}{r} 8'75. \quad | \quad 29.5^+ \\ 2 \times 2 = 4 \\ 2 \times 20 = 40 \\ (40+9) \times 9 = 441 \\ 29 \times 20 = 580 \\ (580+5) \times 5 = 2925 \\ 295 \times 20 = 5900 \\ (5900+7) \times 7 = 41349 \end{array}$$

It will be seen from the calculation that, when multiplying by the constant 20, the decimal point is disregarded, and the figures obtained in the root considered as a whole number. The decimal point must be placed in the root as already explained before annexing the two first ciphers (not in the given number) to the remainder, in order to give the correct value to the root.

SQUARE ROOT OF DECIMALS

When extracting the square root of a decimal fraction, or when the square root of a whole number and a decimal is required, always point off both in the whole number and the decimal in periods of two figures each, beginning at the decimal point, thus:

$$5'72'59.37'51'6$$

If the number of decimal places is not an even number, the period to the right will have only one figure instead of two. By placing a cipher after the decimal in such cases, the last period is made complete without changing the value of the number, thus:

$$5'72'59.37'51'60$$

It should be borne in mind that the pointing off of periods of two figures should always be begun at the decimal point, both for the whole numbers and for the decimals. Thus, the pointing off in the first line below is correct, while pointing off in the second line is incorrect:

$$\begin{array}{ll} \text{Correctly pointed off} & 1.54'37'6 \quad 1'25.36'5 \\ \text{Incorrectly pointed off} & 1.5'43'76 \quad 12'5.3'65 \end{array}$$

When extracting the square root of a decimal fraction, the decimal point is placed in the root when the first period of decimals is moved down.

Example

$$\begin{array}{r} 11.69^{\circ}64 \) \ 3.42 \\ 3 \times 3 = 9 \\ 3 \times 20 = 60 \\ (60+4) \times 4 = 256 \\ 34 \times 20 = 680 \\ (680+2) \times 2 = 1364 \end{array}$$

When it is found that the next figure in the root is a cipher, place it as usual in the root, and move down the next period of two figures and all other respects following the procedure already explained.

Example

$$\begin{array}{r} 25^{\circ}90'81. \) \ 509 \\ 5 \times 5 = 25 \\ 5 \times 20 = 100 \\ 50 \times 20 = 1000 \\ (1000+9) \times 9 = 9081 \end{array}$$

SQUARE ROOT OF COMMON FRACTIONS

The square root of a common fraction may be obtained by extracting the square root of both numerator and denominator, thus:

$$\sqrt{\frac{25}{49}} = \frac{\sqrt{25}}{\sqrt{49}} = \frac{5}{7}$$

When the terms of the fraction are not perfect squares (squares of whole numbers) it is preferable to change the common fraction to a decimal fraction, and extract the square root of the decimal fraction.

PROOF OF SQUARE ROOT

When there is no remainder after all the periods of figures in the given number have been moved down, and the last figure of the root found, the calculation may be proved by multiplying the root by itself, in which case the product must equal the number given, of which the square root has been extracted. If there is a remainder, the figures obtained do not represent the exact root, but a close approximation. If this approximate root is multiplied by itself, the product should very nearly equal the given number. If not, an error has been made.

GEOMETRY

There is no branch of mathematics which is of greater importance and practical value to machinists and toolmakers than that which deals with angles, and particularly with the solution of the right angle. Hardly a machine can be designed or an article constructed without some application of several geometrical theorems. The practical shopman will find that an understanding of the most common geometrical figures and geometrical theorems is of value. Numerous mathematical relationships in practical work can be best proven by an understanding of the underlying geometrical principles.

THE ANGLE

An angle is the opening between two straight lines which meet at a point.

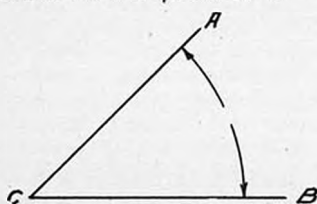


Fig. 6

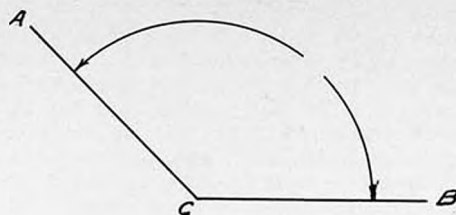


Fig. 7

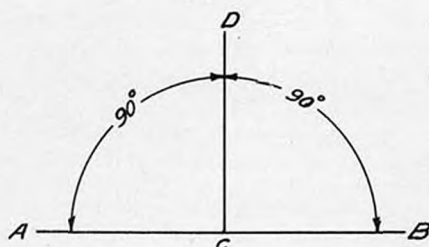


Fig. 8

The point C at which the two lines meet, is called the vertex of the angle.

When one straight line meets another straight line, making the adjacent angles equal, the lines are perpendicular to each other. The angles formed are right angles. (See Figure 8.) A right angle contains 90 equal parts, each called a degree. Hence we say a right angle contains 90°.

An acute angle contains less than 90°. (See Figure 6.)

An obtuse angle contains more than 90° and less than 180°. (See Figure 7.)

Angles are measured in degrees and subdivision of a degree. If the circumference of a circle is divided into 360 parts, each part is called one degree, and the angle between two lines from the center to the ends of the small part of the circle is a one degree angle, as shown.

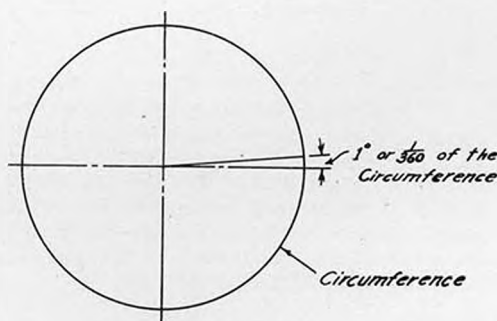


Fig. 9

As the whole circle contains 360 degrees, one half of a circle contains 180 degrees, and one quarter circle contains 90 degrees.

In order to obtain finer subdivisions than the degree for the measurement of angles, one degree is divided into 60 minutes, and one minute into 60 seconds. Any part of a degree can be expressed in minutes and seconds, for instance, 1/2 degree=30 minutes; 1/3 degree=20 minutes; and since 1/4 degree=15 minutes, 3/4 degree=45 minutes. In the same way, 1/2 minute=30 seconds, 1/3 minute=20 seconds; 1/4 minute=15 seconds; and 3/4 minute=45 seconds.

THE TRIANGLE

A triangle is a plane figure bounded by three straight sides. Every triangle contains

three angles whose sum equals 180°, consequently if we know the value of any two angles of a triangle, we can find the value of the third angle. Figure 10 shows a triangle with the value of each angle.

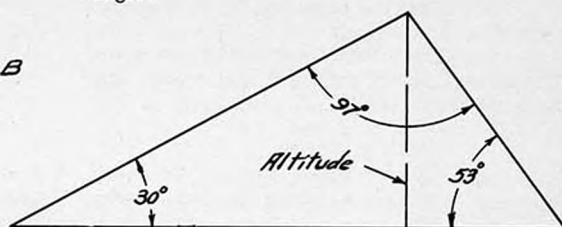


Fig. 10

The altitude of a triangle is the perpendicular drawn from the vertex to the base. (See Figure 10.) The base is the side upon which the triangle rests. Since the triangle can be moved to make any side the base, a triangle can have three altitudes, each upon its appropriate base.

THE ISOSCELES TRIANGLE

An isosceles triangle has two equal sides, see Figure 11. In the isosceles triangle, side XY=XZ. Furthermore, in an isosceles triangle the angle Y is equal to the angle Z. The altitude drawn from the vertex to the third side of the isosceles triangle bisects the third side and forms two equal right triangles.

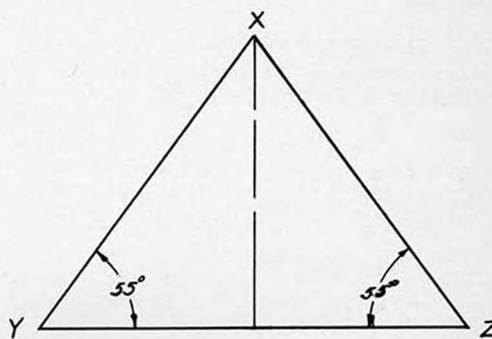


Fig. 11

THE RIGHT ANGLE

A right triangle contains a right angle. Figure 12 shows a right triangle. The side XZ opposite the right angle is called the hypotenuse of the right triangle. The side XY is the altitude, and the side YZ is the base of the right triangle. Either leg of the right triangle could be the altitude.

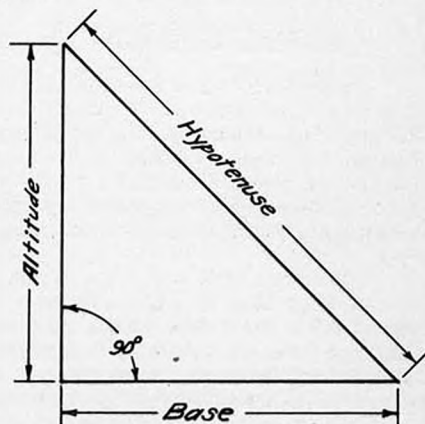


Fig. 12

The right triangle is a very important triangle in shop practice and design. In Figure 12, the angle Y is a right angle; consequently it is equal to 90°. Since the sum of the three

angles of any triangle equals 180° , angle X and angle Z would be acute angles whose sum would equal 90° .

If we are given the value of one acute angle of a right triangle, we can find the value of all the angles of the right triangle. If the value of one acute angle of a right triangle equals 40° , the value of the other angles would be 90° and 50° .

To find the relation between the three sides of a right triangle, we employ the Pythagorean theorem, which is one of the widely quoted theorems of geometry. This theorem states that the square of the hypotenuse equals the sum of the squares of the other two sides.

In Figure 13, squares are constructed upon the hypotenuse, altitude, and base of the right triangle XYZ. The hypotenuse contains 5 units, the base 3 and the altitude 4. Hence, according to the Pythagorean theorem,

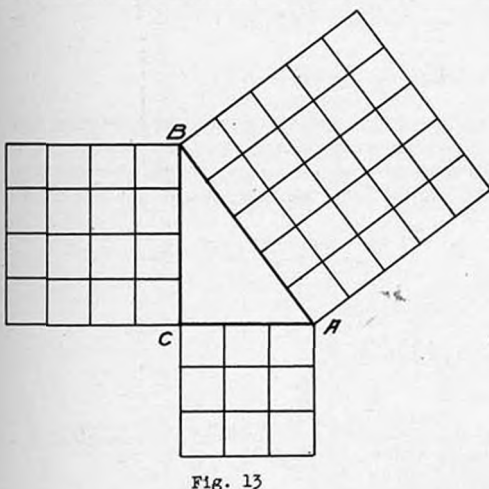


Fig. 13

In Figure 14, let us call the hypotenuse h , the altitude a , and the base b . Then, the relation can be expressed thus, $(\text{hypotenuse})^2 = (\text{altitude})^2 + (\text{base})^2$, or $h^2 = a^2 + b^2$.

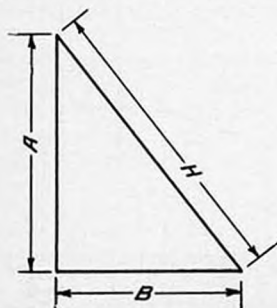


Fig. 14

Extracting the square root of both sides of the equation, we obtain $h = \sqrt{a^2 + b^2}$.

This formula will enable us to find the hypotenuse of a right triangle when the altitude and base are given.

By transposing the equation $h^2 = a^2 + b^2$ so that we have $a^2 = h^2 - b^2$ the formula $a = \sqrt{h^2 - b^2}$ is obtained. This formula will enable us to find the altitude of a right triangle when the hypotenuse and base are given. In a similar fashion we can obtain the formulas $b = \sqrt{h^2 - a^2}$.

The three formulas are as follows:

hypotenuse	$h = \sqrt{a^2 + b^2}$
altitude	$a = \sqrt{h^2 - b^2}$
base	$b = \sqrt{h^2 - a^2}$

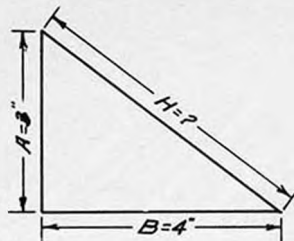


Fig. 15

Problem: Find the hypotenuse of a right triangle whose altitude is 3 feet, and whose base is 4 feet. (See Figure 15.)

Solution: hypotenuse $h = \sqrt{a^2 + b^2}$

$$h = \sqrt{3^2 + 4^2}$$

$$h = \sqrt{9 + 16}$$

$$h = \sqrt{25} = 5 \text{ feet}$$

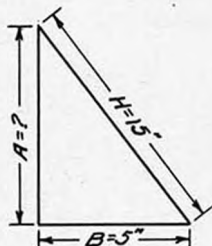


Fig. 16

Problem: Find the altitude of a right triangle whose hypotenuse is 15 feet and whose base is 5 feet. (See Figure 16.)

Solution: altitude $a = \sqrt{h^2 - b^2}$

$$a = \sqrt{15^2 - 5^2}$$

$$a = \sqrt{225 - 25}$$

$$a = \sqrt{200} = 14.07 \text{ feet}$$

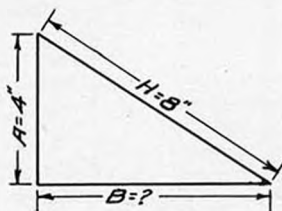


Fig. 17

Problem: Find the base of a right triangle whose hypotenuse is 8 feet and whose altitude is 4 feet. (See Figure 17.)

Solution: base $b = \sqrt{h^2 - a^2}$

$$b = \sqrt{8^2 - 4^2}$$

$$b = \sqrt{64 - 16}$$

$$b = \sqrt{48} = 6.92 \text{ feet}$$

SOLUTIONS

Reduction of Common Fractions

- | | | | |
|-----------|------------|-----------|-----------------|
| 1. $1/2$ | 4. $3/4$ | 7. $7/16$ | 10. $3/4$ |
| 2. $3/11$ | 5. $5/9$ | 8. $3/5$ | 11. $7/11$ |
| 3. $1/2$ | 6. $25/26$ | 9. $1/3$ | 12. $3579/5010$ |

Addition of Common Fractions

- | | |
|---------------|--------------------|
| 13. $1-1/6$ | 19. $16/25$ |
| 14. $19/20$ | 20. $1-51/100$ |
| 15. $1-5/24$ | 21. a) $x = 2-3/8$ |
| 16. $1-31/40$ | b) $y = 4-3/8$ |
| 17. $19/24$ | c) $4-7/16$ |
| 18. $43/80$ | d) $8-31/32$ |

Subtraction of Common Fractions

- | | |
|-------------|--------------|
| 22. $1/3$ | 26. $1/24$ |
| 23. $7/16$ | 27. $41/48$ |
| 24. $11/24$ | 28. $1/25$ |
| 25. $1/40$ | 29. $21/100$ |

Multiplication of Common Fractions

- | | |
|--------------|--------------|
| 30. 3 | 33. $65/512$ |
| 31. $11-1/5$ | 34. $1/5$ |
| 32. $1/6$ | 35. $3/5$ |

36. There are two methods of solving this problem. One, is to find the weight of the barrel full of oil and then take $3/4$ ths of that total for our answer. The second would be to find what the contents of $3/4$ ths of the barrel would amount to and multiply that amount by the weight per gallon.

We shall use the first method for solving this problem.

$31-1/2$ gallons written as a fraction = $63/2$
 $7-5/8$ lbs per gallon written as a fraction = $61/8$

We now multiply these two fractions.

$$\frac{63}{2} \times \frac{61}{8} = \frac{3843}{16}$$

We could reduce this fraction to a mixed number and get the weight of the barrel full of oil. However, since we are now going to multiply, it would simplify the problem to leave the fraction as it is. We now multiply

$$\frac{3843}{16} \times \frac{3}{4} = \frac{11529}{64}$$

Now by dividing 11,529 by 64, we will get our answer as a mixed number.

$$64 \overline{) 11529} \\ \underline{64} \\ 512 \\ \underline{512} \\ 9$$

Therefore, the weight in the barrel is $180-9/64$ lbs.

Division of Common Fractions

- | | |
|--------------|--------------|
| 37. $21/32$ | 40. $2-5/9$ |
| 38. $1-1/15$ | 41. $1-1/82$ |
| 39. $5-5/7$ | 42. $5-1/4$ |

Addition and Subtraction of Decimals

- | | |
|-------------|-----------|
| 43. 389.6 | 47. .2587 |
| 44. 9.3613 | 48. 4.38 |
| 45. 48.0425 | 49. .4995 |
| 46. 773.59 | |

Multiplication of Decimals

- | | |
|----------------|-----------------------|
| 50. 7. | 55. 2.6612250 |
| 51. 93.48 | 56. a. $X = 16.03125$ |
| 52. .4455 | b. $X = 11.38125$ |
| 53. .20335 | c. $X = 20.53125$ |
| 54. 1.52578125 | d. $X = 28.03125$ |

Division of Decimals

- | | |
|----------|-------------|
| 57. 8 | 61. 3400 |
| 58. 1300 | 62. 24.0018 |
| 59. 31 | 63. 4.536 |
| 60. .43 | 64. .750 |

BACK ISSUES OF
THE ORDNANCE SERGEANT
ARE NOT AVAILABLE



THE

Conducted by: M. M. Durney, M. Sgt., Ord. Dept.

THE PROPERTIES, STORAGE AND USE OF ACETYLENE

Oxyacetylene Welding Equipment: The equipment used for oxyacetylene welding consists of a cylinder of oxygen, a cylinder of acetylene, two regulators, two lengths of hose with fittings, and a welding torch with a cutting attachment or a separate cutting torch. It may be either portable or stationary depending upon the class of work being done. A portable outfit is shown in Figure 1. In addition, suitable goggles are required

by W. G. SYLVESTER

Capt., Ord. Dept.

