

THE ORDNANCE SERGEANT



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NO. 1



RESTRICTED

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IN THIS ISSUE

The first article of this issue, the Editorial, has been purposely misplaced. The primary purpose of the issue is to emphasize that sort of cooperation which should, and apparently does, exist between the Ordnance Department and the Field Artillery. General Baehr's article was submitted for that purpose, and it expressed the theme of the issue so adequately that it promptly became the Editorial.

General Baehr is a man of wide experience. He is familiar with the Field Artillery problem, and he has encountered Ordnance service through many years of service. He recognizes virtues and faults, wherever they may be found. Every reader of THE ORDNANCE SERGEANT will do well to read his Editorial frequently — it applies to all branches of the service as well as to the Field Artillery.

The feature articles to be found in the following pages tell a number of little stories of Ordnance Service. They tell of difficulties encountered, and of solutions found and applied. They indicate the variety of problems which any of us may expect to meet during the coming months.

One feature article of special interest is "Handling the 4000-pound Bomb" on page 49. It describes an idea developed by an Ordnance soldier, tested by The Ordnance School, and passed on to you by THE ORDNANCE SERGEANT. We will hear more about the 4000-pound bomb in the future.

Among the regular monthly features are several articles of special interest. That one piece of the Thompson Submachine Gun which can cause so much trouble, the pivot plate, is explained by Tech. Sgt. Fabrizio on page 56, as well as other things about this weapon.



The cover photo, by J. I. Gregor, Fort Bliss, Texas, shows real action at that post, demonstrating the maneuverability of a 75mm Field Howitzer by taking a corner at a gallop.

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REPRODUCTION PLANT
THE ORDNANCE SCHOOL
ABERDEEN PROVING GROUND
MARYLAND

RESTRICTED

Spring type equilibrators, which can perform some nasty antics at times, are tamed by the use of new tools described by Lt. Hampton on page 58.

S. Sgt. Maxwell explains the "Classification of Military Information" on page 68, an im-

AND THE NEXT

portant subject during wartime. The following article, "Simplified Accounting Procedure for Organization Property", by Tech. Sgt. Murphy, is also important with units and individuals moving about more than in normal times.

Organizations which find themselves faced with the assembling or construction of the steel igloo-type ammunition magazine will find Lt. Thomas' article beginning on page 78 extremely valuable. This is a chance to profit by the experiences of others.



A number of articles in the August issue will be interesting to all Ordnance personnel, while others will be of especial interest to Fire Control men. Probably no phase of Ordnance activity has progressed as rapidly in the last two decades as Fire Control. Even at the beginning of World War I its status was still that of a military infant. Its earlier development had been scattered with difficulty over several centuries. But World War I did much for Fire Control, or, rather, Fire Control learned to do much for the fighting forces during World War I.

This "babyhood" of Fire Control is discussed in considerable detail in the August issue, as well as its World War I development, and its rapid progress since that time. More important, probably, are the discussion of modern Fire Control thoughts.

Other articles of general interest will include "The Preparation of a Bill of Lading", by Tech. Sgt. Hathaway; and "Furloughs, Passes and Delays", by S. Sgt. Schor.

All in all, the August issue promises to be well worth the reading time it will require.

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Editorial

CARL A. BAEHR
BRIGADIER GENERAL, U.S. ARMY
COMMANDING 71st F.A. BRIG.

The Field Artillery fights with the projectile. It seeks to strike with destructive effect suddenly, accurately and from a distance. Its tools must be accurate and must remain accurate under trying conditions of field service. In battle, they are maintained and operated by men, tired and worn by campaign, who, frequently for days at a time, must work without relief.

The Field Artillery must depend upon the Ordnance — first for the design and then for the manufacture and supply of the best possible and most effective fighting tools in guns, ammunition and fire control equipment. When issued for

service, these items should have been carefully and meticulously checked so that complete confidence can be placed in their accuracy. Too much emphasis cannot be placed upon the necessity for careful check prior to issue.

(1) WHAT THEY EXPECT OF YOU

The fighting man develops confidence — or lack of it — in his weapons, based upon his experience with them. As he becomes convinced of their effectiveness, he devises more and better ways of exploiting it. No amount of demonstration or advice quite takes the place of the knowledge acquired by actual use that, in his hands, a particular weapon is a deadly threat to his enemy and a reliable protection to himself.

Ordnance personnel concerned with the issue of field artillery materiel should therefore

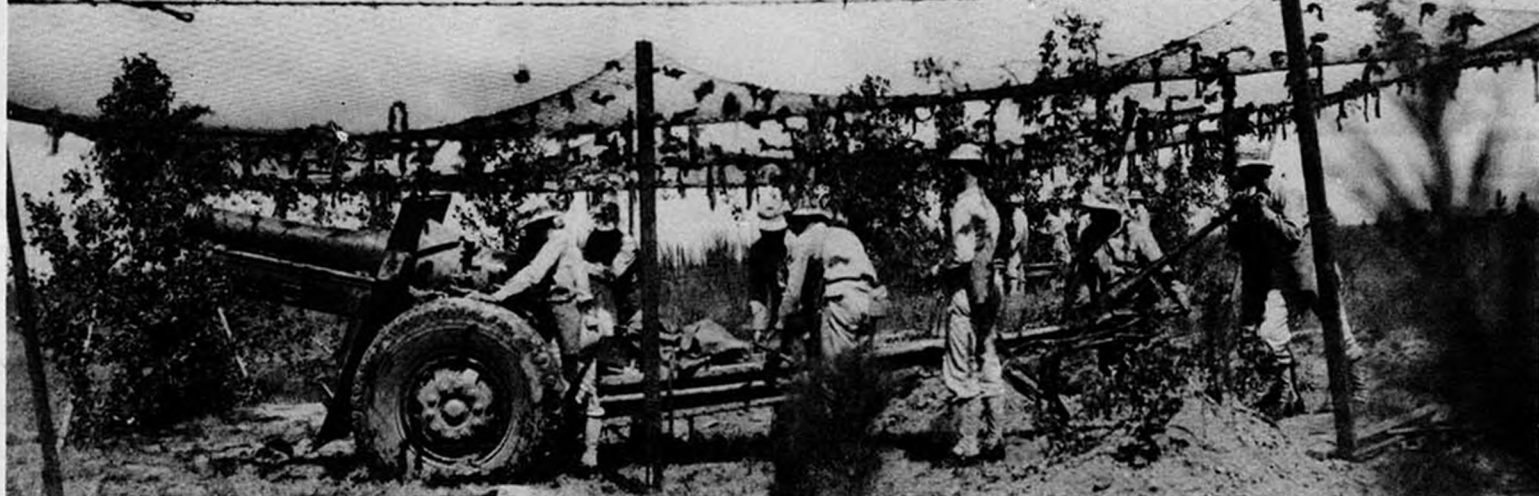
The entire feature material contained in this issue was planned with one idea in mind; to emphasize the sort of cooperation which should exist between the Ordnance Department and the Field Artillery. Correspondence received during the preparation of this issue has convinced the editor that this needed cooperation does actually exist at almost every station. Several articles appear in this issue subtitled "What They Expect of You". The article on this page is the first of these, and in this small space General Baehr has given us a concise and to-the-point digest of what the Field Artillery rightfully expects of the Ordnance Department, and why. He tells in a comparatively few words what the complete issue intends to convey.

feel a definite responsibility for every item being absolutely right at the start. They should have meticulously studied and operated all the instruments and weapons themselves in order to be able to illustrate and tell from their own experience about the critical features, the "bugs", and the little tricks insuring safe, accurate functioning. They must make themselves the experts to be sought for advice on unusual happenings or malfunctions. And they must not guess. Another important thing which the Field Artillery requires of Ordnance is field repairs of equipment, particularly in combat areas where replacements cannot be had. This will usually be of an emergency nature and may even have to be

to some extent extemporary, but whatever is done, it must be done as well as it can be and with the certainty that the materiel will function. Few things cause greater loss of confidence than the discovery that a gun or instrument just returned as repaired still does not function correctly.

They should have a clear picture of what the service conditions are which their products must meet. To prescribe or expect dainty handling is to fail of that understanding which is necessary to offering of proper advice and instruction. Ordnance personnel should, if possible, get out in the field and see the conditions under which Field Artillery must operate. Sometimes what looks like carelessness or neglect is the result of abnormal conditions which it was impossible to avoid.

At the same time, the Field Artilleryman must be impressed with the necessity for proper, meticulous care, and for continued check and inspection. The responsibility is primarily his to minimize the effects of hard service. He must know how to make checks and adjustments — to rely upon himself for determining in general that the materiel is functioning correctly, detecting at once signs of trouble. This is best accomplished by association with Ordnance men who have practical, intimate knowledge of the materiel, who can advise and show what to look for, how to test and how to adjust. Patient and detailed work by Ordnance and field artillerymen working side by side brings about mutual understanding of the materiel and of each other's problems and responsibilities in attaining maximum skill in its handling.



THE BEGINNINGS OF OUR ARTILLERY

BRIG. GEN. OLIVER LYMAN SPAULDING, U.S.A., RETIRED

REPRINTED FROM THE FIELD ARTILLERY JOURNAL

Prior to the Revolutionary War the colonies had furnished troops to all the British campaigns in America. This had been true of artillery as well as infantry; artillery companies had been raised at one time or another in most of the colonies, and these companies had served alongside British artillery, thus absorbing British methods. Some few companies maintained their organization between campaigns, as units in the militia.

When hostilities began at Boston, a regiment of American artillery was raised in June 1775, under command of Colonel Richard Gridley, a retired British officer, consolidating into a single command various artillery companies. This regiment served as the nucleus upon which later organization was based.

So much for the troops and their system of instruction; but what of the guns? These were hard to get, each colony had a few, but cherished them carefully and was slow to give them up to the Continental authority. What few were in the hands of the troops were mostly light field pieces, and the urgent need at Boston was for heavier guns to maintain the siege and permit a definite attack.

Stedman, "History of the American War", London, 1794.)

"A volunteer, of the name of Ethan Allen, assembled of his own accord about fifty men, and proceeded immediately to the environs of Ticonderoga, commanded by Captain De La Place of the 26th Regiment, who had under his command about sixty men. Allen, who had often been at Ticonderoga, observed a complete want of discipline in the garrison, and that they even carried their supine negligence to the length of never shutting the gates. Having disposed his small force in the woods, he went to Captain De La Place, with whom he was well acquainted, and prevailed on him to lend him twenty men, for the pretended purpose of assisting him in transporting goods across the lake. These men he contrived to make drunk; and, on the approach of night, drawing his own people from their ambush, he advanced to the garrison, of which he immediately made himself master. As there was not one person awake, though there was a sentry at the gate, they were all taken prisoners. On the commander's asking Allen by what authority he required him to surrender the fort, he answered, 'I demand it in the name of the Great Jehovah and the Continental Congress'."

And here we may pause to remark that it is a tradition in the family of one of Allen's men that his greeting to Captain De La Place, when he had succeeded in waking him, was "Come out of that, you damned old rat". Both the informal greeting and the grandiloquent demand sound probable; Allen may have used both. But to resume from Stedman:

"The stores taken at Ticonderoga were between 112 and 120 iron cannon, from six- to twenty-four-pounders; 50 swivels of various sizes, 2 10-inch mortars, 1 howitzer, 1 Coehorn, 10 tons of musket balls, 3 cart-loads of flints, 30 new carriages, a considerable quantity of shells, a warehouse full of materials to carry on boat-building, 100 stand of small arms, 10 casks of very indifferent powder, 2 brass cannons, 30 barrels of flour and 18 barrels of pork. The prisoners were 1 captain, 1 gunner, 2 sergeants and 44 rank and file, besides women and children. Captain De La Place, notwithstanding his shameful conduct, was not brought to a court martial, but was suffered to sell out."

Crown Point was taken easily a few days later. The attention of all concerned was thus turned toward a possible invasion of Canada, and the guns which had been Arnold's original objective were forgotten.

Now there was, in the Cambridge camp, a young man whose name, Henry Knox, is extremely familiar to all our present-day artillerymen, especially when the time approaches for the annual Knox Trophy competition. He had been the keeper of a prosperous and fashionable book shop

in Boston, and had used the facilities of the shop extensively in keeping up his hobby of military study. He also went in strongly for military training, and as early as 1768 he had joined the local artillery company. Between theoretical study and practical exercises, he had become a reasonably competent artilleryman and military engineer. As an individual volunteer he had joined the besieging force under General Artemas Ward at Cambridge, and had been employed by Ward and later by Washington in laying out fortifications. For what happened next, we may quote from Noah Brooks' "Henry Knox, a soldier of the Revolution," Putnam, New York, 1900:

"The siege of Boston had now (November, 1775) begun in earnest. But the need of siege guns was severely felt by the patriot army, and men began to cast about in their minds for some means to procure guns of sufficient weight and range to throw shot into the beleaguered town.



Events two hundred miles away supplied the answer.

Even before the battle of Bunker Hill, Benedict Arnold had suggested that there must be plenty of guns for the taking, at Ticonderoga and the other fortresses on the route to Canada. Upon his own application he was commissioned a colonel and authorized to raise 400 men for the purpose. He hastened at once to Lake Champlain, leaving his men to follow. Here he found Colonel Ethan Allen of Vermont, engaged on the same mission by authority of the Connecticut Assembly. Having no force of his own at hand Arnold could make no claim to the command, and served as a volunteer under Allen.

With the events at Ticonderoga we are all familiar, but it may be interesting to digress for a moment from our artillery subject and give the story as told by a British Officer who served in Howe's army. (Charles

The fertile and inventive mind of Knox conceived the daring enterprise of sending to Fort Ticonderoga, on Lake Champlain, to drag thence the supply of ordnance captured by Ethan Allen and then lying there unused. Knox's plan was submitted to Washington, who, after careful scrutiny, gave his approval to the difficult and hazardous undertaking. Cannon must be had or the siege would be indefinitely prolonged, if not ultimately abandoned. Knox's plan was to make the journey to Fort Ticonderoga while the snow and ice combined to render streams passable and roads feasible for sleds and sleighs. In open water, he urged, boats could be employed and the total expense of the expedition on which so much depended, and which could be successfully carried out, need not be more than \$1000. This sum was fixed as the limit of immediate and needful expenditure; but in one of Knox's account books we find this brief and comprehensive entry: "For expenditures in a journey from the camp round Boston to New York, Albany and Ticonderoga, and from thence, with 55 pieces of iron and brass ordnance, 1 barrel of flints, and 23 boxes of lead, back to camp (including expenses of self, brother and servant), L520.15.8-3/4." In his final instructions to Knox, Washington said that the want of cannon was so great that 'no trouble or expense must be spared to obtain them.'

"General Philip Schuyler of New York was instructed by Washington to render to Knox every possible assistance in his expedition to Ticonderoga; and Knox, after securing sundry small stores of ordnance in the city of New York, wrote to his wife that he was thankful to leave so expensive a city. He reached Albany December 1st, and was cheered on his way by Schuyler, who rendered great assistance then and afterward in the way of securing transportation. The winter was severe, the roads unbroken, and the snow deep. Oxen in large numbers were necessary for the hauling of the cannon, and these animals were secured at considerable trouble in the thinly inhabited regions through which Knox traveled.

"He reached Ticonderoga on the 5th of December, and, at once collecting the coveted ordnance, began his homeward journey. His inventory of the arms shows that he took away 8 brass mortars, 6 iron mortars, 1 howitzer, 13 brass cannon, 30 iron cannon, a barrel of flints and a quantity of lead. The heaviest of the artillery were brass 18- and 24-pounders; truly a noble acquisition for the expectant besiegers of Boston. A letter from Knox to Washington, dated at Fort George December 17th, gives us a vivid picture of some of the difficulties encountered on the homeward trip. He says:

"I returned to this place on the 15th, and brought with me the cannon, it being nearly the time I computed it would take us, to transport them here. It is not easy to conceive the difficulties we have had in transporting them across the lake, owing to the advanced season of the year and contrary winds; but the danger is now past. Three days ago it was very uncertain whether we should have gotten them until next spring, but now, please God, they must go. I have made 42 exceeding strong sleds, and have provided 80 yoke of oxen to drag them as far as Springfield, where I shall get fresh cattle to carry them to camp. The route will be from here to Kinderhook, from thence to Great Barrington, and down to Springfield, I have sent for the sleds and teams to come here, and expect to move them to Saratoga on Wednesday or Thursday next, trusting that between this and then we shall have a fine fall of snow, which will enable us to proceed farther, and make the carriage easy. If that shall be the

case, I hope in sixteen or seventeen days' time to be able to present to your Excellency a noble train of artillery'.

"One of the difficulties encountered on the way to Albany from Fort Ticonderoga was the necessity of ferrying the heavy cannon across pieces of open water. This was accomplished by means of 'gondolas', as the flat-bottomed scows then in use were called. * * * Knox's hindrances are further hinted at in a letter which he wrote to Washington from Albany, Jan. 5th, 1776, as follows:

"I was in hopes that we should have been able to have the cannon at Cambridge by this time. The want of snow detained us for some days, and now a cruel thaw hinders us from crossing the Hudson River, which we are obliged to do four times from Lake George to this town. The first severe night will make the ice sufficiently stronger; till that happens, the cannon and mortars must remain where they are. These inevitable delays pain me exceedingly, as my mind is fully sensible of the importance of the greatest expedition in this case."

"The route of this novel expedition lay over the Green Mountains and the wild passes of that range, and down through the hill country of New England, by roads that never bore a cannon before and have never borne one since." On his way up to Ticonderoga from Albany, Knox passed a stormy night sleeping on the floor of a rude log cabin which served as a wayside inn for chance travelers through that sparsely populated region. His bedfellow was Lieutenant John Andre, who had been taken prisoner by General Richard Montgomery at St. John's, and was now on his way to Lancaster, Pennsylvania, to await an exchange. It was a strange change that brought together these two men under the same blankets in a remote cabin in the wilderness. Years later, Henry Knox was to serve on the military tribunal which sentenced Andre to the ignominious death of a spy. Now, all unconscious of what Fate had in store for them, they passed the greater part of the night in conversation."

And with this, we close our quotation. Having left Cambridge on November 15th, Knox was back there on January 24th. His route is now marked by a series of bronze tablets. With these guns in condition for use, Washington felt strong enough to make a move. On March 2nd he opened a bombardment of the city water front. Under cover of this, on the night of March 4-5, a strong force from the Roxbury lines seized Dorchester Heights, from which position heavy guns could command both the city and the ship channel. Working under high pressure, this party had a formidable fortification well under way before daybreak.

Howe's first instinct was to attack, and dislodge the Americans, and troops were concentrated for this purpose. But he soon gave up the idea; it was clearly out of the question. The heights were steep, and Bunker Hill had indicated what kind of resistance might be expected. Moreover, Washington held a force on the Cambridge water front, with boats, prepared to cross over and make a counter-attack.

Nothing remained but to evacuate the city. Supplies were already short there; Howe had been depending upon shipments from Nova Scotia, the West Indies, and the southern colonies. With the new Dorchester batteries, these were cut off, and he had no reserve. The decision was reached with reluctance, for while the possession of Boston was of little advantage to the British, its evacuation was a heavy blow to their prestige.

ETHAN ALLEN

In his "Literary History of the American Revolution", M.C. Tyler says of Allen, "He was a blustering frontier hero — an able-minded ignoramus of rough and ready humour, of boundless self-confidence, and of a shrewdness in thought and action, equal to almost any emergency."

After his march against Ticonderoga he took part in another northern campaign, as a member of General Richard Montgomery's expedition against Canada. He was captured by the British, and after his release was brevetted colonel by the Continental Congress. Then, as a brigadier general of the militia of Vermont, he resumed his old opposition to New York, and at one time carried on negotiations with the Governor of Canada, who hoped to win the Vermonters over to the British cause. He is said to have assured a British agent that "I will do everything in my power to make this State a British province".

Later he wrote to Congress with characteristic bluster, "I am as resolutely determined to defend the independence of Vermont as Congress that of the United States, and rather than fail will retire with the hardy Green Mountain boys into the desolate caverns of the mountains and wage war with human nature at large".

Allen, however, was never proven disloyal when a showdown came, and we owe much to his courage and enthusiasm.

HENRY KNOX

Knox, a native of Boston, was not a war-minded man before the Revolution. As a prominent member of the colonial militia he tried to keep the Boston crowd and the British soldiers from the clash known as the "Boston Massacre" in 1770.

In 1771 he opened the "London Bookshop" in Boston, and while engaged in this business read a great deal of tactics and strategy.

(Continued on page 9)

For 130 years the Field Artillery has looked to the Ordnance Department for the design, supply and maintenance of its principal weapons and many other items of essential equipment.

It would be most interesting to review, historically, the development and growth of the many activities within the Ordnance Department, now largely centered at Aberdeen Proving Ground, which have contributed to the production of field artillery weapons, but space will not permit. We must be content to state what is now being done at the Proving Ground; how these activities affect the mutual endeavors of the Ordnance Department and the Field Artillery to acquire and maintain the best in weapons and ammunition for them.

What are the processes involved in acquiring weapons for the Field Artillery? In general field artillery materiel is obtained as follows:

- American design and manufacture.
- Foreign designs made here.
- Purchased from foreign governments.
- Captured in battle.

The above list is arranged in order of the importance of the present sources of supply.

During World War I few guns of American design and make were used in Europe by our Field Artillery. At that time our industry was not prepared to supply American guns in the quantities and in time to meet our needs. Also, before we entered the war, our French and British allies had a working arrangement of standardized calibers that simplified ammunition supply which it seemed unwise to upset by injecting our calibers. So we bought guns from the French and the British and made some of their designs in American factories.

The situation was obviously unsound from the standpoint of national defense. It is of course unthinkable that this country should depend on any source other than ourselves for such vital things as the weapons of war. Hence, when the National Defense Act was written to give sanction of law to a plan for correcting the errors in our means for making war, as brought out by actual experience in war, thought was given to a method for insuring the design and production of weapons by our own engineers and factories.

The results of this planning, the acceptance of "educational orders" by American manufacturers, and the efforts of our own designers in bringing forth modernized weapons suited to the highly developed methods of mass production long practiced in American factories, are now felt throughout the Ordnance Department, and notably at the Proving Ground where many of such designs and pilot models are tested, often redesigned, and sometimes actually built.

A board of officers, known as the Westervelt Board, appointed shortly after the end of World War I, "to make a study of armament, calibers and types of materiel, kinds and proportion of ammunition, methods of transport of the artillery to be assigned to a Field Army," made recommendations as to ideal and practical types of weapons that should be considered for our Field Artillery. These recommendations were approved and the Ordnance Department immediately started designs



8" Howitzer, M1, on 8" Howitzer Carriage, M1, in traveling position without cover.

ORDNANCE DEPARTMENT. A. P. G. PHOTO

TRIED and TESTED

by
COLONEL M. R. COX
Field Artillery Liaison Officer
Aberdeen Proving Ground



and developments for improving existing weapons and for building new ones.

Designs and projects for development of the new field artillery weapons have come from several sources, namely:

From the Ordnance Department; originating in the Office of the Chief of Ordnance, in the Ordnance Districts, the Arsenal and at the Proving Grounds.

From the Field Artillery; originated by individuals, the Field Artillery Board or The Chief of Field Artillery, now the Field Artillery Section of the Development Branch of the Ground Forces.

From civilian inventors.

From manufacturers.

Regardless of where the idea for the new weapon originates, it passes through a definite process of development, proof and acceptance before becoming standardized for use. It is during this process that the activities and facilities at the Proving Ground play important roles.

The proposed designs and improvements are first submitted to the Ordnance Committee, sitting in Washington; representatives of the Field Artillery and of other arms meet with this committee, and here often is the first opportunity to present the service view with respect to new developments.

The Ordnance Committee, in consultation with service representatives, determines if the new project is worth development. If so, then the military characteristics desired by the Field Artillery, for example, are set forth in detail and arrangements made to produce drawings, construct pilot models and deliver them to the Proving Ground for test. Often a wooden model, or "mock-up", of the new weapon is made before any part of it is converted to metal.

In the process of developing new weapons for Corps Artillery, for example, which have only recently been standardized, "mock-ups" of the two pieces, a 4.5" gun and a 155mm Howitzer, were sent to the Proving Ground. Representatives of the Office, Chief of Ordnance, and several members of the Field Artillery Board went over these wooden models in minute detail with members of the Arms and Ammunition Division of the Proving Ground. These conferences went on day and night for more

Direct view of 155mm Gun, M1,
in firing position



ORDNANCE DEPARTMENT. A. P. G. PHOTO

than a week. In the end, the Field Artillery had arranged for the addition of several features which it felt would make the weapons easier to serve, more rugged and easier to move about in the field. The Board also suggested the elimination or alternation of other features of the original design that appeared in the wooden models.

Hence, when it came time to build pilot models, the Field Artillery was satisfied that the eventual weapons would be what the troops needed, and the Ordnance Department agreed that the designs were sound from an engineering and ballistic viewpoint.

From the time construction is started on pilot models of weapons and vehicles until they are standardized for quantity production and issue, the facilities of the Proving Ground are constantly utilized in testing, re-designing and finally accepting the project. During this procedure with respect to cannon ammunition and vehicles intended for the Field Artillery, our representatives are in close touch with the development, ballistic proof and acceptance tests conducted at the Proving Ground.

The Field Artillery also maintains a Liaison Officer at the Proving Ground, who is instructed to keep his arm informed of the progress of developments respecting field artillery materiel, and to act as the consultant to the Proving Ground officers on matters affecting service views and requirements.

Tests conducted by the Proving Ground are essentially of laboratory and engineering character; the idea being to determine if the cannon, ammunition and vehicles agree with correct engineering practice, are sound and adequate in construction detail, and to collect data useful in future designs.

Tests to determine if the equipment fulfills service requirements are made by the Field Artillery Board. These are largely field tests, although it is not possible to ignore any engineering and mechanical failures or inadequacies that occur during such field tests. Hence, in effect if not by intent, tests by the Board are a continuation of the development and proof tests conducted at the Proving Ground. It is, therefore, important that matters involving mechanical and engineering features of a weapon which are brought to light during field tests should be made known to the Ordnance Department. Knowledge of these discoveries will eventually, of course, come to the Proving Ground by means of the Reports prepared by the Board at the conclusion of its tests.

However, in order to save time and to maintain the cooperative

understanding that is so valuable where two separate agencies are working, each in its own sphere on a development project, the Proving Ground has recently adopted the practice of sending an officer to the Field Artillery Board. This officer, if possible, is the proof officer who conducted the tests at the Proving Ground on the particular piece of equipment to undergo test by the Board. If it is a vehicle, such as a gun motor carriage, a transport wagon, a prime

mover, or some similar item that is to be sent overland, the proof officer from Aberdeen usually goes along on the road trip, thus gathering valuable experience and data.

At all events, this officer arrives with or before the piece of equipment reaches Fort Bragg, N. C. He takes along his record of the Proving Ground tests and a first-hand store of information not in this record. By no means the least advantage of this arrangement comes through personal contact and consequent mutual opportunity for direct face-to-face discussion between representatives of the Ordnance Department and the Field Artillery.

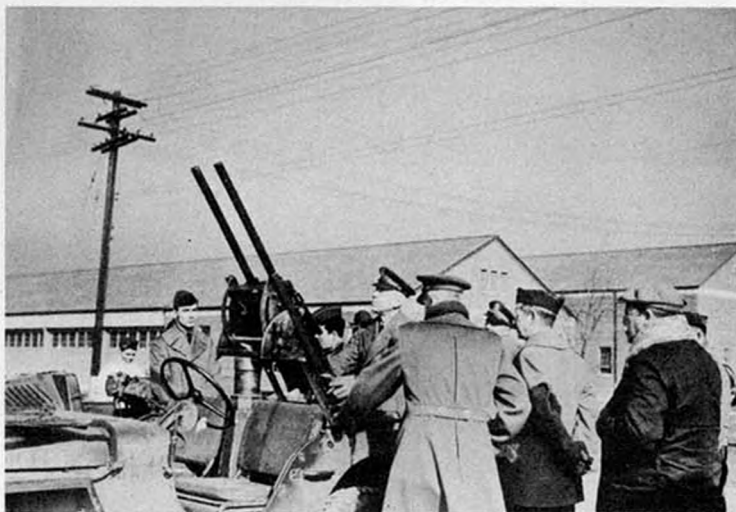
What has been mentioned heretofore would be handled chiefly by the Arms and Ammunition Proof Division, and the Automotive Test and Research Division of the Proving Ground. However, all other divisions, sections and facilities at one time or another during tests of Field Artillery materiel would likely contribute to some particular phase of the test program.

For instance the Ballistic Research Laboratory produces the range tables for all new cannon and the tabular data for, as well as the method of, using the metrological message. It also is consulted with reference to projectile design and the components of propelling charges.

During the development of a base ejecting smoke shell it was found that when fired the shell was very unstable in flight. There seemed to be no good reason why it should perform in such fashion. Its weight and contour was the same as other types of shell of the same caliber which performed satisfactorily in flight. This crazy acting smoke shell was turned over to the Ballistic Research Laboratory for a diagnosis of the trouble. The laboratory weighed, measured and checked the offending projectile, but could find no errors sufficiently great to cause it to turn flatwise to the direction of flight less than 100 ft. from the muzzle. Searching for any probable cause for the trouble, the laboratory considered it might be possible that the three metal canisters containing the smoke mixture were not rotating with the shell body. So some canisters were removed, covered with glue and replaced. When the shells containing the glued-in canisters were fired, they performed perfectly. So that was that.

Another proving ground facility contributing constantly to the development of field artillery weapons is the Gauge and Photo Section. This section will give us an estimate of the wear to be expected and even the ultimate life of the cannon before they are actually fired. From ex-

(Continued on page 35)



A demonstration during a visit of the Chief of Field Artillery at Aberdeen Proving Ground, January 23, 1942. Left to right: Lt. Constance, Capt. Wells, Maj. Gen. Danford, Chief of Field Artillery, Lt. Col. Campbell, Col. Stewart, Col. Hardigg, Mr. Rhein, Lt. Col. Colson.

ORDNANCE DEPARTMENT. A. P. G. PHOTO





AN UNBEATABLE TEAM

So many elements contribute to final victory in battle that in trying to present a formula it is difficult to differentiate as to which of the many elements is the most important. Certainly leadership, with excellent staff functioning, good supply organizations, teamwork, mobility, greater strength, communications and morale are essentials for the formula for victory; but last and certainly not least are the elements which sustain fire power through an efficient system of repair and replacement of the weapons used in battle. In this short discussion the weapons used in battle will be considered as the 155mm Howitzer and the relation of a Field Artillery unit using this weapon to the Ordnance Department.

In arriving at any conclusions as to what the Ordnance Department may expect as demands upon it from the Field Artillery, it is necessary to consider the two schools of thought connected with the servicing of the weapons of that arm of the service, for the problem of keeping the artillery weapons in a firing battery at their highest peak of efficiency in delivering fire on the enemy has developed these two methods of servicing. In the first system, or the centralized plan, all repairs and replacements, with the exception of minor items and adjustments made by the artillery mechanic of the battery, are made by personnel under the direct control of the Ordnance Department; while the second school of thought is a decentralized plan whereby a rough and ready service is performed by enlisted specialists within the battery. Such specialists are called artillery mechanics, and usually are trained at the Field Artillery School in the methods as used by the Ordnance Department. Each firing battery in a battalion or regiment of 155mm howitzers has one artillery mechanic.

2 WHAT THEY EXPECT OF YOU

What may the Field Artillery expect from the Ordnance Department? Generally speaking the Field Artillery expects that the Ordnance Department specialists will accomplish the heavy maintenance and replacement, furnish all of the parts and material necessary to keep the guns in good firing condition, and repair and replace the delicate instruments in the preparation of fire and fire control. However, that service which the Artillery expects from the Ordnance during training periods, and that expected during actual combat, are two different stories, and must therefore be treated separately in this discussion. Repairs and adjustments to guns and fire control instruments ordinarily made by the personnel of the Ordnance Department when units are in a training period or stage in many cases cannot be passed on from the artillery mechanic of the firing battery to the Ordnance Department during actual combat, and this change of situation is due solely to the fact that the Ordnance companies are so limited in number, have so many different units to take care of and generally are located at quite some distance from the battery positions.

During training periods when battalions or regiments are more or less in a permanent camp or post, it is found that there are many repairs and adjustments which a skilled artillery mechanic is able to make but which he is not allowed to touch as under various FM's, TM's, and SNL's, — this work being assigned to the Ordnance Department. Such

LAST, BUT BY FAR NOT THE LEAST
TO BE EXPECTED OF THE ORDNANCE,
IS ADVICE AND COUNSEL.

by W. B. McAllister
Captain, F. A.



Removing tube from cradle of 155mm Howitzer (113th Ord. Co.)

work as heavy maintenance, repair or adjustment to such materiel as quadrant sights, panoramic sights, aiming circles, BC scopes, etc., is authorized to be accomplished only by the Ordnance Department. Under the heading of heavy maintenance would come work such as removal and replacement of tubes from the cradles, recoil and counter-recoil mechanism, removal of the gun from the carriage, and other major items of repair. With an Ordnance Company usually near at hand, such services are quickly and efficiently done and a minimum loss of use is accomplished. Among the many services which the Artillery expects from the Ordnance during training periods are the preparation of a gun newly re-

ceived from the manufacturer, bore-sighting guns after repairs and likewise when newly received, straightening bent axles and various repair jobs which will require the use of welding apparatus and such other tools as the artillery mechanic does not have.

When an artillery unit goes into actual combat, many of the services spoken of above will have to be done within the battery, and the

demands made on the Ordnance will be for heavy maintenance, such as the removal of tubes from the cradle, and repair and replacement of such damaged parts of the gun or carriage as have to be welded, repair and replacement of parts of fire control instruments where the parts have been damaged or lost, and probably more especially, the supply of parts needed in the batteries.

Last, but by far not the least to be expected of the Ordnance, is advice and counsel. The personnel of the Ordnance Department is composed of experts in the administrative, supply, light weapons sections, artillery and instrument sections, and if during the stress of combat the

battery artillery mechanic knows that he has a friend in the Ordnance Department to whom he can turn for advice or help in the many problems which arise, half of the battle of maintenance is won. In the last analysis battles are won by the intelligent use of more and better guns and ammunition than the enemy can assemble, and by keeping the fire power of a unit at its peak performance all of the time, well supplied with ammunition, and all of its fire control instruments in usable conditions. The Artillery and Ordnance will combine into a team which an enemy will find unbeatable.

Repairing and adjusting Fire Control instruments for Field Artillery (113th Ordnance Company)



HENRY KNOX

(Continued from page 3)

He joined the American army at the outbreak of the Revolution, fought at Bunker Hill, and planned the defenses of the American camps around Boston. At this time he made his very useful trip to Lake George.

Knox fought in many of the major battles of the war, at Princeton, at Monmouth, and at Yorktown. At Trenton he crossed the Delaware ahead of the main body of troops and rendered such valuable service that Washington made him a brigadier general and Chief of Artillery of the Colonial Army.

In 1783 he planned and organized a society of Americans and French officers of the Revolution, known as the "Cincinnati".

He became Secretary of War in 1785, the first to hold this position under the new Government of the United States. He urged ineffectually a national militia system, to enroll all male citizens between the ages of 18 and 60 in the "advanced corps", the "main corps", or the "reserve corps".

Continuous Firing of the Field Artillery Weapons Under Adverse Weather Conditions has Presented Manifold Problems to the Ordnance Service



In the California coastal hills, approximately half-way between Los Angeles and San Francisco, is located one of the country's largest Field Artillery and Infantry Replacement Centers; Camp Roberts. Reflecting the present day activities, this post for training armed forces gives a striking contrast to the nearby historic Spanish mission of San Miguel. Contrast is also evident in this area in the many decidedly different weather conditions that prevail in one year. These varied climatic factors, in a camp where a great number of different Field Artillery weapons are used, afford an excellent opportunity for the Ordnance service to know the direct effects of weather on such weapons.

This semi-arid region where Camp Roberts is situated has an average rainfall of about twelve inches, coming in the three or four winter months. However, in the first year Camp Roberts was in existence, the rainfall reached thirty-six inches in about five months. The shallow shale-like top soil of the hills, combined with the clay soil in the new construction areas, made the camp site mesa a bottomless sea of mud. The change of seasons is abrupt. With the coming of summer, mud that was hub-deep becomes dust hub-deep. During the clearing weather the temperature range is from as low as sixteen degrees in early morning to over fifty degrees at mid-day. Summer temperatures, intensified by the glare from dry sun-baked adobe hills, rise as high as one hundred and thirty degrees during the day, but will drop as low as sixty degrees at night, making a temperature variant of seventy degrees for a twenty-four hour period. Fall and spring mornings are often characterized by heavy coastal and valley fogs, whose moisture is another significant factor to be considered in the protection of weapons.

Coupled with the wide range of weather, the fact that all the Field Artillery materiel in the hands of the Field Artillery Replacement Training Center is used continually for training, firing and long road marches, day in and day out, from training period to training period, lends to a perpetual large maintenance and supply problem. In addition to maintenance difficulties caused directly by weather, the wet slippery roads and poor visibility are indirect causes of a few large repair problems. Resulting collisions and other accidents require fourth echelon maintenance. From a year's observance of the necessary work on weapons at this camp, it is apparent that the warm weather, with its accompanying dust, causes the most trouble.

As a result of dust, the main repair for the 155mm Howitzer is on the air brake mechanism, especially on the emergency relay valve. Dust gets in through the hose connections and into the diaphragm of this valve, making frequent repair and replacement necessary. Also, with the constant dry run practicing by the trainee gun crews who open and close the breech block continually, the dust causes the breech block threads to "gaul". It has been necessary at this post while using the M1916A1 (American) 75mm gun, to remove the angle of site worm bushing and the traversing arc about twice a year. This had to be done to remove the burrs and gauls caused by the emery action of the dirt. In spite of the fact that the 105mm Howitzer has been in this camp only a short time, difficulty has been experienced with dust getting into the threads on the gun tube and recoil mechanism ring locks, causing gauling of the threads.

The bottomless sea of mud,
Camp Roberts

The wide temperature variation for a twenty-four hour period makes it essential that air pressures of all pneumatic tires on Ordnance equipment be constantly checked, especially if on long road marches. It is also imperative that the recoil oil be checked frequently during firing, for often during the middle of the day it is necessary to drain off oil, and later the same day, add it again.

MUD MESA?

by V. K. Goodman,
1st Lt., Ord. Dept.



During the rainy season, constant check on all finished surfaces and gun tubes for rust and moisture must be made, and since the rain is almost continual in this period, it is no small job. Moisture gets into the counter recoil cylinder and on the counter recoil spring on the M1918A1 (American) 75mm gun. On the 155mm Howitzer, water seeps through the Bellville spring covers and into the axles. Moisture also penetrates into the M1918 Quadrant Sights, used by this Howitzer and the 155mm gun.

75mm Gun in Camp Roberts mud "dehydrated"

Even with the varied kinds of repairs that have to be made on approximately two hundred and fifty guns of the Field Artillery as well as all the small arms, the Ordnance service has had to deadline but a few

guns, and then only until unavailable parts could be obtained. No accidents or serious malfunctions incurred by lack of Ordnance supervision, have occurred yet at this camp. Without assistance from any maintenance company, the Camp Roberts Post Ordnance, consisting of two officers, twenty-one enlisted men and four civilian Ordnance machinists, handles all the maintenance and supply for the Field Artillery Replacement Training Center, the 75th Field Artillery Brigade and the Infantry Replacement Training Center. Before the recent completion of the Ordnance machine shop, a year's maintenance and repair work had to be done in the field and in temporary buildings. Continuous firing of the Field Artillery weapons under diverse weather conditions has presented manifold duties to the Ordnance Service.

THE ORDNANCE SERGEANT would like to receive one or two articles like this every month. What is happening in the field or in the way of Ordnance Maintenance? What difficulties do you encounter, and how do you solve them? And you don't have to be an accomplished writer to make your knowledge useful to others. If you know the facts, tell us about them. Tell us in your own words, and every effort will be made to present them to our readers in good form.

PHOTOS BY CORP. R. L. McCORMACK
F. A. PHOTOGRAPHER
CAMP ROBERTS, CALIFORNIA

ADDITIONAL

CAMP ROBERTS' PHOTOS

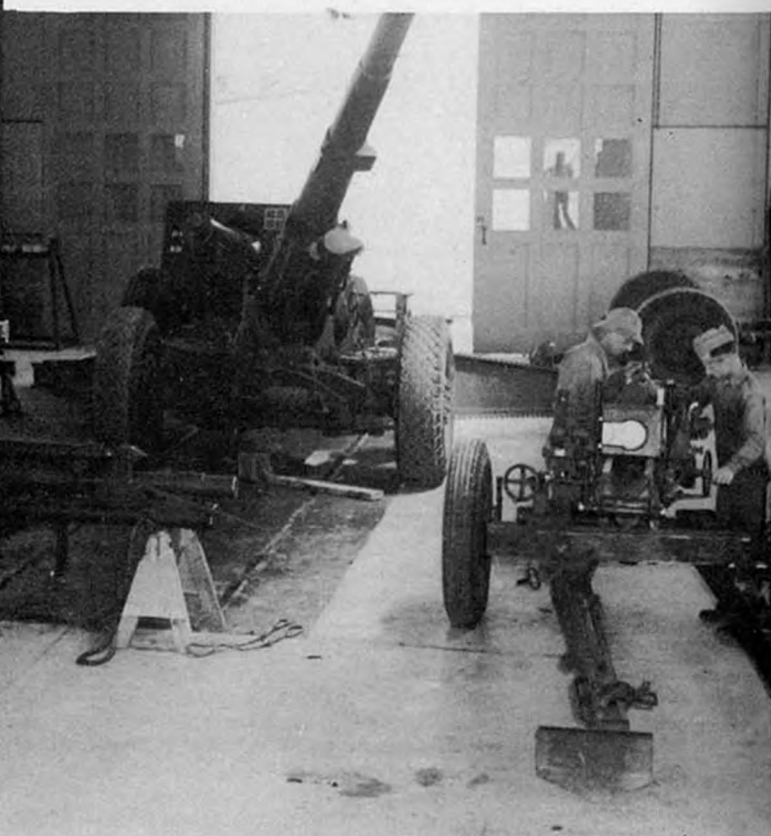
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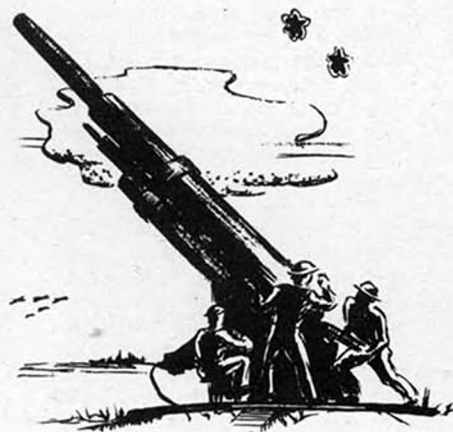


Typical day's activity in Camp Roberts Ordnance Field
Artillery Repair Shop



"OVER HILL, OVER DALE"





115mm Howitzer "stuck in the mud"



The fire control instruments and sighting equipment used by American artillery are the best that an inventive nation, fundamentally industrial minded, can provide. The efficiency and accuracy of our field artillery has been pointedly demonstrated on innumerable occasions. It contributed materially to the epic defense of Bataan and Corregidor. It wrought destructive havoc in the trench warfare of the first world war. Without doubt it will be a decisive factor in determining the outcome of the current conflict.

Here are shown a few of the instruments used by field artillery units of today for the computation and setting of firing data, and for observation. There are many other instruments, peculiar to weapons of varying model, too numerous to show in detail. The photographs shown here, however, are a representative cross section of the sighting and fire control materiel used by modern field artillery, the deadly accuracy of which is so necessary to victory in war.

EYES... FOR THE FIELD ARTILLERY



OBSERVATION

The Binocular, M3, is now the standard field glass for general observation purposes at medium ranges. It is used by scouts, noncommissioned officers, and officers. It may be used for the measurement of small horizontal and vertical angles. It is a six power stereobinocular and has a radius of stereoscopic vision of approximately 6,000 yards.



AIMING CIRCLE AND RANGE FINDER

The Aiming Circle, M1, above, is used for precision measurement of azimuth, either as measured from magnetic north (which is easily converted to map grid readings) or from a known reference point. It is also used for determining the angle of site of the target in relation to the gun or observation post. The one-meter-base Range Finder, M1918, at the right, is used for the estimation of range. It solves the range by optical means, using the triangulation principle, for ranges from 400 to 20,000 yards. It is easily carried in the field and readily adjustable in the combat zone by ordnance personnel.

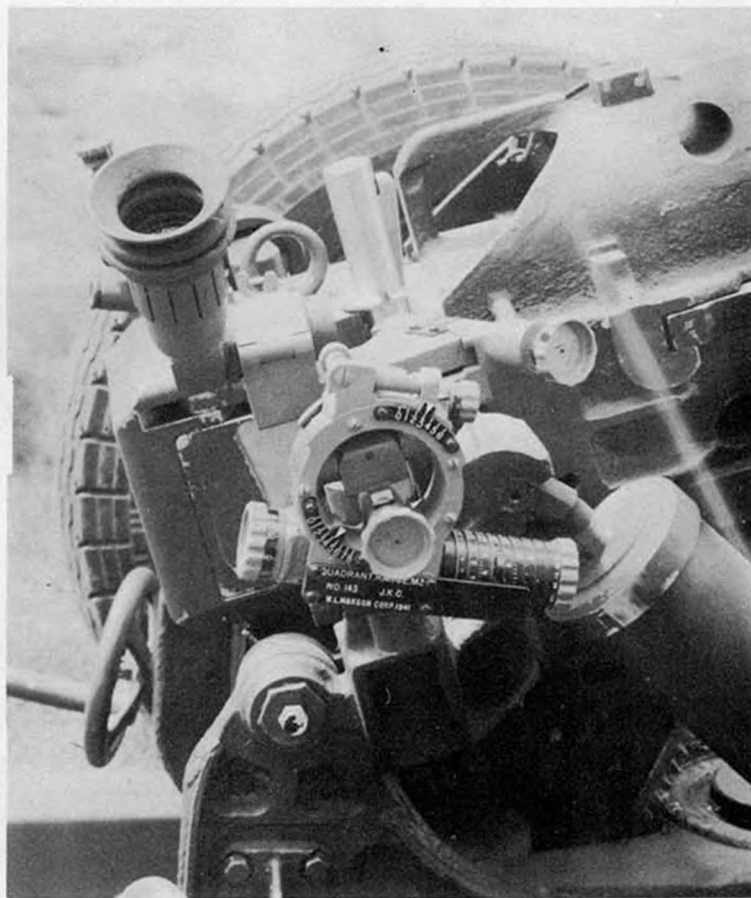
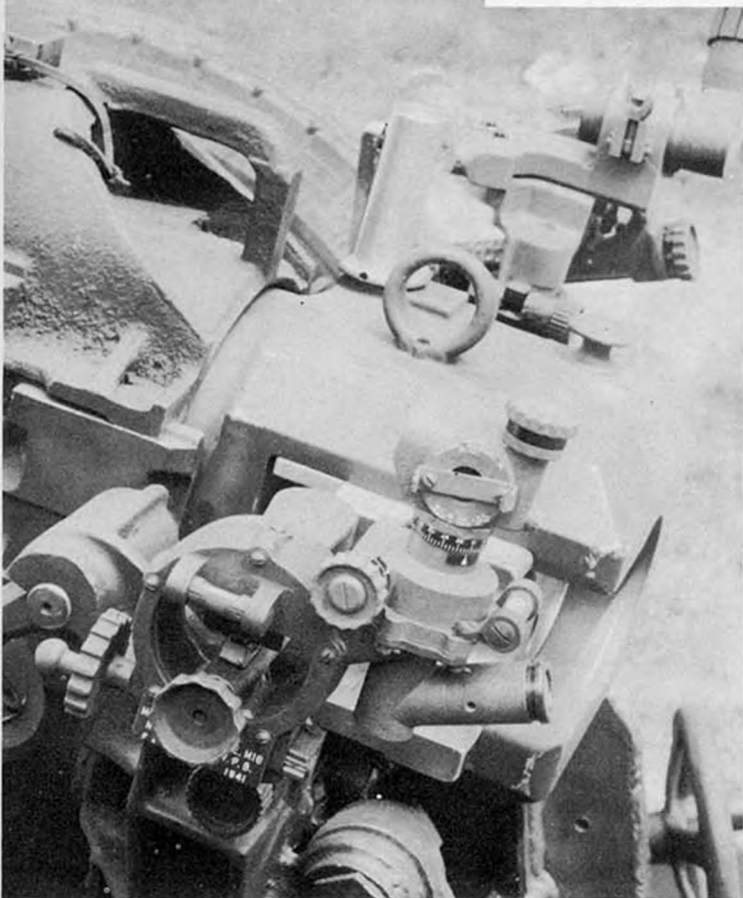




FIELD HOWITZER SIGHTING EQUIPMENT

The 75mm field howitzer is a compact and accurate artillery piece, requiring precision sighting equipment. The photos at the left and below show general views of its sighting equipment, while two photos lower on this page show close-ups of the same equipment.

The two photos below show close-ups of the sighting equipment on the field howitzer. On the left side of the piece is the panoramic telescope, M1, mounted in the telescope mount, M16. This panoramic sight is used to lay off azimuth or deflection for indirect fire. On the right side of the piece is mounted the elbow telescope, used for direct fire against armored vehicles or other close targets, and the range quadrant, for setting final range or elevation data on the gun.





COMPASS

The Compass, M2, is now the standard compass for field issue. Used as a compass it is accurate, dependable and rugged. It may also be used to measure angle of sight or set off clinometer readings or angles. A level and appropriate scales are provided for the last two purposes.



THE BATTERY COMMANDER'S TELESCOPE

The Battery Commander's Telescope, M1915A1, is an observation instrument particularly adaptable to observation of fire. It may also be used for the accurate measurement of azimuth and angle of site. Means are provided for estimating deviations between bursts and targets. The B. C. Telescope may be used as a periscope, as shown at the upper left, or in a horizontal position for maximum stereoscopic effect. In the latter position, as shown at the left, it has a maximum range of stereoscopic vision of approximately 50,000 yards. This is more than sufficient for the accurate observation of "overs" and "shorts" necessary to the accurate correction of firing data. This instrument lends itself readily to natural camouflage conditions, as shown at the upper right. It is a ten-power instrument, and is suitable for use under all conditions of modern warfare. It may be transported readily in the field.

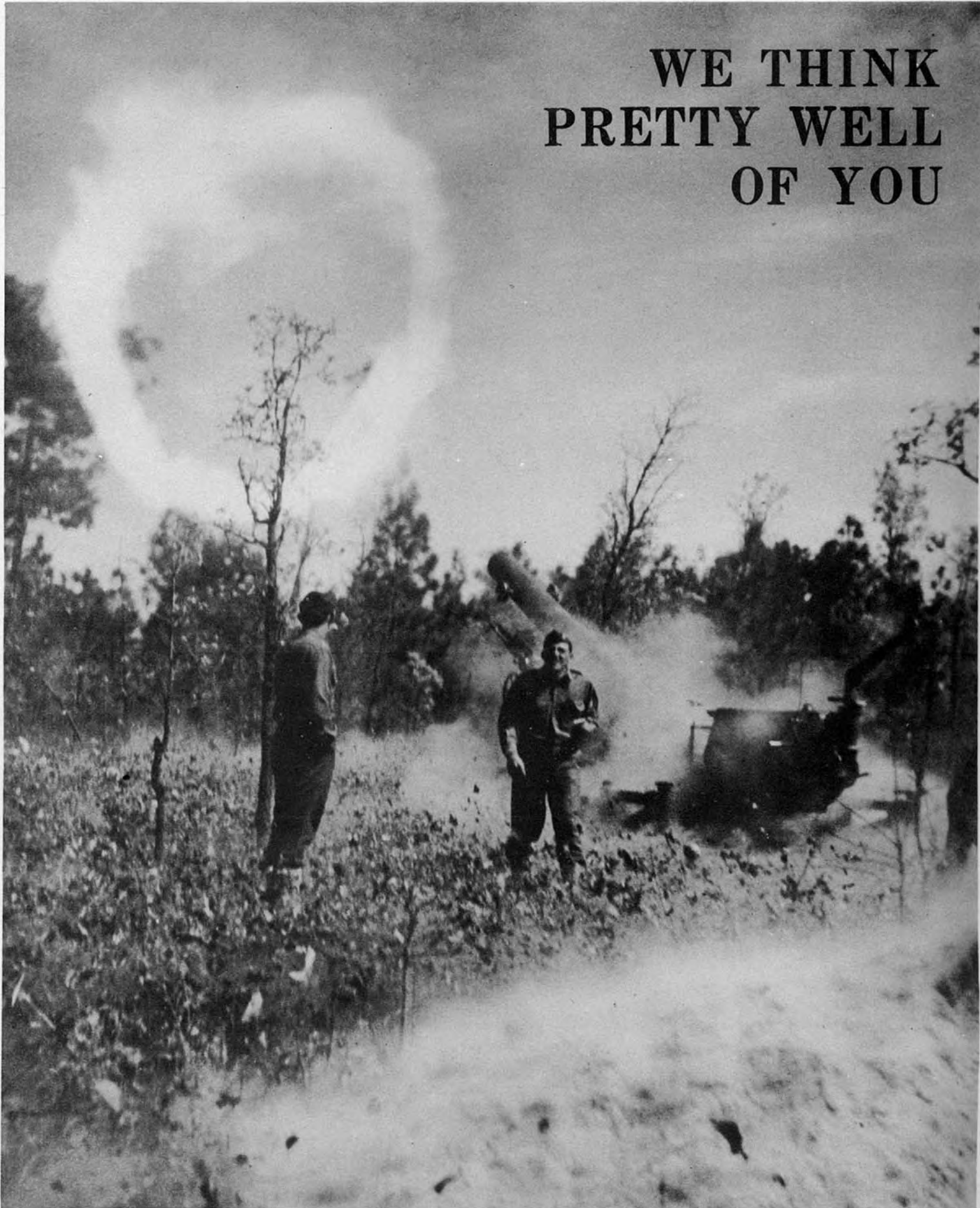
PASSING IN REVIEW AT FT. BLISS



Top: 82nd and 61st Field Artillery Battalions
Bottom: Headquarters Battery, 82nd Field Artillery Battalion



WE THINK PRETTY WELL OF YOU



PROV. F. A. BRIGADE PHOTO BY ROBINOVITZ

by Major Irving J. Newman

Fort Bragg Provisional Field Artillery Brigade

Or at least that seems to be the opinion of quite an assortment of artillerymen that were asked by the writer to give a frank opinion of the Ordnance Department. He didn't feel that the request for such an opinion by the editor of THE ORDNANCE SERGEANT was an invitation for all-out flattery; he felt perhaps that ordnance personnel wanted to know just what the cannoneers thought of them, favorable or otherwise.

But almost to the man, those interviewed felt that the men to whom they look for supply and maintenance of their guns and tractors and other fighting miscellany had a job to do, and did

it rapidly in an orderly and efficient manner with a minimum of confusion and maximum of cooperation. And their opinion of ordnance personnel is that they are a "pretty swell bunch".

Take for example the opinion of Pfc Charles P. Thrall, a gun mechanic in a heavy artillery regiment, who says:

"Every time we call on the boys over at the ordnance they are right there. Many times when they don't have the part I want, they go right to work and turn it out on a machine for me. They know I've got a tough job and they like to help me do it. I just finished one of their schools and I sure enjoyed it. Those instructors sure know their stuff".

Here's one time the 240mm Howitzer of the 79th Field Artillery was caught puffing out a smoke ring.

'THEY'RE A SWELL BUNCH BUT THEY
STICK TO THE RULES.'

Private Thrall added a warning, however:

"But when you go to the ordnance, be sure you have the right papers. If you haven't, don't bother to go. They stick to the rules."

Supply Sergeant Pleasant Gainey repeats that admonition:

"The Ordnance doesn't make you show them in the book where they have to do it — like the Quartermaster sometimes does; but sometimes they will show you that the book says 'no tickee - no laundry'. Be sure you've got those

A 155mm Howitzer in the 17th Field Artillery, a unit of the 13th F. A. Brig., barks and then settles back on its haunches. Notice how the dust and leaves in the front of the gun are whirled about by the blast.



13TH F. A. BRIGADE PHOTO BY KOENIG

papers in good shape. But if you've got the right papers and they've got what you want, they will go out of their way to help you - they are a swell bunch."

Major George E. Halliday has been a battery commander; he is now a brigade supply officer. His opinion is based on experience gained in both those jobs. He feels that ordnance officers for the most part are real human beings; they know that they have a job to do and they know how to do it. He recalls that on maneuvers he was off with his battery in an isolated woods; an ordnance truck located him, however ("Heaven knows how", says Major Halliday). Out jumped an ordnance sergeant, Maj. Halliday continues:

3 WHAT THEY EXPECT OF YOU

"He had an unpronounceable name, but he said he was there to take care of us, and that's exactly what he did - in very short order and with great efficiency. I think he is typical of ordnance men today. Certainly some of them, like men in other rapidly expanding branches of the

army, lack experience; but they try hard, learn quickly, and get results".

Major Halliday concluded by saying that his only complaint seems to be that sometimes the ordnance fails to anticipate the need for certain spare parts. Tractor parts are an example, he stated. Parts which wear out quickly and, therefore, are needed frequently, often must be ordered by the ordnance from factory or stock house because they are not carried on hand. Major Halliday suggests a more careful study of stocking of parts that are likely to be needed.

Praise from the battalion commander's standpoint comes from Lieut. Col. John D. Salmon. Among other things in his battalion are twelve big guns and fifteen heavy tractors, to say nothing of a few hundred carbines, pistols, and a desk basket full of ammunition requisitions. Col. Salmon illustrates his feeling for the ordnance with two examples. In one case a heavy gun limber was broken on a night problem. Emergency repairs by the battery were impossible. The ordnance arrived soon after it heard of the trouble, worked all night, and had the gun moving before daylight.

"Who in the world", says Col. Salmon,

"could do a job like that except the ordnance? Anyone else would have waited until daylight, arrived sleepy eyed and poorly equipped, and then told us we would have to take the gun to their shop to get it fixed. The ordnance, however, thrives on the seemingly impossible".

The other example involved in a gun in which the recoil nuts had not been properly secured when it was put in position by a squad of recruits. When the big gun was elevated, it slid back off the cradle.

"If our men had tried to put it back," said Col. Salmon, "they might have experimented for several days before they found a way to lift it back. But when I notified the ordnance, one of their colonels quickly arrived, looked at the trouble, sent for the necessary tools and personnel, and the gun was carefully and efficiently jacked back into position without damage to the tube."

Perhaps the best opinion, or at least one that sums it all up, comes from a first sergeant who had best be left unnamed:

"I think it's a [!#!] good branch of the service. I wish I was in it."



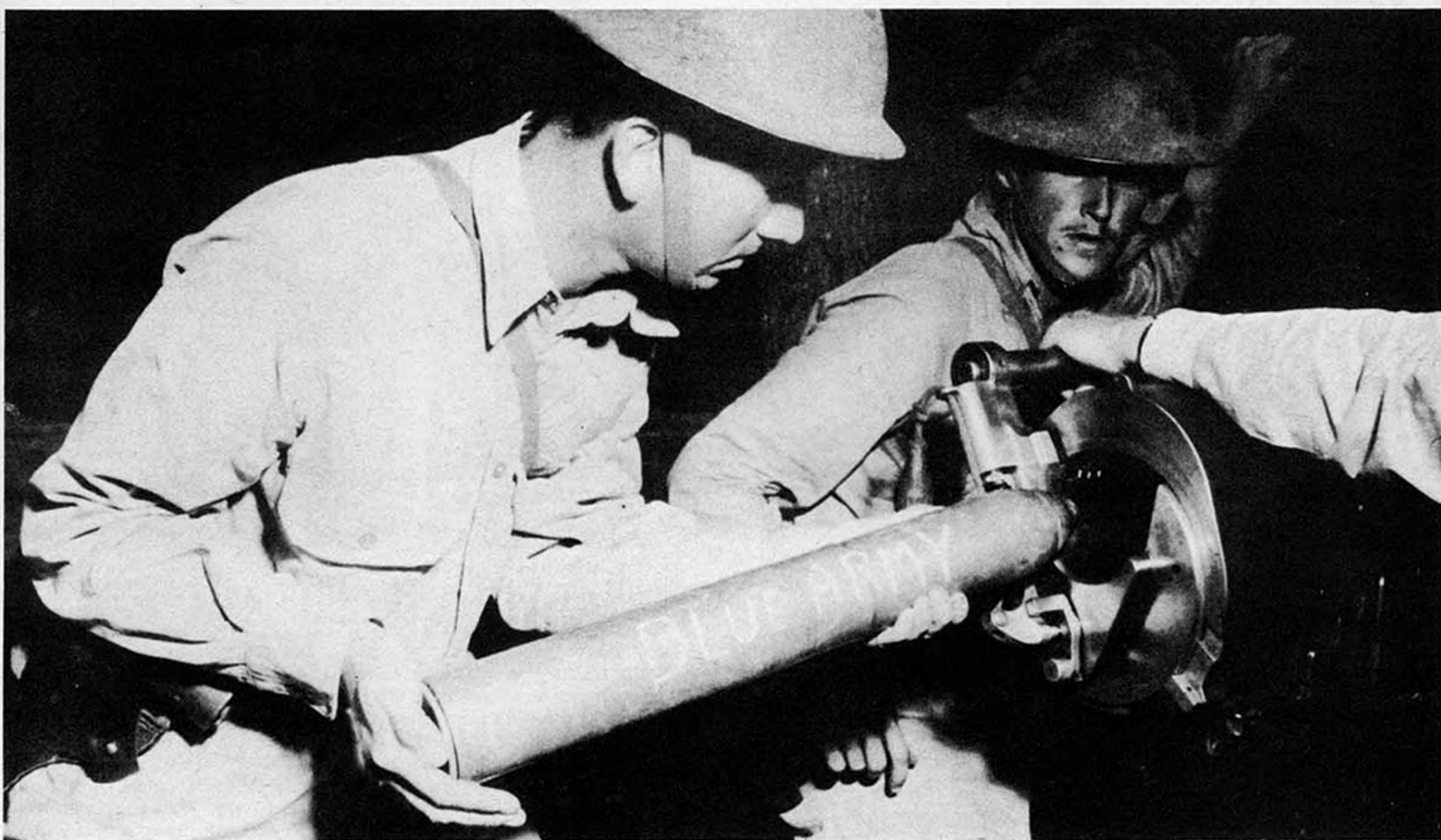
Horse power plus man power at Camp Roberts

"BE PREPARED"

Many scenes similar to these were enacted during the maneuvers of last fall and early winter as our fighting forces engaged in "play" warfare in preparation for the grim struggle which has now become a reality. The top photo shows Battery C, 68th Field Artillery with its 75mm Howitzers, which are towed by half-tracks, in firing position, during the First Army versus Fourth Army Corps Maneuvers in South

Carolina, November 13, 1941. Below, during the Third Army versus Second Army Maneuvers in Louisiana, the largest maneuver ever held by American troops in peace time, Private George Helfrich loads a 75mm gun with a message from the Third Army reading "FOR BLUE ARMY". These same scenes are now being reenacted with the "play" element for-

PHOTO BY U. S. ARMY SIGNAL CORPS.



ORDNANCE ACTIVITIES OF THE FIELD ARTILLERY SCHOOL



Fort Sill Military Reservation, the home of the Field Artillery School of the United States Army, is located on the border of the picturesque Wichita Mountains in the southwestern part of the State of Oklahoma.

Group from Battery Officer's Class conducting fire on the range.

Originally established as a cavalry Indian protective outpost a few years after the termination of the Civil War, Fort Sill has had a long and continuous history as an Army reservation, growing from a small stone stockade, which is still in a fine state of preservation, to a large government military institution covering many thousand acres and representing an investment of millions in permanent buildings and equipment.

The Field Artillery School, known as the "School of Fire" to the veterans of the last World War, was established in 1911 with a small group of artillery officers enrolled for a three months' instruction course.



Recently completed building housing the Materiel Department. Field Artillery School, Fort Sill, Oklahoma

Stretching out over a vast area of undulating terrain, Fort Sill affords an excellent opportunity for the Ordnance in conjunction with the Field Artillery School to test out all the multiple varieties of field weapons and the characteristics of different types of ammunition used.



Lt. Col. D. C. Kelly and Lt. Col. W. L. Coughlin standing in front of a new 155mm M1A1 recently assigned to the Field Artillery School Materiel Department.

There was a spring class and a fall class conducted each year with an average attendance of approximately twenty (20) officers in each class. This procedure ran on until the beginning of the World War when the apparent need for an intensified training course for new Field Artillery officers asserted itself. During that period, the School expanded rapidly, both in number of students and materiel. The French 75 was introduced in this country during this period and succeeded the three-inch Field Piece as the principal weapon of Field Artillery. The guns were imported to this country from France and French Artillery officers were

'To Maintain a High Standard of Efficiency'

sent over to Fort Sill for instructional purposes. Naturally, the Ordnance Department contributed its share to this tremendous growth, in providing the necessary equipment and maintaining it in good condition for School Service. Some 2500 student officers passed through the ten-weeks' wartime course, and many of these men today are prominent in directing the Field Artillery arm of the Service.

The School itself fulfilled completely such a definite purpose during the 1917-18 period in teaching Field Artillery officers the practical handling of artillery equipment and artillery fire,

by Hughes A. Barnard

Major, Ord. Dept.

Post Ordnance Officer

Camp Chaffee, Arkansas

that it became a permanent institution and has become highly departmentized for full productiveness in turning out well-trained and efficient Field Artillery Officers.

Fort Sill has many functions to perform in this service to the arms program now being intensely conducted throughout the nation. Here is the receiving or reception center for this area where enlisted men and selectees are brought in and classified. Many of these new men in the Army are transferred almost immediately into training for Field Artillery units through an adjacent part of this large camp area. This latter section is known as the Field Artillery Replacement Training Center. In this same cantonment area is the Officer Candidate School where young prospective Field Artillery Officers work strenuously and earnestly through a twelve weeks' course, eagerly anticipating a second lieutenant's commission upon successful completion, with an opportunity for an immediate transfer and assignment to Field Artillery units throughout the many camps in the nation.

However, greatest of all units in this enormous training center is the Field Artillery School where knowledge is gravely and seriously



Reconditioned pieces ready for service on the range

imparted to Field Artillery Officers of all grades, with the weekly incoming classes for Battery Officers predominating in size of enrollment. This is a twelve-week's course, and upon completion each officer receives a certificate of graduation. Paralleling this course is the Battery Mechanics Course which gives the enlisted man a full twelve weeks' program of training in the service and repair of motor equipment and Ordnance materiel as pertains to maintenance operations permitted in Field Artillery Units.

Predominantly, Fort Sill is Field Artillery, and a full and interesting chapter could be written about the fine organization of Artillery officer executives and instructors who have been carefully selected to carry on the work so vitally necessary to procure the proper training for men who may shortly be facing combat service in the field. Brigadier General



A group picture showing the activity at the School of Fire during World War I

George R. Allin, Field Artillery, as Commandant, is completely in charge of all School activities and all regiments of Field Artillery attached to the School for use in tactical and field firing problems. These units are equipped with all types of light, medium and heavy Field Artillery weapons, some batteries having as many as 15 units to care for, and the personnel are well trained in the service of every piece of equipment.

The Materiel Department of the School, ably directed by Lieut. Col. W. L. Coughlin, Field Artillery, occupies an important part in the instructional program. This Department gives the student officers a full study course in the design and construction of all Field Artillery Ma-



One of the recently completed units in the Ordnance Area, Fort Sill, Oklahoma

teriel, and Field Artillery Ammunition. Practical work in disassembly and assembly of all units and the adjustments of sighting and laying equipment is included in this course. A new building has recently been completed for the proper housing of these activities.

Naturally, the coordination between the Ordnance and the Materiel Department in the School is very close, with Ordnance furnishing all necessary equipment. The staff of instructors in the Materiel Department is entirely composed of Field Artillery Officers and enlisted men, giving the utmost in cooperation to the Ordnance Department. The materiel furnished by Ordnance is well handled and seldom, if ever, requires any attention or adjustment; this equipment, of course, is not used in active field service on the firing range.

One of the principal services of Ordnance to the Field Artillery School is the procurement and maintenance of sufficient weapons for the School service batteries and the proper distribution of ammunition each day for range firing activities.

Due to the preliminary training of enlisted men, which takes place at the Field Artillery Replacement Training Center and the Officer Candidate School, the Ordnance Department has a normal round of activity which occurs at any training camp. To this at Fort Sill must be included the Field Artillery School responsibility in supplying weapons and many thousand rounds of ammunition daily, which are expended on the range.

In taking up the subject of ammunition, a large stock of all types for every kind of weapon must be maintained at all times. For the storage of this ammunition, a large magazine area has been established on the post with building facilities at the present time sorely pressed to take care of the larger quantities of ammunition so vitally necessary for war-time training.

Ammunition is issued daily to batteries firing on the range. Unspent ammunition is returned each evening so that all possibility of fire or explosion hazard is eliminated from the post except in the magazine area itself. This work is very efficiently handled by the 601st Ordnance Company (colored) assigned to Fort Sill for this specified purpose. Ammunition is issued out beginning at 6:00 a.m. each morning and returns are seldom completed before 10:00 p.m. in the evening. A careful check is maintained on the issuing of all lot numbers and any difficulty occurring is immediately reported and the particular lot is restricted from further use until a thorough investigation has been completed. Accidents have been very rare considering the tremendous amount of ammunition fired daily on the range.



A 155mm Howitzer in action on the firing range.

Batteries in service for the school make their own adjustments to weapons and equipment, such as are permitted according to Field Service Regulations. Once a year, or on any occasion where a request is made, each Battery is thoroughly inspected by the Ordnance organization and a complete record of the inspection is written up and filed. Recommendations are made in the report as to whether adjustments should be made by the battery mechanics or turned over to the Ordnance Department for overhaul and rebuilding. For this purpose, a competent corps of civilian mechanics are maintained in the several departments set up for repair of all ordnance property on the post. These function under the direct supervision of an experienced Ordnance Armament Foreman and consist of a Machine Shop, Gun Shop, Instrument Shop, Small Arms Repair Shop, Paint, Leather and Carpenter Shop. New buildings under construction and recently completed have expanded facilities somewhat commensurate to the pressure of war-time needs.

There is also a matter of maintenance and repair of all tractors and truck equipment on the post coming under Ordnance supervision. This is handled through an Ordnance service shop where facilities are adequate to turn out any repair up to and including major overhauls.

A large warehouse built in the peacetime year of 1934 is maintained for the purpose of handling shipments, transfers and the storage of spare parts. A complete bin system has been installed where parts are carefully arranged according to S.N.L. groups and a perpetual inventory system is kept active which prevents surpluses accumulating and permits rapid handling of all requisitions and transfers of materiel.

Ordnance activities at Fort Sill come under the competent and able direction of Lieut. Col. D. C. Kelly, who recently has been detailed here, although he is no newcomer to the post, having served at Fort Sill previously from 1929 to 1934, and at that time supervised the construction and established the efficient system now being used in the warehouse.