ACETYLENE AND ITS PRODUCTION

Acetylene is a fuel gas composed of carbon and hydrogen. Its chemical formula is C_2H_2 . When burned with oxygen, acetylene produces an oxyacetylene flame with a temperature, for an oxidizing flame mixture, of approximately 6300°F. A neutral flame produces a temperature of ap-

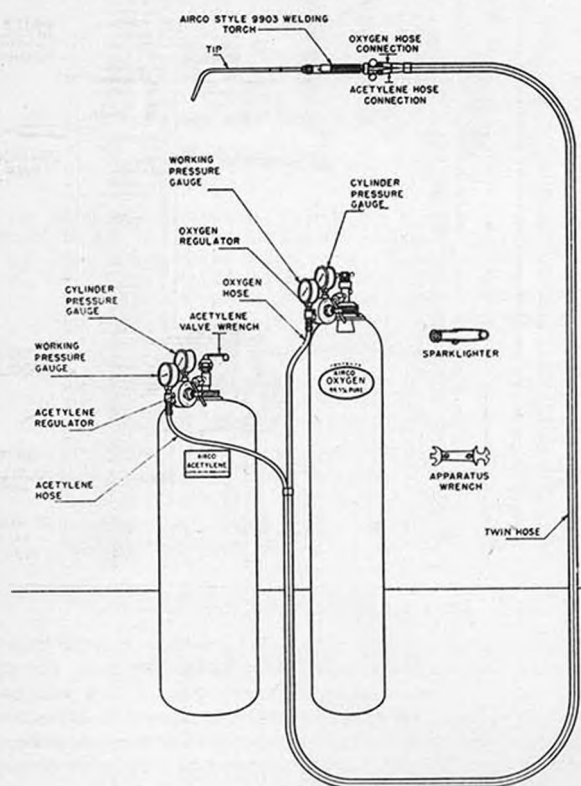


Fig. 1 -- Oxyacetylene welding and cutting outfit

for eye protection, a spark lighter to light the torch, gloves to protect the hands, and an apparatus wrench for the various connections on cylinders, regulators and torches. A stationary welding outfit is similar to the portable outfit except for the source of oxygen and acetylene. The oxygen is obtained from a number of cylinders manifolded or connected together and equipped with a master regulator to control the pressure and the flow. The oxygen is thereby supplied to a pipe line which distributes gas to a number of stations. A typical stationary type oxygen cylinder manifold is shown in Figure 2. Both the oxygen and the acetylene is obtained at the station through a station outlet similar to that shown in Figure 3. In the stationary type welding outfits the acetylene is obtained from either an acetylene manifold or is generated in a suitable acetylene generator. A typical acetylene cylinder manifold used to supply acetylene to a pipe line for distribution to welding stations is shown in Figure 4. The manifold is equipped with special safety devices to protect it from flashbacks occurring in the torch and which might be carried back to the cylinders. A suitable regulator is also required to control the flow of acetylene from the manifold to the pipe line. In installations where an acetylene manifold is not used the acetylene is obtained from an acetylene generator similar in design to that shown in Figure 5. The generators are set to deliver clean cool acetylene under a pressure not exceeding 15 lb. per sq. in.

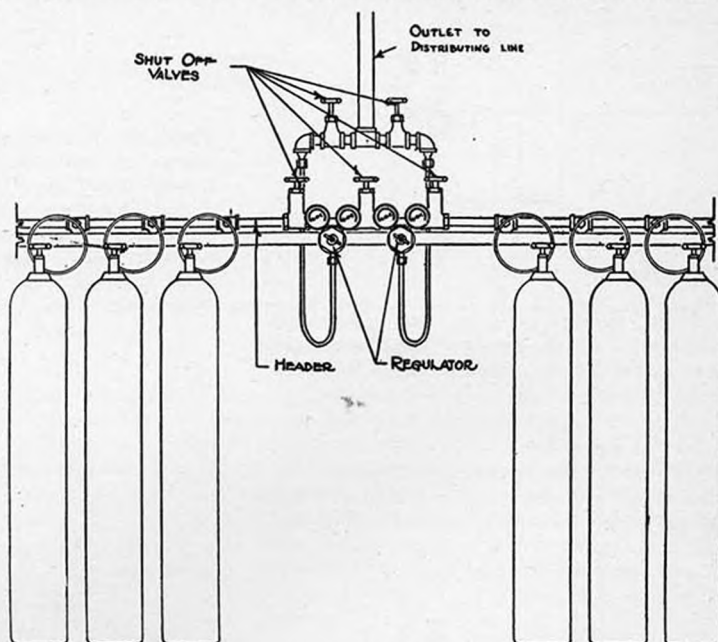


Fig. 2 -- Stationary type oxygen cylinder manifold

proximately 5850°F, while a carburizing flame produces a temperature of approximately 5700°F. These temperatures are developed at the tip of the inner cone of the flame. Acetylene is without color but has a distinctive odor that can be easily detected.

Mixtures of acetylene and air containing from 2% to 80% acetylene by volume will explode when ignited. However, with the proper precautions and suitable welding apparatus, acetylene can be safely burned with oxygen for heating, welding, and cutting purposes.

Acetylene is generated by the action between calcium carbide, a gray, stonelike substance, and water, leaving a hydrated (or slaked) lime as a sludge. The reaction of the carbide and the water produces acetylene gas leaving the sludge of lime at the bottom of the generator. Since considerable heat is given up in this reaction special precautions are taken to prevent excessive pressures in the generator which might cause fire or explosions. The calcium carbide is added to water through a hopper mechanism, and the rate of feed of carbide is regulated so as to maintain a given working pressure automatically, usually about 15 psi. A pressure regulator is required at the generator to control the pressure of the gas entering the pipe line. This unit is built in as part of the generator.

Acetylene generators are known as single rated or double rated depending upon their capacity to produce acetylene. A single rated 300-lb. generator is filled with 300 lb. of calcium carbide and 300 gallons of water. This generator has a capacity of delivering acetylene at rates up to 300 cu. ft. per hour. Since calcium carbide generates 4.5 cu. ft. of acetylene per pound this generator can operate at full load for a period of 4.5 hours. A double rated 300-lb. generator when filled with 300 lb. of calcium carbide and 300 gallons of water will deliver 600 cu. ft. of acetylene per hour for 2-1/4 hours when operating under full load. The double rated generator is similar to the single rated generator except that finer-sized calcium carbide is used through a special hopper.

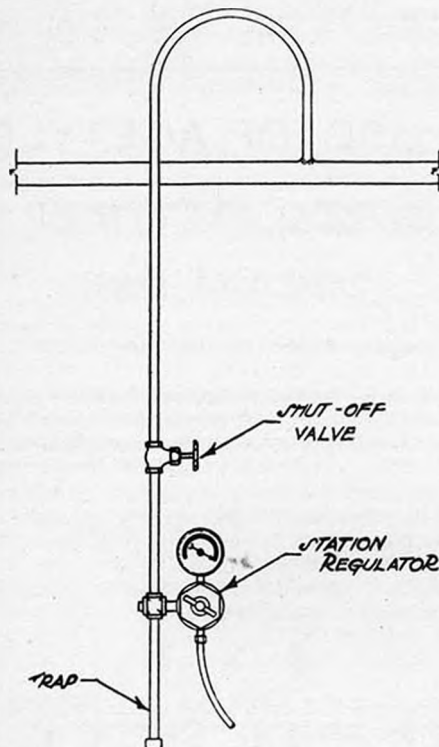
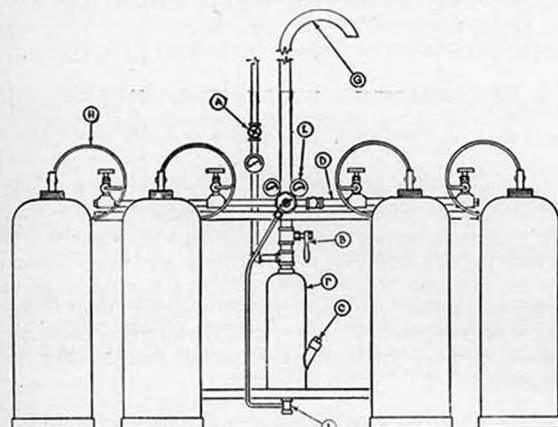


Fig. 3 -- Station outlet for overhead acetylene distributing line

ACETYLENE CYLINDERS

Acetylene can be compressed in steel cylinders under a pressure of 250 lb. per square inch or it may be directly piped from the generators to the stations where it will be used. Acetylene cylinders used to supply gas for welding purposes are constructed to comply with the specifications of the Interstate Commerce Commission and the Bureau of Explosives. They have gas capacities of 110, 250, 275, and 300 cu. ft.



- A. Line valve.
- B. Release valve.
- C. Filler plug.
- D. Header pipe.
- E. Regulator.
- F. Flash arrestor chamber.
- G. Escape pipe.
- H. Cylinder connection pipe.
- I. Check valve and drain plug.

Fig. 4 -- Stationary type acetylene cylinder manifold

When compressed into cylinders the acetylene is dissolved in acetone, which is a liquid, and this solution is absorbed in a porous filler consisting of such materials as balsa wood, charcoal, finely shredded asbestos, infusorial earth, corn pith, and portland cement. These cylinder filler materials are porous and are used to decrease the size of open spaces in the cylinder, as shown in Figure 6: This is necessary because

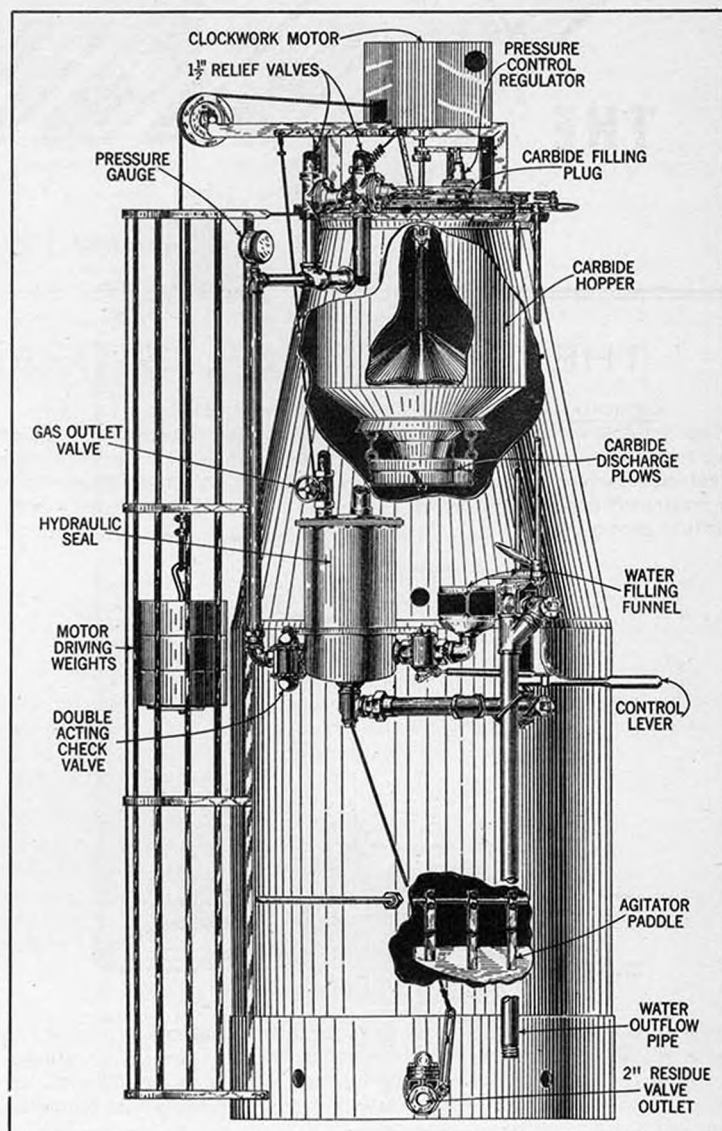


Fig. 5 -- 300-pound capacity acetylene generator

acetylene when stored in a free state under pressure greater than 15 psi. can be made to disassociate or breakdown by heat or shock and possibly explode. Pure acetylene when under a pressure of 29.4 psi., becomes self-explosive, and a slight shock is likely to cause it to explode even in the absence of oxygen or air. When dissolved in acetone, however, it can be compressed up to 250 psi., at which pressure a cylinder contains approximately 275 cubic feet of acetylene.

The charging capacity of acetylene cylinders, as set forth by the Bureau of Explosives, is 250 psi. at a temperature of 70° F.

Acetone is a colorless liquid produced in the dry distillation of wood, and when under a pressure of 250 psi. it dissolves about 420 volumes of acetylene. When acetylene is used from a cylinder it should not be drawn off at a continuous rate in volumes greater than 50 cubic feet per hour, from a 275 cubic ft. standard cylinder. This precaution is to prevent acetone from being drawn off with the gas and thereby impairing the quality of the weld made. When volumes greater than 50 cu. ft. per hour are required the acetylene cylinders should be manifolded as shown in Figure 4.

The acetylene cylinders have a porosity of from 75 to 80% of the total bulk of the porous filler. The filler acts as a large sponge to absorb the liquid acetone which in turn dissolves or absorbs the acetylene. About 40% of the porous filler is filled with acetone. This allows room for expansion as acetone increases in volume when it absorbs acetylene, while acetylene, being a gas, decreases in volume.

When filling the cylinders the manufacturer determines the weight of acetylene dissolved in the acetone by using the factor 14.5 cubic feet per lb., at 70°F. To determine the amount of acetylene in the cylinder, the cylinder is weighed before and after filling. The difference in weight

multiplied by 14.5 gives the volume of acetylene in cubic feet. The acetylene cylinders are designed with steel safety plugs having a small hole through the center which is filled with a low melting-point metal alloy. The metal alloy in these plugs melts at a temperature of 212° to 220° F. The plugs are located in the base of the acetylene cylinders and in the cylinder valve located at the top of the cylinder. In case the cylinder is overheated, this alloy will melt and be forced out, thus permitting the gas to escape through small openings in the plugs before a dangerous pressure is built up in the cylinder. The holes in the plugs are small enough to cause the gas to escape at a speed which will prevent a

Acetylene Capacity
Approx. 275 Cu. Ft.
at 250 Lb. per Sq. In.
Pressure and 70° F.
Water Capacity
Approximately
4021 Cu. In.

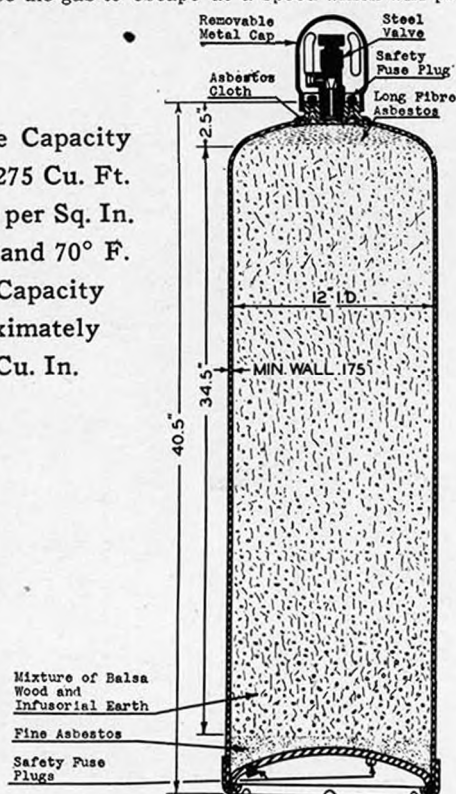


Fig. 6 -- Acetylene cylinder

flame from burning back into the cylinder if the escaping gas should become ignited. If these were not provided, the pressure in the cylinder would reach a point sufficiently high to form a bulge in, or to burst, the cylinders, should they become exposed to an excessively high temperature.

The cylinder valves are designed so that a squared end on the stems can be fitted by a cylinder wrench and opened or closed when the acetylene cylinder is in use. The outlet of the valve is threaded for connection to an acetylene pressure regulator using a union nut. The regulator inlet connection gland fits against the face of the threaded cylinder connection and the inlet connection nut draws the two surfaces together. Whenever the threads on the valve connection are damaged so as to prevent assembling to a regulator, the cylinder should not be used but should be marked or set aside for return to the manufacturer. A protective cap screws on to the valve to prevent damage during shipment or in storage. All cylinders should be checked for leakage as acetylene accumulated in a confined space is a fire or an explosive hazard.

ORDNANCE VEHICLES: WARM-UP PROCEDURE

When TB 700--? is published it will direct that the following information be brought to the attention of every individual directly concerned, particularly company officers, shop officers, noncommissioned officers and specialists affected. Ordnance officers will make every effort to disseminate this information to personnel of other arms or services concerned with this materiel.

Improper warm-up procedure in the operation of vehicles equipped with in-line engines has resulted in piston scuffing. Extensive investigation and tests have proven that the following warm-up procedure will alleviate any piston scuffing tendency:

a. Immediately upon starting, the engine will be brought up to and maintained at a speed of 1,300 rpm, no load, until the engine coolant temperature gage indicates 160° F. before load is applied to engine.

b. The warm-up procedure as outlined in "a" above, can be accomplished in a minimum of time at extremely low temperatures by blanketing the radiator to cut off cold air blasts from the fan.

c. Where warm-up difficulty is experienced, the engine thermostat should be checked to insure accuracy of operation.

d. Some vehicles may be encountered that are not equipped with engine tachometers. In such cases, it will be necessary to use a portable tachometer to determine 1,300 rpm. The hand throttle should be notched close to instrument panel with a file so that operator can determine the proper speed without use of tachometer in subsequent cold starting warm-up periods.

e. Operators are to be cautioned against excessive use of choke as this will result in unburned gasoline washing the protective lubricant from cylinder walls which will aggravate the scuffing action. Choke should be released as soon as engine will run without it.

f. The oil pressure gage should be watched closely, and if the gage does not immediately indicate oil pressure the engine should be shut off. Cases have been experienced where freezing of water and sludge in oil pump screen have prevented oil pump operation.

Where extremely low temperatures constantly prevail, it may be necessary to blank-off a portion of the radiator surface at all times, to insure an engine operating temperature of approximately 160° F.

Unit commanders and motor officers will immediately take steps to put this warm-up procedure into operation. It has been determined that any other warm-up procedure will result in progressive piston scuffing.

This bulletin is effective until the above information can be included in the pertinent 700 series TM's.

CREDIT WHERE CREDIT IS DUE

72ND ORDNANCE COMPANY (DEPOT)
APO #957, C/O POSTMASTER
SAN FRANCISCO, CALIFORNIA

14th December 1942

SUBJECT: Portable Shelves and Bins for Field Depot.

TO : Editor
THE ORDNANCE SERGEANT
The Ordnance School
Aberdeen Proving Ground, Maryland

1. In your September issue, Vol. 4 No. 3, of THE ORDNANCE SERGEANT, there appeared an article, "Portable Shelves and Bins For Field Depots."

2. It is noted that under the title of this article the undersigned is given full credit for submitting same. Whereas this article was forwarded by the undersigned, and he did assist in some measure, the credit should be given to 1st Lt. CARL J. ALLEN, who was Depot Officer of this organization at that time. Lt. ALLEN spent considerable time and effort in working out the logistics of these Shelves and Bins, which may be used for shipping containers as well. Lt. ALLEN was more recently with the Port Ordnance Officer, San Francisco Port of Embarkation, San Francisco, California.

3. A system very similar to this one is being used by this organization now, in the operation of a Sub-Depot, and is proving very satisfactory. Where lumber of the specifications listed is not available, it has been found that automatic rifle boxes may be utilized in an emergency. The application of this system by Depot Companies operating in the field is strongly recommended.

/s/ Thomas V. Burgett

THOMAS V. BURGETT,
Capt., Ord. Dept.,
Commanding.



FORGING

Conducted by:

Nathan Stutz, T. Sgt., Ord. Dept.

QUALITY CONTROL IN FORGING OPERATIONS

by W. G. SYLVESTER

Capt., Ord. Dept.

The successful accomplishment of all forging and forge welding operations is dependent upon the satisfactory control of two important factors. These may be generally classified as metallurgical and physical. The first of these covers the internal structural changes in metals brought about by varying the rate of heating, the temperature to which the metal is heated, and the rate of cooling. By properly varying the temperature history of a piece of metal the desired properties of grain size, hardness, tensile strength, toughness, ductility and other properties can be controlled. The second factor covers changes in the dimensional size and shape of the piece of metal being forged. These changes can be controlled by the blacksmith, and the degree of success from this standpoint is largely dependent upon individual experience and skill. By proper use of hammer, anvil and other forging tools, the blacksmith can apply his skill to perform bending, twisting, drawing out, upsetting, punching and forge welding operations. Although both of these factors are capable of separate control they must be properly coordinated to bring about the desired results in the finished forging. The importance of this coordination is reflected in the time-worn adage — "Strike the iron while its hot".

FORGING TEMPERATURES

The time rate of heating a piece of stock to a forging temperature should be controlled so that the outer surface of the stock is not overheated and burned in the process of bringing the center of the stock to the desired temperature. In forging plain carbon steels up to three inches in diameter or thickness and containing up to 0.50% carbon, the time rate of heating should be five minutes or more per inch of stock diameter or thickness. Larger stock sizes and steels containing more than 0.50% carbon require a slower heating rate. In general, the larger a piece of stock, or the higher the carbon content the slower the cooling rate that must be used.

The following table indicates the maximum forging temperature recommended for steels of the carbon content indicated.

% Carbon	Maximum Forging Temperature °F.
0.10	2400
0.20	2375
0.30	2350
0.50	2300
0.70	2225
0.80	2190
0.90	2150
1.10	2075
1.30	1975
1.50	1900

In forging alloy steels up to 3 inches in diameter or thickness and containing up to 0.50% carbon, the time rate of heating should be 6 minutes or more per inch of stock diameter or thickness. For larger stock sizes or higher carbon contents a slower rate of heating or a low temperature preheat should be used. The alloy steels considered in this group are classified under the following S.A.E. steel series. S.A.E. 2300, 3100, 3200, 3300, 3400, 4100, 4600, 5100, and 6100. The alloys represented by these S.A.E. numbers are the nickel, nickel chromium, molybdenum, chromium, and chromium vanadium steels. The following table indicates the maximum forging temperatures as a function of carbon content recommended for steels in any of these classifications.

FORGING TEMPERATURES OF ALLOY STEELS

% Carbon	Maximum Forging Temperature °F.
0.10	2350
0.20	2300
0.30	2250
0.40	2250
0.50	2200
0.60	2200

It should be noted that the maximum forging temperatures for alloy steels of a given carbon content are slightly below those recommended for plain carbon steels. The finish forging temperature in all cases, should not be lower than that which produces the smallest grain size in the particular steel being forged.

Alloy steels containing chromium and nickel form a scale which is actually welded to the steel and is therefore very difficult to remove. Precautions should be taken when forging these steels to use a carburizing fire, to avoid heating at the forging temperature for prolonged periods and to use a lower forging temperature especially on larger sections.

The complete forging in large or irregular pieces should be cooled slowly to prevent internal cracks. This can be accomplished by placing the still hot forging in dry sand, lime or ashes or near the fire bed of the forge.

OVERHEATING AND BURNING OF STEELS

The term "burning" as applied to forging of steels is a condition which occurs when the maximum forging temperatures are exceeded either at the surface or inside of the forging stock. Thus a steel might be burned inside yet appear quite satisfactory on the surface. Burning of steel inside can be caused by either decarburization at the surface (removal of carbon from the surface of the metal) or by a high inside temperature which is much hotter than the surface at the time of forging. A steel can also be burned inside of the forge fire before any forging is performed.

The effects of burning on a steel are such as to produce internal porosity, coarse grain size and brittleness. Excessive blasts of air against steel in the forge fire, too rapid a rate of heating or the use of an oxidizing fire may cause local scaling on the surface as well as internal damage due to overheating. The higher carbon steels when exposed to this treatment will become decarburized at the surface and will not respond to heat treatment after forging.

Pieces that have been forged at too low a temperature will remain in a highly stressed state and should be stress-relieved by heating to temperatures of from 1100 to 1250°F one hour per inch of diameter or thickness to prevent cracking.

THE ORDNANCE SERGEANT is always happy to receive original articles or photographs from the field. There is a lot of good Ordnance knowledge floating around in the largest army in our history. Almost anything which is interesting is also instructive. And anything which is readable is also usable. You don't have to be a novelist or a newspaper man to send us a story about some subject of Ordnance interest.



Conducted by: W. L. Parker, M. Sgt., Ord. Dept.

AMMUNITION FOR THE 40mm GUN, M1

WEAPON

The 40 mm A.A. gun, identified by its funnel shaped mouth was designed by Bofors, a Swedish concern. Considered to be one of the finest of all antiaircraft weapons, this gun was already in production in Sweden when the Spanish War demonstrated that a medium calibre automatic cannon would be a requisite in future defensive action against low flying aircraft. In 1940 exhaustive tests were made at Aberdeen Proving Ground, with the 40 mm Bofors. The results of these tests together with authoritative information on their European performances combined to effect standardization of a weapon of this type by the Ordnance Committee early in 1941, as the U. S. Army 40 mm gun, M1.

Fire with this weapon is usually in bursts of four or five rounds and is fully automatic. Other general information on the 40 mm Automatic Gun, M1, on the Carriage, M2, is tabulated below:

Bore: Calibre - 40mm or 1.58".
Length - 56.24 calibres or 88.58 inches.

Rifling: Length - 76.09 inches.
No. Grooves - 16
Twist - Right hand, 1 turn in 45 calibres initially.
1 turn in 30 calibres ultimately.

Elevation: Max. - 90 degrees.
Min. - Minus 5 degrees.

Traverse: 360 degrees.

Rate of fire: 120 rounds per minute.

Range: Maximum effective limited by the director - 2500 yards.

Magazine Capacity - 7 rounds.

Muzzle Velocity - 2960 f/s; travels 1500 yards in 2 seconds.

AMMUNITION, General

All ammunition for the gun, automatic, 40 mm M1, is issued in the form of complete rounds of fixed ammunition. There are two basic types of service ammunition, the shell fixed, Q.F., H.E., MK II, T/L, and Shot, fixed, A.P., M81 (see first attached sketch). Both of these rounds employ tracer elements to enable the gunner to follow the path of the projectile in flight.

The complete rounds - components of the high explosive shell are: Shell, Q.F., H.E., 40 mm, MK. II, T/L, assembled with Tracer and Igniter Shell No. 12, MK. I/L. Internal.

Fuze, P.D., M64A1, or Fuze Percussion, D.A., No. 251, which is British in design and limited standard.

Case, cartridge, M25, M22A1, or M22

Primer, percussion, M23A2, or primer, percussion, Mk. II, Limited Standard.

Propelling charge - 10.4 ounces of FNH (flashless, nonhygroscopic powder).

This round may be identified by the fact that the projectile is painted yellow and carries a fuze which forms somewhat over one half of the ogive. Total length of the round is 17.64 inches, total weight 4.67 lbs.

The complete round components of the A.P. Shot:

Shot, A.P., M81 w/tracer.
Case, cartridge, M25.
Primer, percussion, M23A2
Propelling charge, 10.4 oz. FNH.

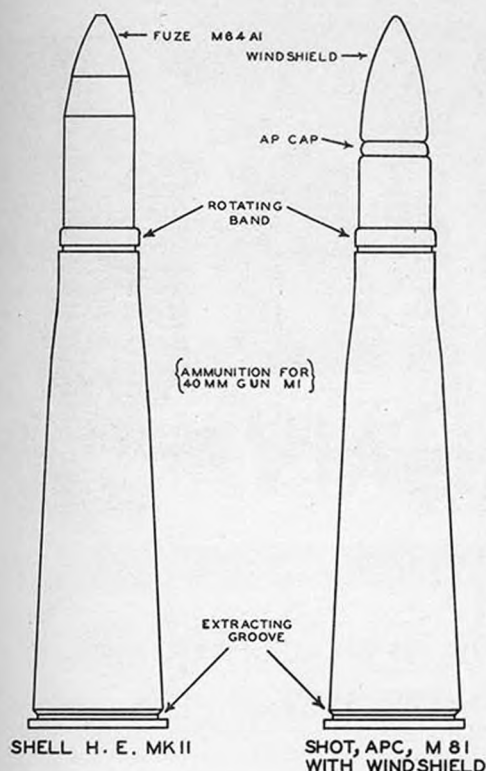
This round may be identified by the black color of the projectile and the fact that an armor-piercing cap and windshield are visible at the nose of the projectile. The weight and over all dimensions of the round are approximately the same as for the H.E. round. (See first attached sketch).

DETAILS AND FUNCTIONING OF COMPONENTS

Primer, percussion M23A2 - This is a percussion type primer, containing 20 grains of black powder. A firing plug of soft metal receives



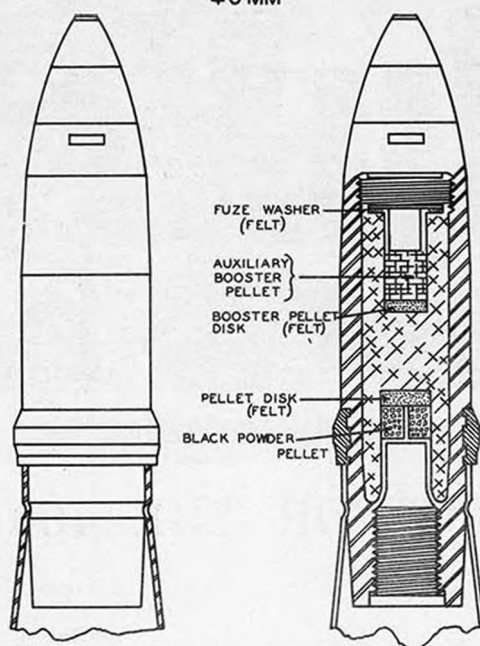
40mm Ammunition



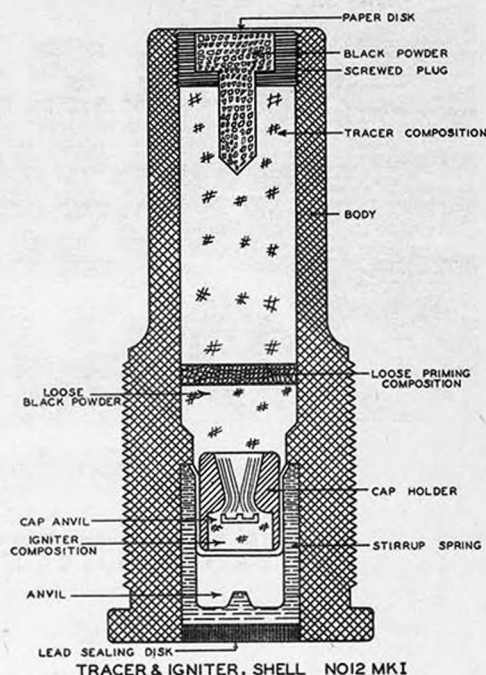
First sketch

SHELL H. E. MK II T/L

40 MM



Second sketch



Third sketch

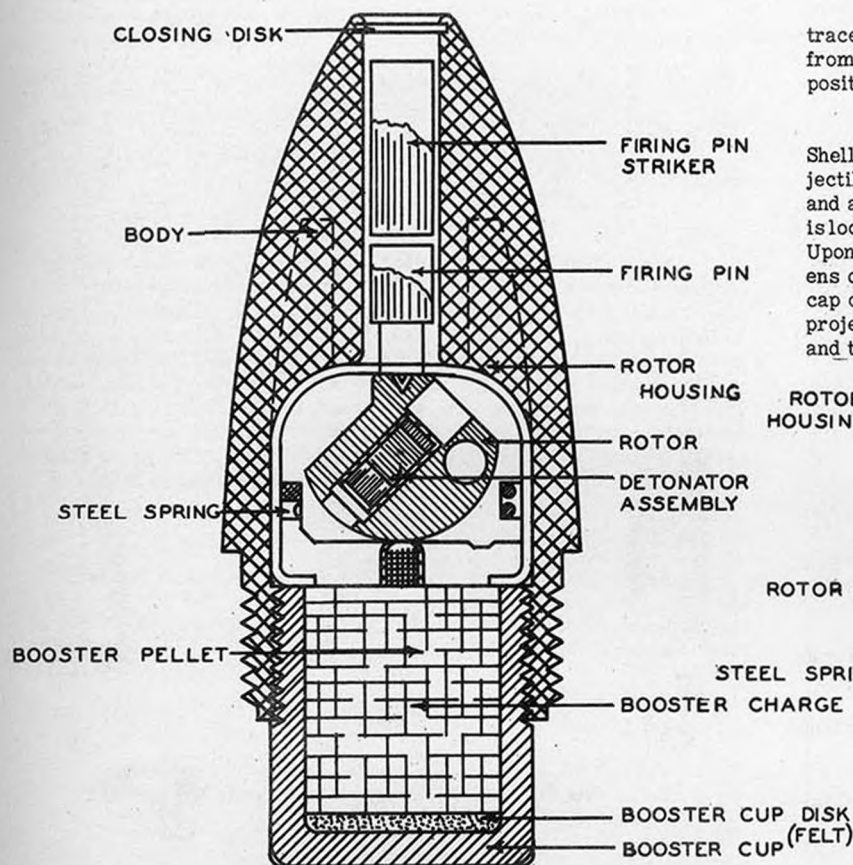
the blow of the firing pin and since the plug is of soft metal, the blow does not penetrate the primer cap, but merely crushes the primer cup over the apex of the anvil. The primer composition is thus ignited, and flashes through to the 20 grain black powder auxiliary charge.

Propelling charge - The propelling charge of loose, flashless non-hygroscopic powder is in turn ignited by the auxiliary black powder charge in the primer, and propels the projectile from the gun.

Cartridge cases, M25, M22, and M22A1. - All cartridge cases are drawn brass cases and have an extracting groove with an unusually thick flange at the base. The M25 case is designed with sloping side walls and a taper 2-1/2 inches from the mouth. The overall dimensions of the case are 12-9/32 inches long with a base 2-7/16 inches in diameter and 1/4 inch base flange. As with all fixed ammunition; the cartridge case which contains the loose propelling charge and seats the primer is crimped firmly to the projectile.

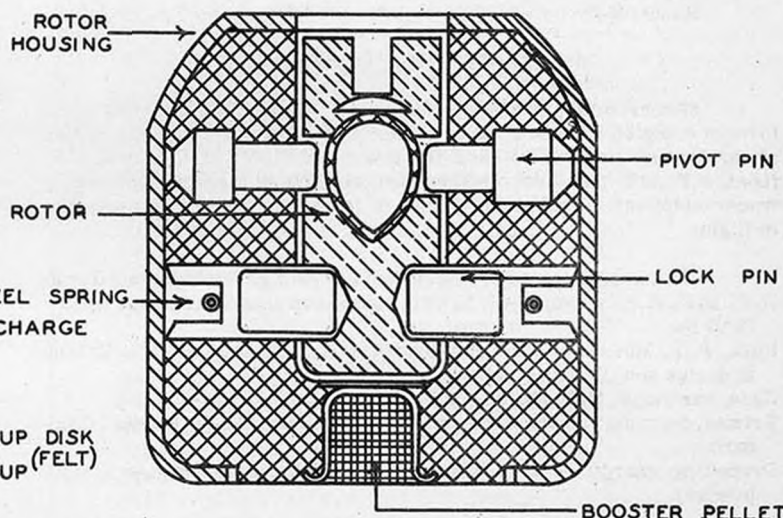
Shot, A.P., M81 - This projectile is a solid shot with a tracer and tracer igniter in the base. Upon ignition of the propelling charge, the heat from the combustion ignites the tracer igniter and in turn the tracer composition itself. (See first attached sketch).