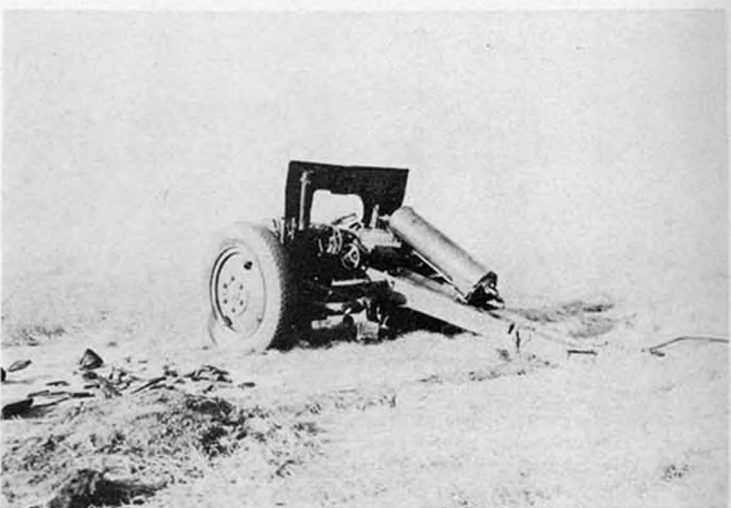


One of the early French 75's brought to this country for instruction purposes at the Fort Sill Reservation

Many of the men employed in the shops are ex-soldiers, having served principally with Field Artillery units and having long records of enlistment behind them. Veterans of the service are given preference, although many younger men are taken in and trained to become good armament mechanics. The instrument shop where the finest of precision workmanship must be maintained, now keeps eleven skilled men actively engaged in repairing and reconditioning all the fire control and optical instruments on the post.

A strict liaison is maintained at all times between Ordnance and the Field Artillery School activities. Office space is provided in the Administration Building of the School where a non-commissioned officer and clerical staff are kept constantly on duty for the purpose of coordinating activities, making up schedules for all ammunition requirements several weeks in advance and keeping an accurate record of all ammunition consumed, both through the Field Artillery School and the Officers Candidate School. Ordnance activities at the Field Artillery Replacement Training Center are handled by an Ordnance Detachment, separate from all School activities.

In conclusion, let us say that Ordnance service at Fort Sill is of great importance due to the wide variety of problems encountered and the fact that all materiel is subject to constant use through an intensive training program. The Ordnance policy here is dedicated to service for the Field Artillery School and its many components, and Field Artillery policy can be described as a fine spirit of cooperation toward the sincere efforts of the Ordnance Department to maintain a high standard of efficiency of all Ordnance equipment.



Caused by a premature burst in the bore. The tube fractured at the end of the reinforcement hoop. Fortunately, neither the gunner nor the #1 man were seriously injured.

Major Barnard agreed to write this article while stationed at Fort Sill, but was almost immediately transferred to Camp Chaffee. At his new station, however, he generously continued the agreement.

AT RADFORD ORDNANCE WORKS

Radford Ordnance Works, at Radford, Virginia, is the scene of varied activities, including the testing of ammunition manufactured and packed there. On the Proving Ground there, because of the limited area available, a 450-foot tunnel has been built into the side of a nearby hill. In testing, projectiles are fired into this tunnel, 155mm and 105mm guns being used in most cases. In the chronograph room some distance away the results of this testfiring are automatically recorded on instruments.

At the right, Bruce Wall, gunner, is shown firing an 81mm Trench Mortar, during testing activities at Radford.

Below, a number of different artillery weapons used for testing purposes at Radford are shown. Left to right: 155mm Gun M1, on Carriage M1; 155mm Howitzer M1917, on Carriage M1917; 105mm Howitzer M1A1, on Carriage M2; 75mm Gun M1897, on Carriage M1897M1; 37mm Gun M3, on Carriage M4; 37mm Gun M1916, on Carriage M1916.

PHOTO BY U. S. ARMY SIGNAL CORPS.



The Field Artillery thinks a lot about the Ordnance, and a lot of it. Constituting a big percentage of the customers of that wholesaler and retailer, we should and do know a great deal about the merchandise, and a great deal more about the service given in other ways.

If we don't always get what we want, we really have ourselves largely to blame. We have always opposed, and always will, a system whereby the Ordnance privately produces some gadget and then hands it to us with 'Take it and like it' on the delivery slip. However, that system is in the discard, and for many years we have had our say as to what is wanted and how it is to be made. If our materiel is not perfect, we evidently failed to do our share in its development, for the Ordnance has certainly tried to meet our specifications.

We have our full armament, 155mm howitzers, 105mm howitzers, 37mm antitank guns, 50-cal. machine guns, revolvers and rifles. We still desire our carbines, in lieu of the somewhat clumsy rifle, and hope they will be forthcoming at an early date.

Our fire control instruments are complete, if not all of the newest model. The problem facing the Ordnance in the procurement of optical glass and the manufacture of lenses is familiar to most of us, so we are not complaining.

We need ammunition — lots of it. With cadres to train, a constant influx of new men and officers, and facing actual battle, we must fire our weapons if we are to be able to carry out in practice the theories we study so long and hard. With the meager allowances we have been receiving lately, the sight of a service round causes as much excitement as does a square meal in Italy — a state of affairs which must be corrected if our artillery is to be fully prepared for its role in war.

Each of us has wondered, at some time or other, why some inexpensive type of practice ammunition has not been developed. Perhaps there is some good reason, but if production of a cheaper round would increase our allowance, it would do incalculable good in our training, save the high grade stuff for battle, and, on the face of it, please everybody. It is worth a thought now, when one considers the tens and hundreds of thousands of field artillerymen to be trained.

"DON'T SKIN US...HELP US!"

While a lot depends on the individual with whom we deal, we get excellent cooperation and service from our Ordnance people in maintenance and repair. Nor are they averse to building for us gadgets and such that we hope and think will help us in our job, or make our materiel function more efficiently. The field services have a much clearer idea of why things happen and what is needed than have the office people. No criticism, but we hope the office gang cocks an attentive ear to the words of our division ordnance personnel, for they will learn much that will be useful in present operation and future design.

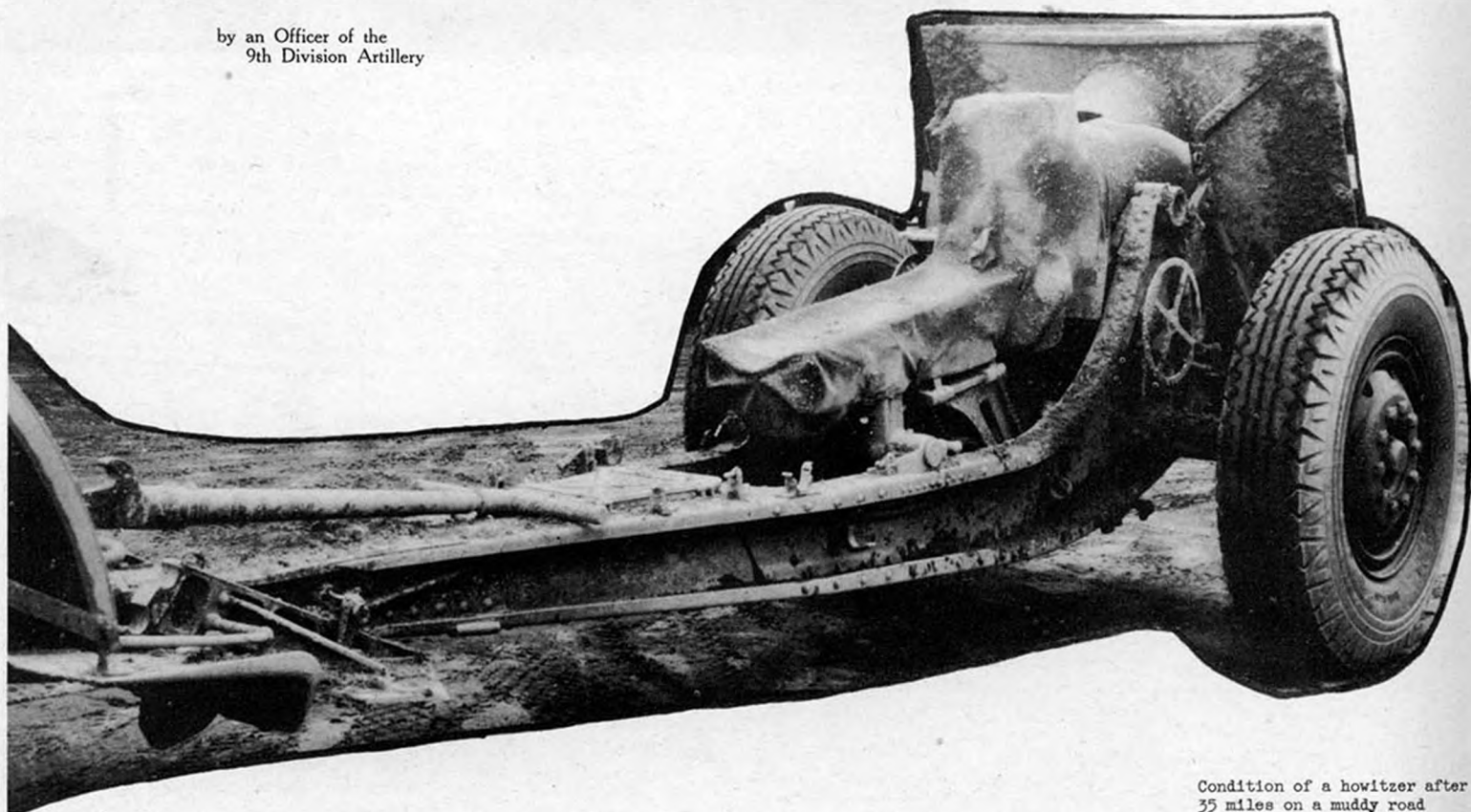
As a matter of fact, the engineers and designers should come out in the field with the troops and the guns to get the real picture. That is the only way they can really understand why this thing breaks too often, and that is cursed by its users. Pilot models and bugs are close relations, and it takes a lot of work to find the pesky insects and eliminate them. The experts and the troops, working together in actual field operation can certainly expedite the process.

We are as anxious to maintain our equipment properly as you are to have us do it. You can help us in many ways. Make frequent informal visits to the gun parks, and check our maintenance. If the proper standards are not being maintained, tell us what should be done, and how to do it. Don't skin us. Help us. Provide schools for mechanics, particularly on new types of materiel, and teach them exactly how best to handle their jobs. If appropriate, assist battalions in conducting schools for chiefs of section, who are responsible for the materiel, and who must be thoroughly familiar with its use, adjustment and care.

In conclusion, we think our Ordnance equipment is good, and that you are giving us the help we need in keeping it serviceable. We fondly believe that it is possible to produce a better model of every item in the book of standards, and hope that you think so too, and work unceasingly to develop, test and produce it. We are in for a long war, and there will be time to provide us with equipment superior to anything dreamed of. We won't be satisfied with equipment as good as that of our enemies. We want it to be definitely better in every way, and we look to you to get it for us.

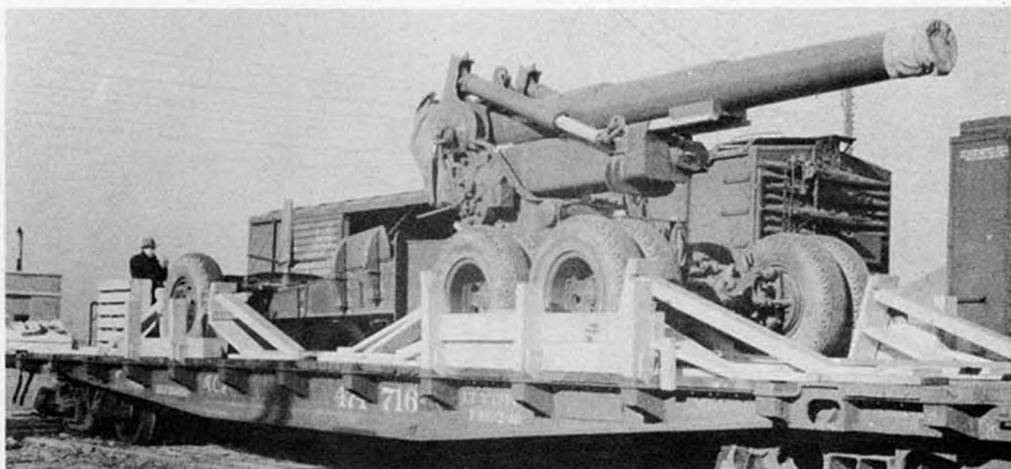
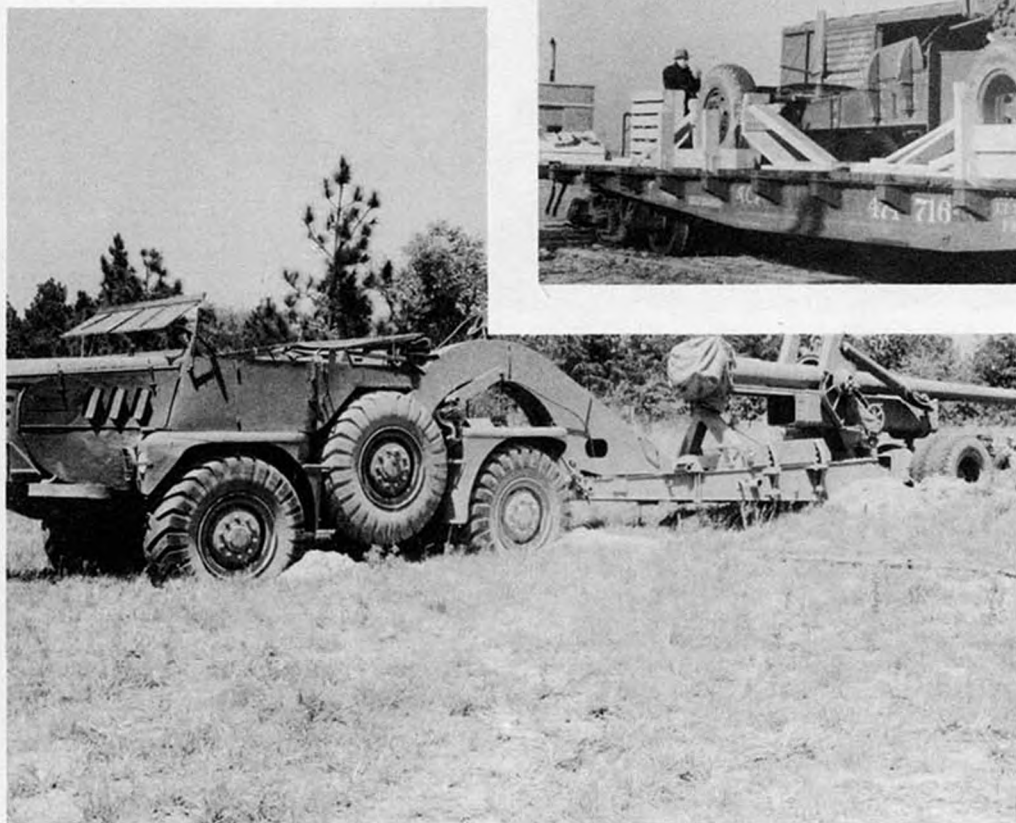
OUR ORDNANCE EQUIPMENT IS GOOD

by an Officer of the
9th Division Artillery



Condition of a howitzer after
35 miles on a muddy road

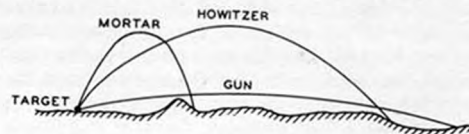
Right: Blocking of an 8" howitzer on a flat car. Below: Walter, 4x4, Heavy Prime Mover, towing a 155mm Gun, M1. The truck has just crossed an old gun emplacement. Trails of the carriage bearing on the ground have resulted in a heavy pull.



WHAT'S THE DIFFERENCE?

On this page are pictures of the gun and the howitzer. What's the difference?

GUN (Anglo-Saxon, gonne, machine for throwing missiles) is a term somewhat loosely employed to describe several widely different varieties of firearms and, more particularly, relatively long-barreled varieties. Among the larger firearms, gun is the designation of the long-barreled rifled weapon which, on account of their stronger construction, permitting higher chamber pressures, and consequently greater



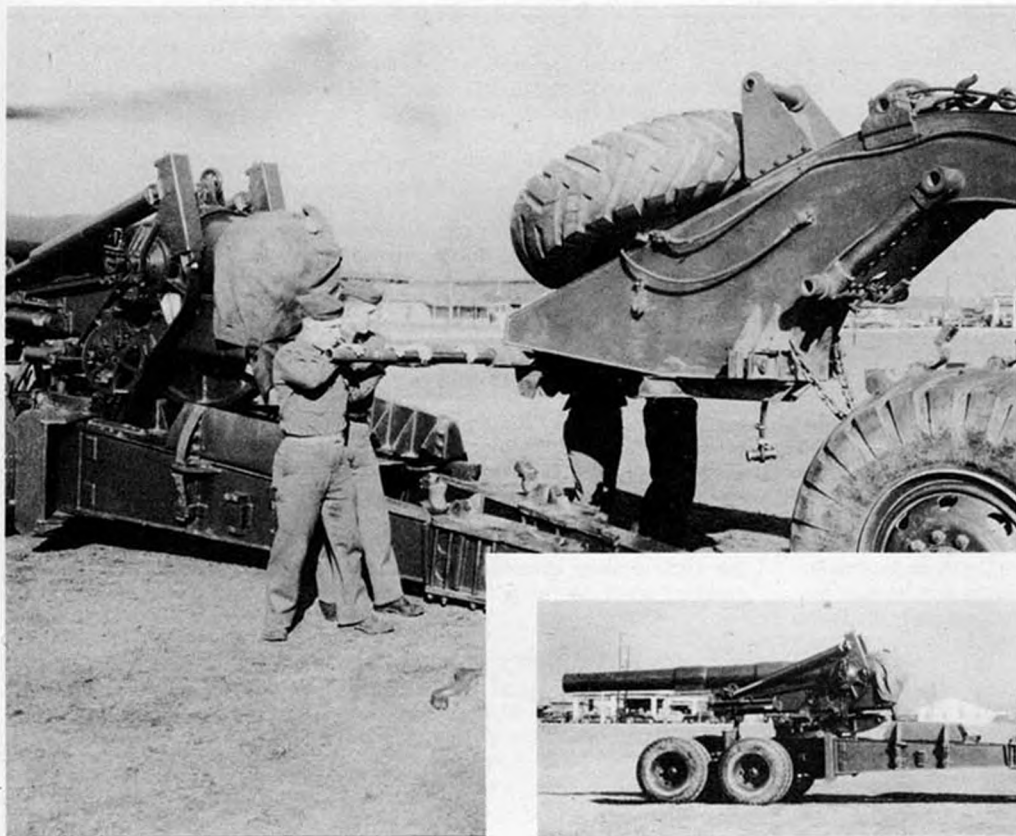
muzzle velocity of the projectile, are able to throw the latter a greater distance with a comparatively flat trajectory in contradistinction to the more lightly constructed howitzers which, though they may throw a projectile of equal or greater weight for similar calibers, work at lower pressure, have a shorter range, and attain this by a very steep or high trajectory.

HOWITZER (through the earlier forms howitz and hawbitzer, from the Bohemian houfnica, catapult). A weapon having a comparatively short barrel and discharging heavy projectiles at a low muzzle velocity, consequently firing at a high angle of elevation to attain the desired range.

A MORTAR, which usually employs a trajectory higher and steeper than that of the howitzer, is shown on page 25. Whereas both

(Continued on page 35)

Below: Oshkosk Heavy Prime Mover coupled to an M1 8" Howitzer. Left: Operations in uncoupling the equipment shown below, with the goose neck being lifted from the trails, held in place by four men.





In traveling position, being towed by a six-horse team

HORSE ARTILLERY IN MODERN WARFARE

By Hobart G. Gillespie, S. Sgt., Ord. Dept.

Even with the development of cross-country and mobility characteristics of the modern military vehicle, light horse artillery still has its place. It is true that there aren't many places left where a 6 x 6 or a "jeep" can't go — providing it is dry, but this is not always the case. After seeing a few pictures of the Russian Front of last Spring, one is readily convinced, as were both the Russians and the Germans, that even the best vehicle is no match for mud. As a consequence, Cavalry and Horse Artillery were used in many of the major battles fought on that front last spring. The ability of Horse Artillery to negotiate mud and mire practically goes without saying. The statement, "Not

WHERE vehicles can't go, but WHEN they can't go" aptly describes Horse Artillery.

Another advantage of Horse Artillery, as far as mobility is concerned, is its ability to move with ease under black-out conditions. A horse never had headlights, so it is no problem for him to travel in darkness. If the rider knows the general direction of his objective, the horse's inherent instinct and ability to see more in darkness than a human will get them both through.

The mission of Horse Artillery is the direct support of a unit; the 75mm Pack Howitzer M1A1 being seldom used for assault or AT work.

Since the demolition characteristics of 75mm arms are not great enough to be effective against a point target; an area target is the usual objective. To scatter their shots over a large area will cause the enemy to take cover, thus putting their small arms and machine guns out of action long enough to allow the friendly troops to advance to new positions. The fact that a trained battery of 75mm Pack Howitzers can get into action in about two (2) minutes, together with the design of the pack howitzer which presents a low silhouette, enables them to work well up on the front, their average range for that type of work being from three to four thousand yards. Any ditch or gully is a gun position since the pack howitzer is cap-

When Sergeant Gillespie submitted this article he started something. "Is horse artillery on the way out?" Sergeant Gillespie says definitely that it is here to stay in spite of motorization and/or mechanization.

When Mr. McComas, the foreman of The Ordnance School Reproduction Plant, first saw this article and some pictures of horse artillery, he remarked that he supposed horse artillery was almost a thing of the past. But after he thought a minute or two he waxed enthusiastic about the advantages of horse flesh over steel. Here are some of the points he mentioned:

The horse will start in any kind of weather without priming or choking and whether or not it contains fuel (food) at the time.

The horse needs rest occasionally, but he doesn't depend upon a supply system to keep him going after he leaves his base of operations. Therefore he can keep going, even though at a slower rate of speed than a motor vehicle, even if he leaves the entire remainder of the army behind.

The horse can find a meal on almost any hillside or in almost any valley. He can fill his radiator with water from any stream or pond. Neither the food (fuel) nor the water must positively be free from foreign matter in order to prevent clogging or fouling of his interior mechanisms.

Even if the rider or driver of a horse becomes too weak from exhaustion, starvation, or for any other reason, to steer continuously, the horse can and probably will get him to his destination, picking a passable route and avoiding obstacles.

If worse comes to worse, the driver can eat the horse as a last resort, and according to some reports there are foods less palatable and nutritious than horse flesh.

Mr. McComas would rather be lost in a wilderness with a horse than with a truck or a tractor.

While opinions may differ on the subject, an interesting question was thus raised. "Is horse artillery on the way out?" The question is interesting from several angles of an Ordnance viewpoint. The presence or absence of motor vehicles affects the maintenance problem. The method of locomotion certainly affects the treatment which will be received by the weapon, and thereby changes the maintenance problem. The motorized unit moves faster per hour but not necessarily faster nor farther per day. The question of maintaining contact with the artillery unit must be considered. An Ordnance vehicle can follow the route of an artillery vehicle, but it might not so easily follow in the path of horse artillery. The question of ammunition supply cannot be forgotten. Although the final delivery of ammunition to the using battery is an artillery problem, the Ordnance service is interested in the subject. So, both the horse and the vehicle have advantages and disadvantages. It is a two-sided question which has been disputed for years and remains unanswered.

THE ORDNANCE SERGEANT wondered how opinions might vary on this question. A number of individuals were asked to give spontaneous answers. They will be found on the next page. Certainly they will not determine the future policy of the War Department but they are interesting — and well worth the time it will take to read them.

"NOT WHERE VEHICLES CAN'T GO, BUT WHEN THEY CAN'T GO"

able, with the use of zone charges, of firing over a house and dropping the projectile on the other side.

After the initial objective has been gained,



On the firing line

a battery of 75mm Pack Howitzers can go out of action in about three (3) minutes, hence the advancing unit has direct close-range artillery support no matter how rapidly the front advances. This also provides a unit fighting a delaying action effective artillery support because of the ease and speed a Horse Artillery unit, such as a battalion of 75mm Pack Howitzers, can go in and out of action.

From the Ordnance maintenance viewpoint, little criticism can be offered about the design of the 75mm Pack Howitzer. To begin

with, it is a sturdy and well balanced artillery piece — in fact it is so well balanced that two men can move it into position with little effort. The



An example of what can happen on the battlefield

M3A1 high-speed carriage can be towed behind a truck at a high rate of speed to a new sector of the front should the tactical situation demand. This sturdiness is necessary in Horse Artillery, for the guns must at times be towed over rocks, stones, ditches, and other hazards that would normally stop a truck. The absence of large castings in the carriage is another feature of the 75mm Pack Howitzer; hence a welding torch can effect many repairs that would be impossible on most guns of similar calibers.

Despite the predominance of the tank, the airplane, and other motorized equipment in this war, Horse Artillery remains a vital part in any army. The Horse Artillery snorts and forges



The rest of the pieces

THE ORDNANCE SERGEANT isn't inclined to jump at conclusions, but it is curious about the matter of getting stuck in the mud. In this issue more than one illustration shows artillery stuck in the mud — motorized artillery. Does horse artillery get stuck in the mud? Don't people take pictures of such difficulties? If you have a picture of horse artillery stuck in the mud, THE ORDNANCE SERGEANT would like to have a copy of it. A brief account of the occurrence would prove useful, too.

ahead dragging guns and caissons over jagged and mountainous country, through mud and swamp and across steep rocky slopes that will always defy mechanized steel.



IS HORSE ARTILLERY ON THE WAY OUT?

At Fort Myer, Virginia, Captain R. M. Hood, Post Ordnance Officer, put the question to two Field Artillery officers. Captain T. R. McAndrew furnished this statement in writing, over his signature.

"Is horse artillery on the way out? Hardly, when one considers snow, slush and mud. Ever watch a truck negotiate in three feet of mud? Compare that with the noble well-fed Artillery Horse and hairy Cannoneer. Ask the Germans. Their use of horses in Poland wasn't due to a gas ration card system."

And then Captain McAndrew, in a verbal answer to Captain Hood, said: "Yeah, with cavalry divisions and special mission troops, GHQ."

Lieutenant Ross Woolsey answered: "Horse drawn, no, but horse artillery will always have a place. The new mechanized artillery can go any place that the horses used to pull the pieces."

Captain Hood then asked for the opinion of an old-timer sergeant, who replied, "It has taken me fourteen years to find out that trucks can do the work of horses, and I don't care if we ever have horses again."

To this last remark Captain Hood wrote the editor, "That sounds like treason to me."

At Fort Bragg, N. C., there was quite a difference of opinion, with some good points brought out on both sides. According to Lieutenant William J. Greene, Jr., Assistant Officer, who handled the questioning, the officers quoted hold key positions in Field Artillery organizations, and are better qualified to answer this question than the average Field Artillery officer. Still they disagree.

A Lieutenant in a horse artillery outfit:

"There are two points of view on this question. Some say that the horse artillery is on its way out, and some say that it isn't. Our outfit right now is being motorized. It is true that there are places the horse can go that a vehicle cannot, and until recently it was thought that the horse could not be done away with. But with the jeep, reconnaissance cars, etc., being built definitely for the Army, vehicles which have proven their value, the use of the horse is becoming more limited each day."

A Lieutenant in a pack artillery outfit (but formerly with horse artillery):

"There is still a place for the pack artillery in that it can go places where vehicles cannot. The Japs showed this in going through jungles, swamps, etc., near Singapore. Our outfit can go through a smaller place than a horse artillery outfit, and is consequently of more value than the horse artillery. Although I was formerly in the horse artillery, and have a very warm spot in my heart for the horse artillery, I feel that its uses are becoming less and less with the advent of vehicles like the jeep that can go places which we never thought could be traveled by a motor-driven vehicle."

A Lieutenant now engaged in testing Field Artillery equipment, and who was formerly in a motorized artillery outfit:

"Horse artillery is definitely on the way out, as far as being used overseas is concerned, and its only use here will be with the cavalry along the Mexican border."

A Major in a motorized outfit:

"I feel that there will always be some (Continued on page 55)

ARTILLERY AMMUNITION SUPPLY

By Lieutenant Colonel H. D. Kehm, F. A.

(Reprinted by permission from the Field Artillery Journal)

It is not necessary to indicate to field artillerymen the importance of ammunition supply, for they all realize that cannon without ammunition are just so much expensive hardware on the battlefield. However, it is always well to recall that tremendous quantities and tonnages are expended in action.

In the World War the 1st Field Artillery Brigade in one day fired some 14,000 rounds of 75mm ammunition weighing roughly 180 tons, and 3,550 rounds of 155mm ammunition weighing about the same amount. General Bishop reports that the artillery support in the battle of St. Mihiel was furnished by 667 batteries of over 3,000 guns, including 26 calibers and 49 models, firing 75 kinds of ammunition. For this battle, 3,300,000 rounds of ammunition were provided, of which about 840,000 rounds were expended. The 75mm ammunition brought in weighed about 24,000 tons and that supplied for the 155mm weapons weighed some 55,000 tons. Cargo space requirements for the ammunition of these two calibers, expressed in modern terms were 79 railway ammunition trains, or 26,000 2-1/2-ton trucks, each with a 1-ton trailer.

In the history of the 6th Field Artillery there is a report that one battery fired 1,500 rounds (about 19 tons) of 75mm ammunition in one hour.

METHOD WITHIN AN ARMY

Supplying the required amounts of the proper kinds at the right time and place requires good organization, careful planning, and thorough execution. In a field army, the ammunition supply system functions in the following manner: Based upon estimates of requirements made by the army artillery officer, GHQ authorizes the issue of credits to the army to cover a given period of time. Detailed instructions worked out by the army G-4 in collaboration with the army artillery officer and army ordnance officer provide for the establishment of army supply points, which may be depots or simply rail (truck) (navigation) heads. The number of supply points depends upon the tactical situation, the terrain, the rail and road net, and the amount and distribution of the artillery. Two supply points per corps are normal; these establishments are stocked and operated by ordnance ammunition companies or detachments. Distributing points for particular divisions and for corps artillery may also be established.

Constant collaboration between the three officers above-mentioned is necessary to assure that the several supply points are properly stocked to meet the needs of the units they serve. Stockages are made to fit expected needs, as determined from records of allocations of credit and ammunition reports returned by artillery units.

The army artillery officer recommends the allocation to the army artillery and to the corps of the ammunition credits made available to the army. He may initially hold a portion of the credit as a reserve. Allocations of credits should show the amounts and kinds of ammunition made available, the period the credits cover, the supply points from which they may be secured, and any special instructions as to distribution.

The corps artillery officer likewise allocates to the corps artillery and the divisions the credits granted to the army corps. The division artillery officer in turn repeats the process. The army corps or the division may establish distributing points or dumps or both, forward of the army supply points if the situation indicates need for them; but the current belief is that supply direct from army depots or railheads will usually be the most practicable.

Army corps and division quartermaster trains carry such items as the corps or division commander prescribes, and some cargo space for artillery ammunition could be allotted; however, the consensus of

Recently THE ORDNANCE SERGEANT devoted considerable space to "Organization for Ammunition Supply", this problem being discussed on the basis of approved Ordnance Department policy.

This article, reprinted with permission from the FIELD ARTILLERY JOURNAL, discusses the problems and responsibilities of those customers whom we serve with our "Organization for Ammunition Supply". It should be understood that it presents the viewpoint of the consumer rather than that of the supply agency. It is presented as a comparison of two viewpoints which must always be closely related.

opinion seems to be that the commander who does so will be an avis rara indeed. Thus it follows that no transportation other than that within artillery battalions is earmarked for artillery ammunition transport and that the haulage problem forward of the army supply points is normally an artillery job.

Last July, Training Circular No. 42 prescribed a rather elaborate system of supply within the division. Briefly, it provided for a system of check and control through a division ammunition office (DAO) established (by the division ordnance officer) forward of the supply points. Most artillerymen encountered this phenomenon in the recent maneuvers, so little discussion of it is needed. Many officers feel that the plan is unduly complicated and results in a waste rather than a saving of time and effort.

Regardless of details, the principle is that the ammunition trains with proper authority proceed to the designated supply points, are loaded up, the issue is checked off against the credit of the drawing unit, and the trains "take it away".

AMMUNITION SUPPLY PRINCIPLES

The fundamental principles which govern artillery ammunition supply are those which control supply in general, but some additional ones need special mention.

The first of these is that normally the only reserves of ammunition carried within any artillery command are the amounts carried in the battalion ammunition trains. There are no organic artillery ammunition trains in units above the battalion. Furthermore, as we have noted, the artillery cannot count on any cargo space in corps and division quartermaster trains. It is possible that when GHQ reinforcing artillery is made available to certain commands, some ammunition transport may come with it. Here again, however, there is nothing certain about this.

The second is that supply is normally by credits. This means that a given quantity of ammunition is made available for a given unit at a given supply point to cover a given period of time. For example, the III Army Corps may be informed that it has a credit of 5 units of fire of all classes at First Army Ammunition Supply Point No. 3 for the period 6:00 PM 1 Jan. to 6:00 PM 4 Jan. Undrawn portions of credits revert to the command which allocated them. It is important to note that the time element enters into a credit. Very frequently ammunition instructions in map problems and maneuvers indicate that a certain unit has a credit of a given amount but fail to show a time limit. It should be obvious that an artilleryman who knows he has a credit of say 2 units of fire but does not know whether that credit is to cover one day or one week, is in no position to make an intelligent plan of artillery support.

Third, the ammunition supply of an artillery unit must be so arranged that the unit may displace with its normal loads intact. Analysis shows that the amount of ammunition which it is estimated will be expended from a position must be brought to that position prior to displacement. If the ideal is attained, the unit can displace with its normal load intact and leave no unexpended ammunition in its old position. Incidentally, when an artillery element is forced to abandon ammunition, it should inform the next higher artillery commander of the location, quantities, and types of ammunition abandoned.

A fourth fundamental is that artillery normally hauls its own ammunition from an army supply point to battalion positions. It should be noted in this connection that this does not mean that battalion ammunition trains must always go to an army depot, as the army may establish railheads or truck heads in front of its depots. Under certain circumstances, corps and even divisions may establish dumps or distributing points; and supply of the battalions may be effected from them. Thus, a division or corps operating on the side of a river away from army supply

points would often set up dumps and DP's on the near side of the river. It is believed, however, that under average conditions the artillery will be able to supply itself from points relatively far to the rear. It should be noted that there is an increasing tendency both in foreign armies and in our own maneuvers to use truck trains and truckheads in ammunition supply, as opposed to rail movements terminating in depots or railheads. When truckheads are used it is important that they be located where hard standings are available. British reports indicate that this matter was sometimes neglected to their sorrow in the campaign in France.

A corollary of the above is that only ammunition transport is used in ammunition supply. It is not contemplated that prime movers and wire trucks, for example, be used in ammunition supply — only the battery 5th sections and the battalion train vehicles are available for this purpose. Of course we all realize that in case of necessity we will use our prime movers, the battalion or battery commander's car, or anything else we can get our hands on, under the principle that "when you've got to go, you've got to go." However, as motor vehicles which are used excessively break down very quickly, and since an artillery piece with its prime mover miles away is exceedingly immobile, the use of prime movers in ammunition supply (as for any other stray purpose), should in the light of common sense be limited to actual emergencies.

A further corollary is that within artillery units ammunition transport is pooled when such action will facilitate supply. For example, within the battalion, it is frequently advisable to pool the battery 5th sections with the ammunition train rather than to have those battery trucks remain idle or operate independently in supplying ammunition. Sometimes it will even be desirable to pool the transport within the division artillery or within a brigade. It is quite likely that in most cases division artillery commanders and brigade commanders will regulate the resupply operation of their subordinate battalions very closely.

A seventh principle is that commanders and artillery officers are responsible for the ammunition supply of elements under their command or control. Specifically, the features involved in this responsibility are:

1. To estimate ammunition requirements for forthcoming operations.
2. To recommend sites for ammunition supply installations.
3. To allocate such ammunition credits as are allotted to the unit.
4. To disseminate information to the subordinate units covering such items as:
 - a. Quantities available.
 - b. Periods covered by the allocations.
 - c. Places from which the ammunition is to be drawn, and any restrictions as to time during which the ammunitions may be drawn.
 - d. The times at which ammunition reports are to be made.
5. To supervise operations. This includes specifying quantities to be dumped at gun positions and giving special instructions concerning the care of ammunition at gun positions. It also entails responsibility for estimating the transportation requirements for executing supply and making requests to higher authority for additional transport when the need thereof is indicated. It likewise includes regulating the operation of the ammunition trains, organic or attached.
6. To render reports of expenditures. The supply services base the restocking of depots and other ammunition supply installations on the reports of quantities expended and on hand as reported by artillery units. These reports are initiated by batteries, consolidated in the respective artillery echelons, and copies are furnished to the appropriate ordnance officers and G-4's.