Shell, Q.F., H.E., 40 mm Mk. II Assembled with Tracer and Igniter Shell No. 12, Mk. I/L, Internal. (See 2nd attached sketch). - This projectile loaded and fuze weighs 1.923 lbs., and contains .15 lbs. of TNT and a black powder pellet weighing .005 lbs. In the base of the projectile is located an igniter and shell destroying tracer. (See 3rd attached sketch). Upon set back a cap holder in the igniter moves to the rear and straightens out the stirrup spring which had retained it. This action carries the cap onto the central projection of the anvil, and crushes it between the projection and the cap anvil. Thus the igniter composition is functioned and the flame flashes through the funnel shaped hole in the holder and the



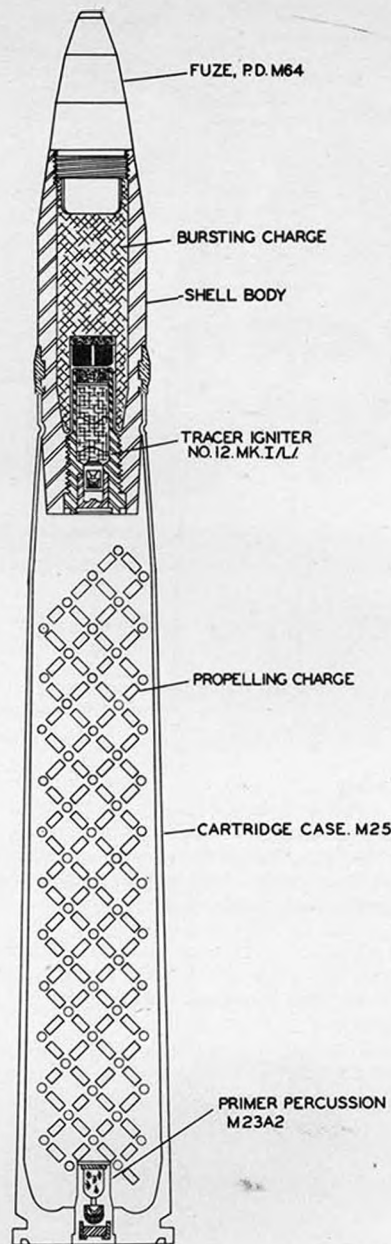
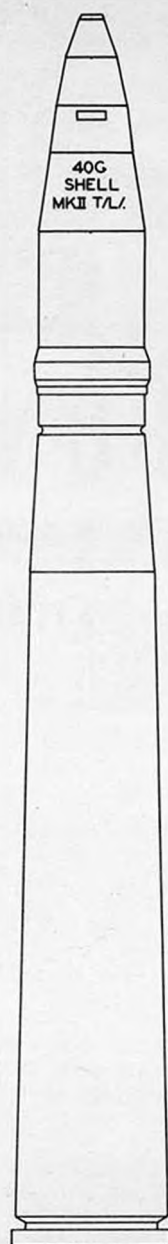
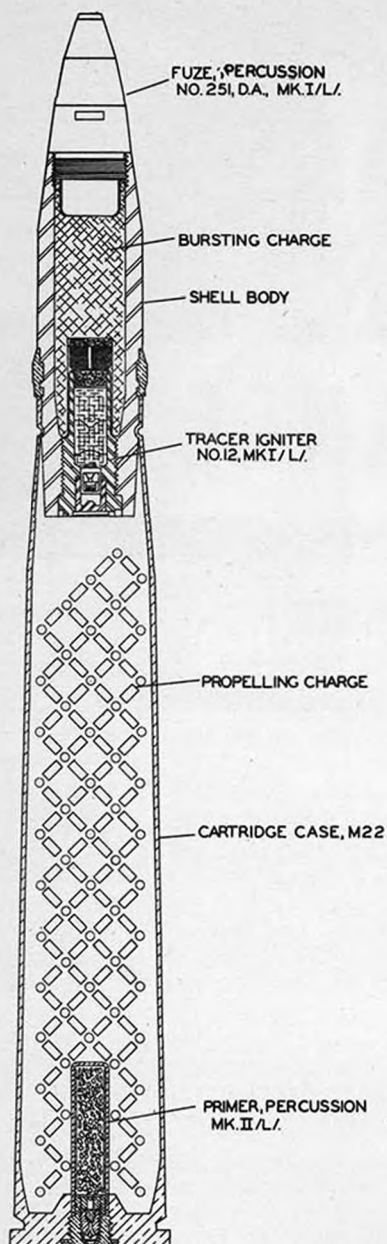
FUZE, POINT DETONATING, M64 AI

Fourth sketch

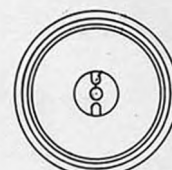


ROTOR HOUSING ASSEMBLY

Fifth sketch



REAR FACE OF M22 CASE
W/PRIMER MK.I/L.



REAR FACE OF M25
CASE W/PRIMER M23A2

communicating passage to the black powder in the upper chamber. The black powder is thus ignited, and blows out all components assembled in the lower chamber, i.e., the lead sealing disc, anvil, stirrup spring, cap, cap anvil, and cap holder; simultaneously with this blow back, the priming composition is ignited which in turn ignites the tracer composition. When the tracer composition burns through, it ignites the black powder in the forward end of the tracer plug which flashes to the shell - destroying black powder pellet at the base of the bursting charge.

Fuze, M64A1 (See 4th and 5th attached sketches). - This fuze is a point detonating, superquick type of fuze, and is considered to be bore safe. In the event the high explosive projectile strikes the target before the shell destroying tracer is completely consumed, this fuze will function the shell. Its action is as follows:

NOTE: The fuze, M64A1, as described in this article, has recently been superseded by the fuze, point-detonating, M70.

The point-detonating fuze, M70, as used with 40 mm H.E. ammunition, has the identical mechanism of the M56 P.D.F. used with 37 mm H.E. rounds. The two fuzes have the same diameter, booster charge and internal assembly. The only difference between the two fuzes is in the overall length, for the M70 fuze measures 2.387" and the M56 fuze 2.21". The nose of the M70 fuze is slightly longer than the corresponding part of the M56, but this does not alter the performance of the fuze.

When centrifugal force develops, the two lock pins, which have held the rotor in a safe position, move outward against the pressure of the steel retaining spring. This action frees the rotor, allowing it to rotate on the pivot pins in a counterclockwise direction ultimately positioning itself in a horizontal plane in relation to the longitudinal axis of the projectile, thereby aligning the detonator with the firing pin and booster. Upon impact, the closing disc is sheared, and the firing pin striker is forced down on the firing pin, driving the point of the firing pin into the upper detonator. This action results in a functioning of the upper detonator, booster pellet, booster, and finally the bursting charge of TNT.

PACKING

Ammunition for the 40 mm gun M1 is packed in two ways; in chargers, four rounds per charger, six chargers (24 rds.) per metal lined box, weighing 153 lbs. in all; in fiber containers, one round per fiber container, 24 containers (24 rds.) per wooden box, total weight 161 lbs.

REFERENCES

TM 9-2005, Vol. VI - Ordnance Materiel, General
O.O. Form No. 5981 - Complete Round Chart
S.N.L. P-4.

**BUY BONDS NOW,
AND A BUNGALOW LATER,
ALL WITH THE SAME DOLLARS**



AVIATION ORDNANCE

Conducted by: Ordnance Section, Army Air Forces

TRAINING PUBLICATIONS

Certain publications are essential, in order that organizations may effectively operate their training programs.

It is the responsibility of the organization commander, and persons appointed by him, to review all indices of publications and to secure those applicable to the particular training anticipated.

It is believed that many individuals, whose duty it is to prepare and operate training schedules, are not familiar with the large volume of publications available to them, nor, are they familiar with the procedure of obtaining these publications.

While it is not believed advisable to list all publications that might be used with training programs; as these programs will differ depending upon the organizations mission, it is believed that information on the various types of publications and where and how they are obtained, would be of interest.

Publications may generally be classed as follows:

1. War Department Publications

2. Special Air Force Publications

3. Ordnance Publications

4. Ordnance School Publications

War Department publications are those listed in the 310 series of Army Regulations and the latest revision of FM 21-6. Requests for War Department Publications should be made to the Air Base adjutant, using the distribution authorized in AR 310-200 and FM 21-6 as a basis for the requisition.

Special Air Force publications include Air Force Regulations, Technical Orders and like publications. Requests for these publications should be made to the Air Base Adjutant, who procures them from the Air Force or Command.

Ordnance Publications are those listed in OFSB 1-8 and are requested from the Ordnance Officer of each Air Force or Command.

Ordnance School Publications are available upon request to the Librarian, Ordnance School, Aberdeen Proving Ground, Maryland. Listing should be made by title and number.

NOTES ON ORDNANCE MATERIEL

90mm Recoil Mechanism, M1 and M1A1

Ordnance Field Service Technical Bulletin 1370-1, page 9, paragraph 11, pertains to adjusting the length of recoil for the 90mm AA Recoil Mechanism M1 and M1A1. The next page (10), paragraph b, section 3, states that after the throttling valve stop (A14776) has been properly set according to available recoil data, the length of recoil should be checked by firing a round at 70° elevation.

The first round should be fired at 0° elevation and NOT at 70° elevation. It is mandatory that these instructions be carried out because there is a possibility of obtaining excessive recoil at 70° elevation and causing considerable damage to the materiel.

Carburetor Float Bowl, Generating Units, M5

Inspections reveal that certain Generating Units, M5, are being operated with carburetor bowls which are cracked. Bowls manufactured by a different process are now available at Frankford Arsenal.

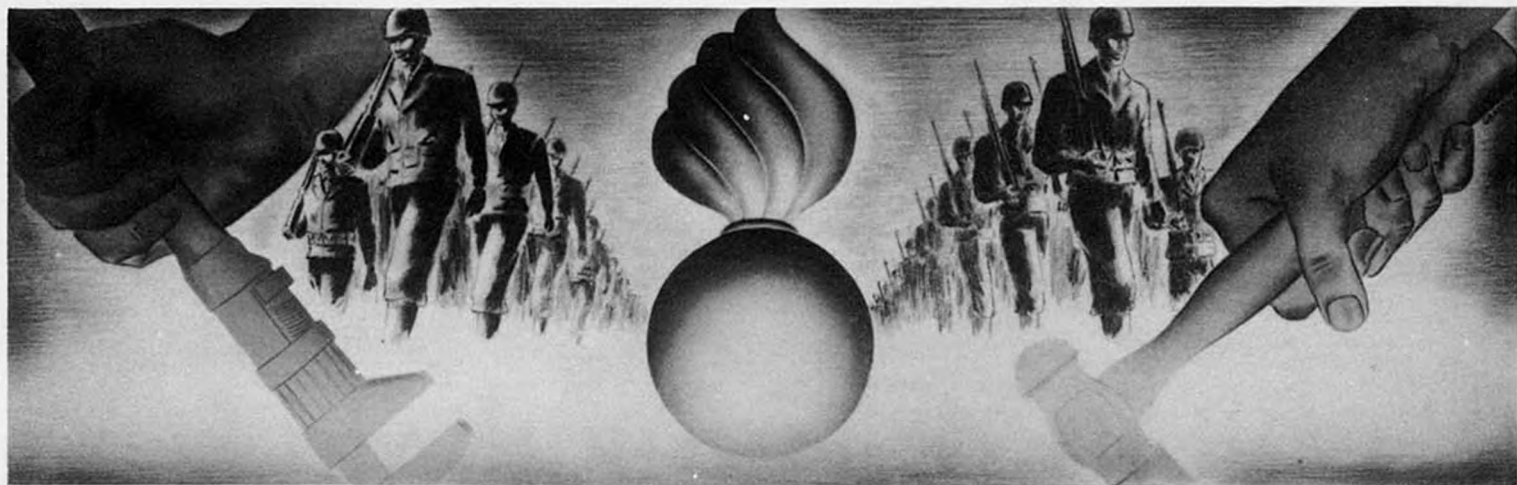
The carburetor float bowls (part No. 65-157, Temporary SNL F-227) should be inspected on all Generating Units, M5. The requirements for any replacement bowls should be pooled where possible, and a requisition placed through channels on Frankford Arsenal Field Service Stores for the necessary quantity, marking the requisition "To Replace Defective Material".

At the time that the requisition is forwarded, information should be furnished relative to the serial numbers and name of the manufacturer of the Generating Units, M5, which have the cracked bowls. There are two of these manufacturers with similar names, Hobart Mfg. Co., and Hobart Bros. Co., and the correct name must be furnished.

Upon receipt of the new bowls, the defective bowls should be replaced immediately as follows: (See Temporary SNL F-227).

- a. Remove main nozzle and bowl lock plug (80-117).
- b. Remove bowl gasket, outside (16-14).
- c. Remove float bowl (65-157) and bowl gasket, inside (16-14).
- d. Replace parts in reverse of above, substituting new bowl.

The defective bowls should be tagged with the serial numbers and names of the manufacturers of the Generating Units, M5, from which they were removed. They should be concentrated and as soon as a quantity is accumulated shipped to Frankford Arsenal Field Service Stores for salvage and adjustment with the manufacturers.



Conducted by: G. D. Meixel, 1st Lt., Ord. Dept., Secretary, The Ordnance School

SAVANNA SECTION, ORDNANCE SCHOOL

Establishment

The Savanna Section, Ordnance School, is located adjacent to the older Ordnance establishment, The Savanna Ordnance Depot, on the east bank of the Mississippi River, eight miles north of Savanna, Illinois.

The School officially came into existence on January 20, 1942, by the official activation of the Savanna Section, Ordnance School, and Headquarters Company, Savanna Section, Ordnance School. Four Provisional Ordnance Training Companies were subsequently activated as required to handle students as follows:

1st and 3rd Prov. Ord. Tng. Cos.	February 1, 1942
4th Prov. Ord. Tng. Co.	April 1, 1942
2nd Prov. Ord. Tng. Co.	May 1, 1942

The permanent personnel to staff the School were, in general, secured by transfer of personnel from The Ordnance School, Aberdeen Proving Ground, Maryland. A few members of the School staff were, however, already "on the ground". These consisted of Captain Gunnar C. Carlson, Director; Capt. Milton O. Bunker, Military Director; 1st Lt. Edwin G. Koch, Secretary; and 1st Lt. Paul B. Schuppener, Supply Officer. These officers had occupied similar positions in an Ordnance Unit Training Center which had occupied the facilities into which the School moved. The Chief Instructors of the Ammunition and Depot and Supply Sections, 1st Lts. R. R. Fitzwater and J. E. Dempsey, arrived from Aberdeen late in January, followed closely by the first contingent of enlisted instructors and School overhead personnel.

The existing facilities, utilized by the former Unit Training Center, were available and ready for occupancy by the first arrivals at the School. Certain barracks were used as classrooms for the first classes while two existing warehouses were being converted into instruction classrooms. Equipment and instruction material arrived from Aberdeen on January 30th in a truck convoy. The next few days were filled with hard work preparing classrooms and equipment for the first classes.

The first students arrived on February 2nd. On February 4th the first classes at the School began. Three courses were opened: Aviation Ordnance Ammunition, Field Ammunition, and Depot and Supply.

Organization

The organization of the School consists of:

- Headquarters, Savanna Section, Ordnance School
- Headquarters Company, Savanna Section, Ordnance School
- Commanding Officer - Captain R. E. Johnson
- 1st Provisional Ordnance Training Company
- Commanding Officer - 1st Lt. J. D. Motlow, Jr.
- 2nd Provisional Ordnance Training Company
- Commanding Officer - 1st Lt. J. M. Roach
- 3rd Provisional Ordnance Training Company
- Commanding Officer - 1st Lt. C. C. Ingram, Jr.
- 4th Provisional Ordnance Training Company
- Commanding Officer - Capt. W. C. Marcum
- Supply and Military Administration Section
- Chief Instructor - Capt. J. E. Dempsey
- Ammunition Section
- Chief Instructor - Capt. R. R. Fitzwater



A Supply and Military Administration class in session



Supply and Military Administration class in session in Field Shop area.



Headquarters, Savanna Section, Ordnance School

The Headquarters, Savanna Section, Ordnance School, is the headquarters directing all activities of the School and performing all manner of administration for all companies. This headquarters is organized into the following sections and sub-sections:

Staff and Faculty:

Director - Major M. O. Bunker
 Military Director - Capt. E. G. Koch
 Secretary - 1st Lt. C. K. Harper
 Personnel Officer - 1st Lt. C. K. Harper
 Supply Officer - 1st Lt. R. G. Lamberton
 Capt. R. R. Fitzwater & J. E. Dempsey
 Instructors - 1st Lts. H. B. Dunham, L. E. Reisman,
 2nd Lts. E. Knickerböcker, W. C. Schick
 Utilities Officer and Provost Marshall -
 2nd Lt. R. B. Devay
 Special Services Officer - 2nd Lt. J. Bramson
 Student Registry and Orders Section
 Report of Change Section
 Personnel Section
 Military Training Section
 Mail and Files Section
 School Record Section

The student Registry and Orders Section is charged with the duty of registry of incoming students, checking return transportation, assigning students to Provisional Training Companies, and preparation and issue of all orders and memoranda.

The Report of Change Section prepares all reports of change and checks all rosters and returns from the machine records unit.



Instructors' Office, Supply and Military Administration Section

The Personnel Section accomplishes all personnel administration. This section consists of a payroll and service record section, a correspondence section, and company clerks section. Each Company clerk accomplishes all details of administration for his particular company. Payrolls are prepared and service records maintained and checked by each clerk under the close supervision of the payroll and service record section. Correspondence is prepared under supervision of the correspondence section. Miscellaneous forms and administration are accomplished by each clerk under the supervision of the Chief Clerk of the personnel section.

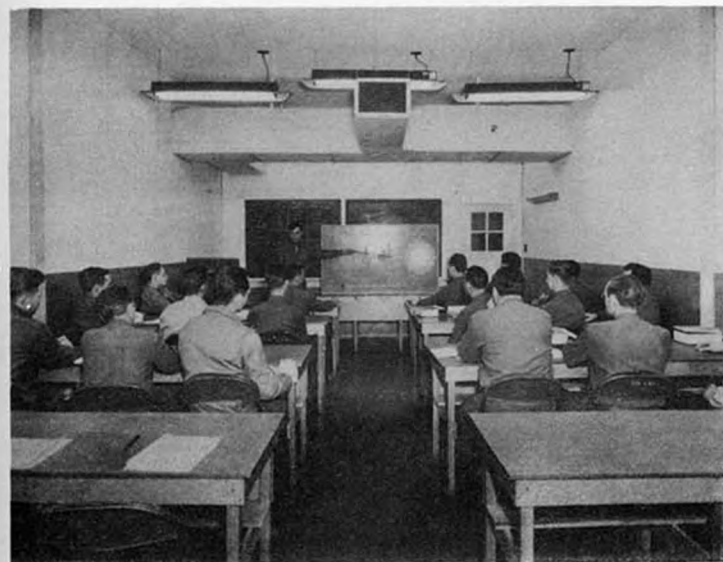
The Military Training Section directs and supervises the physical and military training of the entire school, and conducts a weekly formal retreat parade.

The Mail and Files Section handles the voluminous daily official and personal incoming and outgoing mail and maintains the general office files.

The School Record Section maintains the academic records of all students and prepares all letters of attendance and administrative details pertaining to School training records.

The Headquarters Company of the School consists of all enlisted instructors, headquarters clerks, utility maintenance details, truck drivers, automotive mechanics and miscellaneous administrative personnel.

The four Provisional Ordnance Training Companies comprise the organizations to which incoming students are attached for administration, quarters, messing, etc. Each company has a permanent cadre of about



An ammunition class in session



Sand tables, Ammunition Section

twenty-one enlisted men who form the company overhead for operation of the company.

The supply and Military Administration Section was organized as such in July 1942, from the former Depot and Supply Section due to the fact that the old cognomen, Depot and Supply, was a misnomer which did not fully portray the scope of instruction provided by the section.

Organically the Section has been divided into groups, or subsections, to provide the greatest elasticity so that the groups may be expanded or contracted to meet the ever-changing student load, which, in the past, has fluctuated drastically in direct ratio to the demands of organizations in the field for trained clerks with specific qualifications. At present the Section is divided into a Section Administrative Office, a "Supply and Library" Section, known as the operating overhead group, and two technical training groups, the "Military Administration Clerks Instructors' Group", and the "Supply Clerks Instructors' Group".

The "Administrative Office" Group is located in the Main Office of the Section, and performs various clerical duties common to the other groups, such as maintaining the main files, student statistical records, records of enrollments and relief of students, reproduction of texts, such as Army Regulations, Ordnance Field Service Bulletins, etc., and records pertaining to instructor qualifications of personnel assigned to the Section.

The "Supply and Library" Group, as the name implies, is responsible for the requisitioning, receipt, storage and issue of textbooks, stationery and other office supplies, and equipment required for the operation of the Section. The chief of this Section is an experienced typewriter repair mechanic, and the repair and overhaul of all the School typewriters and other office labor saving devices is performed by him in a specially constructed repair shop in the School building. Assistant mechanics under his supervision are responsible for the timely repair and upkeep of other section equipment, such as office chairs, students' desks, instructors' stands, chart stands, etc., as well as preventive maintenance to the Section School buildings proper.

The "Military Administration Clerks Instructors' Group" is charged with the training of clerks for eventual duty as company clerks, personnel clerks and First Sergeants.

The "Supply Clerks Instructors' Group" is divided into two distinct sub-groups; one, the "Ground Force Ordnance Supply Clerks", and the other, the "Aviation Ordnance Supply Clerks".

The officers and senior enlisted assistants in charge of the two technical training groups are charged with the preparation of lesson plans, problems and examinations for the use of instructors in the classes, to insure that instructors are properly prepared to impart instruction on the assigned units, and for the proper coordination of instruction among the different instructors who will be teaching the same group of students at various periods during their course of instruction. These duties require that the supervisors of the instructors "work up" and then "rework" problems and examinations, hold conferences with instructors to determine that instruction will follow the approved schedule, and then "sit in" on classes at least once each week for every instructor who has a class. This is for the purpose of checking up on the efficiency of the instructor, his teaching methods, how he handles his students, and the utilization of time. A report is submitted weekly to the Chief Instructor rating each instructor for that week. Any faults which the instructor has are then brought to his attention, and the way is shown for him to improve his efficiency as an instructor.

The Chief Instructor, Captain John E. Dempsey, is responsible for the general supervision of the entire Section, outlines the instruction to be given, prepares the general schedules, initiates general planning and research for the improvement of instructional methods, makes inquiries as to the cause of student failures, and takes the required remedial action.

The Ammunition Section was organized concurrently with the activation of the School. The section is headed by Captain Roger R. Fitzwater, Ordnance Department, and is divided into three divisions: The Training Division, the Supply and Planning Division, and the Utilities and Visual Aids Division.

The Supply and Planning Division handles all matters pertaining to supply of equipment, supplies, texts, etc., for the section, and accomplishes advance planning for proper utilization of classrooms and facilities of the section to meet the ever changing requirements for future classes.

The Utilities and Visual Aids Division maintains all utilities and facilities of the section and plans, develops and improves visual aids used by the section, such as charts, films, film strips, etc.



OFFICERS, SAVANNA SECTION, ORDNANCE SCHOOL.

Seated, Left to Right:

Captain R. R. Fitzwater - Chief Instructor, Ammunition Section; Captain R. E. Johnson - Commanding Officer, Hq. Co., S. S. O. S.; Captain J. E. Dempsey - Chief Instructor, Supply & Military Adm. Section; Captain W. C. Marcum - Commanding Officer, 4th P. O. T. C.; Major M. O. Bunker - Director, S. S. O. S.; Lieutenant C. K. Harper - Secretary, S. S. O. S.; Captain P. B. Schuppener - Military Director, S. S. O. S.

Standing, Left to Right:

Lt. R. B. Devay - Utilities Officer and Provost Marshall, S. S. O. S.; Lt. C. C. Ingram, Jr. - Commanding Officer, 3rd P. O. T. C.; Lt. L. E. Reisman - Instructor - Supply & Military Adm. Section; Lt. J. M. Roach - Commanding Officer, 2nd P. O. T. C.; Lt. H. B. Dunham - Instructor, Ammunition Section; Lt. J. Bramson - Special Services Officer - S. S. O. S.; Lt. J. D. Motlow, Jr. - Commanding Officer, 1st P. O. T. C.; Lt. R. G. Lamberton - Supply and Transportation Officer, S. S. O. S.; Lt. E. Knickerbocker - Personnel Officer, S. S. O. S.; W. O. J. F. Gorski - Instructor, Ammunition Section; Lt. W. E. Hughes - Assistant Military Director, S. S. O. S.

The Training Division handles all matters pertaining to the actual instruction given to classes conducted by the section. Schedules are arranged, changed, and kept up-to-date, instructors are developed, guided, and improved, and the actual instruction so coordinated and controlled as to assure all classes receiving equal and like instruction in various subjects. This division is divided into two departments: Air Force Ammunition Instruction and Ground Force Ammunition Instruction.

Courses of Instruction

The present courses of instruction are of eight weeks duration. Each day is divided into four periods; two each morning from 8:00 AM to 11:45 AM and two each afternoon from 12:45 PM to 4:30 PM.

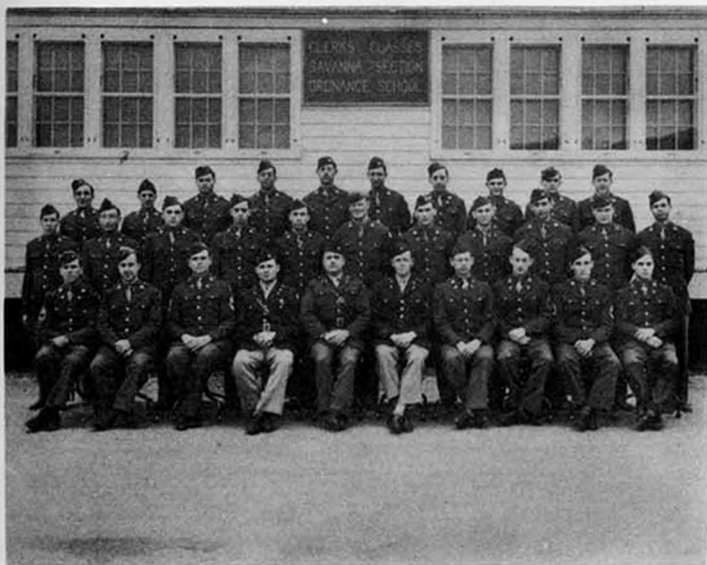
The Supply and Military Administration Section conducts three courses: Military Administration Clerks, Aviation Ordnance Supply Clerks, and Ground Force Supply Clerks. Each of these three courses consists of the following subjects, occupying the number of periods indicated:

MILITARY ADMINISTRATION CLERKS

Subjects	Periods
Sources of Information	12
Organization of the Army	2
Organization and Duties of the Ordnance Department	2
Ordnance Service with Troops	4
Correspondence and Filing	20
Daily Reports	40
Individual Records	34
Pay	30
Company Fund	6
Company Supply Sergeant Administration	10

AVIATION ORDNANCE SUPPLY CLERKS

Sources of Information	12
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Supply & Military Administration Section Instructors

Front row, left to right:

T/Sgt. Ernest F. Hohaus, T/Sgt. Clyde B. Hudson, M/Sgt. Gerson D. Brand, 1st Lt. Leonard E. Reisman, Capt. John E. Demosov, 2nd Lt. William C. Schick, M/Sgt. Carl Carter, T/Sgt. John Besig, T/Sgt. Wesley Kern, T/Sgt. Milton G. Snyder,

Second row, left to right:

Sgt. Frank W. Schlewitt, S/Sgt. Mortimer Gordon, S/Sgt. Wayne T. Varner, S/Sgt. Joseph J. Lindsay, S/Sgt. Louis H. Pacquin, Corp. Jack W. Stringham, S/Sgt. William M. Flood, S/Sgt. Gustave L. Kreischer, Sgt. Abraham Resnek, Sgt. Donald W. Wyatt, Sgt. Sanford B. Segel.

Third row, left to right:

T/Sgt. Albert Deltondo, Pfc. Nicholas Vonl, Pfc. Philip M. Grant, Corp. Joseph W. Gray, Sgt. Ira R. Mulson, Corp. Henry L. Sondheim, Pfc. Maurice B. Thompson, T/5 Emil P. Zreljak, Sgt. Alan R. Christiansen, Pvt. John Caulfield.

Organization of the Army	2
Organization and Duties of the Ordnance Department	2
Aviation Ordnance Organization	4
Correspondence and Filing	12
General Supply Procedure	2
Procurement of Property	10
Receipt of Property	6
Accounting for Property	10
Shipment of Property	12
Storage and Safekeeping of Property	6
Issue of Property	6
Supply and Use of Training Allowance Ammunition	6
Lost, Destroyed, Damaged and Unserviceable Property	16
Transfers, Inventories and Audits	4
Ordnance Supply Operations in the Air Force	4
The Ordnance Company, Aviation (Air Base)	22
Supply of Ammunition to the Air Forces	14
Company Supply Sergeant Administration	8

GROUND FORCE SUPPLY CLERKS

Subjects	Periods
Sources of Information	12
Organization of the Army	1
Organization and Duties of the Ordnance Department	1
Ordnance Service with Troops	2
Correspondence and Filing	12
General Supply Procedure	2
Procurement of Property	10
Receipt of Property	6
Accounting for Property	10
Storage and Safekeeping of Property	6
Shipment of Property	12
Issue of Property	6
Supply and Use of Training Allowance Ammunition	6
Supply of Ammunition in the Field	10
Supply of Ammunition to the Air Force	10
Lost, Destroyed, Damaged and Unserviceable Property	16

Transfers, Inventories and Audits	2
Supply Operations in the Western Defense Command	2
Ordnance Company Shop Property and Administration	28
Company Supply Sergeant Administration	6

A student assigned to the Military Administration Clerks' course will study the principles and operation of personnel records and procedures. For the first four weeks of his course, from 8:00 AM to 11:45 AM, he will cover the use and preparation of Daily Reports, including Morning Reports, Reports of Change, Duty Rosters, and Sick Reports. He is required to set up and operate these Daily Reports from the standpoint of a First Sergeant of an Ordnance Company and the Personnel Clerk of a Unit Personnel Section. All remarks and changes in the status affecting personnel are carefully studied and clearly explained for future reference.

During the afternoon of the first four weeks, from 12:45 to 4:30 PM, the student acquires the basic training of any administrative clerk. He is taught the importance and use of "Sources of Information" of which Army Regulations, Tables of Organization, Tables of Equipment, Tables of Allowances, Ordnance Field Service Publications, and Manual for Courts-Martial are only a part. He is also instructed in the general "Organization of the Army", "Organization and Duties of the Ordnance Department", and "Ordnance Service with Troops" so as to clarify for him his place in the larger picture. For the third and fourth weeks of his course, the student is instructed and drilled in the mechanics of all phases of Military Correspondence. He learns the use and method of preparation of Military letters, indorsements, special orders, telegrams, radiograms, etc. Neatness and accuracy are stressed until the student, at the end of the first four weeks, is capable of handling any clerical duty expected of a basic clerk.

The last four weeks both morning and afternoon, are devoted to the advanced subjects which a personnel clerk must handle. The morning is concerned with a three-weeks unit on Pay of Enlisted Men, and covers general provisions, allotments of pay, preparation of payrolls and soldiers' deposits. The last week is concerned with the duties of company supply sergeants with emphasis on clothing records, requisitions, the company property book, and disposition of property. During the afternoon the student handles all individual records. He works detailed problems involving Service Records, Furloughs, Charge Sheets, action in case of Desertion, and lastly, procedure in discharging enlisted men. It is believed that this course of instruction contains the essentials of information which, when learned and understood by the student, fit him for any assignment in the field of personnel administration.

The purpose of Ground Force Ordnance Supply Clerks' course is to train selected students in the performance of the duties of an Ordnance supply clerk in an Ordnance unit or administrative headquarters. It has been determined that to properly train an Ordnance supply clerk certain aspects be considered. A student must be taught a general background of the "Organization of the Army" and "The Organization and Duties of the Ordnance Department", and must be able to comprehend and refer to the sources of information which are the basis of requisitioning for and the issue of Ordnance property. The remainder of his basic clerical training consists of an intensive study of Correspondence and Filing, and at the end of this initial phase of his course he is fully prepared for the specialized units of instruction in property administration which follow.

At this time he begins the study of the complete cycle of property handling. He learns the principles by which property is procured, with emphasis on requisitioning and local purchases. The next step is Receipt of Property, which is of three mornings duration and deals with factors involving inspection and checking of property received from supply points. Since regulations state that all public property must be accounted for, the course next deals with methods of accounting for property in the Zone of the Interior. The Stock Record Account is the basic study of the unit and students are required to set up and operate an account complete with vouchers and other supporting papers. With property in his possession and on record the next responsibility is that of storage and safekeeping. General principles, warehousing, plans of arrangement of stacks of supplies, and storage of special ordnance materiel (motor vehicles small arms, fire control equipment, optical equipment, etc.) are considered until the student has gained a working knowledge of the problem of property in storage.

With units continually on the move, the shipments of property by rail is an important task of any supply establishment. The student next deals with methods of marking property for shipment, methods of packing and blocking, use of Bills of Lading, carload shipments, and regulations and limitations on loading and unloading of cars. While it is not task of the supply clerk to actually perform the mechanics of loading, blocking, staying, etc., of property in railway cars for shipment by common carrier, it is essential that he understand this phase of property admin-

istration in order that he may perform his own duties more efficiently because of his general knowledge of all the mechanics involved in the shipment of property.

In turn follow the units of "Issue of Property", "Supply and Use of Ammunition to the Ground Forces", and "Lost, Damaged and Unserviceable Property". The authorities for the issue of property are studied, and also the forms used in accounting for and reporting on all phases of Ammunition supply. Under the last of these three units are taught the disposition of property that are unserviceable, and include the preparation, use and disposition of Inventory and Inspection Reports, Reports of Survey, Ammunition Condition Reports and Statements of Charges.

One of the most important units of the entire course is that which deals with the operations of the Ordnance Company, Medium Maintenance. It has been found that the greatest percentage of ground force ordnance supply clerks students comes from medium maintenance companies, and for that reason more than a full week is devoted to the duties, functions and operations of this type Ordnance company. The student works many problems concerned with Shop Expenditure Records, Bin Cards, Bills of Materials, Work Orders, and Want Lists, and applies the principles of War Department Circular 105 to organizations who do not keep formal accountability for their property. No phase of ordnance company shop property administration is overlooked until, at the end of the 8-weeks course, the student has acquired the essentials to be able to handle intelligently almost any phase of Ordnance supply.

The increase in attendance at this school of men from Aviation Ordnance units has necessitated a change in the organization of the courses. It became apparent that the general supply clerks' course as given some months ago was not applicable to the peculiar conditions of supply of Ordnance equipment to the Army Air Forces. Accordingly a special course was written and placed in operation which is known at present as the "Aviation Ordnance Supply Clerks Course", designed to train students to assume clerical supply responsibilities in Ordnance units whose mission is service to the Army Air Forces.

The course of instruction is similar in scope to the Ground Supply Clerks course, differing only in its application. Instead of treating property from the standpoint of procedure in supply to Army Ground Forces, the emphasis has been placed on supply to the Army Air Forces. Units have been drawn up which deal with Aviation Ordnance organization, Ordnance supply operations in the Army Air Forces, the Ordnance Company Aviation (Air Base) and the Supply of Ammunition to the Army Air Forces. These are sufficient to give the student a clear, working picture of his job in an Aviation Ordnance unit. Since his basic clerical training has not been overlooked either, it is evident that enlisted men completing this latest course are qualified to handle assignments which require a background of supply and clerical training in the Army Air Forces.

The Ammunition Section conducts two courses: Air Force Munition Workers and Ground Force Munition Workers. Each of these two courses consists of the following subjects, occupying the number of periods indicated:

Air Force Munition Workers

<u>Subjects</u>	<u>Periods</u>
Introduction	2
Military Explosives	14
Chemical Agents	6
Small Arms Ammunition	22
Pyrotechnics	10
Antiaircraft Artillery Ammunition	14
Aircraft Bombs	26
Transportation	8
Storage	10
Demolition	14
Camouflage	6
Ammunition Supply in Zone of Interior	22
Supply of Ammunition to the Air Forces	22

Ground Force Munition Workers

<u>Subjects</u>	<u>Periods</u>
Introduction	2
Military Explosives	14
Chemical Agents	6
Small Arms Ammunition	14
Trench Warfare Ammunition	10
Pyrotechnics	4

Artillery Ammunition	24
Aircraft Bombs	8
Transportation	6
Storage	10
Demolition	8
Camouflage	8
Ammunition Supply in Zone of Interior	22
Ammunition Supply to the Ground Forces	40

The two courses, Air Force Munition Workers and Ground Force Munition Workers, both cover certain identical subjects. The main difference between the two courses is that a certain amount of time is devoted to instruction covering ammunition, ammunition supply, and procedure peculiar to the force to which the student is assigned.

The first unit, "Introduction", covers explosives and ammunition used in the military service, tactical employment thereof, and the responsibilities of the Ordnance Department in the design, procurement, storage, and issue of ammunition.