THE PRINCIPLES APPLIED

With these general principles in mind, let us see how they apply specifically to the various echelons of artillery command.

Field Army

It should be clear that an army artillery officer finds the first four of chief concern to him. Even if his army is not the echelon which is to execute the operation, it will nevertheless be definitely concerned and hence he will have information of the plans as they are formulated and developed. Therefore, his task will be to make the estimate for his army in the light of these plans. This estimate must go hand in hand with one covering the requirements in weapons. The artillery officer must analyze both the tactical and logistical situation as it can develop and then recommend requests for the necessary ammunition credits to cover all or one phase of the operation. Such an estimate must be more than a

simple statement that five units of fire are needed to cover the period dark 1 June to dark 3 June; that will be sufficient for a general picture of transportation requirements but it will have to be supplemented by data giving the various calibers and kinds required and information as to how much should be furnished as a mobile reserve, how much should be stocked at depots or railheads, and the rate of flow of the ammunition to the army ammunition supply points.

As the army is the basic supply echelon of our field forces and is charged with establishing ammunition supply points, including depots, and since it is believed that battalion ammunition trains will generally haul directly from army installations to the battalion position area, it follows that the army artillery officer can materially facilitate ammunition supply by making timely recommendations for the location and movement of ammunition supply points and designating the units to be served by each of them.

The army artillery officer must apportion between the army artillery and the army corps the ammunition allotted to the army. This allocation must reflect their relative needs as determined by the tactical situations, and should be made as far in advance as practicable to facilitate the preparation of plans of fire by subordinate artillery commanders.

Artillery officers frequently may place in the hands of their commanders a powerful tool for influencing the course of an action if, initially, a proportion of the ammunition credits is not allocated but retained as a reserve to be allocated later as the situation develops. While this appears to be a sound principle, in echelons as high as the army the picture of prospective actions should be sufficiently clear to make the retention of an ammunition reserve unnecessary.

So far as the duty of disseminating information is concerned, the army artillery officer's chief concern is informing subordinates of the allocations made to them, the places and times at which the ammunition may be drawn, and giving instructions as to ammunition reports.

An army artillery officer supervises ammunition distribution only in a general way. He may be able to anticipate calls for additional transport and facilitate its assignment when and if it can be made available.

His interest in ammunition reports is on the receiving end. A careful check of the status in the various units will enable him to shift credits, ask for changes therein, and influence the rate of flow. Tactically, this knowledge will facilitate decisions as to the assignment and changing of missions of the subordinate elements.

Army Corps

The army corps artillery officer will have all the specific duties involved in the previous discussion when his corps is operating independently; otherwise his responsibilities, although covering the same general field, will be considerably restricted. For instance, he may usually be expected to make estimates only as a matter of assistance to the army artillery officer. He will less frequently be called upon to recommend sites for ammunition installations, except when dumps or distributing points are set up for the corps artillery.

His activities regarding allocation of ammunition are exactly the same as those of the army artillery officer. Not only will he be called upon to apportion the ammunition between the divisions and the corps artillery, of which there may be considerable, but generally he will also retain an initial reserve, as discussed above. Any reserve retained must be reallocated judiciously and in ample time to permit hauling it so that the primary purpose — placing it in the hands of the units which can make the best use of it — can be accomplished.

His duties in the dissemination of information and supervision of supply operations are similar to those of the army artillery officer.

His headquarters is in the chain of reports. Like the army artillery officer, he can gain considerable information of logistical and tactical value from these reports. Our current doctrine calls for the consolidation of ammunition reports in the corps prior to their transmission to the army. Since this is bound to take some time and serves no vital purpose, some observers suggest that consolidation should cease above the division (brigade) and that the army corps should simply pass on the division reports together with a consolidated report for the corps artillery. The merit in this proposal lies in not only that it saves time,

(Continued on page 53)

F. A. REPLACEMENT CENTER



This 37mm gun crew from Battery D, 7th Battalion, 3rd Regiment, is seen in its well-concealed gun position in the Training Center's camouflage area.



No horses pull this 75mm gun of the 1st Training Regiment. The men just load it onto a truck and speed away.

— FARC PHOTOS BY

FT. BRAGG, NORTH CAROLINA



The 37mm gun crew works swiftly and efficiently in its camouflaged location. The men are members of battery D, 7th Battalion, 3rd Regiment.



Battery C, 13th Battalion, 4th Regiment, is seen as it loads up for an overnight road march. The men, trainees in the gun and general mechanic battery, are in full pack; a weapons carrier carries a machine gun, and a 2½-ton-truck pulls a 105mm howitzer.

SGT. JOHN BUSHEMI

IN THE NICK OF TIME

Based on a report submitted by
Major H. Barrows,
Ordnance Officer,
Ft. Ethan Allen, Vt.



The howitzer is laying at the roadside.



If at a future date a history of the ordnance activities involved in the current war effort is written, it must of necessity include the stories of many small incidents and activities which have added much to the experience and final efficiency of ordnance units.

As an example, suppose we observe an occurrence at the Jericho, Vermont, Artillery Range in April, 1942. An artillery unit has been firing on the range. It is under orders to leave Fort Ethan Allen three days later to engage in maneuvers. As we stand by the roadside watching the various units return from the range, our attention is attracted to one particular vehicle. A truck is towing a 155mm Howitzer, M1918A1. The weather is dry and visibility is good. The vehicle is traveling on a dirt road at a speed of approximately thirty miles per hour; it starts to round a curve but something happens. To the driver and his companions it must seem that an earthquake suddenly struck their vehicle. There is a sudden upheaval, the truck lunges forward, there is a loud crash, then all is quiet.

Clambering out of the truck the personnel are amazed to see that their howitzer is laying at the roadside, still attached to the truck, but upside down and in a condition which they are almost afraid to investigate.

There is no apparent explanation for the accident. The tires were checked in the morning before starting to the range. A check after the accident shows that the tire pressure remains unchanged. The gun brakes were tested before starting out in the morning. The gun acted in an ordinary manner while in use at the range. Before leaving the range the brakes were again tested and found to be satisfactory. But there the howitzer lays, apparently badly damaged.

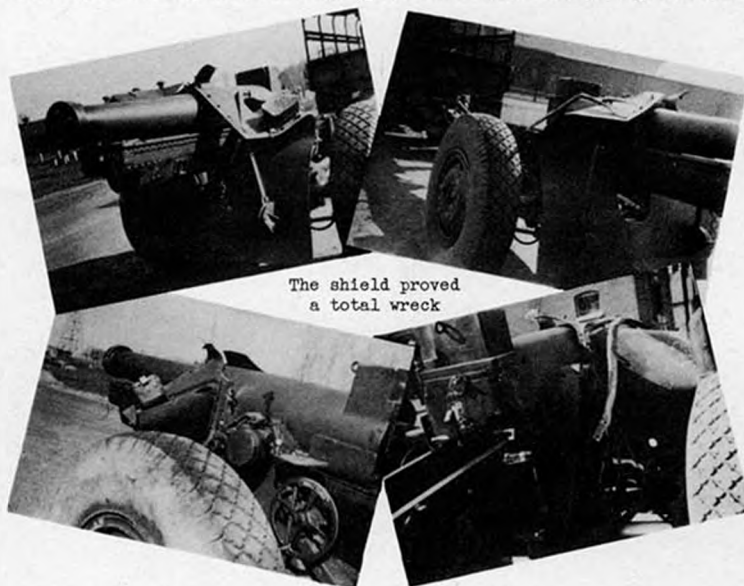
Other vehicles with other personnel, of course, arrived quickly. Another truck was driven out into the field. A cable from a winch was attached to the far hook on the bottom of the carriage at right angles to the gun. With the gun still hooked to the truck, the overturned weapon



The overturned weapon was righted

was righted. Because the ground was soft it bounced very little, and no additional damage was caused by this operation.

The shield proved a total wreck. The axle was bent rather badly. Braces, of course, were also damaged. After a hurried survey the wea-



The shield proved a total wreck

pon was towed back to the Post behind the truck. One of the brake connections had come off but was replaced, and the only readily apparent difficulty in towing was a slight shimmy of the wheels.

At the Post Ordnance Shop, after careful consideration was given to all the factors involved, it was decided that repairs could be made in the three days remaining before the artillery unit was due to leave for maneuvers. The time factor and the cost of repair were the two outstanding items to be considered. In all probability at least a week would have been required to procure parts, so that solution was out of the question. The axle was so badly bent, however, that it had to be replaced. The shield was put back in shape by press and the cold method rather than applying heat. All other parts were welded and repaired, and the gun was turned back to the using service in three days after entering the shop. Thus, the reputation of ordnance personnel was upheld and the Field Artillery was enabled to carry on with its training program.

The following summary of the costs of repairs as they were actually performed and as they would have been if all parts had been replaced may be of interest.

Summarized account of Cost of Repair:

48 hours Civilian labor at \$1.06 per hour	\$ 50.88
1 Axle assembly at \$141.06	141.06
Acetylene, oxygen and Misc. items at \$2.00	2.00
TOTAL COST OF REPAIR	\$193.94

To Replace parts, instead of repair:

1 Axle assembly	\$ 141.06
2 Brace, Shield	40.00
1 Brace, Shield Diagonal, R. H.	7.80
1 Brace, Shield Diagonal, L. H.	7.80
1 Shield Assembly	492.56
TOTAL COST OF REPLACEMENT:	\$ 689.22

TRIED AND TESTED

(Continued from page 5)

perience data involving the factors of caliber, pressures, rate of fire and method of manufacture of the tube, remarkably accurate estimates of wear have been furnished. Using methods of accurately measuring to 1/500,000 of an inch our weapons are star gauged here, detecting the least amount of wear and distortion during and after proof testing.

True to the habits of all soldiers, we of the Field Artillery will do our share of growling and griping, but we can have no serious quarrel with the care and thoroughness in testing and proofing our guns as practiced at Aberdeen Proving Ground, nor with the opportunities offered of having our say about it during the process of their design and development.

WHAT'S THE DIFFERENCE

(Continued from page 27)

the gun and the howitzer are breechloading, the mortar is muzzle loading.

Bear in mind that the statements made here refer to normal usage. The gun can be fired at a high angle of elevation as well as the howitzer; for example the antiaircraft gun usually does fire at a high angle of elevation. However, high angle fire is usually reserved for either the howitzer or the mortar, with the exception noted. Under certain circumstances, for example because of terrain, a mortar may have a greater effective range for a specific situation than either a gun or a howitzer. In his article on page 28 Sergeant Gillespie states that the 75mm Pack Howitzer can fire a projectile from a position on one side of a house so that the projectile will drop close on the other side, by means of zone charges. No doubt Sergeant Gillespie stretched the facts somewhat in order to stress his point, for the maximum elevation of this weapon on the M1 mount is 45°, and almost any charge capable of expelling the projectile from the bore of the weapon would send it a greater distance than that specified.

Don't overlook the significance of the word "comparatively" as it is used here. And note that the sketch is intended to show the comparative trajectories of these weapons.

KEEP 'EM FIRING!

DON'T SAY "NO"

Frequently THE ORDNANCE SERGEANT finds it advisable to ask organizations and offices for material for publication. This issue is an example. Much of the feature material in this issue would not have been possible without the cooperation of offices and individuals. Their assistance is appreciated.

While the Ordnance School has for many years been the seat of actual Ordnance educational facilities, it cannot be assumed that all Ordnance knowledge is located in that institution. Basically, that might be true. Actually, because of wartime conditions, it must be acknowledged that a great deal of the latest Ordnance knowledge is that which is being acquired by Ordnance personnel in the field. As an example; the Ordnance Department has been interested in tanks for many years. Conscientious efforts have been made to learn as much as possible about them. But it is a fact that an American tank had never been engaged in actual combat until a few months ago when they received their baptism of fire in northern Africa.

It is not difficult to believe that those individuals who were in Africa at the time soon learned things about American tanks which they could not have learned elsewhere. Of course, it is not expected that personnel in Africa has either the time or the facilities to tell us all that they have learned. But — individuals who are still in the States are also acquiring knowledge of many things. That knowledge will be helpful to other individuals, but only if it can be gotten to them. Probably the best means available for transferring that knowledge from one man to another, except locally of course, is through the pages of THE ORDNANCE SERGEANT.

When we ask you for information, don't say "NO". Your refusal must be passed on to several thousand readers, and although they may not realize it, they have missed valuable knowledge which you could have passed on to them.



Elsewhere in this issue is a discussion of "Horse Artillery in Modern Warfare", accompanied by several brief discussions of this "horse and buggy days" use of horse artillery as compared with the more modern adaptations of the same weapons. The 75mm Pack Howitzer receives special attention in Sergeant Gillespie's article on page 28. On the page at the right are pictures of this weapon and of another which is similar to it. Above is shown the 75mm Pack Howitzer, M1, on the M1 carriage. This is the weapon which is intended for animal transport when the going is rough. Below, the 75mm Field Howitzer is shown on the carriage M3. In these weapons the tube and recoil mechanism is identical, the principal difference being found in the carriage mounting, which includes, of course, the equilibrators.

The cover picture also shows the 75mm Field Howitzer in an action photo which indicates that it is quite adaptable to horse transportation. The carriage shown may be either the M3 or the M3A1, the latter including a modification of the traveling lock which cannot be seen in the picture.

On this page an ultra-modern use of the 75mm Pack Howitzer is shown. Above we see the weapon being fired (with blank ammunition) under what would appear to be ordinary circumstances, except for the

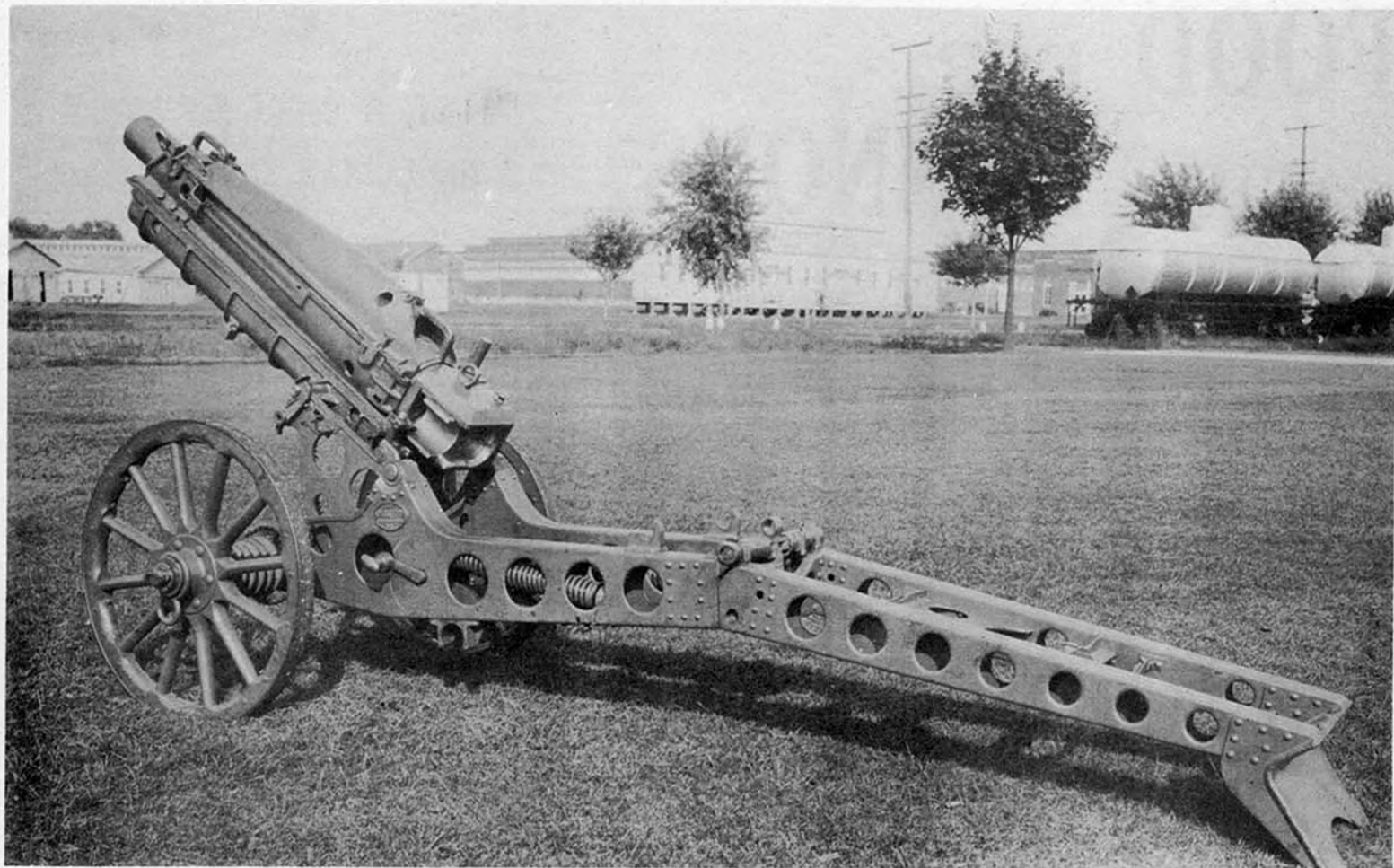
OUT OF THE SKY!

costumes of the members of the gun crew. The reason for these costumes is shown below in two photos. At the left the barrel of the weapon is being unpacked from a parachute in which it has been dropped from a speeding transport plane. Other parts, as well as the gun crew, were also dropped by parachute. After being unpacked from its chutes, the parts are carried at a run, as shown at the right below, to be assembled at a selected spot, and the weapon is firing within six minutes after it strikes the ground.

The carriage shown for this purpose appears to be the M1, modified by the use of special wheels intended to ease the manual movement of the weapon after it is landed and assembled.

Wouldn't all this give a conscientious and faithful artillery horse (or a pack mule) the jitters?





FOOD FOR THE CANNONS

by

Henry B. Barnet, Jr.,
2nd Lt., Ord. Dept.

Generally, a "round of artillery ammunition" consists of the projectile with all the components necessary to propel it from the piece and function it at the desired point. The components are the primer, the propelling charge, the container (cartridge case or bags) for the propelling charge, the fuze, the booster, and the filler in the projectile.

Since the firing of the first shot from a cannon, much time and effort have been expended in the improvement of these components with the result that, at present, the artillery of all modern armies is equipped with projectiles, fillers, and fuzes of scientific design, and powders with which to propel them with the proper velocity for required ranges.

Artillery was first used mainly against fortifications for the purpose of breaching the walls for the passage of foot troops in the attack. Because the hand weapons of the defending forces were crude and of short range, the cannon of the attacking force could be emplaced at close range. There was, therefore, no need for long-range fire and artillery was put into position in front of the foot troops. With the development of shoulder weapons of increased range and accuracy, it became necessary for artillery to seek positions at greater distances from the opposing forces and in the rear of friendly troops, in order to avoid neutralization by enemy small-arms fire and possible capture in the event of a repulse.

These conditions called for greater range and power, which, in turn, necessitated improved projectiles and propellant powders. The assignment of special missions to artillery brought about the development of special ammunition with which to accomplish these missions.

Following is a discussion of the development of the several components of artillery ammunition to meet the varying needs of the service.

DEVELOPMENT OF PROJECTILES

Early projectiles fired from cannon were iron darts wrapped with leather, of a size to fit the bore. These continued in use up to the 16th century, when they were replaced by spherical shot. One example was roughly rounded stone balls chosen because of their cheapness. Forged iron, bronze and lead balls were tried but expense prevented their general adoption. Further, as the heavy metal shot necessitated the use of a correspondingly large propelling charge, too great a demand was made on the strength of the feeble pieces of the period. This frequently caused rupture of the cannon. Stone shot being about one-third the weight of those of iron, the powder charge was reduced in proportion, thus effecting an additional economy.

Both iron and stone shot occasionally were covered with lead, both to preserve the interior of the bore (by reducing the friction) and to afford a closer fit between the shot and the bore, thereby bettering the obturation (preventing the escape of the powder gases around the projectile) and thus increasing the muzzle velocity and range. Hollow projectiles filled with explosives or combustibles, and variations of canister, appeared during the 16th century.

From the beginning the demand for greater and greater range has influenced the shape of the projectile. Toward the end of the 16th century cannon shot was made of cast iron and was spherical in form. The spherical projectile was inefficient ballistically, that is, erratic in flight. Because of the crude methods of manufacture, a tight fit could not be obtained between the projectile and the bore of the cannon. Its rough surface increased the air resistance and, by virtue of its shape, it presented a maximum surface to air resistance for its weight; nevertheless, the spherical form continued in use up to the advent of rifled cannon about 1860, when projectiles were elongated to a cylindrical form with a pointed nose.

The amount of air resistance depends upon the size, shape and "presentation" of the projectile; upon size, because of the number of air molecules to be displaced by movement of the projectile; upon shape,

because of the important effect it exerts on the manner in which the molecules are shouldered aside. (See Figure 1.) "Presentation" affects both the number of air molecules displaced and the manner in which they are pushed aside. A projectile of two feet in diameter displaces four times as many molecules as does a projectile of one foot diameter, since the

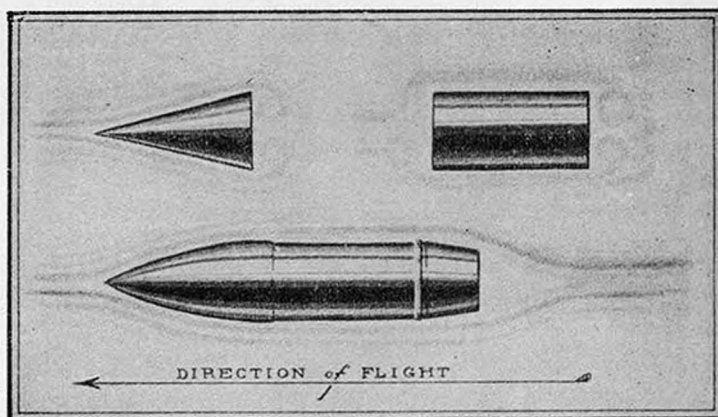


Fig. 1. - Air currents caused by different shaped projectiles.

area of the cross section of a projectile varies as the square of the diameter. A cone with a base diameter of two feet, since its greatest cross section is the same as a cylinder of the same diameter, displaces just as many molecules, but, because of its pointed shape, effects the displacement more smoothly and consequently encounters less resistance.

Weight exercises a great effect on the power to overcome resistance, since one of the factors upon which the energy of the projectile depends is its weight (the other is its velocity). Thus two cylinders of equal diameter and length composed of different materials, one twice as heavy as the other, would experience the same resistance in travel through the air, but the heavier one would possess double the power of the other to overcome it.

Again, since length has little effect on resistance, a cylinder twice the length of the original one and composed of the same material, if solid, would be twice as heavy and possess double the energy. In order that a cone possess the same energy as a cylinder of equal diameter, it must of necessity be longer (since it otherwise would be of less weight), and, as the length of the projectile is limited by certain other considerations, the modern projectile represents a compromise, combining energy-producing effect by means of increased weight, and resistance-reducing effect by means of the pointed head.

The air resistance is affected in a marked degree by the shape of the head. It is found that, in a shell of the usual form, the shape of the shoulders is more important than that of the actual point. This is explained by the fact that, as air streams outward from the point to pass over the shoulders of the shell, it leaves a partial vacuum near the point, while the main air pressure comes near the shoulders. But, when a projectile with an ogive (Figure 2) of five or six calibers or larger radius is used, the shape of the point becomes important, as determining the direction of the air currents which flow over the shoulders.

The ideal shape for a projectile intended to travel through the air with the minimum resistance would be one of streamline profile — one having a nose with an ogive curved for pushing aside the air molecules with the least disturbance, and a long tapered tail to eliminate vacuum-forming eddies in its wake. The flat, sawed-off bottom of the type of projectiles in use prior to World War I is inefficient, because the partial vacuum formed behind the projectile during flight greatly retards it and

causes unsteadiness in flight. For this reason modern projectiles are of the boat-tailed type.

Modern projectiles combine weight and form in the most practical way to secure a maximum of stability and a minimum of air resistance in flight. The cylindrical body usually is from one to two calibers long, and extends from the bourrelet to the rotating band. The cylindrical surface in rear of the rotating band is coned slightly to form the boattail, with an inclination of from six to eight degrees to the axis of the projectile.

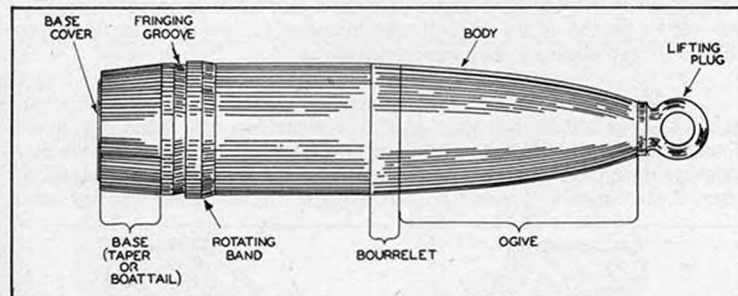


Fig. 2. - A modern projectile.

The ogive describes an arc whose center lies on a line perpendicular to the axis of the projectile, with a radius usually expressed in terms of caliber. This radius formerly was two calibers for all projectiles, but experiments have proved that a marked reduction in air resistance, resulting in greater range, can be obtained by increasing the radius of the ogive to as much as ten or eleven calibers. Figure 2 shows the exterior of a modern artillery projectile.

"Rifling" consists of a number of spiral "grooves" in the surface of the bore of the gun. The spaces between the grooves are the "lands". The purpose of rifling is to rotate the projectile about its axis, in order to give it stability in flight. If the projectile did not rotate in flight, it would fly end over end, or "tumble"; its flight would be irregular and inaccurate, and the range would be reduced.

The introduction of rifling brought about the use of elongated projectiles of increased weight. For projectiles used in rifled cannon, some device was necessary to cause the projectile to take the rifling. Several devices that were developed are shown in Figure 3.

The studs on the projectile shown in figure 3 were fitted into the grooves of the rifling as the projectile was inserted at the muzzle. In the Butler projectile, the part marked (x) was of brass and, on firing, was expanded outward into the rifling by the pressure of the powder gases.

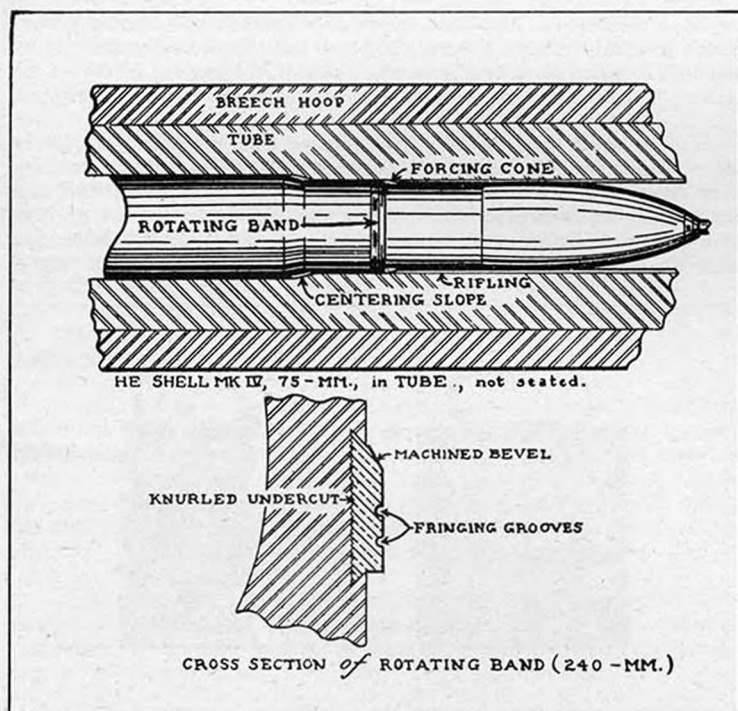


Fig. 4. - Rotating band in gun chamber - projectile not seated.

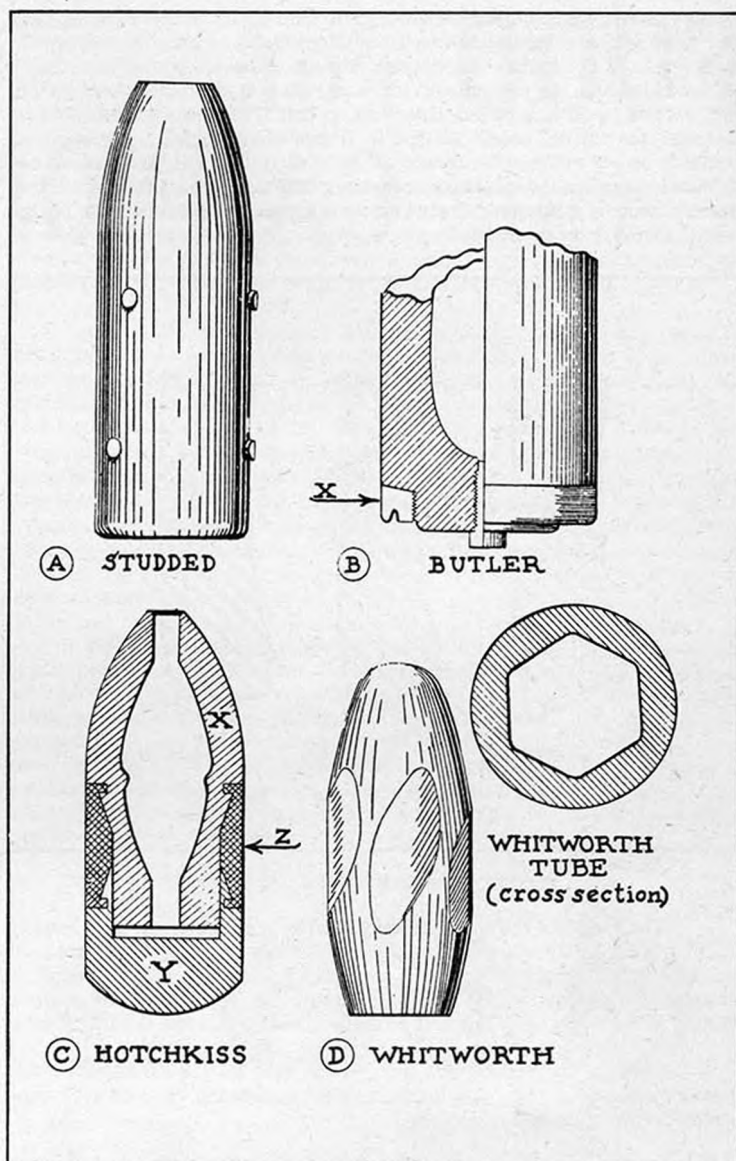


Fig. 3. - Means of obtaining rotation, early projectiles.

In the Hotchkiss projectile the parts (x) and (y) are of iron and are held apart by the ring of lead (z). The gas pressure acting on the part (y) forces the lead outward into the rifling.

The bore of the Whitworth gun was a twisted prism of hexagonal cross section. The projectile was fashioned to fit the bore, its sides being provided with surfaces of a similar prism.

With the introduction of breech-loading cannon, the problem of giving rotation to the projectile was simplified. As previously explained, the raised portions between grooves are known as lands, and the caliber as the diameter between opposite lands. The bourrelet of the projectile has the approximate diameter of the lands; at the rear of the projectile is a smooth band of soft metal which has the diameter of the grooves. The projectile is inserted into the smooth-surfaced chamber in rear of the rifled portion of the bore, (see Figure 4) and it then is rammed forward. The grooves partially engage the soft metal of the rotating band and hold the projectile in place while the tube is elevated. On the explosion of the propelling charge, the projectile moves forward and the lands cut into, or etch, the rotating band, causing it to conform in sections to the rifling, thus giving the projectile a rotary motion about its long axis.

Since the band of a modern projectile completely fills the grooves, it prevents the escape of gas past the projectile, centers the projectile in the bore, and determines a fixed position of the projectile when rammed into the piece. The front surface of the band is machined to seat itself readily in the coned seat (forcing cone) at the origin of rifling.

During firing, a small amount of the copper of the rotating band is forced back and behind the band, and along the surface of the projectile in the rear of the band. The pressure of the released gas at the muzzle of the piece and the centrifugal force of rotation combine to throw out this excess metal in a radial direction, so that it becomes a fringe around the rear part of the band. When this fringe is excessive and irregular, it builds up air resistance, lessens the stability in flight, and causes decreased range and decreased accuracy. This fringing is obviated to a great extent by cutting a fringing groove around, and in the rear of, the band. (See Figures 4 and 5.)

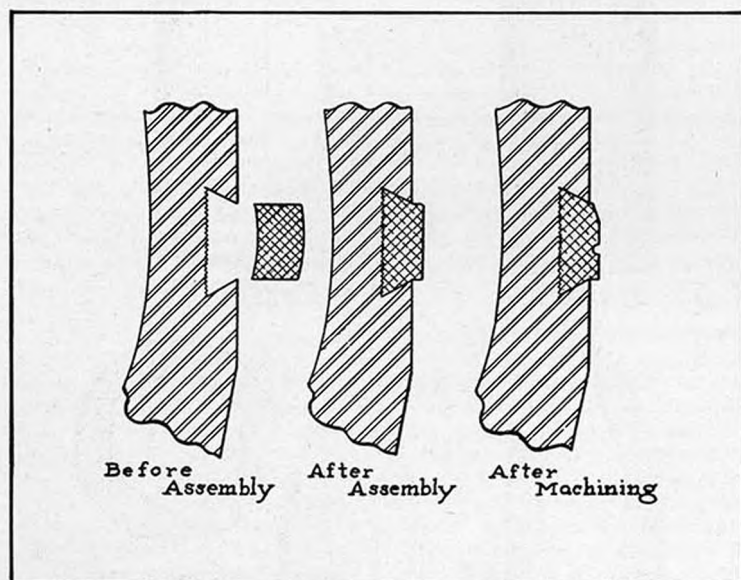


Fig. 5. - Assembly of rotating band.

The metal of the rotating band must be soft enough to flow readily to fill the rifling grooves, and to prevent excessive wear of the lands. It must be hard enough to prevent stripping under the resistance met in rotating the projectile and to avoid fouling the bore. Both copper and gilding metal seem to be favored as the best materials for rotating bands.

Certain projectiles for the 155mm gun, M1918 (GPF), have two rotating bands, but generally there is only one rotating band on each projectile for all guns and howitzers.

The forward bearing surface of the projectile is the bourrelet, the purpose of which is to keep the projectile centered in the bore. (See Figure 2.) It is about one sixth of a caliber in width, and is machined and polished to an accurate dimension slightly less than the diameter between the lands of the rifling. A clearance of .005" is prescribed for the bourrelet of the 75mm projectile. The bourrelet must fit closely to prevent wobbling, but, of course, must not be tight enough to cause great friction or wear on the lands.

Artillery projectiles containing high explosive, 75mm or larger, are fitted with base covers. (See Figure 6.) These are designed to prevent the gas of the propelling charge from coming in contact with the explosive charge of the shell through possible defects in the base. Three types of base covers are in use, as follows:

The old type, common to all calibers, consisting of a slightly dished brass plate covering a lead disk, the brass plate being crimped to the base of the projectile.

The new type for small and medium calibers, having a disk of sheet brass or steel sweated to the base of the projectile with solder, or a steel disk welded to the base of the projectile.

For the larger calibers, the base cover assembly consists of a copper cup covering a lead disk. The copper cup is held in a dove-tailed groove in the base of the projectile by means of a strip of lead caulking wire, which is hammered down to fill the groove completely and to bend the flange of the copper cup. However, in large caliber projectiles that are not fitted with base covers, the steel disk is welded to the base, as mentioned above. (See Figure 6.)

Projectiles fired by field artillery are classified according to their nature, as shrapnel, high-explosive shell and A. P. Shot. Following is a

discussion of the development of the various types of projectiles, together with the purpose and action of each type.

The earliest projectiles were spheres of solid metal and depended for their effect upon their weight and velocity, no attempt being made to produce effect by explosion at the target.

The first departure from the solid type of projectile came with the advent of case shot. (See Figure 7.) Case shot can be traced back to the early part of the 15th century; it retained its original form throughout the entire period of its use. It was intended for use at close quarters when a volley of small shot was required.

Cast shot consisted of a cylindrical container of tin with a cast or sheet-iron bottom and top plate. The container was filled with small round shot and the voids were packed with sawdust to prevent undue dislodgement of the balls due to the shock of discharge. The shock of discharge disrupted the case, and the balls were scattered shortly after

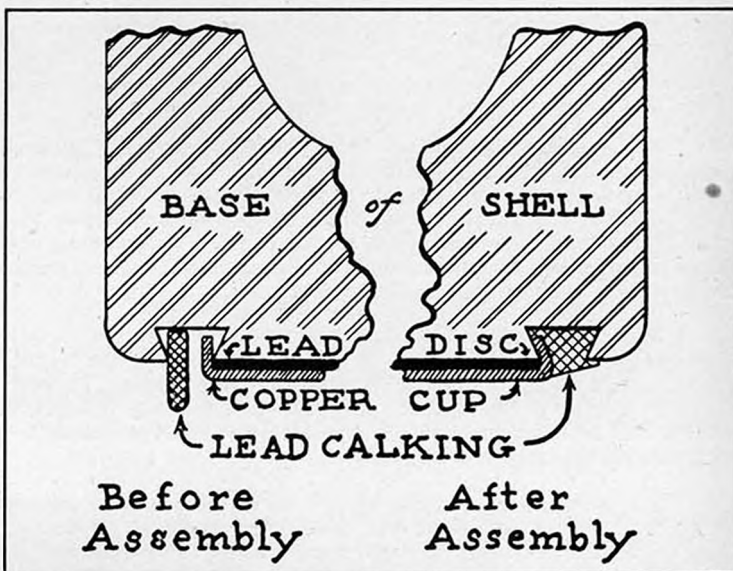


Fig. 6. - Base cover assembly.

leaving the muzzle of the cannon. Case shot was very effective against troops at short ranges owing to the wide pattern made by the spreading shot, but when the range exceeded five or six hundred yards there was practically no effect.

A variation of case shot, known as grapeshot, (see Figure 7) consisted generally of three tiers of cast-iron balls separated by iron plates and held in place by an iron bolt which passed through the center of the plates. The effect of grapeshot was similar to that produced by cast shot.

Explosive shell do not appear to have been in general use before the middle of the 16th century. About that time hollow balls of cast iron were fired from mortars. The balls were almost completely filled with gunpowder; the remaining space with a slow-burning composition. The slow-burning composition was ignited by the flash of discharge and burned until the flame reached the bursting charge. As there was no way of

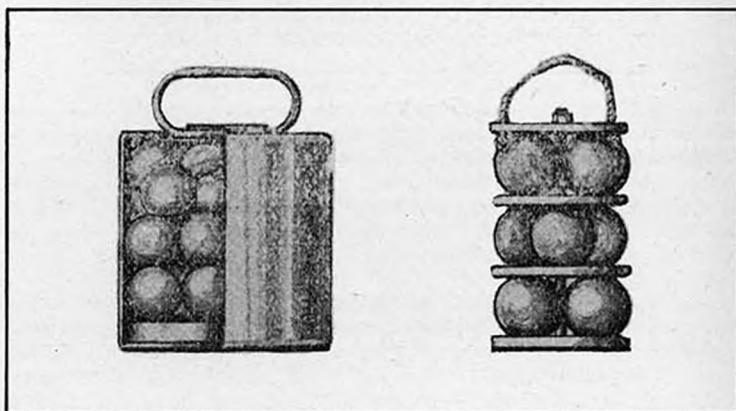


Fig. 7. - Case shot and grape.

regulating accurately the time of burning, some of the projectiles burst during flight, but many of them did not explode until a considerable time after they had struck the ground. With the development of more accurate fuzes, these projectiles became formidable missiles against fortifications, and were used with some effect against personnel in the open.

Modern shell, made of forged steel, are filled with high explosive, and upon reaching a predetermined time or upon impact explode with terrific energy, breaking up the shell walls into several hundred fragments. Depending upon the fuze employed, they are designed either to

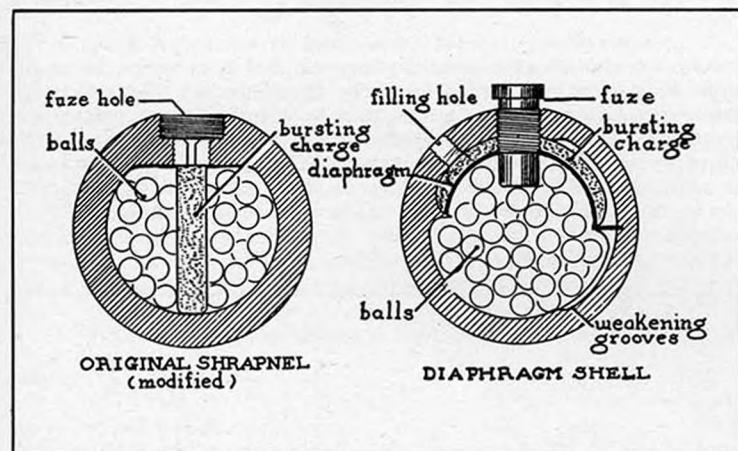


Fig. 8. - Early shrapnel projectiles.

burst in the air or promptly upon impact — for effect against personnel, or to penetrate a short distance before explosion — for the purpose of destruction. Several high explosive fillers, such as T.N.T., amatol, and Explosive D, are used.

The shrapnel projectile was developed during the latter part of the 18th century as a result of the lack of an effective projectile for use against troops in the open beyond the range of case shot.

The original shrapnel (Figure 8) was a spherical shell filled with lead musket balls mixed with the bursting charge. With the advent of rifled guns, the form of the shrapnel projectile has changed but its character has remained. Modern shrapnel cases are made of forged steel. The lead balls are contained in a matrix of smoke-producing compound and are separated from the base charge by a steel diaphragm. They are provided with a time fuze designed to cause the projectile to burst during flight; or a combination time and percussion fuze designed to cause the projectile to burst either during flight or on impact. Shrapnel is designed to carry the balls to a point over the heads of troops and, by the functioning of the fuze and base charge, to scatter the balls with increased velocity over a considerable area.

Chemical shell are a development of World War I, resulting from the desire to transfer quantities of chemicals into enemy territory. Chemical projectiles are filled with chemical compounds designed to produce casualties, or with smoke-producing composition for use in screening certain areas from view. Very little effect is produced by fragmentation, since the bursting charge is just sufficient to crack the projectile and scatter the chemical filler. In firing chemical shell it is important that the shell burst before entering the ground, in order that the chemical be spread instead of being concentrated in and near the shell crater.

Since the earliest days of cannon, numerous means have been devised to project incendiary materials against enemy works. Perhaps the first effective incendiary projectile fired from cannon was known as red-hot shot, developed about 1580. It consisted, in general, of a cast-iron shell filled with molten cast iron and immediately fired. On impact the shell broke, freeing the still molten iron and producing the desired effect.

At present there is a projectile designed primarily to give incendiary effect and certain projectiles now in use have this characteristic. Low-bursting shrapnel has some incendiary effect, as has white phosphorus (WP) smoke shell.

Should any loading of incendiary material into projectiles be made in the future, it is likely that the material used would be the thermite

(TH), a mixture of iron oxide and aluminum. It is in the form of a dark gray granular mass. When ignited, it burns with great rapidity and with evolution of extreme heat, the iron oxide being reduced to boiling molten iron.

DEVELOPMENT OF PROPELLANTS

The earliest propelling powder was black powder, of about the same composition as we know it today. In the 16th century it was used in the form of a fine powder or dust, but, owing to the difficulty of loading this fine dust into the muzzle of small arms, a granular form was developed about 1600, and continued in use for more than 200 years.

Smokeless powder came into use about 1890, and quickly replaced black powder as the universal propellant for artillery. The first smokeless powder experiments by United States Army Ordnance were with nitrocellulose-nitroglycerin, or "double-base", powder, which remained in use for small arms until 1906. The smokeless powder now used consists essentially of a gelatinized nitrocellulose in the form of short multiperforated grains. The United States and other countries have developed powders in the form of long tubes or flat ribbons and cords which usually contain a certain percentage of nitroglycerine. Because of their hotter gases of combustion, nitroglycerin powders produce more erosion in the bore of the piece than nitrocellulose. For this reason the latter are generally used as propellants.

Rapid development of gas pressure within the gun should be of such a progressive nature that the force exerted does not attain its maximum at the time of ignition (as would be the case if a high explosive in its usual form were used as a propellant), but rather attains it by a relatively gradual rise. Control of this pressure lies in the composition of the powder; form or shape of individual powder grains; and size or dimension of any particular form of grain. Granulation determines the area of the burning surface of the grain, which in turn controls the rate of combustion and through that, the pressure. (See Figure 9.)

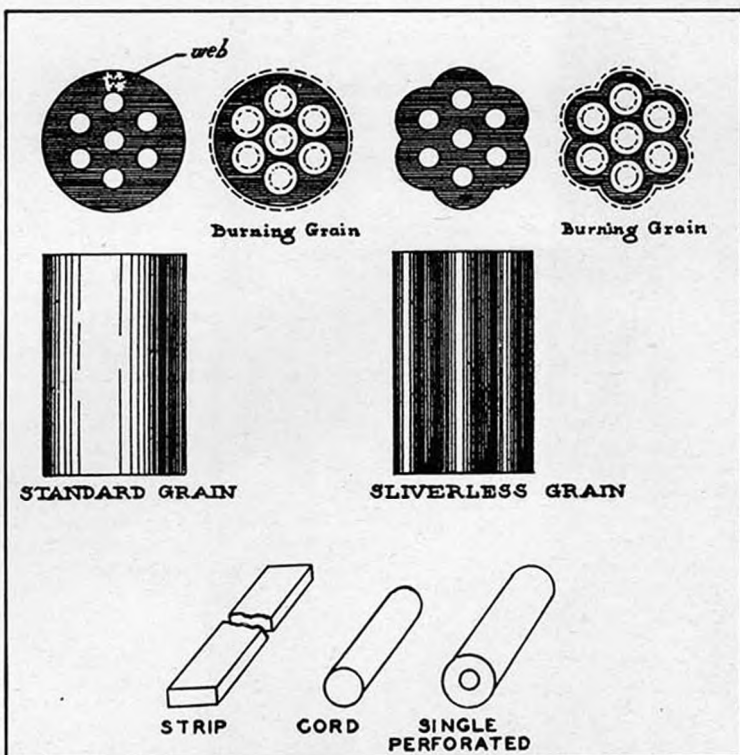


Fig. 9. - Grains of powder.

The best form of granulation from a ballistic point of view is; first, that which with the smallest weight of charge will impart to the projectile the prescribed muzzle velocity within the permitted limit of maximum pressure; second, that which will cause minimum erosion to the bore; and third, that which shows maximum regularity in ballistics. The grains burn uniformly from the surface and the rate of burning varies directly with the pressure; the greater the burning surface, the higher the pressure; all other things being equal. The shape of the grain is a direct factor in determining the total amount of burning surfaces of a given weight of powder.

At the outbreak of World War I, the United States Army and Navy employed the same type of smokeless powder as a propellant that has been described above. Certain weaknesses were discovered, which lead to post-war experimentation.

Smokeless powder, if exposed to the atmosphere, is subject to change. The volatile solvent, ether-alcohol, used in manufacturing, is not completely removed, the powder retaining from 3 to 7.5%, depending on the size of the grain. In a warm atmosphere this residual solvent partially escapes, and the rate of burning of the powder is increased. On the other hand, if the powder is exposed to a humid atmosphere, it absorbs moisture and the rate of burning is decreased. Thus, ballistic properties of the powder are appreciably affected by changes in atmospheric conditions to which it may be exposed. The powder is said to have hygroscopic properties.

Another objection to smokeless powder was the fact that when fired it produced a large, brilliant flash at the muzzle of the gun. This proved to be a serious objection during World War I owing to the great amount of night firing conducted, since the flash aided the enemy in locating positions of the guns. The need was recognized for a nonvolatile, nonhygroscopic, and flashless powder which would still retain the property

of being substantially smokeless. Such a powder has been developed since World War I.

The FNH type of powder has been obtained by adding to the nitrocellulose inert or partially inert materials for the purpose of cooling the products of combustion and reducing the hygroscopicity of the powder. Such a powder may be flashless in certain weapons but not flashless in others. When flashlessness is not attained, the powder is designated as NH.

Flashlessness is dependent not only upon the composition of the powder, but also upon the quantity of powder used as a charge, the length of the bore of the gun, the weight of the projectile, etc. While it might appear possible to obtain flashlessness in any weapon by merely increasing the amount of the flash-reducing agent in the powder composition, such a procedure may be impracticable either because of increased smoke or reduction in potential of the powder. While the present type of FNH powder has less strength than the standard pyrocellulose powder, it has sufficient strength to permit its use in all weapons without change in ballistic requirements.

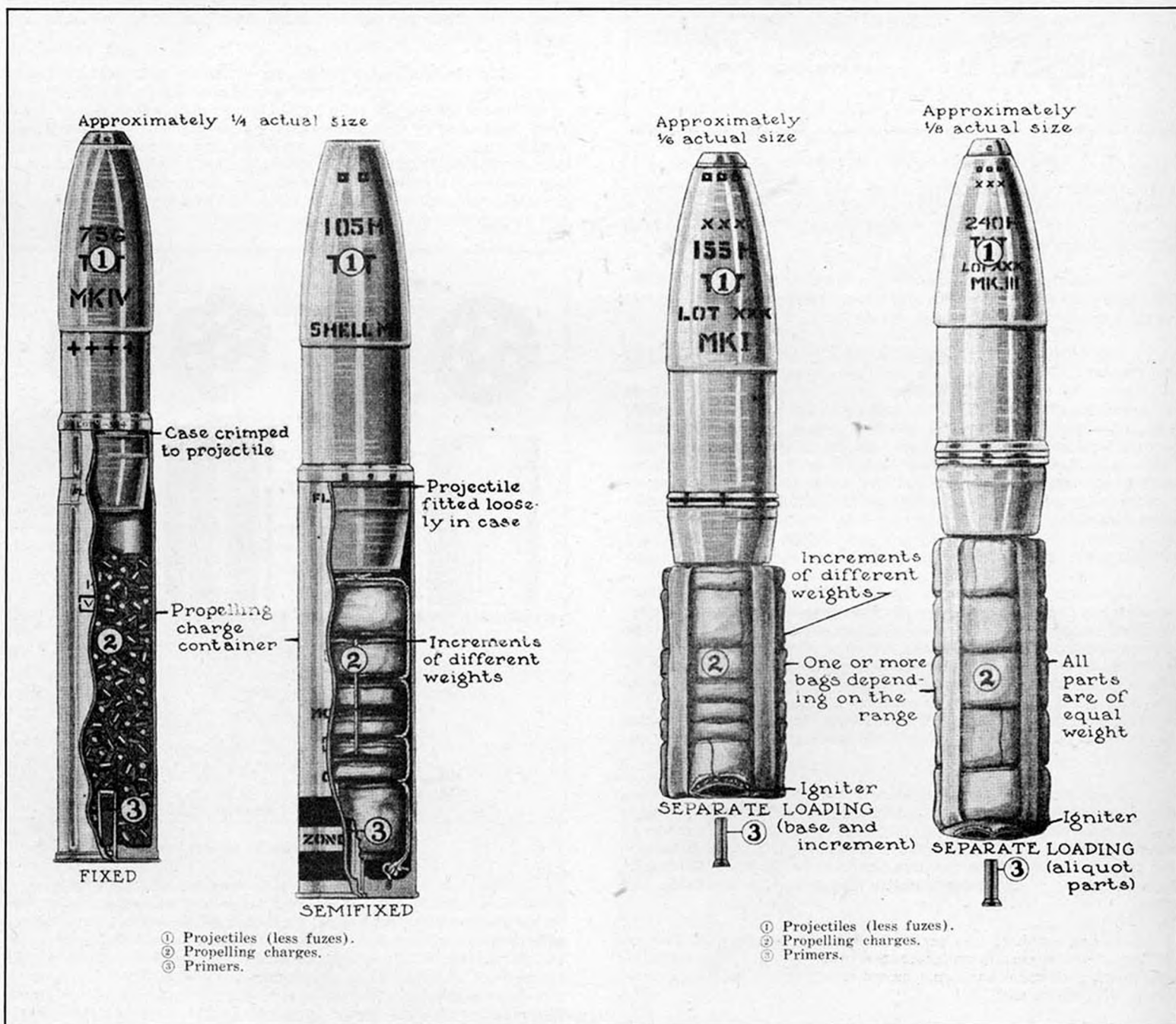


Fig. 10. - Ammunition classed for transportation and loading.

PROPELLANT CONTAINERS

According to the method of assembly for transportation and for loading into the piece, ammunition is classified as "fixed", "semi-fixed", or "separate-loading" (unfixed). These classes of ammunition are shown in figure 10.

Fixed ammunition comprises a cartridge case (which contains the propellant) whose base contains the primer, and whose forward opening is crimped to the projectile so that the entire round is integral and all components are loaded into the gun in the same operation.

Semi-fixed ammunition differs from fixed ammunition in that, while the projectile and cartridge case are issued assembled and are loaded into the gun as a unit, the cartridge case is not permanently attached to the projectile, but may be removed from it at the firing point for the purpose of varying the amount of the propelling charge as desired.

Separate-loading (unfixed) ammunition is characterized by the fact that it requires 2 or more operations to be loaded into the breech of the gun. The propellant and primer are loaded separately from the projectile, the propellant being contained in either cartridge bags in definite quantities (or increments), or loosely in an uncrimped cartridge case. In both instances the amount of propelling charge may be varied as desired. The primer is generally inserted after the breechblock has been closed.

Where fixed or semi-fixed ammunition is used, a drawn brass or steel cartridge case is supplied. This case has a profile and size to conform to the powder chamber of the cannon for which the case is intended. The head of the case is relatively thick and is provided with a flange for the purpose of mechanical extracting and for seating the round in the gun.

In the center of the head is the primer seat, a circular hole into which the primer is seated by pressing to make a gastight joint. The wall or body of the case is relatively thin and of an outside diameter throughout its length just slightly less than the diameter of the powder chamber of the cannon.

The primary function of the cartridge case is to hold the propelling charge, the primer and projectile, permitting the round to be loaded into the gun in one operation.

Its secondary function is to block the pressure of the gas generated by the burning propellant charge. When the gun is fired, the case expands and the thin walls of the case fit themselves tightly against the surface of the loading chamber, thereby preventing the escape of the gas to the rear. This function of preventing the escape of propelling gas is known as "obturation". The action of the side walls and base of the metal cartridge case provides the means of accomplishing this function. The metal of the cartridge case, however, is springy enough so that, when the gas pressure is released, the cartridge case will contract, and can be extracted from the piece without difficulty.

Cartridge bags are used with separate-loading and semi-fixed ammunition. They form a suitable and convenient means of containing the propelling charge. Two classes of cloth are used in the manufacture of cartridge bags: "Cartridge bag cloth" and "cartridge igniter cloth".

Cartridge bag cloth is made of pure silk, wool, or mohair, but raw silk has been found to be the most practicable material. This cloth is used in the manufacture of all components of the bag, except those components containing the black igniting powder. It is necessary that the cartridge bag cloth have sufficient strength to withstand service conditions of handling, at the same time it must be consumed entirely during combustion of the propelling charge, as smoldering parts of it might cause the ignition of the next charge before the breech is closed, probably resulting in injury to members of the gun squad.

Cartridge-igniter cloth is made of pure silk, with properties similar to those of cartridge bag cloth, but is more closely woven to prevent the black ignition powder from sifting through. All igniter containers used with cartridge bags are manufactured from cartridge-igniter cloth. In order to avoid any possibility of error and to indicate clearly that they contain black powder, all igniter pads are now dyed red. In the older types that are not dyed red, the pads are stenciled, in black, with the word "igniter".

PRIMERS

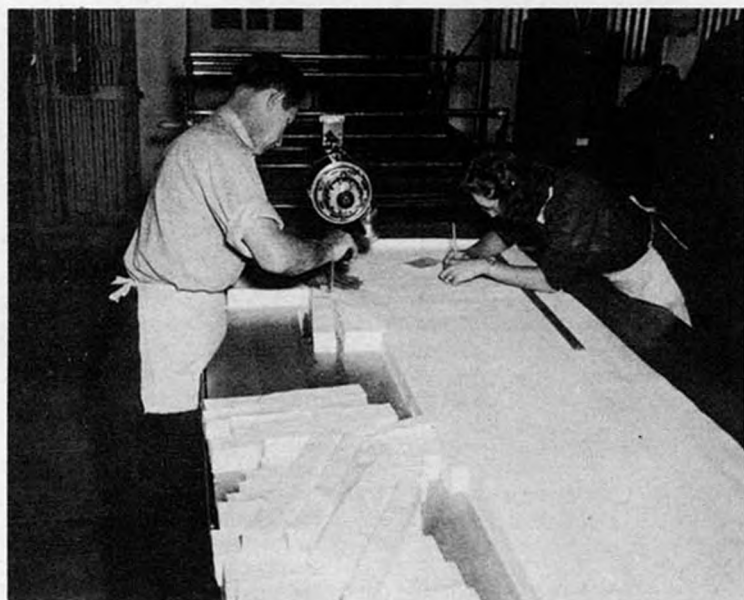
A primer is used to ignite the propelling charge of smokeless powder. The primer is loaded with a charge of black powder which, in ammunition for small calibers, is sufficient to ignite the propelling charge. In the larger calibers additional ignition powder is required.

PUTTING IT IN THE BAG

At Radford Ordnance Workd, Radford, West Virginia, a Bag Loading Training School is conducted. Here the powder bags are manufactured, marked by printing presses, and workers are then taught the method of loading powder into cartridge bags by going through the identical loading procedure with all equipment used with the exception of the powder. In place of powder in this phase of the training, wheat and corn are used. The first step in the manufacture of powder bags is to lay the material on a table, mark for the size of the bag, and then cut

with an electric knife as shown below at the left. Below at the right, girls are assembling smokeless powder propelling charges for 12-inch mortars (using powder instead of grain). The powder is weighed carefully and poured into bags which are then sealed by sewing. Several powder bags are then laced together to form the correct charge for cannon of various sizes. The completed charge is placed in a strong waterproof container for shipment.

PHOTO BY U. S. ARMY SIGNAL CORPS.



With fixed and semi-fixed ammunition, the primer is forced into the base of the cartridge case before loading the propelling charge.

With bag-loaded (separate loading) charges the primer is inserted in the firing mechanism in the breech of the cannon. Primers for separate loading ammunition are of the obturating type in that the body of the primer is thin so that when the primer charge explodes, the primer will be expanded and pressed tightly against the surface of the primer cavity, thus preventing the escape of propelling charge gases to the rear.

The general classification of primers is based on the method of firing or initiating the ignition, as follows: percussion; friction; electric; combination percussion-electric; igniting. Figure 11 and the following descriptions indicate the general characteristics of the various types.

The percussion primer is fired by means of a blow from the firing pin in the breech mechanism. Cartridge cases are in general fitted with this type. Percussion primers are made in several sizes for particular calibers of ammunition, the size referring more especially to the weight of the black powder charge; for example, a 49-grain primer contains an igniting charge of 49 grains of black powder. The primer known as a saluting primer is a percussion primer of special size.

The friction primer, used only in seacoast cannon, is fired by the heat generated by pulling the serrated plug attached to the wire through the friction composition.

The electric primer is likewise used only in seacoast cannon. The primer composition is ignited by a wire heated by an electric current. In outward appearance the friction and electric primers are similar except that the wire of the electric primer is covered with black insulating material and the head of the primer is grooved.

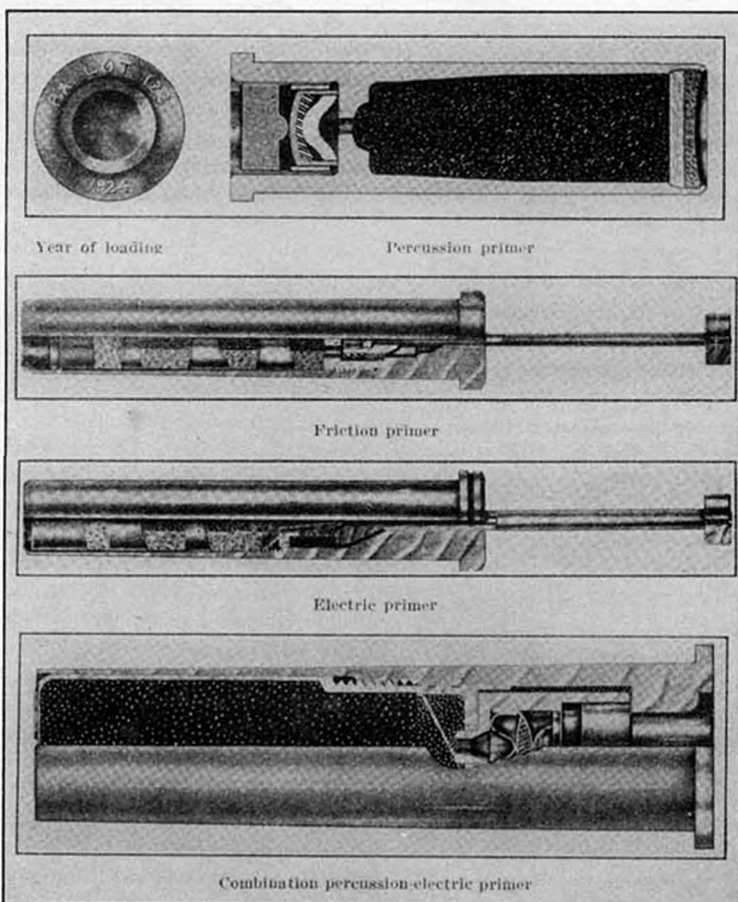


Fig. 11. - Primers.

The combination percussion-electric primer may be fired either electrically or by the blow of a firing pin.

The igniting primer is used with subcaliber ammunition. It has no initiating primer cap, but is provided instead with a hole in a dummy percussion cap which allows the igniting flame from the service primer to fire the black powder charge in the igniting primer.

A fuze is a mechanical device used with a projectile to explode it at the time and under the circumstances desired. Fuzes as originally used in spherical projectiles were "time" or "concussion" fuzes. The oldest form of time fuze was a piece of "fuze" or "slow match". This was followed by a wooden fuze forced into the opening in the shot, containing a compressed black powder charge, which was ignited by the blast of the gun and when burned down to the end spit through an opening into the burster charge and exploded the projectile. The wooden fuze was cut off or pierced along its length to fix the time of burning. In later developments, metal cases were substituted but the principles involved were the same. (See Figure 12.)

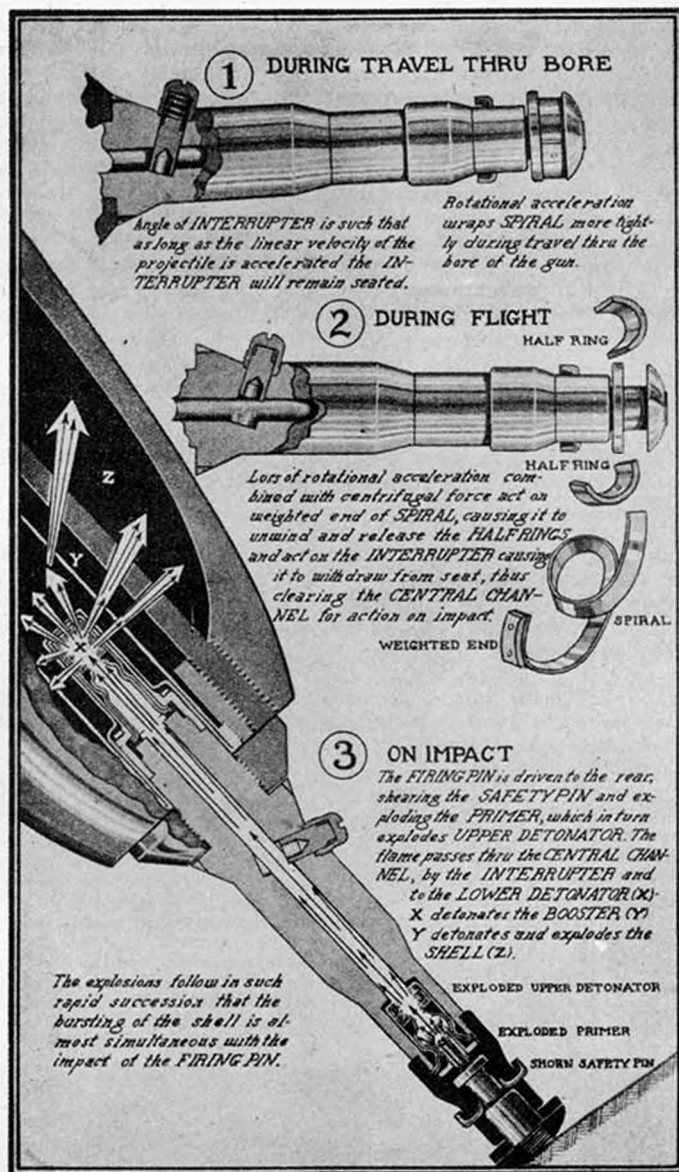


Fig. 12. - Action of the Mk. III (World War Type) Fuze.

In a concussion fuze, an inflammable composition was ignited on discharge of the gun. On impact, by some contrivances, the flame was admitted to the burster charge. The contrivances used were glass, plaster of Paris or zinc tubes which, when heated by the burning powder inside, would break off on impact.

Due to the fact that a spherical projectile would strike on any point of its surface, percussion fuzes did not operate satisfactorily though tried in many forms. In one type, three distinct double-ended plungers were used with their axis perpendicular to each other. The plunger, whose axis was in line on impact, was arranged to strike a fulminate composition. The plungers were held in place during flight by copper shear wires.

On the introduction of rifled guns and elongated projectiles a great deal of the trouble with percussion fuzes was eliminated. As the projectile then struck point first, the use of a plunger striking a cap, on impact, was made possible. The use of the rotation of the projectile to function additional safety features marked the further advancement in the design

of fuzes. With the modern use of high explosives a further change was required in providing a detonating element and producing a delay feature.

Fuzes are grouped according to assembled position in the projectile and action of functioning. The following types are now in use:

Assembled in Point			Assembled in Base
<u>Time</u>	<u>Combination</u>	<u>Impact</u>	<u>Impact</u>
Powder	Time & Impact	Superquick, super-sensitive, selective superquick or short delay, or delay only (limited use).	Non-delay
Mechanical			Short Delay

The terms "superquick" and "delay" are used in reference to the action at the instant of impact, whereas "time" refers to time after the instant of firing.

"Superquick" fuzes are designed to burst the shell promptly on impact and before it has penetrated. Very little crater effect will be obtained from this type. It is used where the target to be demolished is above the ground, such as wire and personnel.

"Supersensitive" fuzes are designed to burst the shell promptly on impact against a light target, such as an airplane wing.

"Delay" fuzes are designed to burst the shell shortly after impact. They are used where it is desired to obtain penetration.

"Time" fuzes are designed to burst the projectile at some predetermined time after the projectile leaves the cannon. They are used against personnel and aircraft, and in barrages, and contain either a powder or mechanical time train.

"Combination" fuzes combine two or more of the features such as "time and superquick".

During World War I the application of science and engineering to the art of warfare reached such proportions that the system employed in fuzing our projectiles proved entirely inadequate to meet the requirements imposed on ammunition components. The history of fuze development shows a more or less regular progress, but much progress seems to have been made at the time the problems and the new situation demanded improvements in the functioning of the fuze. The development of fuzes has, since World War I, resolved itself into a problem requiring extensive study in order that our Ordnance program be complete.

Ammunition is of no value unless the projectile can be made to function at the time and place desired; hence a fuze must function with exactness. A fuze is but a small part of a complete round of ammunition yet it requires a high degree of technical skill in its perfection and offers much difficulty in design.

Fuzes can be standardized only to the point where their efficiency is not impaired. The more action a fuze is required to perform, the greater its cost and delay in production. Since the actual life of a fuze in service is but a few seconds, a multi-purpose fuze would be required to perform more than required for an individual shot and would represent wasted effort. The standardization of fuze design must meet the requirements of supply, use, and manufacture.

The technical requirements which must be met in the design of a fuze are governed by the requirements of the using service. The caliber of the cannon in which a fuze is to be used may vary over a wide range with corresponding variations in muzzle velocity and pressure. The forces available for the design of a fuze are:

- Pressure of the propellant gases.
- Forces due to acceleration of the projectile (inertia or set-back forces).
- Centrifugal force, due to rotation of the projectile.
- Creep force, due to retardation of the projectile in flight.
- Impact force, due to the projectile striking the target.

These forces vary with the cannon in which the fuze is to be used and,

if the fuze is to be used in ammunition of several different calibers for the purpose of functioning under varied tactical requirements, it is evident that the new development becomes quite involved.

The various stages in the development of a new fuze design, from the time the requirements are specified until final approval for manufacture and issue, are as follows. The first step is to prepare a drawing board study and thereby determine the size limitations in the various shell for which the fuze will be used. To attain mass production the design must be based on the practical interchangeable manufacture of the components. It is highly desirable to develop a design the components of which can be manufactured on punch press or automatic screw machines. The safety features of the fuze and the manner of loading and assembling the explosive train are very important considerations in a new design.

The second step is to prepare detail drawings of the fuze which apparently meet the requirements. These working drawings must conform with the requirements of sound manufacturing methods whereby interchangeability of parts can be procured under mass production. This step involves a study of tolerances and manufacturing methods.

The third step is the placing of an experimental order in the shop where the desired quantity, which is usually small, is manufactured and such changes in design recommended as may be found desirable from the manufacturing standpoint.

The fourth step consists of design tests and service tests. The design tests are conducted at the experimental arsenal and the proving ground. The service tests are conducted by the using service. The fifth and final stage in the development of a design is its standardization by the Secretary of War.

All types of fuzes now in use are arranged with safety devices which tend to prevent functioning until after the fuze has been subjected to the forces in the cannon for which it was designed. In addition, the later types of fuzes have been designed to be detonator (bore) safe. A bore-safe fuze is one in which all detonating elements are separated, by some form of interrupter, from the booster charge until the projectile has cleared the muzzle of the gun. This prevents premature action of the shell charge in the bore of the gun, even though the more sensitive elements of the fuze should function prematurely.

In general, all artillery fuzes are in an unarmed condition prior to firing, although in a strict sense time fuzes are always armed despite the mechanical restraint which prevents initiation of time action. Fuzes of the impact type are usually armed by centrifugal force action on parts of the fuze after the projectile leaves the muzzle. The time element of time fuzes is initiated at the instant of firing by setback (i.e., the effect of inertia). To prevent accidental arming during handling and shipping, safety devices such as a safety wire or cotter pin are used when required. Such safety devices are to be removed before firing.