The Air Munition Workers then cover, in succession: Military Explosives to include types and kinds, their composition, manufacture, uses, limitations, hazards, packing, identification, handling, storage, maintenance, and safety precautions; Chemical Agents to include their types, uses, characteristics, limitations, uses, identification, hazards, and safety precautions; Small Arms Ammunition to include types and kinds, identification, packing, characteristics, and ballistics, with emphasis on the types and kinds most widely used by Air Force units; Pyrotechnics with emphasis on the types most widely used by Air Force units; Antiaircraft Artillery Ammunition to include calibers, types, characteristics, packing, identification, hazards, and safety precautions; Aircraft Bombs to include each type completely and in detail; Transportation of ammunition by truck, rail, and water; Storage of ammunition in depots, installations, and in the field; a thorough course in demolition and destruction of unserviceable ammunition — advantage is taken of the Depot burning grounds, and each student has an opportunity to witness and take part in the destruction of all types of unserviceable ammunition; Camouflage to include materials used, camouflage practice and camouflage discipline; Ammunition Supply in the Zone of the Interior; and finally Ammunition Supply to the Air Forces.

Thus, every attempt is made to train the student in those subjects that will most greatly benefit his unit in the accomplishment of its mission.

Instruction consists, in general, of lectures, study by students, solving practical problems, demonstrations, and trips through various depot installations to observe actual operations and practice of details of instruction given.

Organization Commanders of students attending any course are furnished, at the conclusion of the course, an individual student report showing relative standing of the student in his class, degree of satisfactoriness with which he completed the course, and a statement as to the particular phase of work in which it is believed the student has attained the greatest proficiency.

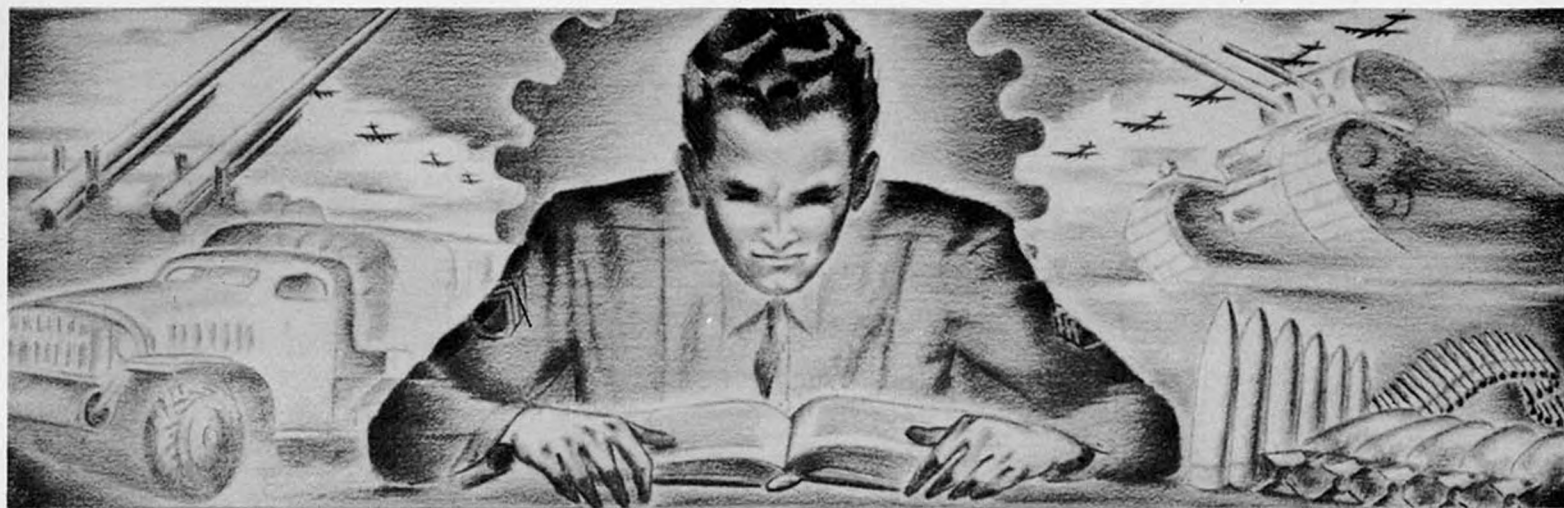
Once before we made brief mention of WOWS, members of the nation-wide organization of Women Ordnance Workers, but until now we haven't been able to show you samples. The WOWS are those women who have deserted the traditional domains of the "weaker" sex, leaving homes, offices, stores, and more leisurely pursuits to enter our factories, arsenals and proving grounds. Now they are testing tanks, driving trucks, operating all types of machine equipment, loading ammunition, in fact they are doing almost any job which will release able bodied men to enter the armed forces.

Three WOWS are presented for your consideration on the opposite page, and in our opinion they are WOWS from any viewpoint you may choose. Voted by their fellow employees the three most representative WOWS at the Production Plant, Charleston Ordnance Depot, these WOWS are proficient in every operation on the hand grenade loading line. All are natives of South Carolina. Reading from left to right: Mrs. Bertha G. Atwood, Miss Addie Young Blackwell, Miss Dezzie Lee Singletary. Address: Charleston Ordnance Depot, North Charleston, S. C. Telephone numbers: Unknown. Extra copies of the photo are NOT available.

If you derive comfort from this slight diversion from strictly technical articles, you should gain even more comfort from the knowledge that these three WOWS are typical of thousands of American women who are helping make it possible for you to bring extreme discomfort to our enemies.



Photo by U. S. Army Signal Corps



LIBRARY

Conducted by: J. M. Kelleher, M. Sgt., Ord. Dept.

PROCUREMENT AND USE OF TRAINING FILMS AND FILM STRIPS BY ORDNANCE TROOPS

Training Doctrine Branch, Military Training Division
Office of the Chief of Ordnance

I. LISTS OF WAR DEPARTMENT TRAINING FILMS AND FILM STRIPS

- A. FM 21-6 as revised by War Department Training Circulars.
- B. Lists issued from time to time by:
 - 1. Office of the Chief Signal Officer, Army Pictorial Service, Washington, D. C.
 - 2. Service Command Signal Officers.
 - 3. Training doctrine Branch, Military Training Division, Office of the Chief of Ordnance, Washington, D. C.

II. PROJECTION EQUIPMENT

- A. Description (See Film Strip 7-75)
 - 1. Training Film Projector
 - a. 35mm sound, theater size, not portable; camp theater equipment; its use should be investigated.
 - 2. Film Strip Projector, 35mm.
 - 3. Reproducer (for records when issued with film strips; Signal Corps designation PH 364).
- B. Procurement
 - 1. Basis of issue: one to a Battalion Headquarters.
 - 2. Supplied by Signal Property Officer of Posts, camps and stations.

III. PROCUREMENT OF TRAINING FILMS AND FILM STRIPS

- A. Training Film Sub-libraries at most troop training centers.
- B. Training Film Libraries at Service Command or Overseas Department Headquarters.
- C. In doubtful cases, ask Signal Officer at post, camp or station.

IV. USE OF PROJECTORS: PRECAUTIONS

- A. Follow instructions which come with equipment, on adjustment, operation and maintenance.
- B. Protect from moisture.
- C. Oil when necessary; keep oil from film.
- D. Keep dirt from sprocket teeth, aperture plates and lenses.
- E. Do not run training film projectors backwards.
- F. Do not stop training film projectors to look at individual frames.

V. USE OF TRAINING FILMS AND FILM STRIPS (See Film Strip 7-75)

- A. Projection requirements
 - 1. Room
 - a. Camp theater, especially if it has a 35mm projector.
 - b. Recreation room, mess hall or other room having curtains

- and power outlet.
- c. Good ventilation is necessary, especially for a darkened room.
- 2. Equipment:
 - a. Screen
 - (1) Fibre board with three coats of flat white (not glossy) paint makes a good substitute for the issue screen.
 - (2) Front row of seats should be six feet from screen.
 - (3) Bottom of picture should be one foot above eye level of seated men.
 - (4) A bright small picture is better than a dim large one.
 - b. Lense must be clean.
 - c. Extra lamp should be handy.
 - d. Return equipment and film in good condition after using them.
- 3. Assistants needed: one for projection, one for regulating room temperature and ventilation.

B. Instruction Procedure

- 1. General
 - a. Films supplement lectures, discussions and manuals, but do not take the place of them.
 - b. Films must be used at proper place in training schedule and not as filler-in.
 - c. The showing of films should be limited to 30 minutes: 20 minutes is better.
 - d. Sometimes it may be a good idea to show a film over again at once.
- 2. Preparation
 - a. See a film before deciding to use it.
 - b. Use only films suited to the knowledge and experience of the men.
 - c. Assemble and test all equipment before using it.
- 3. Showing the film
 - a. Before showing
 - (1) Tell what it is about.
 - (2) Tell why it is important.
 - (3) Stress its battle application.
 - (4) Link it closely with what the men have been doing and what they are going to do.
 - (5) Tell what important points in the film should be watched closely.
 - (6) Warn of a test on content after showing.
 - b. After showing the film
 - (1) Give test, oral or written, on the important points it covered, see par. 26, FM 21-6 (July 1, 1942) for suggested method of testing.

- (2) Explain the connection between what the film showed and what the men are going to do.
- (3) Allow time for discussion.

C. Advantages of using film

1. Showing only what is important.
2. Showing of approved methods by experts.
3. Easy repeating of demonstrations, especially those which need large numbers of troops.
4. Same instruction to large numbers of troops at the same time.
5. Quick review of a subject.

D. Errors in use of film

1. Showing several without interruption.
2. Showing films on different subjects during the same period.

VI. USE OF TRAINING FILMS

- A. Loudspeaker is usually best placed near the screen on a chair or table.
- B. Have paper clips for use if the film breaks.
- C. Sound tests should be made before showing.
- D. Sound should not be too loud.
- E. Advantages of training films.
 1. Show large scale demonstrations without having to move troops to demonstration areas.
 2. Show operation of mechanical parts usually concealed.

VII. USE OF FILM STRIPS

- A. If printing is used on film strips, caution men not to forget to look at the picture also.
- B. Do not read printing when it is clearly visible to the men.
- C. Allow plenty of time for each picture.
- D. Advantages of film strips.
 1. Can be easily previewed to tell if and how they should be used.
 2. Dark room is not needed; a shadow box may be made in the shape of the lower half of a pyramid with black sides and white top.
 3. Easily shown; equipment can be set up quickly; a screen is not necessary.
 4. Give large illustrations of small objects.
 5. Single frames may be held fixed, for discussion.

TRAINING FILM UTILIZATION CHART FOR ORDNANCE TROOPS

Prepared by the Training Doctrine Branch,
Military Training Division, Office of the
Chief of Ordnance

		Running Film-Min.	Ammunition	Artillery	Automotive	Basic Military	Basic Technical	Small Arms
1-107	Attack Aviation - Infantry Targets	16						
1-221	Small Arms Ammunition - Storage and Handling	11	*					
1-222	Small Arms Ammunition - Cal. .50, .30 & .45	9	*					
1-223	Small Arms Ammunition - Loading	19	*					
1-227	Aerial Bombs - Practice	13	*					
1-255	Aerial Bombs - Equipment for Loading Bombs	16	*					
1-256	Aerial Bombs - Method of Loading Bombs	18	*					
1-258	Ident. Airt. - General US Military Airplanes	8						
1-259	Ident. Airt. - US Military Airplanes	15						
1-260	Aircraft MG and Cannon - Cal. .50 MG Mechanism	19						
1-261	Aircraft MG and Cannon - Cal. .50 MG Mechanism	15						
1-294	Ident. Airt. - Characteristics of Foreign Craft	8						
1-311	Airt. Machine Guns & Cannons	31						
1-373	Ident. Airt. - Folk - Wulf "Kurier" FW 200	16						
1-417	Ident. Airt. - Italian Z-1007	8						
1-418	Ident. Airt. - Wellington Bomber	9						
1-419	Ident. Airt. - Bristol Beaufighter	6						
1-420	Ident. Airt. - Manchester Bomber	4						
1-421	Ident. Airt. - Japanese Seaplane 95	7						
1-422	Ident. Airt. - Jap. Navy Patrol Bombers 97	8						
1-423	Ident. Airt. - German FW 187	17						
1-424	Ident. Airt. - Hurricane	6						
1-425	Ident. Airt. - Japanese Biplanes 95 & 96	13						
1-426	Ident. Airt. - British Handen Bomber	4						
1-427	Ident. Airt. - Jap. Fighter Bomber	10						
1-428	Ident. Airt. - Heinkel 115	6						
1-429	Ident. Airt. - British Whitley Bomber	5						
1-430	Ident. Airt. - Bristol Blenheim & Beaufort	7						
1-431	Ident. Airt. - Jap. Medium Army Bomber 98	9						
1-432	Ident. Airt. - German Pursuit Types	14						
1-433	Ident. Airt. - Halifax Bomber	5						
1-434	Ident. Airt. - German Bombers - JU 87 - Ju 88	9						
1-435	Ident. Airt. - Heinkel 111 MK VA	6						
1-436	Ident. Airt. - Japanese Med. Bomber - 96 - 97	16						
1-437	Ident. Airt. - Jap. Army Light Bomber	9						
1-438	Ident. Airt. - Spitfire	4						
1-439	Ident. Airt. - Japanese Fighter - 96 - 97	11						
1-440	Ident. Airt. - Messerschmitt Me-110	7						
1-441	Ident. Airt. - Dornier - DO 215	9						
1-442	Ident. Airt. - Macchi - 200	7						
1-443	Ident. Airt. - German JU 52	5						
1-444	Ident. Airt. - British Stirling Bomber	15						
1-479	Incendiary Bombs - Thermite & Magnesium	37						
1-482	Aircraft MG & Cannons - 20mm Airt. Gun	10						
1-483	Aircraft MG & Cannons - Care and Cleaning	10						
1-619	Ident. of US Army Airt. North Am. B-25 Med. B.	13						
1-672	WEFT Sys. of Airt. Ident. I (Navy Film MN-40A-AH)	10						
1-673	WEFT System of Ident. Part II	10						
1-674	Interrogation of Prisoners, Avn. (Brit. Film B-107)	72						
3-10	Tactical Employment of Chemical Troops in Attack	20						

		Running Film-Min.	Ammunition	Artillery	Automotive	Basic Military	Basic Technical	Small Arms
3-216	Adjustments of the Service Gas Mask	17						
3-217	Inspection of the Service Gas Mask	9						
3-218	Adjustment of the Training Gas Mask	17						
3-219	Inspection of the Training Gas Mask	8						
3-650	Collective Chemical Protection	10						
3-667	Decontamination Procedure (Part I) Personnel, Areas	19						
3-687	Decontamination Procedures (Part II) Equipment	11						
4-156	RR Art. 12-in. Mortar and 8-in. Gun	19						
4-187	AA 37mm Gun Btry - Fire Control Equipment	21						
4-188	AA 37mm Gun Btry - Care After Firing	28						
4-190	AA MG Btry - Care and Adjustment	33						
4-192	AA MG Btry - Fire Control Equipment	15						
4-193	AA MG Btry - Care and Maintenance	21						
4-241	3-in. AA Art. Gun Btry - Preparation for Fire	20						
4-242	3-in. AA Art. Gun Btry - Fire Control	38						
4-269	The 37mm AA Gun - MIA2 on MG	13						
4-586	Height Finder M1, (Part II) Adjustment Prior to Operations	47						
4-589	Height Finder M1, (Part V) Care and Maintenance	16						
4-631	12-in. Gun Btry. Barbette Carriage, (Part II) Block Mechanism	17						
4-666	Aut. Weapons Firing Unit (Part XII) 40mm AA Gun	22						
4-685	AA Mechanical Mathematics	43						
4-686	The AA Gun Director	18						
5-12	Map Reading	9						
5-145	Armored Combat Vehicles	9						
5-146	Means of Antimechanized Defense	8						
5-147	The Antitank Mine M-1	9						
5-148	Antitank Obstacles	9						
5-149	Road Blocks	8						
5-200	Pioneer Equipment - Woodcutting Tools	10						
5-201	Pioneer Equipment - Manila Rope	15						
5-202	Pioneer Equipment - Hitches	27						
5-203	Pioneer Equipment - Knots and Bends	10						
5-237	Portable Water Purification Unit, M. 1940	10						
5-270	Explosives & Demolitions - TNT	10						
5-271	Explos. & Demol. - Nonelectric Blasting Equipment	10						
5-272	Explos. & Demol. - Electric Blasting Equipment	12						
5-273	Explos. & Demol. - Primacord	19						
5-571	Air Compressor & Air Tools	13						
5-575	Explosives and Demolitions - Dynamite	10						
5-598	Explos. & Demol. - Cutting by Explosives	21						
5-623	Air Compressor & Air Tools (Part I) Air Comp.	10						
5-645	Camouflage - Individual Concealment	13						
5-648	Camouflage - Individual Concealment (Use of Artif. Materials)	10						
6-102	Truck-drawn Units, Vehicles, and Accessories	10						
6-103	Truck-drawn Units, Preparation of Routes	29						
6-104	Truck-drawn Units - Difficult Terrain	19						
6-105	Truck-drawn Units - Stream Crossings	9						
6-106	Truck-drawn Units - Mvt. of Disabled Vehicles	8						
6-112	Preparation of Fire Instruments	27						
6-125	155mm Howitzer, Duties at Firing Position - M1918A1	41						
6-128	75mm Gun, Duties at Firing Position M2A2	18						
6-183	155mm Gun (M1918, M3) Service Before & During Action	38						
6-231	240mm Howitzer - Service of the Piece	26						
6-611	105mm Howitzer - Mechanical Functions	15						
7-29	Employment of Machine Guns in the Defense	17						
7-35	Infantry Hasty Field Fortifications	18						
7-108	Technique of Small Arms Fire Against Attack, Aviation	7						
7-109	Defense of Inf. Columns Against Atk, Avn.	10						
7-110	Defense of Inf. Area Against Atk, Avn.	14						
7-143	Infantry Drill - Squad - Close Order Drill	43						
7-144	Infantry Drill - Platoon - Close Order Drill	9						
7-228	Battle Formations - The Rifle Platoon	18						
7-233	Determining Direction in the Field	24						
7-234	Use of Natural Cover and Concealment	22						
7-236	Weapons of the Infantry Division	22						
7-248	Instruction of Soldier, Position and Facing	27						
7-249	Instruction of Soldier, Steps and Marchings	21						
7-266	Sand Table (Part I)	39						
7-266	Sand Table (Part II)	10						
7-275	Operations of Reconnaissance Patrol at Night	58						
7-280	Reconnaissance Scout - Technique	22						
7-295	Military Training - BFM 21-5	33						
7-637	Know Your Enemy - Airborne Troops	26						
7-681	First Aid and Emergency Repair of Equipment	36						
8-33	First Aid	36						
8-150	First Aid - Injuries and Accidents	36						
8-154	Sex Hygiene	36						
8-155	Personal Hygiene	20						
8-304	First Aid to Gas Casualties	13						
9-30	Elementary Principles of the Recoil Mechanism	11						
9-31	Recoil Mechanism French 75mm Gun Model 1897	19						
9-57	155mm Recoil System	17						
9-58	Modern Percussion Fuses	21						
9-113	Making the Shell for 3-inch AA Gun	20						
9-114	Loading, Assem. & Packing Am. for 3-inch AA Gun	9						
9-169	Electric System of the Diesel Tractor	32						
9-170	Fuel System of the Diesel Tractor	19						
9-171	Engine of the Diesel Tractor	23						
9-172	Power Train of the Diesel Tractor	16						
9-173	Track & Suspension System of Tractor	17						
9-614	Heavy Wrecking Truck M1, Series 2, Operation & Use	8						
10-158	Diesel Engine - Principles & Applications	33						
10-166	Gasoline Motors	14						
10-167	Hydraulic Brakes	10						
10-176	Automobile Body Repairing (16mm only)	14						
10-291	Automotive Trouble Shooting - Fuel & Ignition Units	32						
10-299	Automotive Trouble Shooting - Part 13 Hydraulic B	14						
10-319	Automotive Trouble Shooting - Cooling System	14						
10-376	Automotive Trouble Shooting - Cranking System	18						
10-377	Automotive Trouble Shooting - Fuel System	19						
10-384	Keep 'em Rolling - Drivers Instructions - Dodge	24						
10-385	Keep 'em Rolling - Systematic Lubrication	56						
10-570	Automotive Trouble Shooting - Engine Tune-up							