BOOSTERS

Since the small detonator contained in the fuze is not powerful enough to insure complete detonation of the shell filler, it is necessary

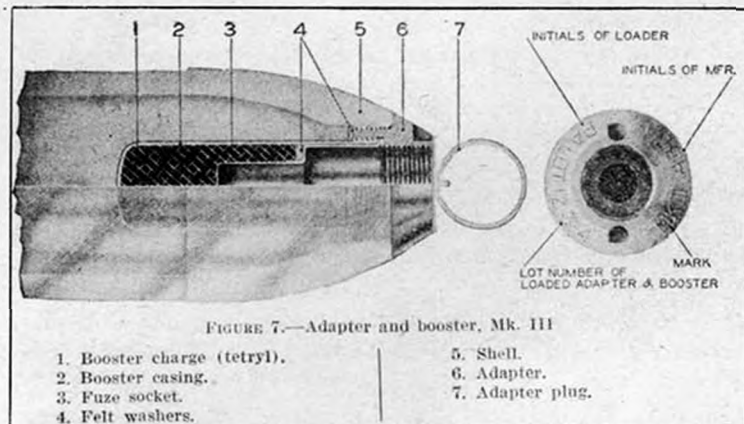


FIGURE 7.—Adapter and booster, Mk. III

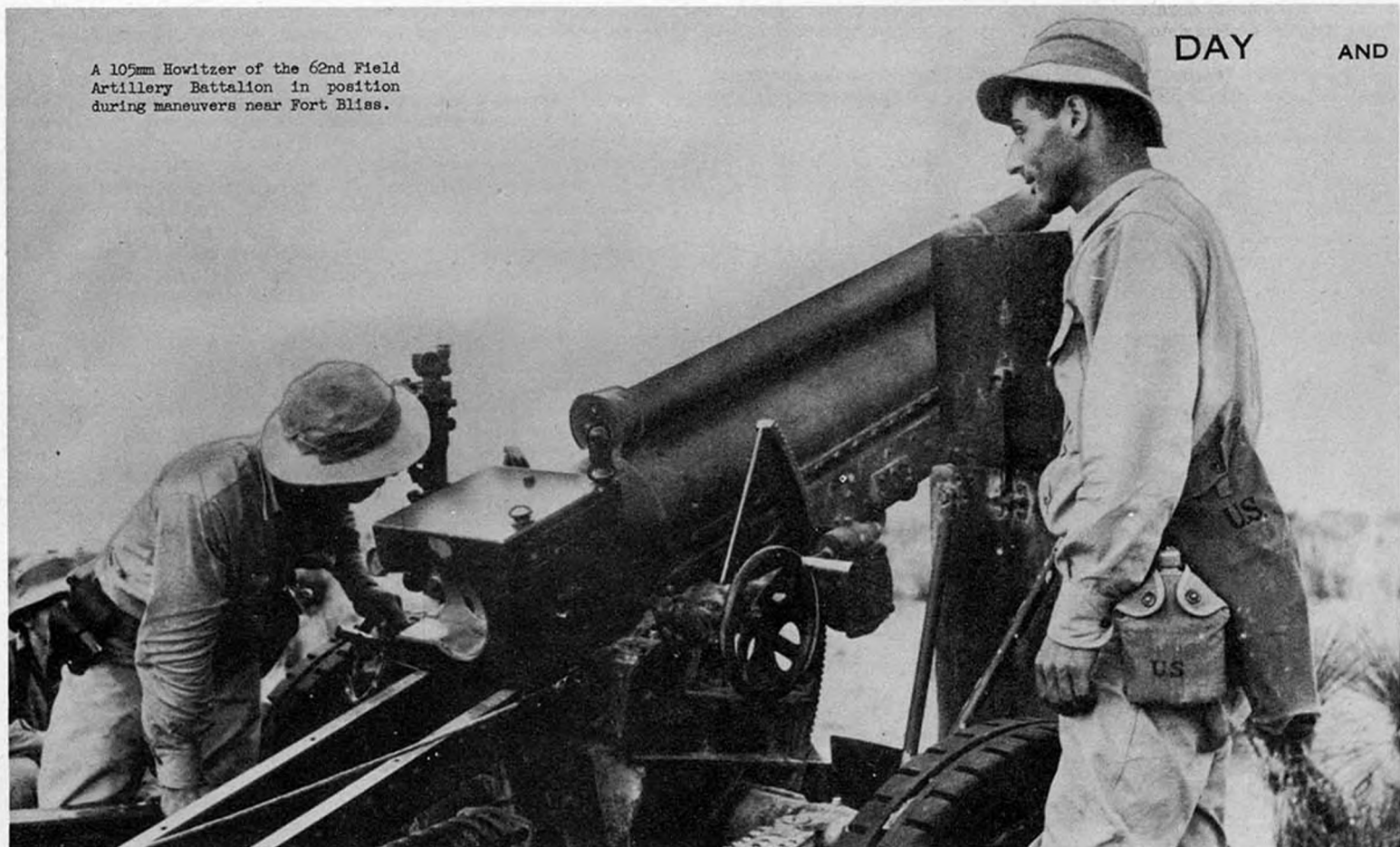
1. Booster charge (tetryl).
2. Booster casing.
3. Fuze socket.
4. Felt washers.
5. Shell.
6. Adapter.
7. Adapter plug.

Fig. 13. - Adapter and Booster.

to have a slightly larger quantity of high explosive, more sensitive than the shell filler, to augment the detonating wave and initiate detonation of the filler. This intermediary explosive is the booster. (See Figure 13.)

(Continued on page 55)

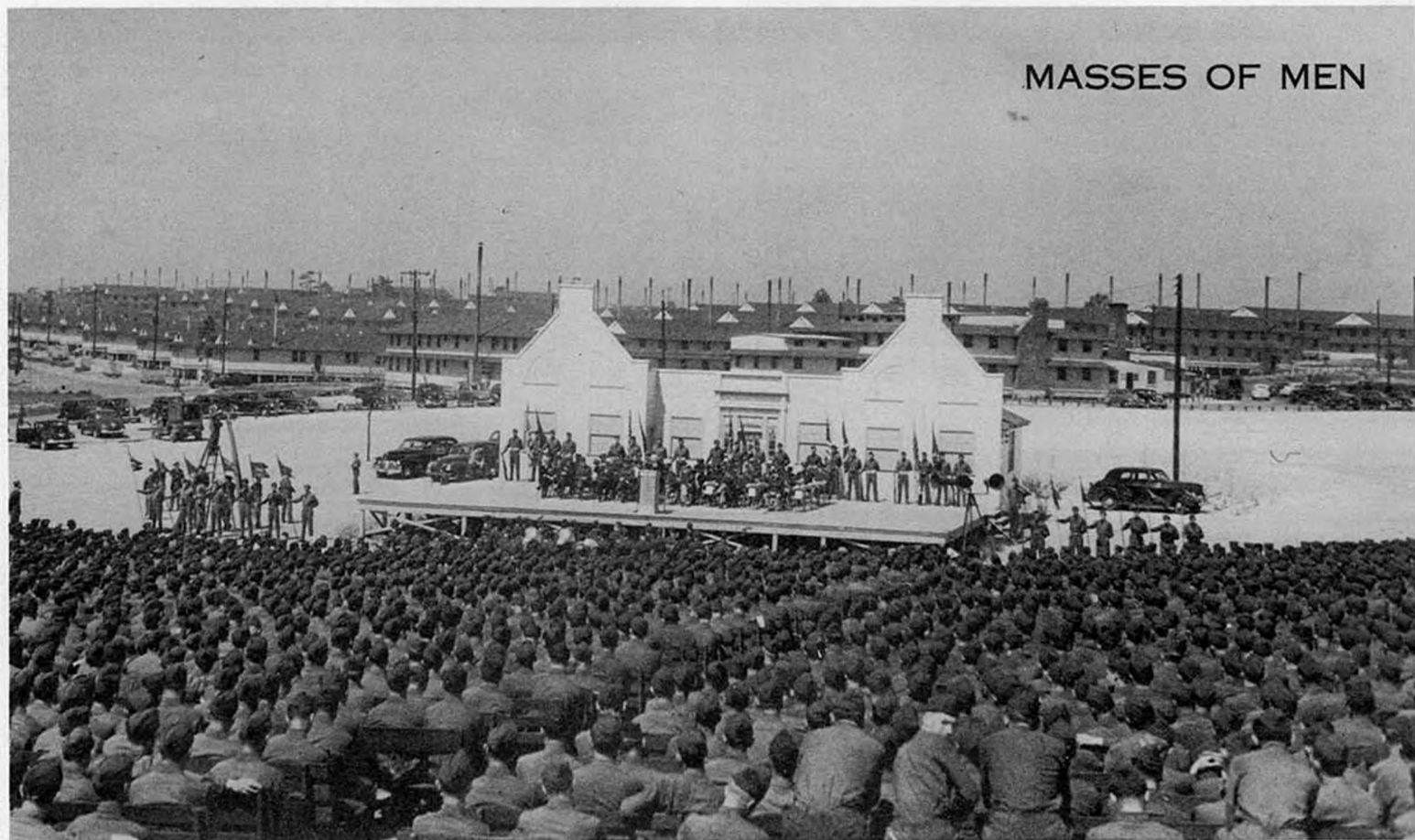
A 105mm Howitzer of the 62nd Field Artillery Battalion in position during maneuvers near Fort Bliss.



DAY AND

PHOTOS BY J. J. GREGOR

MASSES OF MEN



Part of the audience of 5000 soldiers who heard the Army Day program at Fort Bragg, Artillery Replacement Center.

FARC PHOTOS BY

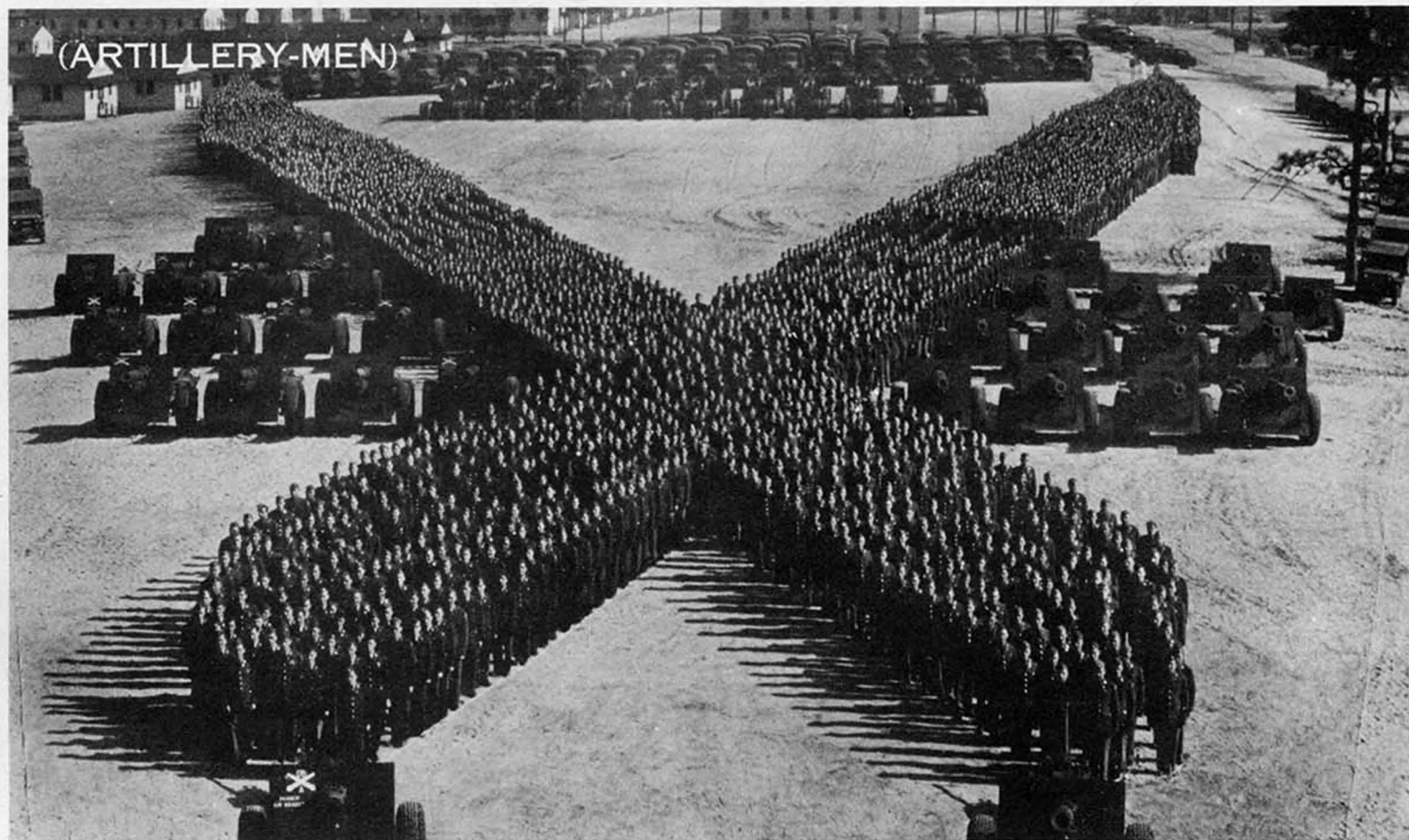
NIGHT

Night firing with the 75mm Field
Howitzer at the Dona Ana target
range.



FORT BLISS, TEXAS

(ARTILLERY-MEN)



SGT. JOHN BUSHEMI

Approximately 5000 men of the 13th Field Artillery Brigade in an unusual formation at Fort Bragg.

COLD WEATHER MAINTENANCE

105mm Howitzer at Pine Camp, New York

There is no one thing that will effect the life of the 105mm Howitzer as the care it receives by the using arm. Proper care will be reflected by infrequent trips to the maintenance repair shop, plus a gun that will function properly and give maximum useful service.

In the 4th Armored Division, at Pine Camp, we are faced with conditions of soil and weather which are detrimental to the gun. In summer we have sand, Natures own abrasive, and in winter snow and sub-zero weather, both of which require special greases and oils.

The temperature range at Pine Camp runs from normal summer weather to 40° below zero in the winter; this has served as a good proving ground for artillery and cold weather tests. The writer has often stepped outside the artillery shop on a clear winter day with the sun shining directly on the thermometer when the reading has been 6° or 8° below zero. Guns brought in for service and manometer tests would have to stand overnight in a heated shop to bring them up to a point where manometer tests could be undertaken.

Early in the winter the 105's were called in to the maintenance shops to be winterized, which consists of washing out the gear case and repacking with a 00 type grease. The 00 type low temperature grease must be used exclusively in all gear cases and fittings. No. 10W oil is prescribed for winter use and the elevating and traversing mechanism should be washed daily with this. A small paint brush dipped into a can of this oil has been found very useful for washing out the traversing and elevating rack. After washing, these should be wiped fairly dry. The breech-block should be oiled daily and while the TM calls for No. 10W oil on the firing lock M13, it was found a sound policy that before firing, the M13 firing lock should be disassembled and wiped dry. This will give a more satisfactory performance in sub-zero weather. However, it must be recoiled when the guns are brought in again.

With regard to the machined surface of the tube which slides in the cradle yoke, Marfax heavy grease or rust preventative compound seems to give better protection than a No. 10W oil. Unless wiped and oiled twice a day, rust may form on this surface under the 10W oil. The coating of Marfax or rust preventative compound eliminates this tendency to rust. Under no circumstances should this machined surface be painted, as this would complicate the removal of the tube through the cradle yoke. During the winter months the equilibrators should be given a coat of oil when the gun is cleaned. This will prevent ice and snow from forming on the plunger and causing elevating difficulties.

It was found that recoil oil 2-96A is not a universal recoil oil in this weapon. Experiments were carried on with various types of oil; however, no figures are given here. Due to the hydro-pneumatic floating piston recoil mechanism, it was impractical to completely drain and refill the recoil mechanism.

A difficulty that was experienced were the Quadrant and the Mount Telescope becoming inoperative at temperatures below +10°. The sights as received were packed with Lanum which is not suitable for low temperatures. This difficulty was overcome by the complete disassembly of the sights by skilled ordnance personnel. They were then cleaned of Lanum and repacked with special low temperature grease which had a congealing point of .50°. This grease was issued to the using arms in 1/2-lb. tubes under the commercial name of Royco No. 6A.

Frequent checks on electric brakes by the using arm often located dead hot-shot batteries, also the electric plug located in the hot-shot box has been known to pack with snow and ice and render it mechanically impossible to insert the male connection into the female socket.

The cleaning of the bore after firing presented a problem. If hot-water was used in the barrel it rapidly turned to ice and made cleaning impossible. Two cleaners, one the soda ash (sodium carbonate) and water solution, and the other, solvent dry cleaning, were used. In the use of the soda ash and water solution, glycerine grade "A", U. S. P. was added in the following amount to form an anti-freeze sponging solution:

Min. Temp.	Glycerine	Parts by volume Soda Ash Solution
18	20	80
12	30	70
0	40	60
-14	50	50
-40	60	40

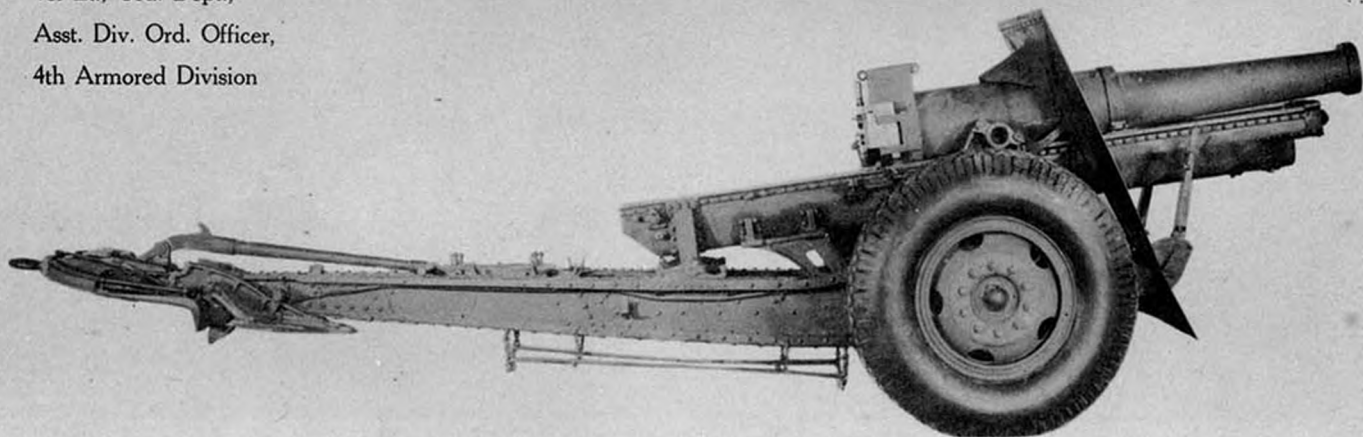
The solvent dry cleaning was more suitable for sub-zero conditions. It was carefully applied and all traces removed by the use of the rammer staff, burlap and rags. After removal of all traces of either solution, the gun was freely slushed with a No. 10W oil. This oil was worked for a short period to insure penetration into the pores of the metal. A careful check was also kept on tire pressures, as variations in pressures would cause the towed gun to behave rather badly on soft snow.

No unusual wear that could be directly laid to cold weather was noticed on any guns. A plastic hand-wheel was tried on one gun and was found more comfortable to the bare hand than the regular bronze hand-wheel.

During firing, length of recoil was carefully checked and every precaution for the safe-guarding of the weapon was taken by both the using arm and the ordnance personnel.

One thing was proven, that the United States has equipment that will work whether it be in Alaska or the Sahara Desert, and that the design of the 105, to this writer's mind, is a very successful one.

by Ernest R. Conover, Jr.,
1st Lt., Ord. Dept.,
Asst. Div. Ord. Officer,
4th Armored Division



HANDLING THE 4000 LB. BOMB

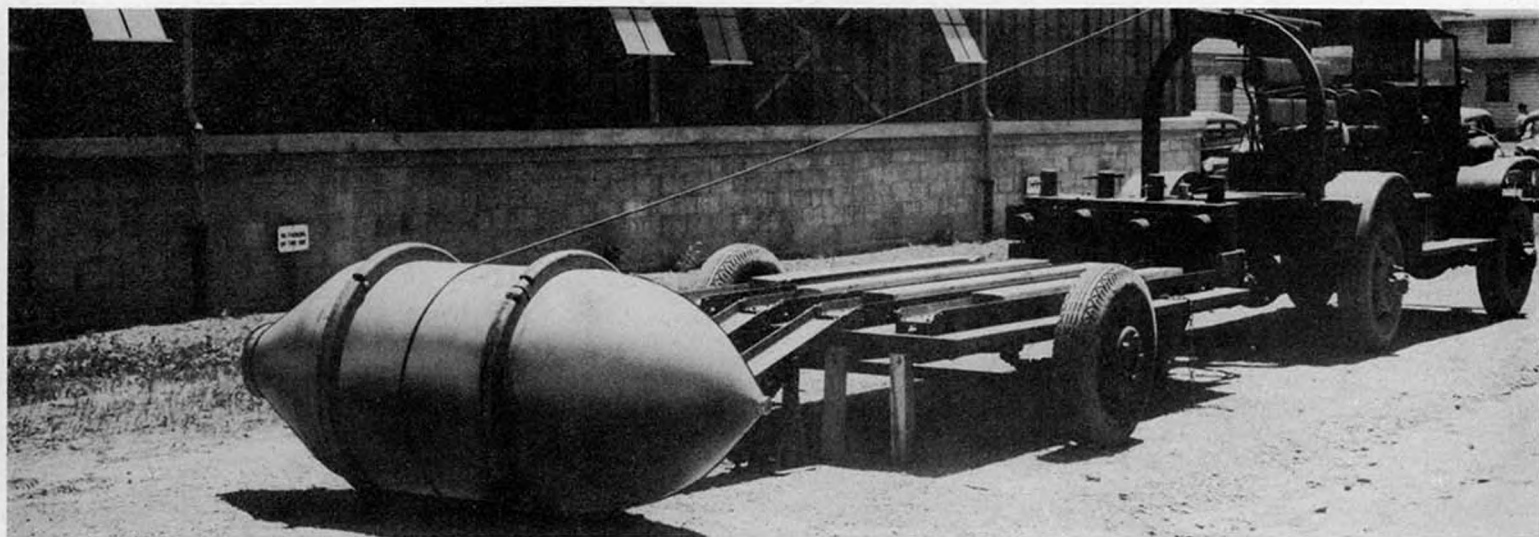


PHOTO BY ORDNANCE SCHOOL PHOTO SECTION

Bomb, (truck and trailer) in position to be rolled on the trailer. Note, Blocking is under the trailer, the pieces of lumber are between the channels, the cable is in proper position around the bomb, and the ramps and ramp stands are in proper position.

The following article on Bomb Handling Drill for the 4000 lb. bomb has been submitted by Corporal Fred Moore, 458th Ordnance Company, Aviation (Bombardment), Columbia Army Air Base, Columbia, South Carolina. The drill has been put to a practical test under the supervision of Lieut. Paul J. Wozny, Aviation Ordnance and Armament Section, The Ordnance School, and, with few modifications, is here suggested for use in the field.

GENERAL

1. Purpose. - These instructions are to be used for the training of bomb service crews in the exact procedure of servicing bombardment airplanes in the field.

2. Scope. - The scope of these instructions covers the loading and unloading of the 4000 lb. demolition, light case bomb.

3. Organization. - The fundamental unit for bomb service drill is the bomb service crew. The bomb service crew consists of a crew chief, one chauffeur, and three munitions workers.

4. Equipment. - The equipment necessary for this drill is the same as required for other bomb service crews; namely, one (1) truck, bomb service, M6, and two (2) trailers, bomb service, M5, with standard equipment. The only additional equipment required is four (4) pieces of suitable wooden dunnage 2" x 6" x 6' or 3" x 6" x 6', two (2) pieces of blocking 4" x 4" x 20", and two (2) extra chains for each trailer.

CREWS LOADING 4000 LB. BOMBS

In general, the drill is conducted in the same manner as the 2000 lb. bomb drill with each member doing the same type of work.

The commands are: 1. PREPARE TO LOAD. 2. CREW CHIEFS TAKE CHARGE OF YOUR CREWS. The crew is alongside the bomb service truck and at this command the bomb service crew will move under the direction of the crew chief, who repeats the first command, PREPARE TO LOAD. Nos. 1, 2, and 3 secure four (4) pieces of wooden dunnage, and place them on the trailer between the channels, and two (2) pieces of 4" x 4" x 20" blocking brakes on the trailer. Nos. 1, 2, and 3 then couple the truck and trailers with No. 4 assisting the Crew Chief. The Crew Chief inspects the trailer chests for their proper equipment. He checks for completeness, the prescribed bomb handling equipment on the bomb service truck and trailers before moving to the bomb storage area. Upon arrival at the proper bomb storage unit, No. 3 uncouples the second trailer and leaves it adjacent to second bomb storage unit, and then the crew proceeds to move the bomb service truck and remaining trailer into position to load the first bomb. The trailer should

be backed in with the second and third channel being centered between the shipping bands or in such a position so the bomb can be easily moved into that position. The shipping bands will be left on the bomb until it has reached the bottom of the ramps in the unloading operation. It should be clearly understood that the bomb is loaded and hauled CROSSWISE on the trailer.

CREWS AT THE BOMB STORAGE AREA

The commands are: 1. PREPARE TO LOAD. 2. CREW CHIEFS TAKE CHARGE OF YOUR CREWS. The crew, being alongside the bomb service truck will move at this command, under the direction of the crew chief who repeats the first command, PREPARE TO LOAD. Nos. 2 and 3 attach the bomb loading ramps to the second and third channels and place the bomb loading ramp stands under the ramps. Two (2) each ramps and ramp stands are required to load or unload each trailer. Nos. 1 and 4 remove the chains and chain binders from the trailer chest and then place the chains in the following positions:

The first chain is placed under the first channel at the fourth opening and through and under the fifth opening of the second channel through and under the sixth opening of the third channel and then through and



Notice that the cable goes around and under the bomb and the hook is attached to the pintle of the trailer. Precautions should be taken to insure that the cable pulls against the back of the hook and not against the opening or point.



The bomb is half way up the ramps, and is being steadied and guided from the nose and tail.

under the seventh opening of the fourth channel. The second chain is placed under the fourth channel at the fourth opening and through and under the fifth opening of the third channel, and through and under the sixth opening of the second channel, and then through and under the seventh opening of the fourth channel. Openings are counted from front to rear. When the chains are in place the turnbuckles will be crossed between the second and third channels. A piece of dunnage is then placed on the channels above the fourth channel chocks, which will later be used for the forward chock, and when the bomb is in place and a second piece of dunnage has been placed behind the bomb, both are then nailed into place.

The crew chief then places blocking under the trailer frame at the rear end of the trailer, (4" x 4" x 20" under each side, to keep the front of the trailer from lifting). This blocking should always be in place when either loading or unloading operations are underway.

The crew chief, Nos. 1, 2, 3, and 4 make any necessary movement of the bomb which might be required in order that it will be in the proper position for loading.

Nos. 2 and 3 then take positions at the loading winch. No. 2 releases the winch gears, and No. 3 releases the winch cable hook from the loading position and passes it on to No. 4, who pulls the hook to the rear, over the trailer, unwinding the loading cable from the winch. No. 4



The bomb is rolled on to the trailer by use of the winch to this point, and from here on it is rolled by hand. Note: the shipping bands are around the outside of the two center channels.

hands the hook to No. 1, who passes the hook over the top and under the bomb and back to No. 4, who wraps the cable around the rear trailer pintle and the hook under the cable. Precaution should be taken to insure that the cable PULLS AGAINST THE BACK OF THE HOOK AND NOT TOWARD THE OPENING OR POINT. When this operation has been carried out to the satisfaction of the crew chief, the crew then falls in AT EASE alongside the bomb service truck. The drill is now ready to be continued.

The commands are: 1. LOAD. 2. CREW CHIEFS TAKE CHARGE OF YOUR CREWS. The crew being alongside the bomb service truck, the crew chief repeats the command LOAD. At this command, Nos. 2 and 3 move to the winch on the bomb service truck to crank the bomb into



The bomb is blocked in front and rear and the dunnage is then nailed in place. The chains are placed around the bomb and held in place with the binders.

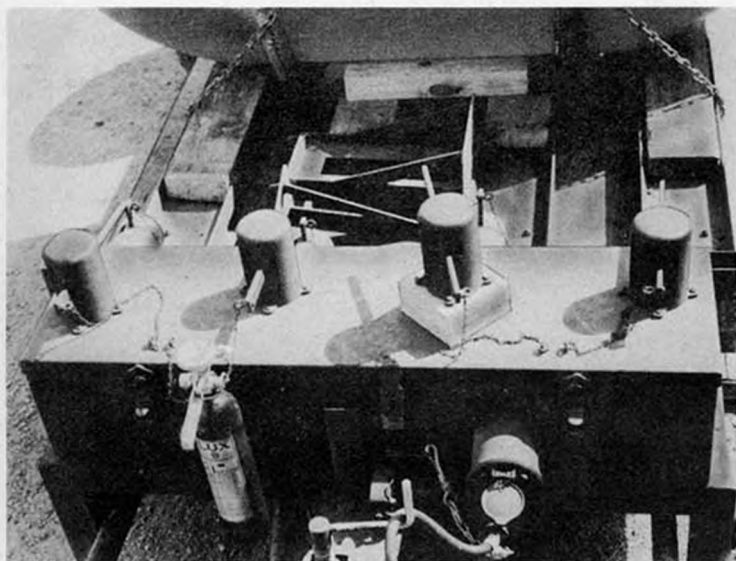
position on the trailer. Nos. 1 and 4 guide and steady the bomb as directed by the crew chief. The crew chief places himself in a position to observe the progress of the bomb as it rolls up the ramps, and he also makes sure that no one is behind the bomb as it is being rolled up the ramp. When the bomb reaches a level position on the rear of the trailer, having been rolled as far as practicable by means of the cable, No. 2 locks the hand winch and No. 3 proceeds to the trailer to assist Nos. 1 and 4 in rolling the bomb forward on the trailer by hand. If the bomb is equally centered on the two ramps, the shipping bands will ride on the outside of the ramps, and the nose and tail end of the bomb will clear the tires of the trailer. Nos. 1 and 4 then secure the bomb in place by means of the chains, chain binders and dunnage.

Nos. 2 and 3 load the ramps, ramp stands, extra dunnage and the blocking. No. 1 checks his truck to make sure it is ready to move out. The crew chief then checks the load, couplings, etc. If everything is found to be satisfactory, the crew and equipment is then ready to move out of the bomb storage area and to pick up the necessary fins and fuzes. It is best to always carry an extra set of fuzes to eliminate any lost time and motion in case one or both fuzes are damaged, thus eliminating delay in delivery to the Air Corps. On arrival at the fuze storage unit, the necessary fuzes are placed in the chest of each trailer. At the fin storage unit, the necessary fins are placed on each trailer. Until such time as a modification comes out from the Chief of Field Service, the fin post may be modified so that the fin for this bomb can be secured properly by placing a 3" piece of wood at the base of the fin post. See accompanying photographs.

CREWS UNLOADING 4000 LB. BOMBS

The bomb service crew, organized and equipped as prescribed, will perform the following drill preliminary to all bomb unloading operations:

The commands are: (The same as for other bomb drill.) 1. UNLOAD. 2. CREW CHIEFS TAKE CHARGE OF YOUR CREW. The crew being alongside the bomb service truck, the crew chief repeats the command, UNLOAD. At this command, the ramps, ramp stands, etc., are placed in position the same as for loading. Then the loading opera-

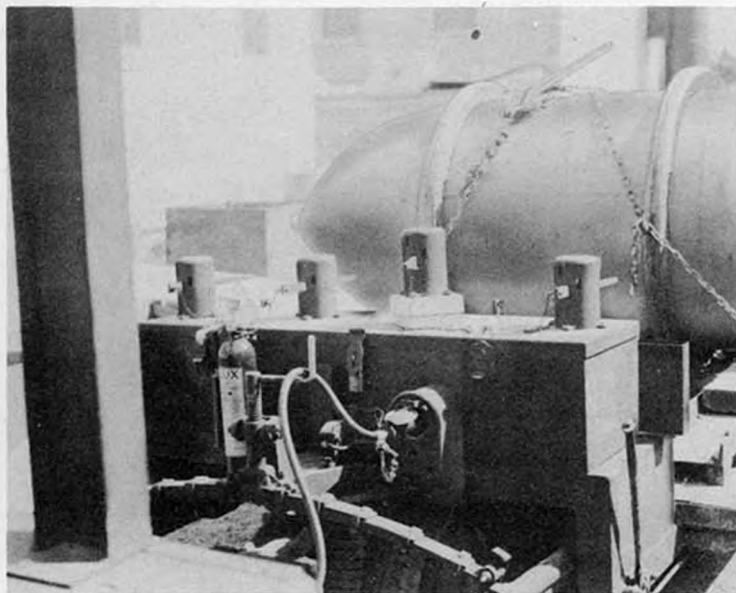


The fin post is raised on a 3" block for a temporary expedient until a modification is approved by the Chief of Field Service.

tions are carried out in reverse until the bomb reaches the bottom of the ramps. One piece of dunnage is placed under the center of the bomb, but must be in a position so that the cable will remain free. Then the shipping bands are removed and the bomb is moved into position under the plane by hand. From here, there are several ways that the bomb may be put in place for loading into the plane, such as follows:

Careful measurements should be made to insure the bomb's arrival, upon completion of its travel, in a position with the suspension lugs in their proper position for loading. The bomb will be finned and fuzed after it has been lifted clear of the ground by the plane hoist.

Special precautions should be taken in unloading, both in "spotting" the trailer and in lowering the bomb. Manual handling of the trailer is recommended for "spotting" if such is practical. The exact procedure will vary according to type of plane, i. e., Tricycle landing gear (B-24) or Conventional gear, as with other planes (B-17). With tricycle landing gear, approach the bomb bay from the rear of the plane while in the case



Another view of the fin post on the temporary base.

of the conventional gear, the approach is made from the front. In view of the above, it is only logical that the unloading should be worked out respecting the type of plane the crew is to service. With reference to measurements to insure proper positions of the lugs, the 28 foot web strap, four (4) of which are standard equipment in each trailer, will generally be used. The length of the strap is equal to three (3) complete revolutions of the bomb, therefore it is the best available equipment.

It is possible that the bomb may be loaded into the bomb bay of a ship in this manner: The bomb is placed in the open, away from the bomb



The trailer is completely loaded and bound. It is now ready to move out.

bay of the ship and the plane moves up to the bomb. The bomb should have at least a three (3) inch clearance, so that the bands, which are connected to the hoist of the ship can be put under the bomb. Two (2) sets of hoisting bands are used, one near the nose and the other near the tail of the bomb. The bomb is finned and fuzed under the plane.

At the present writing, there is a new type of bomb lift truck that has been approved by the Ordnance Committee, and from all indications, it will be the answer to the problem of maneuvering such a large size bomb into proper position for easier handling. This lift truck is made so as to be able to handle the 4000 lb. light case bomb and the aerial torpedo. The information pertaining to this lift truck can be found in OCM Items No. 17947 and 18019, dated March 7 and March 30, 1942, respectively. Tentative military characteristics of such a truck are listed as:

1. Purpose. - To lift the Torpedo, aircraft, Mk. 13, Model 1 and the Bomb, light case, 4000 lb., A.N. M56 into or under aircraft.

2. Type. - Hydraulically operated lift truck, mounted on rubber tires. Rear end to be supported on small steel Athey track wheels when the units become available.

3. Physical Characteristics (approximate):

- | | |
|--|-----------|
| (a) Length (not including tongue) | 130" |
| (b) Width | 66" |
| (c) Maximum height (excluding tires) | 17-1/4" |
| (d) Weight | 1400 lbs. |
| (e) Capacity | 4000 lbs. |
| (f) Range of lift | 24" |
| (g) Carriage loft angle: Variable from 3-1/2° tail up to 11-1/2° tail down. | |
| (h) Clearance between bottom of torpedo and ground: Provisions for 9" minimum and 33" maximum. | |

It is becoming increasingly difficult for THE ORDNANCE SERGEANT to be sure that all issues are delivered to all organizations, due to the fact that so many changes of address are not reported promptly. If you have moved, what is your new mailing address, APO or otherwise?