		Running Time-Min.	Ammunition	Artillery	Automotive	Basic Military	Basic Technical	Fire Control	Small Arms
10-592	Automotive Trouble Shooting - Part IIA - Wheels	15			*				
10-593	Automotive Trouble Shooting - Spring & Shock Absorber	21			*				
10-594	Automotive Trouble Shooting - Steering System	20			*				
10-595	Automotive Trouble Shooting - Lighting System	20			*				
10-596	Automotive Trouble Shooting - Motor Maintenance - Transmission & Transfer Case	19			*				
10-639	The Spark Plug	17			*				
10-654	Motorcycle Driver Trng. Part I, Descrip. & Function	11			*				
11-157	Military Courtesy and Customs of Service	26			*				
11-235	Articles of War	41			*				
11-257	Care & Maintenance of Tapered Roller Bearings	31	*						
11-262	Point Control of Traffic	26			*				
11-296	Technique of Arrest & Search of Persons (16 only)	69			*				
11-321	Combat Counter Intelligence	28			*				
11-324	Safeguarding Military Information	12			*				
11-382	Know Your Enemy - Ident. of Tanks	44			*				
11-383	Friend or Foe - Ident. of Tanks	53			*				
11-551	Motor Vehicle Driver - Responsibility	25			*				
11-552	Motor Vehicle Driver - Hand Signals	12			*				
11-553	Motor Vehicle Driver - Driving Instruction	25			*				
11-554	Motor Vehicle Driver - Difficult Driving	18			*				
11-555	Motor Vehicle Driver - Traction Aids, Winch	27			*				
11-556	Motor Vehicle Driver - Map Reading	9			*				
11-557	Motor Vehicle Driver - Marching & Night Driving	20			*				
11-558	Motor Vehicle Driver - First Echelon Maintenance	35			*				
11-559	Motor Vehicle Driver - Vehicle Abuse	27			*				
11-622	Electricity & Magnetism, Part I - Elem. of Elect.	14			*				
12-578	Classification of Enlisted Men	12			*				
17-314	Half-Track Driving - Advanced	16			*				
17-375	Tank Driving	11			*				
17-617	Motorcycle Driving, Advanced	17			*				
25-5	Carbon Monoxide - The Unseen Danger	16			*				
25-76	Story of Automotive Lubrication	12			*				
25-152	Ignition and the Spark Plug	15			*				
25-333	Engine Lathe - Rough Turning	14			*				
25-334	Engine Lathe - Two Diameters, Turning Work	11			*				
25-335	Engine Lathe - Cutting a Taper	11			*				
25-336	Engine Lathe - Drilling, Boring, & Reaming Work	13			*				
25-337	External Fine Thread	7			*				
25-338	Milling Machine - Introduction	15			*				
25-339	Milling Machine - Cutting Keyways	27			*				
25-340	Milling Machine - Straddle & Surface Milling	18			*				
25-341	Milling Machine - Straddle Milling	25			*				
25-342	Milling Machine - Plan Indexing & Cutting Gear	22			*				
25-343	Vertical Boring Mill	31			*				
25-344	Vertical Boring Mill - Turning a Shoulder	14			*				
25-345	Vertical Boring Mill - Using Two Heads	15			*				
25-346	Steel Rule - General Use	17			*				
25-347	Micrometer - Correct Use & Care	19			*				
25-348	Fixed Gages - Importance in Mass Production	17			*				
25-349	Vernier Scale - Principle & Application	17			*				
25-350	Height Gages and Standard Indicators - Prin. Use	21			*				
25-394	Detection of Booby Traps	12			*				
25-624	Machine Shop Work - Operations on Shaper	21			*				
25-625	MSW - Shaper - Making Cast Iron Rectangular Block	20			*				
25-626	MSW - Drill Press-Drilling & Tapping Cast Steel	14			*				
25-627	MSW - Drill, to Layout Spot Facing	21			*				
25-628	MSW - Shaper - Machine Tool Steel V Block				*				

FILM BULLETIN UTILIZATION CHART
FOR ORDNANCE TROOPS
Prepared by the Training Doctrine
Branch, Military Training Division,
Office of the Chief of Ordnance

		Release of Date	Ammunition	Artillery	Automotive	Basic Military	Basic Technical	Fire Control	Small Arms
1.	(a) Fort Monroe, firing tests of 90mm AA Gun	12-30-41	1		*				
	(b) Fort Storey, Va., firing tests of 16 in. How.				*				
2.	(a) Fort Belvoir, experimental trench digger	12-30-41	1		*				
	(b) Engineers, experimental flame thrower in action against a pill box.				*				
	(c) Engineers, Fort Knox, Experimental rubber boats for ferry for medium tank and for pontoon bridge.				*				
3.	(a) A.P.G. Experimental Carriers for 37mm Gun.	3-31-42	1		*				
	(1) 1/4 ton Ordnance mount.				*				
	(2) 1/4 ton Jones mount.				*				
	(3) Modified Christie tank-type carrier.				*				
	(b) A.P.G. firing tests, experimental half-track carriers for 75mm Gun.				*				
	(c) A.P.G., experimental incendiary bomb.				*				
	(d) Fort Belvoir, blowing wood craters.				*				
4.	(a) Fort Monroe testing wire thrower.	3-31-42	1		*				
	(b) Engineers demonstration of standard flat top camouflage net.				*				
	(c) Engineers experimental tilt-type semi-trailer for transportation of medium tractor				*				
5.	(a) Fort Meade anti-tank action by 1/4 ton vehicles with 37mm gun and half-track with 75mm guns.	3-31-42	1	*					
	(b) A.P.G. testing aerial bombs.				*				
	(1) 500 lb. from 10 in. gun against 3 in. steel wall.				*				
	(2) Dropping from airplane 250 and 1000 lb. against 8 in. steel plate.				*				
6.	(a) A.P.G. Test of Canadian Medium M3 Tank.	3-31-42	1		*				
	(b) A.P.G. Test of U. S. medium Tank M3.				*				
8.	(a) A.P.G. firing test on new S.P. mount for 37mm gun equipped with oversize tires, motor located at rear.	3-31-42	1		*				
	(b) Fort Meade, same carrier on broken and swampy terrain.				*				

		Release Date	Ammunition	Artillery	Automotive	Basic Military	Basic Technical	Fire Control	Small Arms
	(c) Engineer Board, Fort Belvoir testing 25 ton pontoon bridge with medium tank.				*				
	(d) A.P.G. testing Bofors 40mm AA Gun.				*				
	(e) Fort Monroe firing tests of the Bofors 40mm AA Gun.				*				
9.	First Division landing operations, N. C.	3-31-42	2		*				
10.	Firing tests 90mm gun battery operated by remote control.	3-31-42	1		*				
11.	(a) 37mm gun mount T-21 (Fargo), test at A.P.G.	3-31-42	1		*				
	(b) Medium tractor, T-9 tested at A.P.G. as prime movers for 90mm AA gun.				*				
12.	(a) Half-track M2 and half-track T-3 tested by Ordnance Board at A.P.G. Both tested as prime movers for 105mm Howitzer and as personnel carriers; also M2 is shown with the 105mm Howitzer.	4-15-42	1		*				
	(b) Ft. Belvoir, concrete mixer for repair of roads in battle zone.				*				
13.	(a) Making of gas masks for the Army.	4-15-42	1		*				
	(b) A.P.G. Ordnance Board test T-16 half-track and T-32 motor carriage.				*				
	(c) Demonstration of anti-tank obstacles conducted by Engr. Board at Ft. Belvoir, Va.				*				
14.	(a) A.P.G. Ordnance Board test Daimler 4x4 English Scout car.	4-28-42	1		*				
	(b) A.P.G. Ordnance Board test tank gun, M2.				*				
15.	Army Maneuvers in N.C. and S.C. during autumn, 1941.	5-1-42	1		*				
17.	1941 Invasion of Russia by German army	5-1-42	1		*				
18.	(a) Multiple gun, power operated turret	5-2-42	1		*				
	(b) 155mm gun on motor carriage with hydraulically operated trail.				*				
	(c) The new Cal. .30 carbine.				*				
19.	(a) Motorcycle equipped with driveshaft instead of chain, Holabird.	7-7-42	1		*				
	(b) Decontamination of armored vehicles at Edgewood.				*				
	(c) "Sea Jeep" Amphibian vehicle.				*				
21.	Tank obstacles, constructed by Engineers at Edgewood.	7-2-42	1		*				
22.	9th Div., Fort Bragg, Amphibian Training; bayonets, knives.	7-7-42	1		*				
24.	Paraski troops at Alta, Utah.	8-4-42	2		*				
26.	(a) Amphibian tank at Aberdeen.	8-3-42	1		*				
	(b) Mobile Laundry Unit, Camp Lee, Va.				*				
27.	(a) Women in proof work at A.P.G.	8-3-42	1		*				
	(b) Mobile Field Bakery Unit at Camp Lee.				*				
28.	Decontamination of combat vehicles at Edgewood Arsenal.	9-15-42	1		*				
29.	Q.M.C. Troops on rifle range at Camp Lee.	9-15-42	1		*				
31.	Battlefield Sounds	10-1-42	1	*	*	*	*	*	*
33.	(a) Substitutes for Tires	10-7-42	1		*	*	*	*	*
	(b) Brazilian Day at Fort Meade				*	*	*	*	*
34.	New Caledonia	10-7-42	1	*	*	*	*	*	*
35.	(a) Airborne Infantry, Fort Bragg	10-7-42	1	*	*	*	*	*	*
	(b) Air Bombing, Fort Meade				*	*	*	*	*
	(c) Commando Training: Training Dogs				*	*	*	*	*

FILM STRIPS FOR ORDNANCE TROOPS

Prepared by the Training Doctrine Branch, Military Training Division
Office of the Chief of Ordnance

(For more complete description of contents and for methods of procurement and use, see FM 21-6 and amending War Department Training Circulars or consult Camp Signal Officer)

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FUNDAMENTALS OF ARTILLERY

(Continued from page 59)

type of irreversible gear, such as a worm and wheel, must be included in the system to prevent movement of the gun when the handwheel is released.

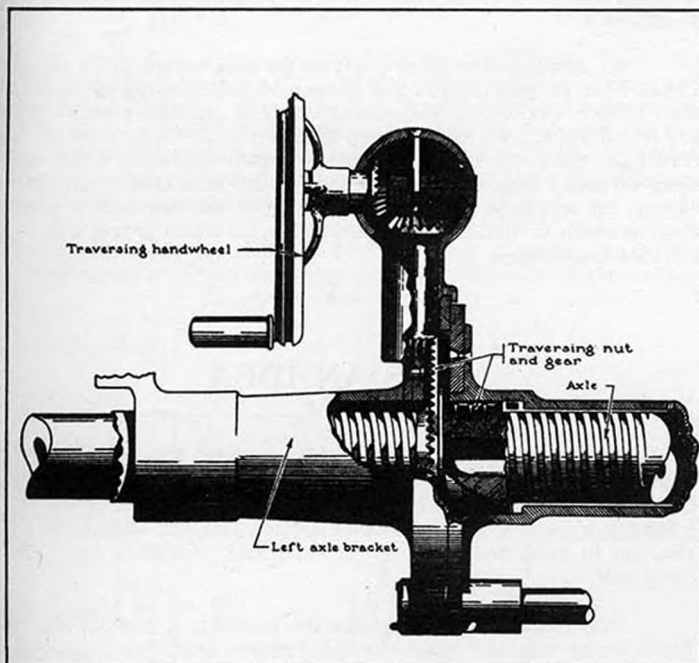


Fig. 57 -- Axle traverse with threaded axle and traversing nut

The handwheel may be attached to the traversing parts or to the fixed parts of the carriage.

BASE RING AND RACER TYPE. (Figure 61.) - This type of traversing mechanism is used on most heavy-caliber cannon which are mounted on barbette carriages. Essentially, the mechanism consists of a very large roller bearing with rollers operating between two bearing surfaces: namely, the basering and the racer. The base ring is the lower

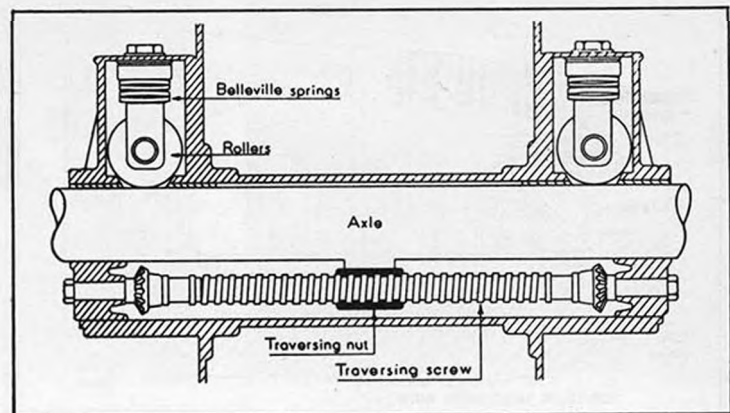


Fig. 58 -- Axle traverse with separate traversing screw and nut

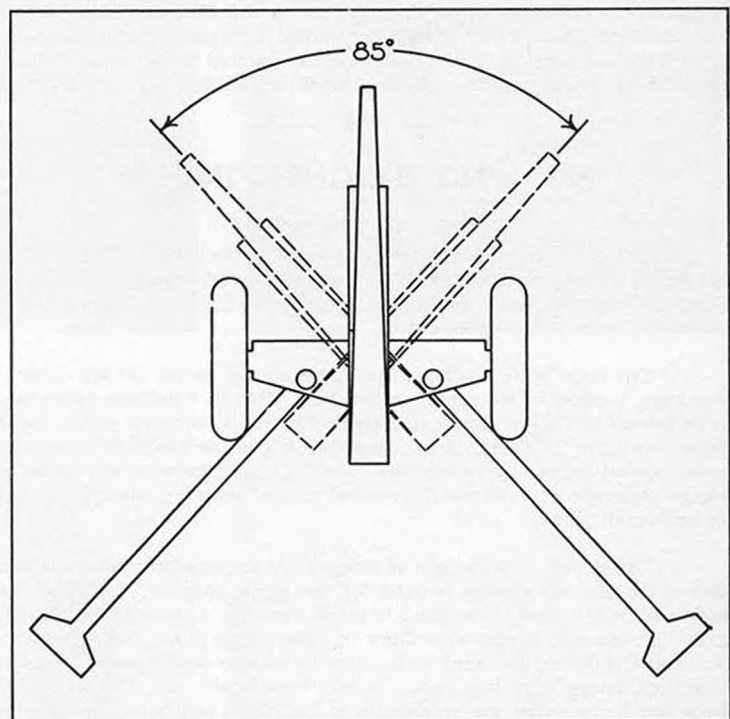


Fig. 59 -- Pintle traverse (schematic drawing)

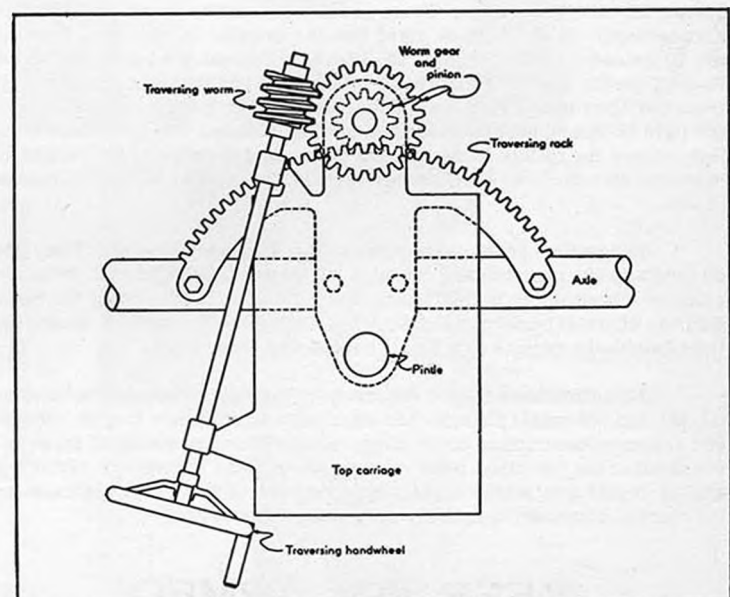


Fig. 60 -- Pintle traverse -- Construction

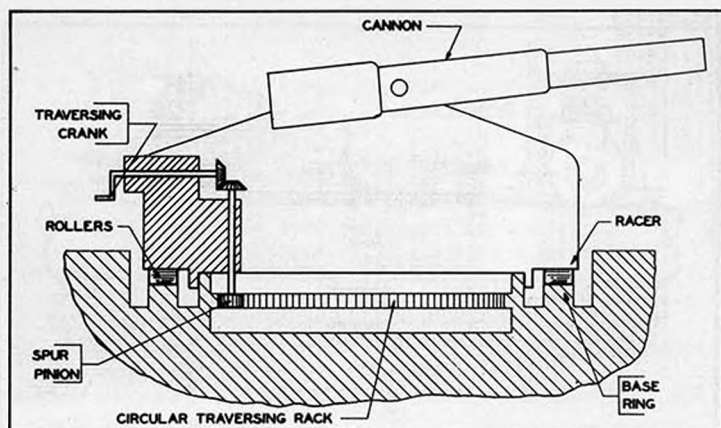


Fig. 61 -- Base ring and racer traversing mechanism

bearing surface, and the racer is the upper bearing surface. The main frame of the carriage is bolted to the racer and rotates with it. Inside and concentric with the base ring is mounted a circular traversing rack. A spur pinion, meshing with this rack and connected to the main frame of the carriage, traverses the cannon under the action of a traversing crank.