In these hectic days, when development of materiel progresses so very rapidly, it is not surprising that we forget about the models and types of not so many years past. When we do stop to look back at them they seem clumsy, inefficient, and very old fashioned. Yet many of them were once the pride and joy of our fighting units — and a lot of efficient

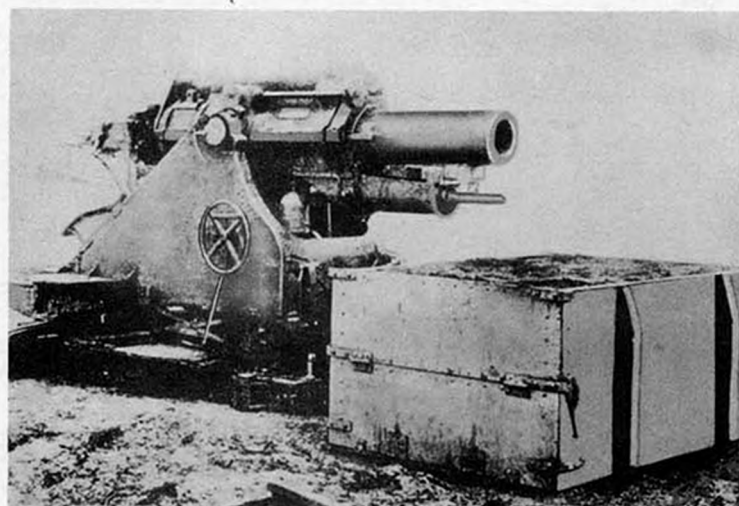


Fig. 1.
defense and offense has been accomplished by their use.

Not so well known, perhaps, are the experimental models of the past. Some never successfully met the tests to which they were put,

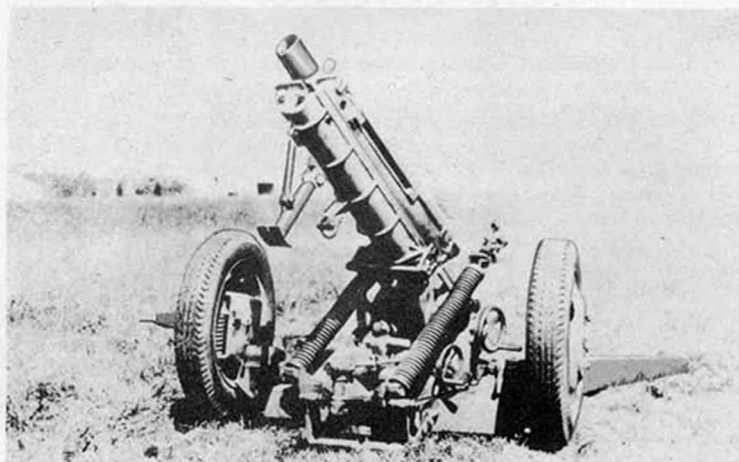


Fig. 2.

some which proved quite successful with modifications were put to good use, only to be outdated within a few years. Hundreds of these experimental models are interesting — space allows a glance at only a few.

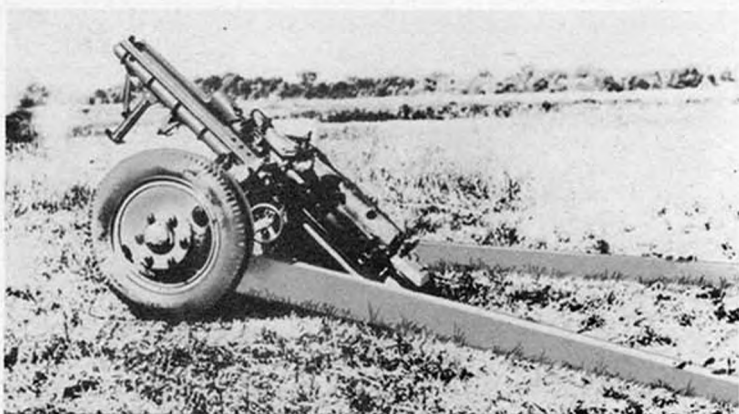


Fig. 3.

The 29,100-pound 9.2-inch Howitzer, M1917 (Mk I), is shown in Figure 1. The weight shown is that in the firing position. The projectile weighed 290 pounds, and the weapon has a maximum range of 10,060 yards. For

Shades OF THE FORGOTTEN PAST

traveling the unit was divided into three transport wagon loads.

We can easily see a resemblance to a modern weapon in Figures 2, 3 and 4. The 75mm Howitzer, M1, on the Carriage, T1, isn't such a long step back from our current 75mm Field Howitzer. Figure 2 shows

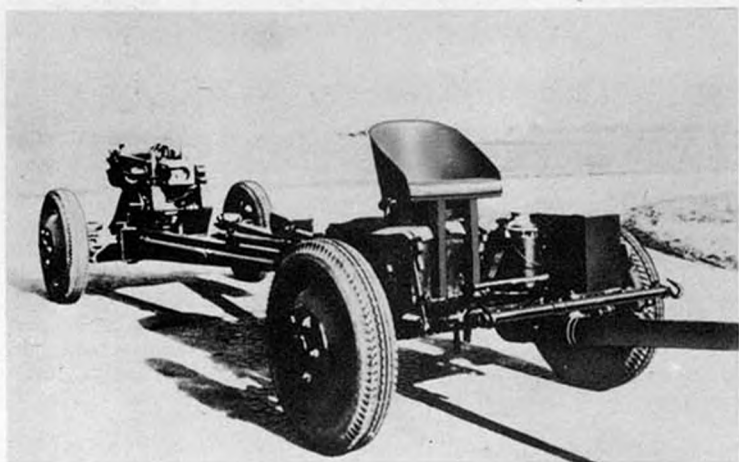


Fig. 4.

a side view of the weapon in firing position at an elevation of 45°, while Figure 3 shows a front view at the same elevation. Figure 4 shows it being towed behind a Light Carriage Limber.

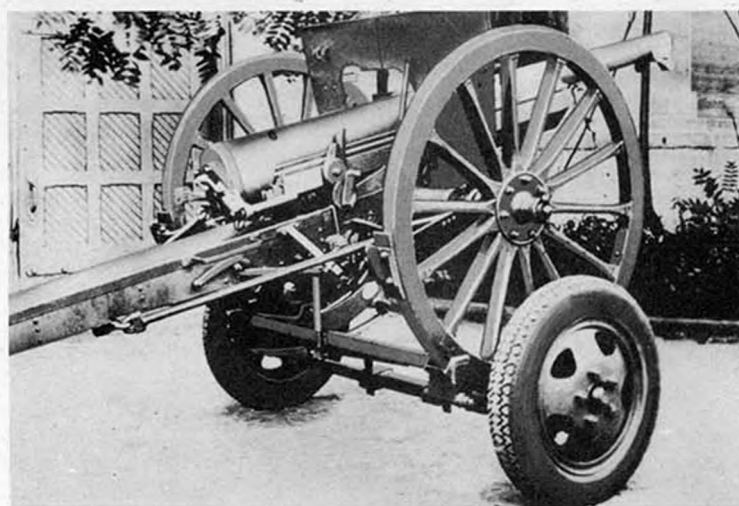


Fig. 5.

Figure 5 gives us an idea of the Light Trailer, T5, which was tested back in 1931. Its purpose was the transportation of the 75mm Gun Carriage, M1897, at high speeds. It weighed 590 pounds, and 3240 pounds when carrying its load. It was capable of a speed of from 35 to 40 miles per hour. It was fast in 1931 — it might be left behind in 1942.

Getting back to another big idea, we see in Figure 6 the World War I 240mm Howitzer, Mk 1918. It weighed 41,300 pounds in firing position, and hurled a 345-pound projectile a maximum range of 16,390 yards. Like the 9.2-inch Howitzer shown in Figure 1, it was divided for transport into loads for three transport wagons.

In Figure 7 is shown the 155mm Gun, of the days of World War I in firing position. This weapon weighed 25,960 pounds in firing position

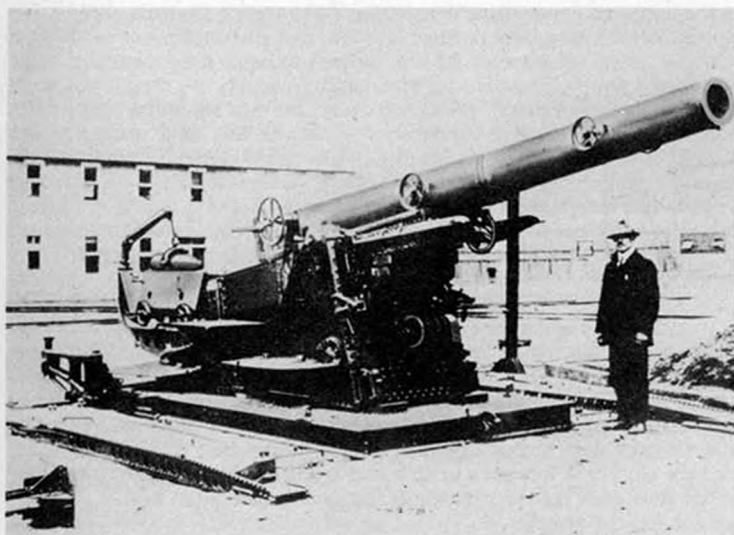


Fig. 6.

as shown, and 29,920 pounds when traveling with the M1918 Limber. It threw a 95-pound projectile a maximum of 17,460 yards.

An interesting experiment was the 75mm Gun, M1925EI, on the



Fig. 7.

ARTILLERY AMMUNITION SUPPLY

(Continued from page 31)

but also that it gives the army a picture of the ammunition status by division. This should be of greater tactical and logistical value to both army corps and army artillery officers than one based on reports consolidated by corps.

The corps artillery staffs provided in our current tables of organization are inadequate for any coordinated corps operation. A study of this meager staff indicates that the corps artillery officer has only an S-4 to assist him in the performance of duties concerned with ammunition supply; presumably there are no other assistants, clerical or otherwise, earmarked for this important duty.

Division

In the division (brigade) the artillery commander's most important responsibilities concerning ammunition are those of making allocations and supervising supply operations. Questions of sites for installations will ordinarily arise only when division dumps or distributing points must be employed.

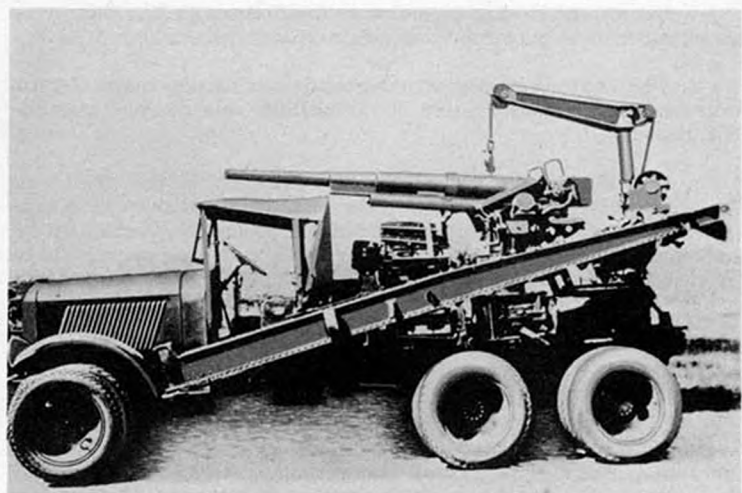


Fig. 8.

75mm Truck Mount, T2. This weapon was mounted on a six-wheeled, 6-cylinder Garford truck. It could be fired either from the truck or from the ground, a crane being provided for maneuvering it from one position to the other. The girder-like pieces shown in Figure 8 were

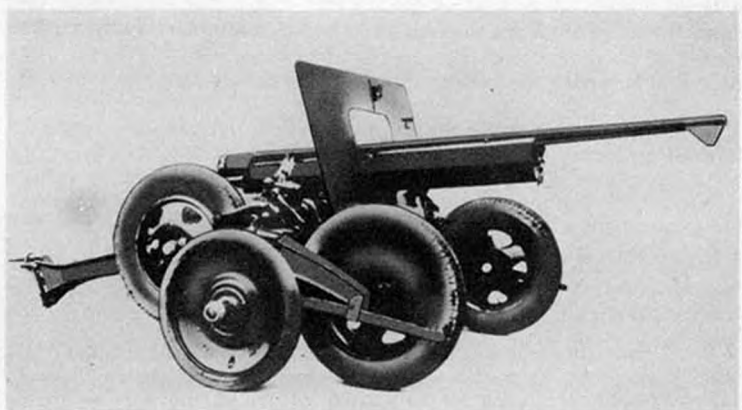


Fig. 9.

extended to the side when the weapon was fired from the truck.

Another interesting if not useful experiment in the transportation of the 75mm Gun was the Carriage, M1897MIE4, shown in Figure 9. The entire outfit weighed 3,435 pounds in firing position. Pneumatic tires were provided for traveling and solid rubber tires for firing.

Estimation of requirements will be incidental except when the division is on an independent or semi-independent mission.

T. C. 42, previously referred to, indicates that the ordnance officer makes allocations within the division, but it seems both unfair and unwise to burden him with this added task. He will ordinarily not be informed of the tactical situation in sufficient detail nor have the requisite artillery training to perform this duty to the best advantage, and he is already charged with many other responsibilities of a highly technical nature.

Although the division artillery officer has no organic transport to effect supply operations, it is visualized that in most cases the tactical situation and limitations on traffic will force him to exercise very close control over supply operations, even to the extent of scheduling the movements of trains.

The insertion of the division ammunition office in artillery ammunition supply procedure has thrown a monkey wrench of annoying proportions into the conception that the artillery, being responsible for hauling ammunition from supply points to positions, should be free to do as it seems best, subject only to necessary restrictions as to where and when it can get the ammunition. The "how" is an artillery problem. Under all cases so far examined the division ammunition officer simply turned into a bottleneck.

Dissemination of information in the division is like that in the corps, but is more concerned with details of haulage.

The division artillery officer (brigade commander) has an S-4 and an ammunition sergeant to assist him in fulfilling his ammunition responsibilities.

It should be noted that the artillery officers of all the echelons so far discussed may request and receive reinforcing artillery from time to time. Any such request should include a request for ammunition for the weapons desired. All the details of haulage and resupply should be furnished to the commanders of incoming units, and frequently some ammunition will be stocked at the prospective position areas for such artillery before it arrives.

Regiment

In the regiment, ammunition supply deals primarily with passing on information, making allocations, and the general supervision of supply operations. The regimental commander should not hold out an ammunition reserve. He can help battalion commanders by securing information as to the availability of ammunition, and getting that information to the battalions promptly. Furthermore, he can direct the pooling of transport and coordinate any requests for additional transportation when the need therefor arises.

The omission of a regimental S-4 from our current T/O is considered proper since most of the matters respecting ammunition that arise in the regiment are so closely tied in with matters normally handled by S-3 or the executive that either one of them can readily give the regimental commander any necessary assistance on this subject.

In a groupment, the commander has ammunition supply responsibilities analogous to those of a regimental commander. Normally, the artillery officer of the echelon under which the groupment is formed should handle most problems regarding supply operations and thus leave the dissemination of information and making of allocations as the chief ammunition responsibilities of the groupment commander.

Battalion

Under our present tables of organization, the battalion is the basic echelon in actual ammunition supply. The battalion commander allocates ammunition by controlling the assignment of fire missions, by requiring a report of expenditures after each mission is completed, and frequently by prescribing the expenditure for each mission.

He is particularly concerned with securing and disseminating information concerning ammunition supply operations, i.e., times when haulage is authorized, routes available, and the location of the supply point (or of the division ammunition office).

If higher authority does not issue instructions concerning dumping ammunition at gun positions, he must do so. He must also indicate whether and how the battery 5th sections are to be used in resupply operations and any unusual precautions to be taken in the care and storage of ammunition.

He must select or approve the bivouac of the ammunition train and the site of any battalion dumps or distributing points that may be established.

The consolidation of ammunition reports is an important job in the battalion because it involves at least four units, the maximum that will ordinarily be involved in any artillery echelon.

Although the division (brigade) artillery commander will often control resupply operations very closely, the battalion commander will frequently be responsible for the planning as well as the execution of the haulage.

To assist him in all these duties, the battalion commander has an S-4 and an ammunition train. The train is an element of the service battery which the S-4 commands; it is composed of three sections so that one or more sections may be sent with batteries having detached missions. Our current tables designate the train commander as munitions officer; he must conduct supply operations and has a full-time job keeping his train in operation, selecting routes, and planning the required haulage. There is considerable doubt whether he can find time to keep track of the status at each battery, make appropriate recommendations

to the battalion commander concerning dumping and haulage, receive and consolidate battery ammunition reports, and at the same time operate his train most effectively. There appears to be no good reason why the S-4 should not be charged with ammunition supply. He should and could perform the purely staff duties and could use his subordinate, the train commander, in tasks of execution. A plan of this sort worked in one organization when tables prescribed S-4 as the munitions officer and the train as part of the headquarters battery. Likewise, when the artillery brigade had an ammunition train there was a separate munitions officer to perform the necessary staff duties; the train commander was charged only with the operation of the train and such distributing points as might be set up.

The S-4 of our present battalion has many trying tasks indeed. However, the staff aspects of ammunition supply as distinguished from the haulage jobs are not so weighty but that he could perform them as well as his general supply duties. Furthermore, staff matters concerning ammunition supply will come up at times and places which will cause no interference with duties affecting supply in general; on the other hand, haulage activities are sure to do so. If S-4 is the munitions officer there is one less staff officer with whom the commander must deal.

Battery

The battery commander has the following specific responsibilities in respect to ammunition supply: first, unload at his position such quantities as the battalion commander specifies; second, store and protect this ammunition as prescribed in standing or special instructions; third, submit reports of expenditures on the completion of each firing mission; fourth, submit the ammunition report at the specified time. In the usual case he will not conduct resupply operations; his 5th section can be used for that purpose but when so employed it will normally operate under battalion control. It is always the duty of the battery commander to inform his battalion commander when stocks of ammunition are running low. When battalion distributing points are established he may be required to execute part or all of his necessary haulage.

In light batteries the battery commander has the executive and a fifth section specifically earmarked for ammunition supply duties. Most duties affecting the care and storage of ammunition have in the past fallen to the assistant executive. However, since he is frequently used as a forward observer and for such reconnaissance as the battery commander and reconnaissance officer cannot make, this is leaning on a frail reed for an important task.

Many battery commanders charge the fifth section only with supply operations and have the recorder at the guns to keep account of the ammunition status. The battery gun mechanic should be trained to be the technical expert in the care and handling of ammunition at the guns. Since there are two noncommissioned officers in the fifth section, one of them can perform these duties, i.e., keep track of the ammunition status and supervise the care and storage thereof, under the battery executive. Our current manuals suggest that the chief of the fifth section be charged with these duties and that the artillery mechanic assist him. Since the other duties (camouflage and defense against chemicals) of the corporal in the fifth section make it desirable that he be near the gun position as much as practicable, it might be better to charge him with duties pertaining to ammunition records and storage and leave the sergeant free to handle haulage.

In medium and heavy batteries there is an ammunition corporal (he also has other duties) in each gun section. He is presumably needed because the care and handling of separate loading ammunition is more difficult than is the case with fixed or semi-fixed ammunition. In other respects the organization for ammunition supply is like that in the light batteries and a similar assignment of duties is practicable.

In the medium batteries there is a peculiar situation brought about by the fact that the only spare prime mover is in the fifth section. In many cases, therefore, it will be advisable to use some other vehicle, such as the executive's truck, in resupply, especially when there is any unusual danger of losing trucks in this operation.

SUMMARY

In this discussion the ammunition supply responsibilities have been listed as pertaining to the commanders. In various places in our field manuals certain duties flowing from these responsibilities are listed as appropriate for various staff officers and other individuals. No such suggested distribution will fit all cases. Personal factors play a

large part in deciding the best distribution of duties in any particular case. The important thing is to insure that a competent man who is properly trained is charged with them.

This paper is intended to indicate the particular ammunition supply tasks which confront artillery commanders in each of the echelons. Plans for meeting these tasks must be made with the utmost care. They must be prepared far enough in advance to facilitate efficient execution. Planning is a function of command. Those who execute the plans must be men of good judgment and courage. Successful commanders in all wars, including the present one, have attested to this fact. The artillery fire that made history in Bataan was possible because wise plans were laid for ammunition supply and because intestinal fortitude made them work.



FOOD FOR THE CANNONS

(Continued from page 45)

In recent years boosters have been designed to be assembled directly to the projectile, the old "adapters" being discarded except in chemical shells. The fuze is customarily screwed into the booster. Boosters are used in all high-explosive and chemical shell for all guns and howitzers.

The term "booster", when applied to chemical shell, is converted to "burst", as the function of this component is to break up the shell and disperse the chemical filler. The burst charge is therefore greater than in the high-explosive booster.

Many of the chemical shells have a bushing screwed into the nose, known as the adapter. This affords a recess to receive the fuze. Attached to the adapter is the burst casing, which in turn contains the burster.

The following methods are used to seal the chemical filler in chemical shell: provide the projectile and the adapter-booster or adapter with pipe threads; force the burst casing into the adapter to form a gas-tight seal; or force the burst casing into the nose of the projectile itself, as in recent types of 75, 105 and 155mm chemical projectiles.



IS HORSE ARTILLERY ON THE WAY OUT?

(Continued from page 29)

horse artillery in use, particularly with the cavalry."

So go the answers at Fort Bragg.

From Pine Camp, N. Y., Brigadier General Carl A. Baehr, the author of the Editorial in this issue, sends us this opinion.

"Present thought in our Army appears to be that horse-drawn artillery has limited use in comparison with other types.

"It is still retained in some of the continental armies which indicates that it still can be used to advantage in some form of present day operations. Ability to move off roads thereby freed for motor traffic, requiring less drain on vital supplies such as gas and oil, utilizes equipment available which otherwise would be discarded, constitute some of the arguments in its favor."

Fort Jackson, South Carolina, sends in a number of opinions, for which the names of the authors cannot be furnished. All, however, are well informed artillery officers.

(1)

"I believe there will always be a place for Horse Artillery. A strong argument in support of this view is that the Germans and Russians have found it advantageous to retain a considerable amount of Horse Artillery throughout the war. There are certain conditions of terrain, climate and supply which are likely to continue valid for the retention of Horse Artillery.

"Also, the Japanese have been able to make very effective use of animal-drawn artillery in their campaigns in China and Southeastern Asia.

"An important factor which often prevails is the possibility of replenishing animal motive power from native stocks in the Theater of Operations."

(2)

"Horse Artillery will remain as long as the doughboys walk."

(3)

There will always be a definite need for Horse Artillery to follow the doughboys in certain types of terrain."

"As long as any Artillery is used in warfare there will be a place for Horse Artillery. Machines are still unable to go where a horse or sure-footed mule can go, and artillery fire from such places is very often essential to success in an operation."

Fort Jackson, therefore, seems to favor horse-flesh over metal.

A late entry, but an interesting one, comes from Lieutenant Guy E. Noyes, of Battery C, 55th Field Artillery Battalion, Fort Myer, Virginia.

"The outstanding success of aircraft in the present war makes it very easy for its proponents to dismiss the battleship as an outmoded relic of another age. Those who attempt, honestly and logically, to point out the risks involved in swinging too far and too fast from modern and properly protected battleships always take the chance that they will be pigeon-holed as short-sighted sentimentalists.

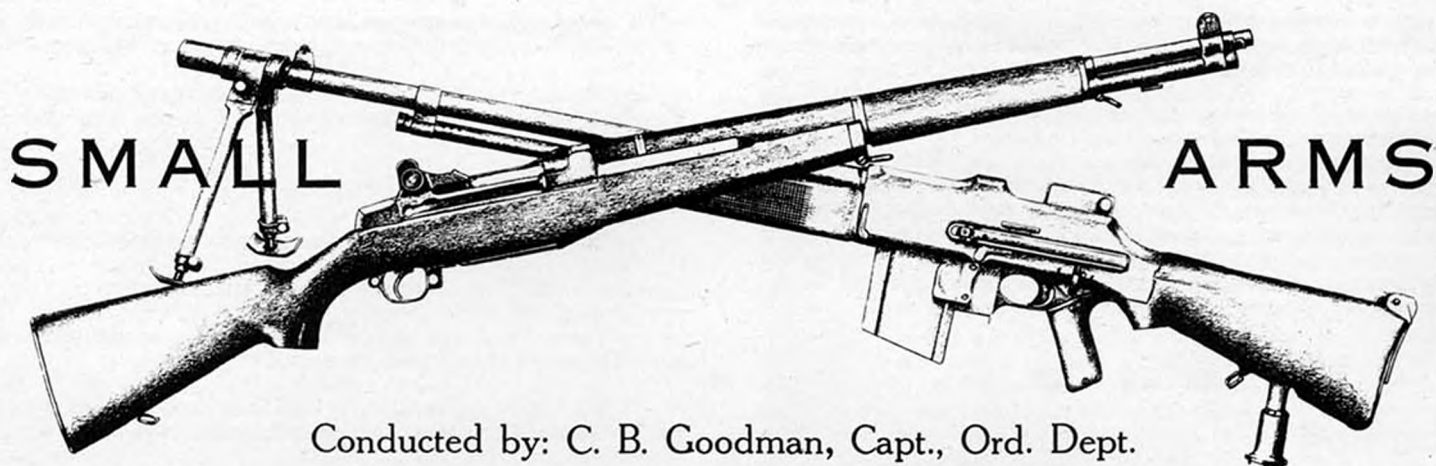
"Much the same situation holds in regard to the horse artillery. Nobody pretends that "the automobile will never replace the horse." Probably 90% of the functions performed by horse-drawn equipment in 1918 can be carried out more effectively with the motorized equipment which is available today. There remains, nevertheless, a relatively small but important area of operations, in which the superiority of horse-drawn equipment is clear to those who have operated under these conditions. Light, modern artillery, which can be emplaced in positions that cannot be reached by any type of motorized equipment, can be invaluable as a defense against the most highly modernized forms of attack, that is, with paratroops, glider-borne troops, and armored vehicles."

Ordnance men can take their choice of these opinions. Upon a correct solution of this problem many maintenance problems for Ordnance personnel will depend. THE ORDNANCE SERGEANT has not attempted to provide an infallible answer — it was known before the question was asked that a number of contradictory opinions would result. But a number of interesting and useful factors have been exposed. They are worth thinking about, and the beneficial results of the brain exercise may actually be reflected in your Ordnance maintenance activities.



INDEX

The Index for Volume 3 of THE ORDNANCE SERGEANT (January to June, 1942) will be ready about August 1, 1942, or shortly after you receive this issue. No general distribution will be made — write for a copy if you want it. Address: The Editor, THE ORDNANCE SERGEANT The Ordnance School, Aberdeen Proving Ground, Maryland.



Conducted by: C. B. Goodman, Capt., Ord. Dept.

THOMPSON SUBMACHINE GUN, CAL., 45, M1928A1

By A. C. Fabrize, T. Sgt., Ord. Dept.

This article is intended to assist Ordnance men in the field in some of the highlights in the maintenance and repair of the submachine gun.

Pivot Plate

If the pivot plate is removed while the weapon is assembled the consequences will be the loss of valuable time trying to disassemble the weapon. The majority of the interior parts in the frame group are held



Fig. 1. -- Left to right: H. L. Bagley, 2nd Lt., Ord. Dept., Checking the frame group mechanism; A. C. Fabrize, T. Sgt., Ord. Dept., Reshaping the lips on a magazine; J. E. Johnson, 2nd Lt., Ord. Dept., Assembling recoil spring, buffer pilot and pad in the receiver.

by the pivots attached to the pivot plate. These parts are under spring tension. Removing the pivot plate will cause the parts to be forced up and jam against the bolt and other interior parts.

Recoil Compensator. (Cutts)

Replacing the compensator improperly has caused the threads on the barrel to become burred, and in many cases the slot in the barrel threads to become enlarged. In cases where the burrs are not bad the threads may be sharpened by working graphite grease or emery flour into them. It is sometimes necessary to have the barrel rethreaded. Such cases may be avoided by checking the positive alignment of the hole in the compensator with the slot in the threads of the barrel and front sight, before inserting the pin.

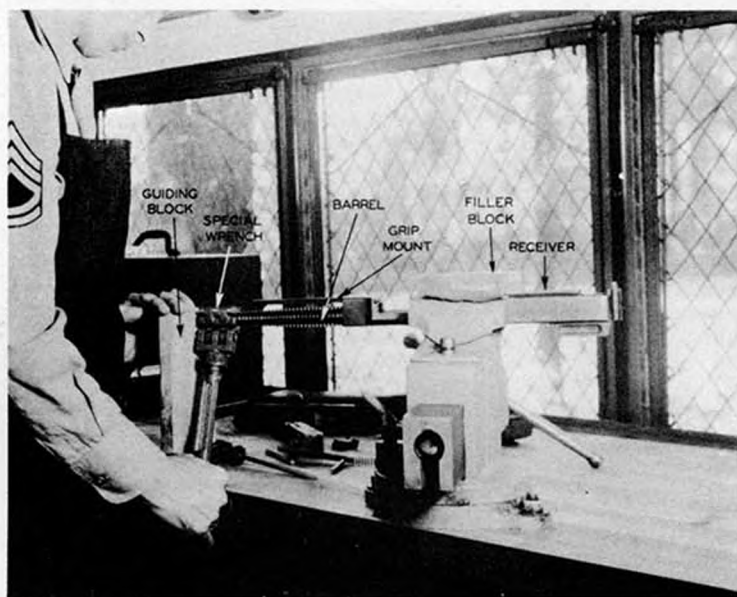


Fig. 2. -- Removing and replacing an unserviceable barrel or grip mount or both.

Trigger Pull.

The trigger pull on this weapon should be between eight and twelve pounds. Due to the great number of parts and surfaces involved, that can in some way effect trigger pull, creeps are a common occurrence. The replacement of worn parts, removal of burrs, and the interchanging of parts will greatly improve the trigger pull.

Springs

In some instances new recoil springs have prevented the bolt from recoiling enough to feed the following cartridge. (This stoppage can also be the fault of the ammunition, binding parts, or a dirty weapon.) Disassemble the weapon and operate it manually a reasonable number of times. This should remedy the stoppage, providing there is not a major fault. Some springs (trigger and butt stock catch) have flared ends. For better operation of these springs, set the flared ends down into their seatings.

The ends of the magazine catch spring become worn and slip from their seatings. Bend the ends slightly or replace the spring.

Disconnecter and Spring

A worn disconnecter, or weak or broken disconnecter spring, will not allow the sear to be disengaged from the bolt by pulling the

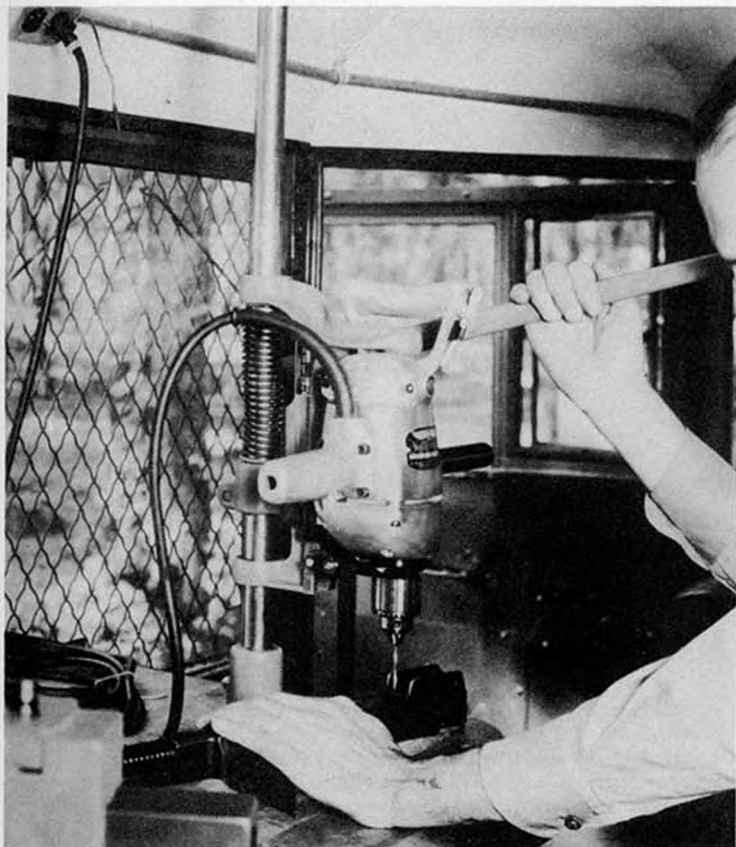


Fig. 3. Removing and replacing an unserviceable rear sight fixed base.



Fig. 4.

trigger. (The bolt must be forward to disassemble the frame group from the receiver group.) One method of allowing the bolt to go forward is to remove the rocker pivot, insert a punch or similar tool in the disconnector hole on the left side of the receiver, and pry up on the sear lever. Another method is to remove the safety and pry down on the sear.

REMOVING AND REPLACING UNSERVICEABLE BARREL OR GRIP MOUNT OR BOTH

To remove the grip mount it is necessary to first remove the barrel, because a projection on the mount is in rear of the shoulder on the barrel. If the barrel is serviceable, precautionary measures should be taken not to damage the barrel while removing or replacing it. Place

a filler block in the receiver and a guiding block under the barrel, forward of the mount. (See Figure 2.) The receiver is clamped in a vise with protection against burrs, preferably copper jaws. Attach a special wrench on the barrel between the mount and the guiding block. Then unscrew the barrel, putting pressure on it with the hand over the guiding block. To replace the grip mount and barrel, place the mount in its proper seating in the receiver, then replace the barrel. Screw the barrel up to a draw fit. Then check to see that the alignment marks on the barrel and receiver coincide. To remedy an improper fit of the barrel, shims may be used, or the shoulder of the barrel peened, filed or stoned, depending on the improper fit. When fitting a barrel a "Work and Try" method should be applied to work up to the proper fit, i.e., work a little,

(Continued on page 63)

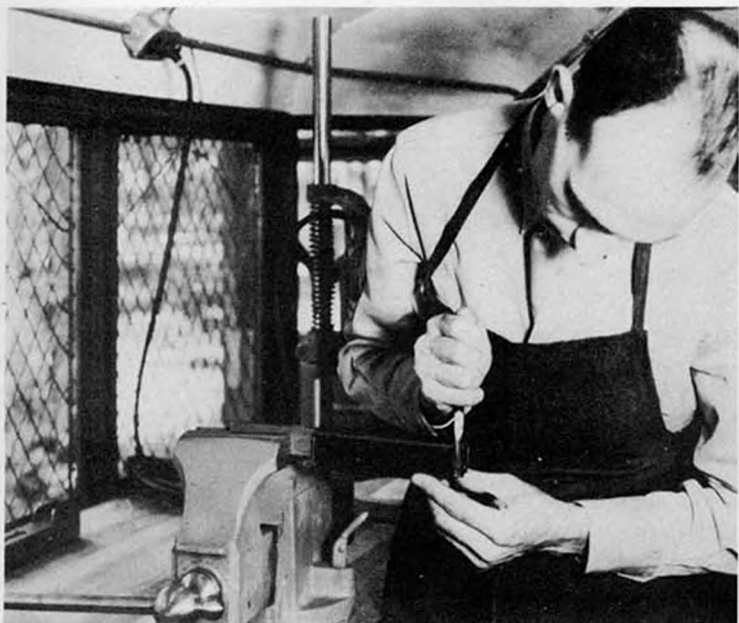


Fig. 5. -- Reshaping the lips on a box type magazine.

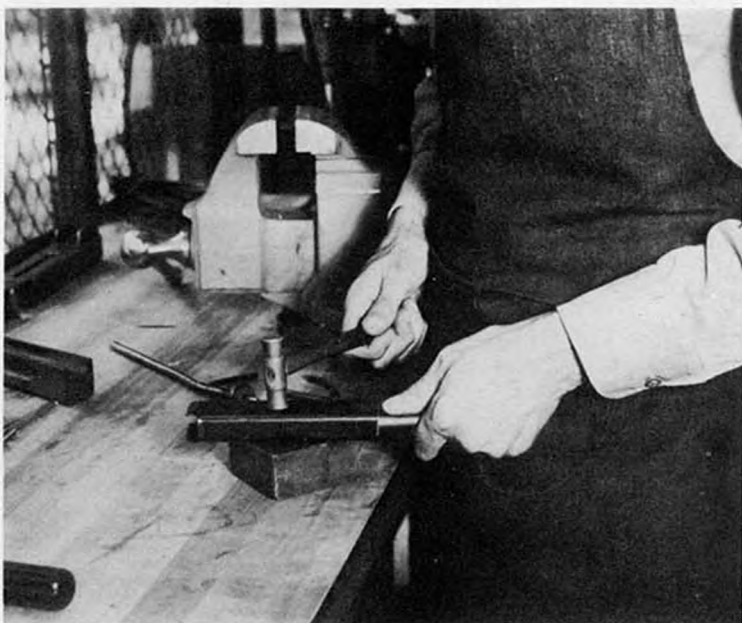


Fig. 6. -- Ironing out dents on the magazine body.