M1 vs M2 HEIGHT FINDER

(Continued from page 66)

by removal of the objective cover plates and at the center by removal of the entire eyepiece assembly. The ones at the end screw on a threaded portion of the bar, while those in the center are bolted in place and may consist of from one to three plates.

The main optical components of the optical bar of the M2 instrument are located in the center of the bar. This is a definite difference over the M1 and allows for easier replacement. By removal of the cover plate located in the center of the outer tube, below the eyepiece assembly, these optical parts may be exposed. It will be seen then that the height of image plate, the reticles and the central prisms are all compactly housed in this small place.

The design of the height of image plate is somewhat different than that of the M1, but it still is used for the same purpose. In the M2 the height of image plate is mounted in a cell to which is attached a rocker-arm. On one side of this arm there is a pin riding under spring tension, while on the other side rides a pin connected to the shaft coming from the height of image adjusting knob. In this manner the cell may be rocked back and forth giving the proper tilt to the plate, and hence causing the image in the left field of view to move up and down in a vertical plane.

The M2 reticles are much more solidly built than those of the M1; they are composed of three pieces of optical glass, the center one containing the reticle pattern. Thus, greater protection is afforded by this arrangement. It will also be noted that the manner in which the reticles are illuminated for use at night is different. Instead of a lucite rod which is employed in the M1, the M2 has a solid glass rod that conducts the light from the illuminating bulb and shines it on an illuminating segment. Here the light is fanned out and passed on into the reticle. The point where the light enters the reticle is clear while the rest of the edge of the reticle is silvered; this tends to keep a maximum amount of light within the reticle lenses.

The central prisms are quite similar to those of the M1. They are silvered on but one side and mounted so they reflect light 100° from the plane of triangulation and 90° from the optical axis; this being the same purpose of the M1 prisms. But attached directly to the surface where the light leaves the prisms is a small condensing lens.

This concludes a brief summary of the major differences between the M1 and M2 height finders. No attempt has been made to give concise and accurate description of Ordnance maintenance on either of these instruments, the intention being merely to present a compact picture of what a repairman might expect upon removal of the cover plates on an instrument about which there is very little information.

KEEP 'EM ARMED

LEADERS OF MEN

(Continued on page 50)

ship by the man who is most immediately concerned in its exemplification. This system is of invaluable aid in eliminating the "heel", the social misfit, the shirker, and the emotionally unstable. It is also a fruitful source of original information concerning the candidate's rationality. The conduct of the candidate on the drill field is but further indication of his thought habits, his ability to think clearly under pressure, and respond quickly to the exigencies of the situation, whatever it may be.

Intellectual curiosity, the yearning for information, the seeking for a view beyond the hill, the true indication of the awakened mind, will carry the candidate a long way toward his accomplishment of the leadership integral. Numerous candidates report to this school completely lacking in this characteristic. Their ignorance alone is saddening, but it, in conjunction with their personal history of wasted years, is inexcusable. A man who is satisfied to just get along, who looks neither to the right nor to the left, who is mentally logged and intellectually apathetic, does not belong in the ranks of the leader. Of more than passing interest is the fact that this school has in many cases struck the spark of curiosity, which blossoms into a satisfactory flame during the course, permitting the candidate to meet the minimum standards required.

Last, but not least of the requirements of the leadership integral, is forcefulness of purpose, without which the characteristics heretofore discussed would be useless. The true leader, a combination of moral integrity, rationality, and intellectual curiosity, can only meet the requirements of the highest sense of responsibility when driven by dynamic force. This self-activating quality goes beyond the realm of the physical and includes character. Its existence speaks for itself as command presence, bearing, poise, and indifference to adversity. Discovery and development of this trait is a prime objective of infantry drill as used at this school. Can a man command? Without forcefulness of purpose, no!

What does it avail a genius without the courage of his convictions or the purpose of their accomplishment? How can a man lead others who are not thoroughly convinced by his every act and word that he is master of their destiny as well as his own? The meek, the mild, the milquetoast, must throw off their neurotic shackles and assume the air of physical as well as mental self-assurance. Those, who, weak to begin with, cannot develop must be relieved. The wavering, the vacillating, and the undecided, are not to be entrusted with the profound responsibility that is an officer's.

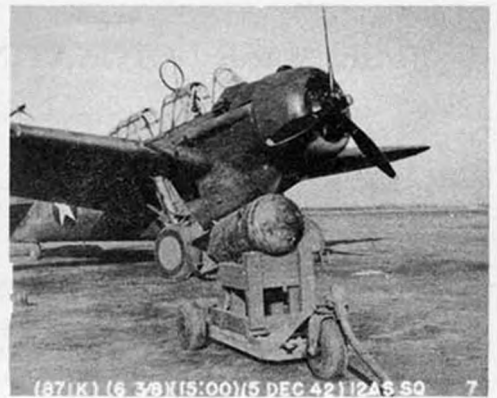
So, now becomes more apparent the goal toward which we strive. Drawn from all walks of life and stations of society are a small group of men, officer candidates, who, through a brief, strange metamorphosis, are transformed from enlisted men to officers. To them, however, is the credit and the glory, for essentially it is their character which carries them through. Emerging at long last on the threshold of an officer's career, the erstwhile candidate fondly recalls that all too brief period of training which, to him, seemed interminable, but which proved him a man, a leader four-square.

IT'S AN IDEA

The following suggestions on the mounting of the 325 lb., Mk. XVII Depth Bomb on an O-47 Observation Airplane, may be of interest to other Ordnance personnel in the field. This idea was originated by PFC Henry J. Schultz, a member of the Ordnance Section, 12th Anti-Submarine Squadron, and is submitted by Lt. F. H. Guterman, Ordnance Officer of the same unit.

The first photograph shows the delivery of the 325 lb., Depth Bomb on the standard Bomb Service Trailer, M5. The Depth Bomb is about to be pulled from the channel iron of the Trailer onto the wooden dolly which is home made and mounted on the standard M1 Lift Truck. Because of the height of this dolly, it is a simple procedure to pull the depth bomb off of the Trailer and on to the delivering dolly.

Photograph 2 shows the Depth Bomb about to be delivered to the Airplane. The Bomb, because of its angle on the dolly, must be guided, although it is fairly stable. In order to get the Bomb into position, the bed of the bomb lift truck is raised slightly as shown in figure 3. Figure 4 shows the bomb with the shackle assembled to it placed under the bomb rack station. Now, the bed is further raised until the shackle can be



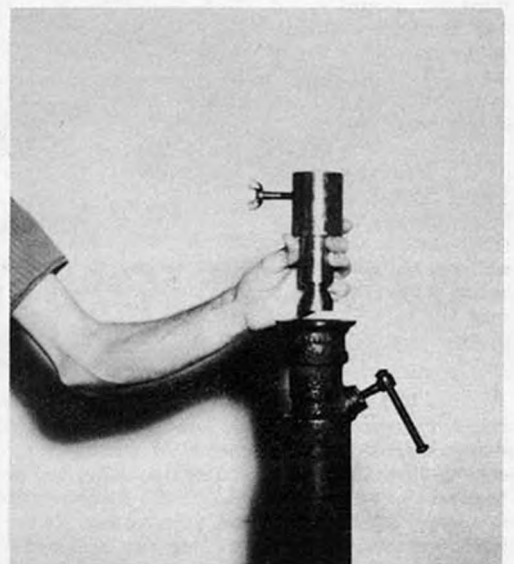
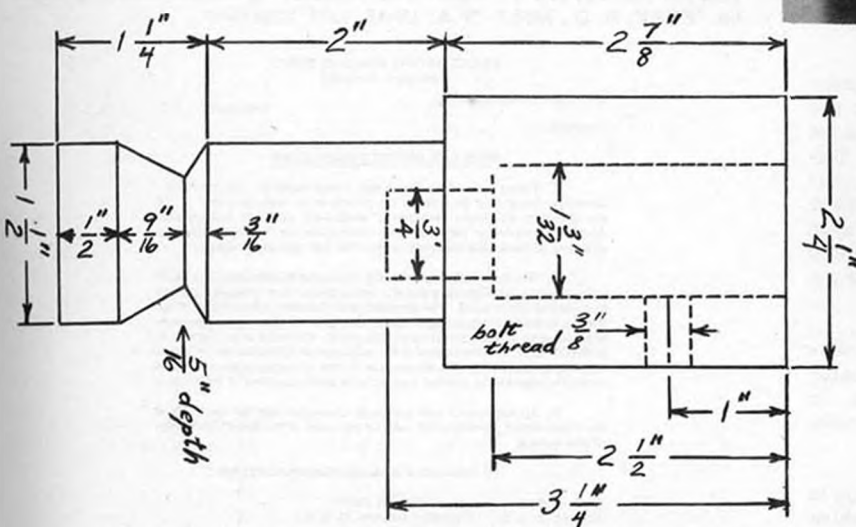
engaged in the lugs of the bomb station, and the release pawls of the shackle engaged in the release mechanism. At this point, the bed of the lift truck is lowered, and the bomb is left hanging in position on the aircraft.

We feel that this, "It's an Idea", has performed a task rapidly and in a far easier way than has hitherto been published.

Lt. F. H. Day, Ordnance Officer of the 51st Fighter Squadron, submits a drawing and three (3) photos of a handy gadget intended for use in airdrome defense. By means of it, flexible machine guns can be used with infantry tripods and truck mounts without removing the Air Corps adapter. Merely insert this pintle in the M1919 tripod or the M24 truck mount, lock it and insert the Air Corps adapter in top of the pintle, locking it in place with the wing bolt.

Dimensions do not have to be held extremely close, and the gadget can be manufactured locally by anyone having a lathe and a length of steel shaft.

It's an ideal!



FUSE, BASE-DETONATING, M68

(The following information is extracted from a forthcoming revised edition of OS 9-20, Artillery Ammunition.)

1. **GENERAL DESCRIPTION.** - The base-detonating fuze, M68, is standard for use with the projectile, A.P.C., 90-mm, M82. The fuze is generally similar to the M66A1 B.D.F., which is standard for the A.P.C. projectiles, M61 and M62, for the 75-mm and 3" guns, and which has been described in paragraph 112 of the third edition of OS 9-20.

a. The M68 fuze has an over-all length of 3.453 inches and weighs 1.56 pounds. It extends 0.62 inches beyond the base of the projectile body, in the form of a boattail, the rearmost portion of the fuze containing the tracer assembly.

b. The composition of the entire fuze may be broken down into five subassemblies; the body assembly, the booster assembly, the primer assembly, the detonator assembly, and the delay charge assembly. Each of these is described below, the last four of the subassemblies being grouped under the title "booster holder assembly", since they are all held in the booster holder.

2. **BODY ASSEMBLY.** - The body of the fuze consists of a steel part which is threaded on the outside to fit into the base of the projectile body and on the inside to receive the booster holder. It has a tapered head indented to house the tracer assembly and is hollowed out in the inside so that the firing pin and safety washer will be held in place when the booster holder is screwed into the body.



a. **Tracer assembly.** - The tracer assembly in the rear of the fuze body consists of two pellets of tracer composition, one pellet of igniter composition, and a celluloid closing cup. The tracer mixture weighing 49 grains is loaded into the cavity and pressed in place under a pressure of 110,000 lbs./sq.in. The igniter composition, weighing approximately 20 grains, is then pressed into place at the same pressure. Finally the clear celluloid closing cup is inserted and secured by the application of N.R.C. compound, which has adhesive qualities.

b. **Firing pin.** - The firing pin is a cylindrical brass plug with a small nipple on one face. It is a freefit in the hollow of the fuze body and is held in place by the safety washer until the fuze has been fired and the projectile impacted. The safety washer is a brass disk one-inch in diameter, with a half-inch hole in the center and eight 1/16-inch slots extending approximately 1/8" deep. These slots leave eight lips of brass to support the firing pin, but these lips are designed to collapse upon impact so that the inertia of the firing pin when the travel of projectile is abruptly halted, as when striking a hard surface, will carry the firing pin into contact with the primer assembly.

3. **BOOSTER HOLDER ASSEMBLY.** - The booster holder comprises the steel part which holds the primer, delay charge, detonator and booster assemblies and secures them to the body of the fuze. In short, it holds the explosive elements of the fuze in their proper relative positions.

a. **Primer assembly.** - The primer is contained in a cavity in the rear face of the primer holder, a commercial brass cylinder which screws into the booster holder and which houses the delay charge holder

assembly on its opposite face. The primer is designated as Primer No. 26, and consists of a brass primer cup holding a pellet of 0.45 grains of primer mixture No. 70, a thin paper disk, and a brass anvil. Primer mixture No. 70 consists of 25% lead sulphocyanate, 17% antimony sulphide, 53% potassium chlorate, 5% TNT. This primer is the same one that is generally used in cal.30 ammunition.

b. **Delay charge assembly.** - The delay charge assembly is held on the other side of the primer holder and is connected to the primer by means of a flash channel. The flame from the primer passes down the flash channel, through a brass retaining washer, into contact with the delay charge of approximately 1.0 grain of black powder pressed at approximately 60,000 lbs./sq.in. When the delay charge has burned through, the flame again passes down a flash channel and into the detonator assembly.

c. **Detonator assembly.** - The detonator holder is a steel cylinder which is designed to fit snugly into the booster holder and to be held in place when the primer holder is screwed down tightly. It is bored through the center with a hole 0.242 inches in diameter, so that it provides a snug fit for the detonator cup. The detonator cup is a tube made of aluminum which, when loaded, is crimped over both ends to provide an assembly 0.342 inches long. Inside the cup, closest to the delay charge is a thin aluminum disk, 0.001" thick. Then is loaded the detonator charge of 3.86 grains of lead azide pressed at 10,000 lbs./sq.in., this being in contact with the detonator pellet consisting of 1.34 grains of tetryl. A closing disk of aluminum is inserted at the end, one side of this disk being coated with red printer's ink and left visible so that the detonator will not be assembled in the fuze in an inverted order. This detonator assembly is the same as that used in the boosters, M20, M20A1, M21, and M21A1. The detonator cup is separated from the detonator holder by a cork cushion in the shape of a washer.

d. **Booster assembly.** - The last component of the explosive train in the M68 fuze is the booster charge. The flame from the detonator passes through a flash channel and through a thin booster washer made of fuze cloth. It then detonates the booster charge consisting of 78 grains of tetryl. This charge is usually loaded in approximately three equal increments.

4. **FUNCTIONING.** - a. The M68 base-detonating fuze must be considered nonbore-safe despite the action of the restraining washer, which holds the firing pin from the primer until the projectile in which the fuze is being fired strikes a solid object so that its travel is abruptly halted. When the solid target is struck, the inertia of the firing pin tends to make it try to follow in its course of flight. Thus it forces itself through the lips of the washer and into contact with the primer.

b. When the firing pin strikes the primer, the nipple of the plug indents the primer cup and grinds the pellet of primer composition against the anvil, causing it to detonate. The flame from this detonation is passed on to the delay pellet of black powder, which burns for approximately one-tenth of a second. The upper detonator charge of lead azide picks up the flame again, and passes it on to the tetryl charge in the lower detonator. The main booster charge amplifies the detonation to a size sufficient to detonate the main bursting charge of the projectile.

5. **MARKING.** - The M68 fuze is stamped with letters and figures one-eighth inch high around the edge at the point where the fuze is flush with the base of the projectile. It is stamped with the name and model number of the fuze, the loader's initials or symbol, the date (month and year) of loading, and the loader's lot number. A sample stamping would be, "FUZE, B. D., M68." "P.A. 12-42, LOT 1234-56."

HEADQUARTERS ARMORED FORCE
Fort Knox, Kentucky
TRAINING MEMORANDUM
NUMBER 41) December 8, 1942

37MM GUN, MOTOR CARRIAGE, M6

1. Firing tests of the 37mm gun, motor carriage, M6, have indicated that firing over the front of the vehicle at an angle less than 15° of gun elevation will cause breakage of windshield and dash instruments. Also, injury to driver personnel will occur if driver remains in his seat when gun is fired over the front or over the left side of the vehicle.

2. The blast deflector recently developed to eliminate this damaging effect is unsatisfactory and will not be installed on weapons assigned to Armored Force units. The blast deflector does not permit firing of the weapon to the front at an angle of less than plus 2°. Since the range corresponding to 2° elevation is over 2500 yards, the value of this device is doubtful. Also, the installation of the deflector prohibits the use of 37mm canister ammunition. The elimination of this type ammunition is undesirable as attested by current reports from active theatres of operations.

3. All Armored Force personnel concerned with the operation of the 37mm motor carriage, M6, will be informed of the firing limitations of this weapon.

By command of Lieutenant General DEVERS:

E. F. OLSEN, DAVID G. BARR
Colonel, A. G. D., Brigadier General, G. S. C.,
Adjutant General, Chief of Staff.