ARTILLERY



Conducted by W. C. Minshaw, Capt., Ord. Dept.

During the process of development of the modern gun carriage many improvements have been made over the carriages of earlier periods. One of the outstanding features is that weapons may be elevated to higher angles than ever before without the necessity of digging a pit to allow space for recoiling parts. At the same time the breech is maintained at a convenient height for loading at all elevations. In order to accomplish

DISASSEMBLY OF SPRING TYPE EQUILIBRATORS

By L. D. Hampton, 2nd Lt., Ord. Dept.

It is the purpose of this article to show how certain specific types of equilibrators (employed on Field Artillery carriages) may be safely disassembled. The tools and jigs shown in the accompanying photographs and drawings were designed in the Artillery Section of the Ordnance School and were fabricated by the School Machine Shop. The materials needed for the construction of these tools are easily procured. In fact, most of these may be found in the scrap pile.

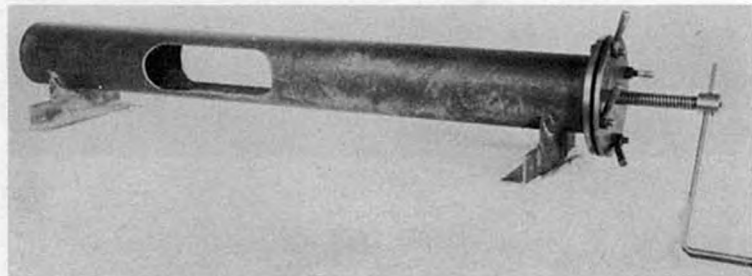


Fig. 1.

this feature of construction it has been necessary to move the trunnions from the center of gravity of the tipping parts to a point near the breech. This change, of course, creates a muzzle preponderance and thereby tends to make elevation difficult. To offset this condition, equilibrator assemblies are used to recreate a state of equilibrium in the tipping parts as they are rotated around the trunnions. Today several types of equilibrators are in common use, the type depending upon several factors such as weight and angle of elevation. The most commonly used types are: (1) Spring, (2) Pneumatic and (3) Pneumatic-spring. On some of the newest types of the heavier carriages another equilibrator is coming into use, namely, the hydropneumatic. Due to the assistance offered by the equilibrators the handwheel effort necessary to elevate or depress a weapon is no greater than would be required were the tipping parts mounted at the center of gravity.

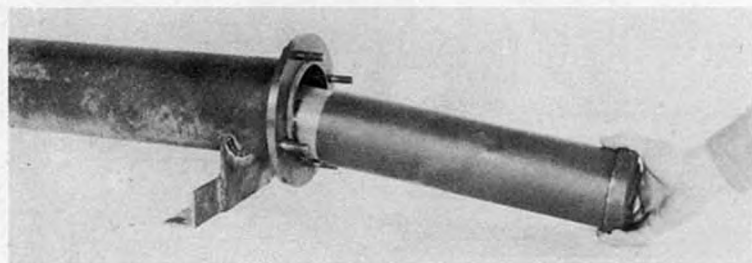


Fig. 2

Coincident to actual service conditions, equilibrators require a certain amount of routine maintenance. Occasionally it becomes necessary to partly or completely disassemble the mechanisms in order to clean, repair or replace parts. In some cases, such as with the pneumatic equilibrators, complete disassembly by the Medium Maintenance Company is not permitted due to the type and quantity of tools and fixtures necessary. This is not the case with spring type equilibrators. However, the task of disassembly can be hazardous, or may even result in fatalities, if the equilibrators are not approached with the respect due the energy of the compressed spring or springs.

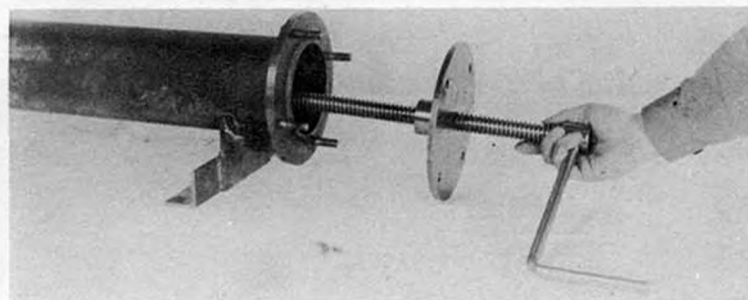


Fig. 3.

Figure 1 shows an assembled jig that is used for the assembly and disassembly of the equilibrators employed on the 75mm howitzer carriages, M2, M3 and M3A1, and also for those employed on the 75mm gun carriages, M2A1, M2A2 and M2A3. It would be satisfactory for use with any equi-

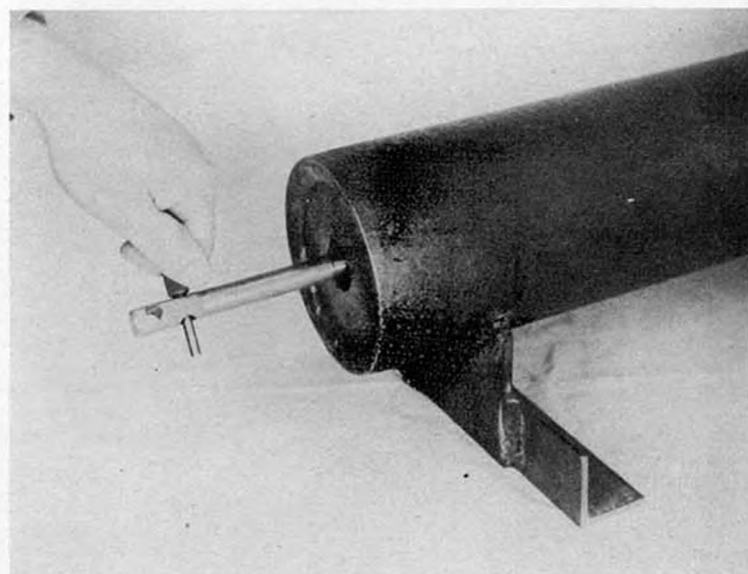


Fig. 4.

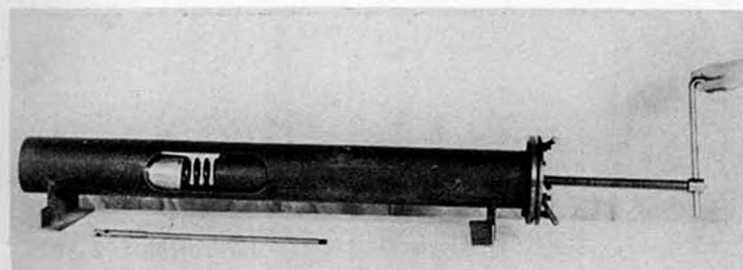


Fig. 5.

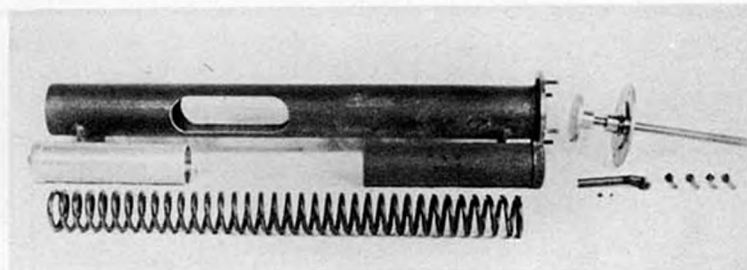


Fig. 6.

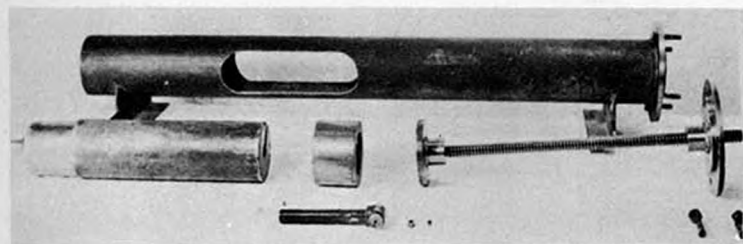


Fig. 7.

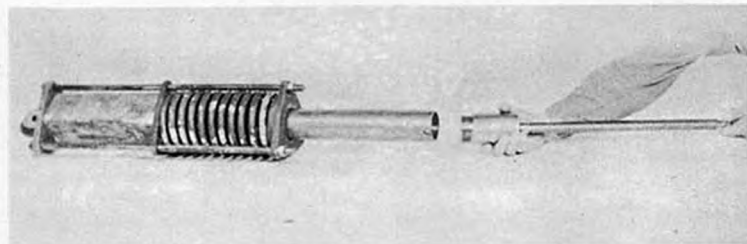


Fig. 8.

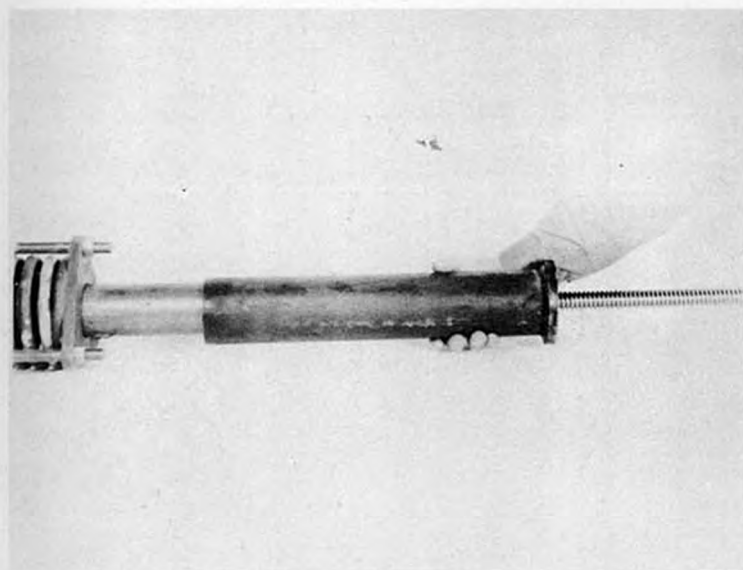


Fig. 9.

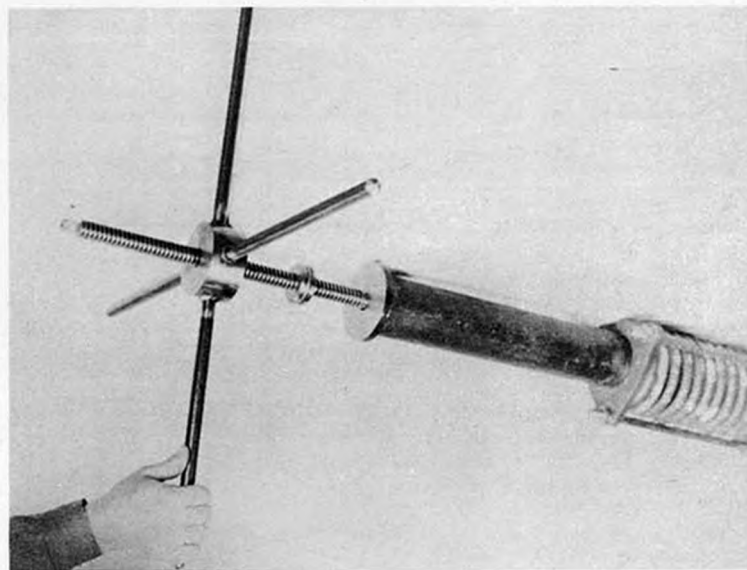


Fig. 10.

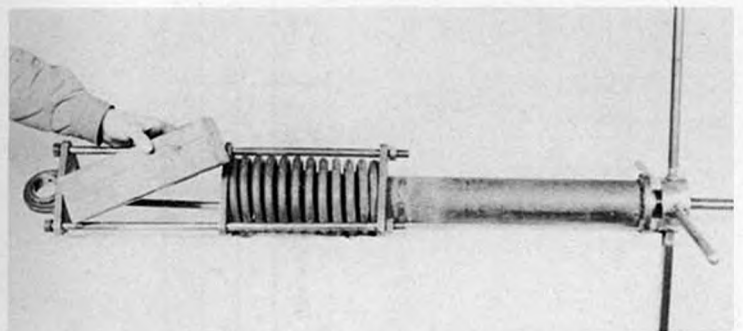


Fig. 11.

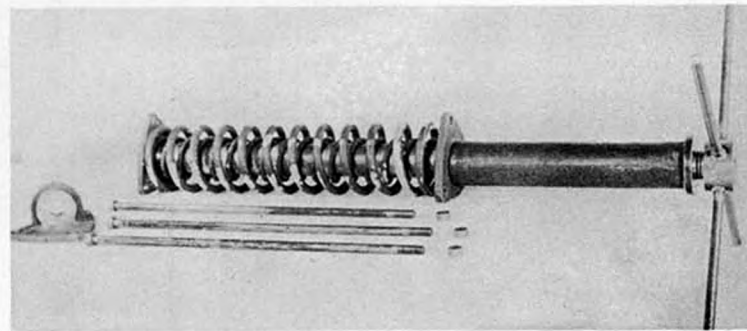


Fig. 12.

brator of approximately the same type and size. The same general construction, except of smaller size, will provide a convenient jig for use with the equilibrators employed on the 75mm pack howitzer carriage, M1. Details of construction may be found in the drawing on page 60. It will be noted that two sets of dimensions are shown on this drawing. The small size shown is for use with the pack howitzer, and the large size for the others mentioned above. The material used is all steel, the tubular body being 3-1/2 and 5-inch steel pipe for the small and large sizes respectively.

Figure 2 shows an equilibrator from the 75mm howitzer carriage,

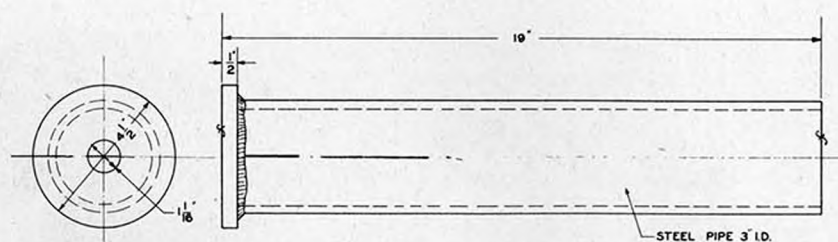
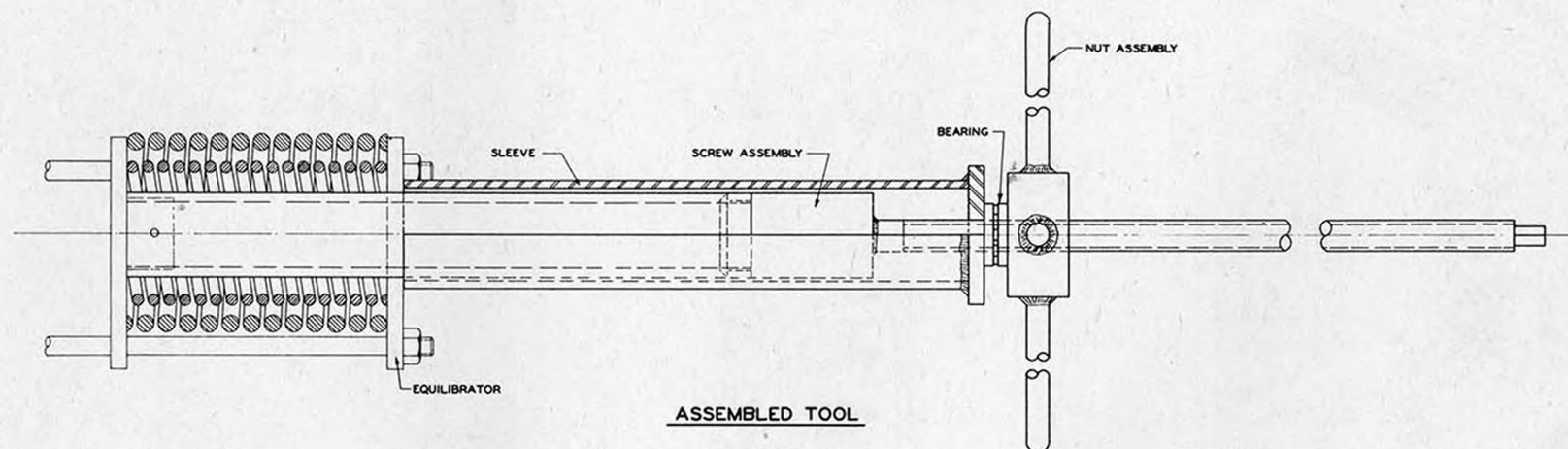
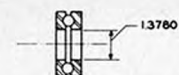
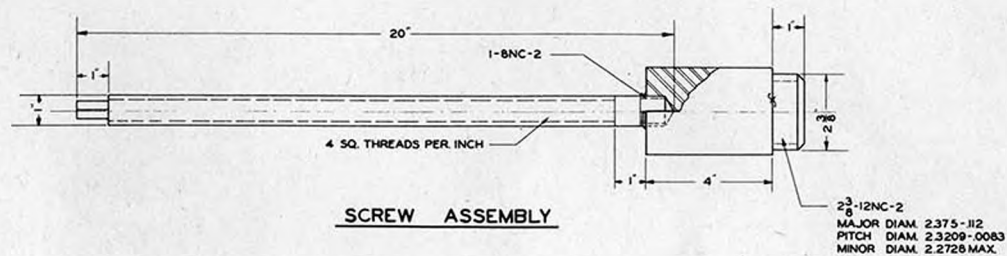
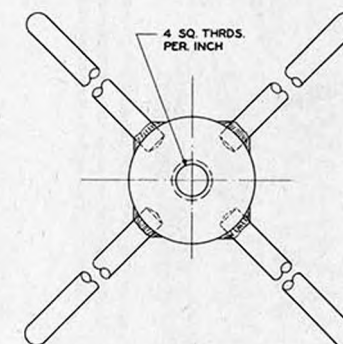
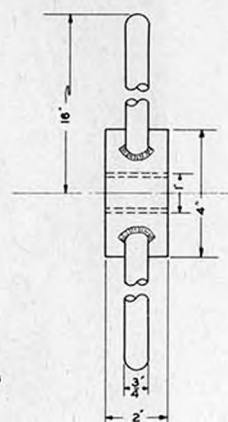
M3A1, being placed into the jig for disassembly. The trunnion pin has been removed from the equilibrator.

The jack screw assembly is then assembled to the jig, as shown in Figure 3.

As in Figure 4, the jack screw is turned until the piston forces the spring to be further compressed. The equilibrator assembling bolt is then removed.

The jack screw is then turned in a counter-clockwise direction

ASSEMBLING TOOL FOR 105MM HOW. EQUILIBRATOR

SLEEVEONE DIRECTION FLAT
SEAT BALL THRUST
BEARING - MEDIUM
TYPEBEARINGNUT ASSEMBLY

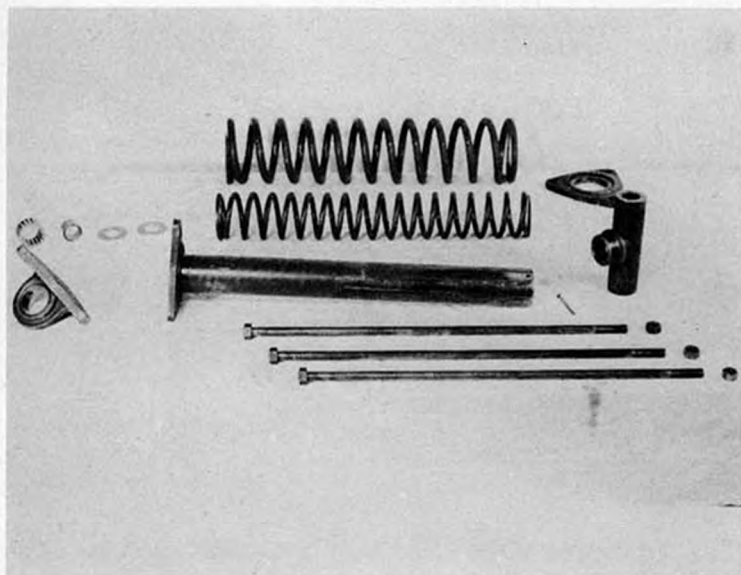


Fig. 13.

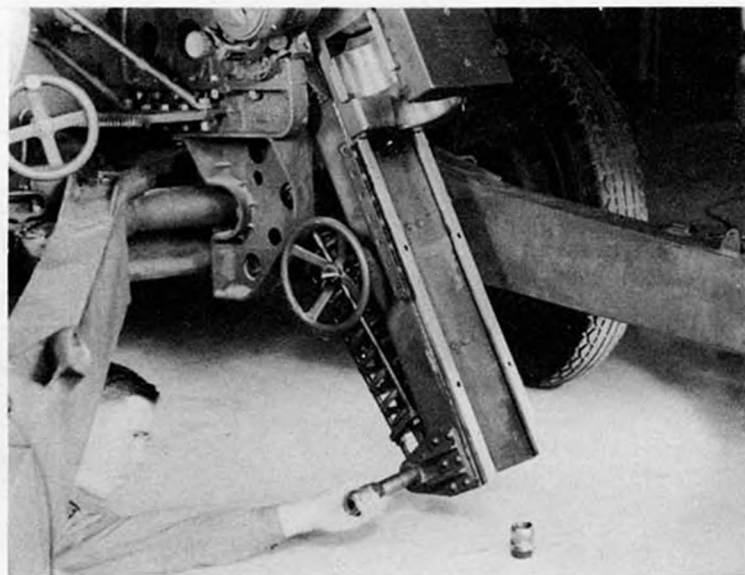


Fig. 14.

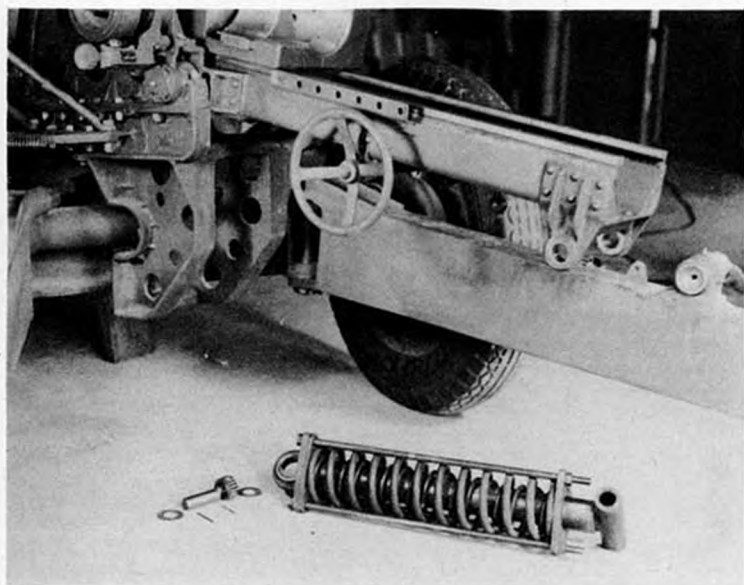


Fig. 15.

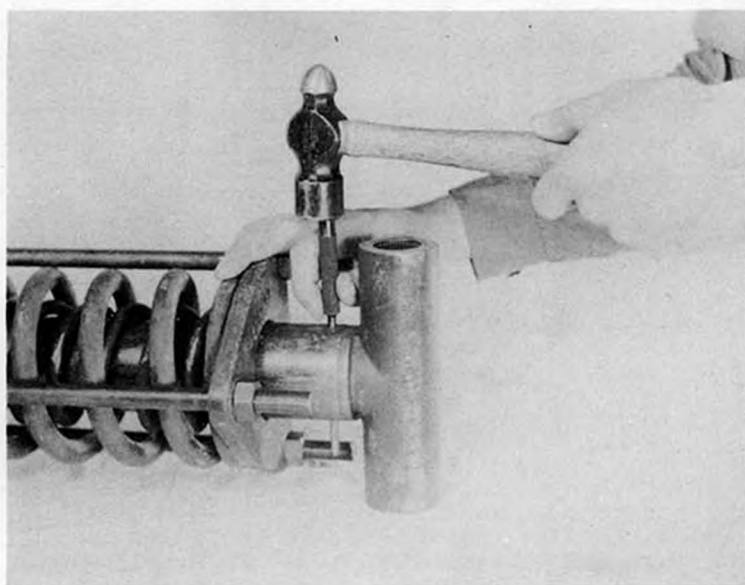


Fig. 16.

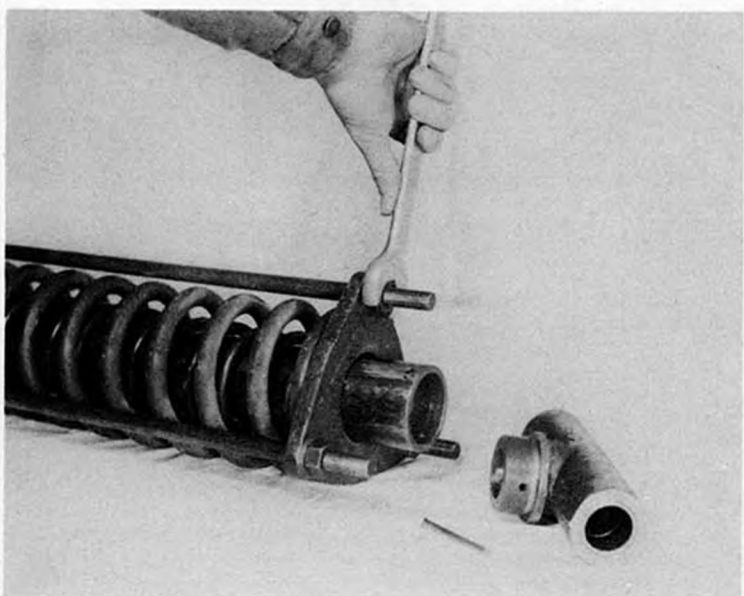


Fig. 17.

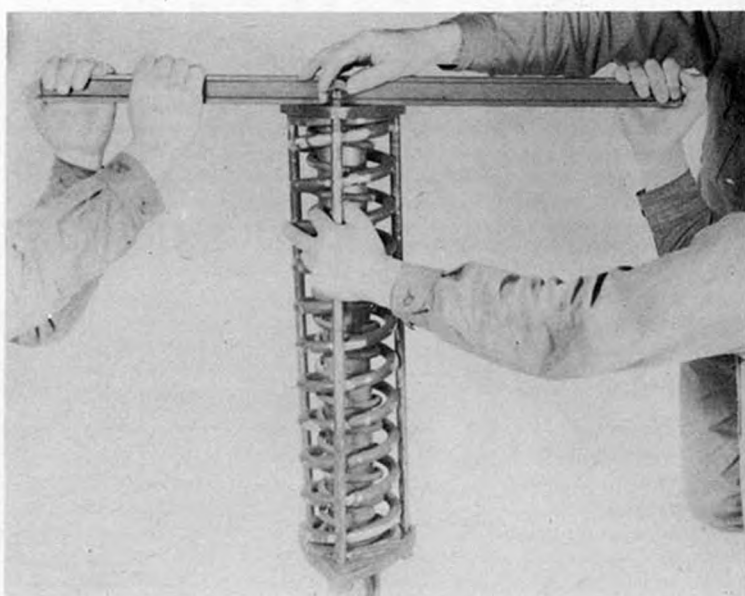


Fig. 18.

until the equilibrator spring reaches its free length. In Figure 5 it can be seen that the barrel and tube have separated and that the spring is being held between them still partially compressed. (The hand holes are to facilitate aligning the barrel and tube upon re-assembly.)

Figure 6 shows the equilibrator after removal from assembling jig.

In order to keep the screw as short as possible, a 4-inch spacer is used between the piston and the outer cylinder when disassembling the equilibrators of the 75mm gun carriages of the M2 series. In Figure 7 the assemblies are laid out in the relative position they would occupy in the jig.

Assembly of the equilibrator is accomplished by reversing the procedure of disassembly.

The photographs which follow will show the use of a tool which is used in connection with assembly and disassembly of the equilibrator employed on the 105mm howitzer carriage, M2. This tool is not absolutely necessary but is considered a time saver if the amount of work justifies its construction. Details for the construction of this tool are shown in the drawing on page 61. The tubular body of the sleeve is ordinary 3" steel pipe. The thrust bearing has been fitted with a brass sleeve to reduce the inside diameter to a free sliding fit over the square threads of the screw. This sleeve is pressed into the stationary race, the inside diameter of which is less than that of the movable race.

After having removed the equilibrator assembly in the manner prescribed in TM 9-325, drive out the straight pin as shown in Figure 16 and remove the bearing as shown in Figure 17. Attach the screw assembly as shown in Figure 8.

As shown in Figure 9, place the sleeve over the screw.

Assemble the thrust bearing and nut assembly in the order shown by Figure 10.



SUBMACHINE GUN

(Continued from page 57)

then try your work, repeating the process when necessary.

REMOVING AND REPLACING REAR SIGHT FIXED BASE

Drill and punch out the four rivets. (See Figures 3 and 4.) Replace with a serviceable base and rivets. Set a filler block in the receiver and clamp in a vise. With a steel support in the inner part of the receiver against the rivets, peen the rivets with a punch and hammer. File and stone the rivets smooth.

RESHAPING LIPS ON BOX TYPE MAGAZINE

Disassemble the magazine, then place a filler block inside of it. Clamp the work in a vise. (See Figure 5.) Grasp the lip with round nose pliers and bend it to its proper angle. The distance between the lips of the magazine should be .55". This repair may be made without the use of the vise as shown in Figure 1.

IRONING OUT DENTS ON MAGAZINE BODY

Disassemble the magazine and insert a filler block in the interior. With a brass or lead hammer iron out the dents. (See Figure 6.)

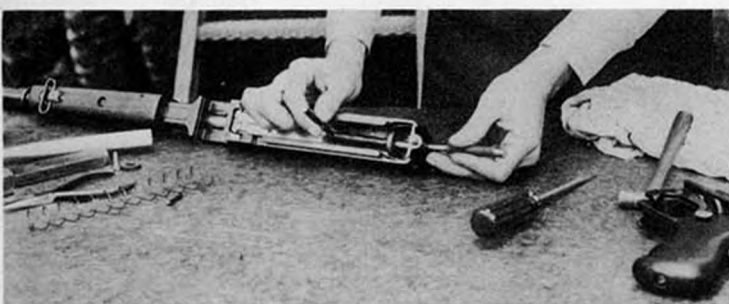


Figure 7.

Turn the nut up tightly, further compressing the springs, and remove the 3" x 3" x 12" block, as shown by Figure 11.

Turn the nut in a counter-clockwise direction until the springs have almost reached their free lengths. Remove the three guide rods and the fulcrum. Remove the nut assembly and complete the disassembly of the equilibrator as shown by Figure 12.

Figure 13 shows the equilibrator completely disassembled.

Assembly of the equilibrator is accomplished by reversing the procedure of disassembly.

The following photographs show how the equilibrator employed on the 105mm howitzer carriage, M2, may be safely disassembled without a special tool or fixture.

Elevate the howitzer to maximum elevation. At this time the front spring seat will contact the fulcrum. Operate the elevating hand-wheel to free the traveling lock shaft and remove the shaft as shown in Figure 14.

While applying downward pressure on the rear of the cradle and/or upward pressure on the muzzle, depress the howitzer. Remove the fulcrum pin. Remove the equilibrator assembly from the carriage. See Figure 15.

Drive out pin as shown in Figure 16.

As shown by Figure 17 remove the bearing and unscrew the guide rod nuts until they are almost ready to be taken off of the rods.

Stand the equilibrator on end and, while holding pressure on the rear spring seat, as shown by Figure 18, remove the nuts completely. Allow the springs to expand to free length.

Assembly is accomplished by reversing the procedure of disassembly.

DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING ON BUFFER PILOT

The following figures show the disassembly of the recoil spring, buffer pilot and pad, also the assembly of the recoil spring on the buffer pilot.



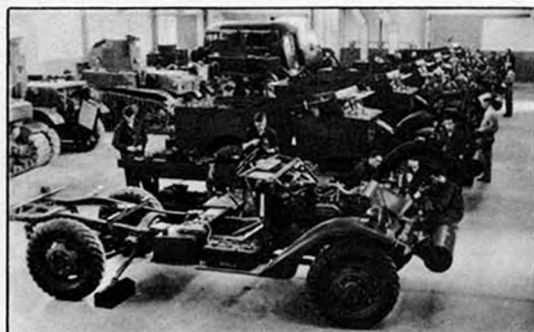
Figure 8.

With a punch or similar tool push forward on the buffer pilot. (See Figure 7.) Insert a punch in the hole in the buffer pilot. (F.S.M.W.O. A32-W1). Guide the pilot and recoil spring out of the receiver. When the receiver is cleared give a quick thrust to the rear to prevent buckling of the spring.

Set the rear of the pilot in the pilot hole in the receiver. Compress the recoil spring. (See Figure 8.) Insert a punch in the pilot hole. (The flat surface of the buffer pilot is placed opposite the side that the punch is to be engaged in.)

To assemble the recoil spring, buffer pilot and pad into the receiver, feed the recoil spring into the hole in the actuator. Place the pilot into its hole in the receiver. Retract the actuator to cover spring space between the actuator and the pilot, then remove the punch.

**KEEP
MUM
CHUM**



Automotive

Conducted by:
J. W. WINSLOW,
M. Sgt., Ord. Dept.

ENGINE DISASSEMBLY AND INSPECTION STANDS

By A. L. Hettrich,
Capt., Ord. Dept.

The pictures on these pages show the use of an engine disassembly and engine inspection stand.

Figure 1 - Engine disassembly stand.

Figure 2 and 3 - Engine mounted on stand. Adaptor brackets are used with each type engine.

Figure 4 - Engine may be turned over. The engine is held in position by a bolt that drops thru holes in both outer and inner sleeves. The outer pipe sleeve has a slot in the top and a clamping bracket. This clamping bracket can be either tightened or loosened to allow the inner pipe to rotate tightly or freely.

Figure 5 and 6 - Inspection stand.

Drawings of this equipment are shown on pages 65 and 66.



Fig. 1.

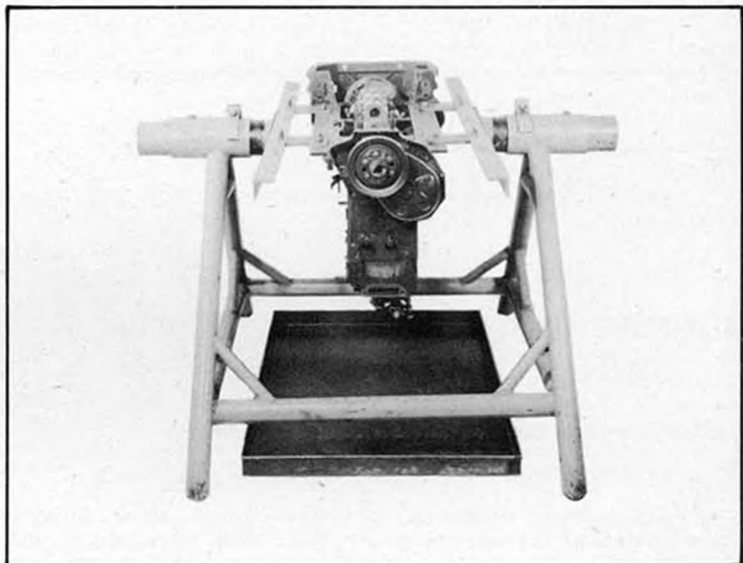


Fig. 3.

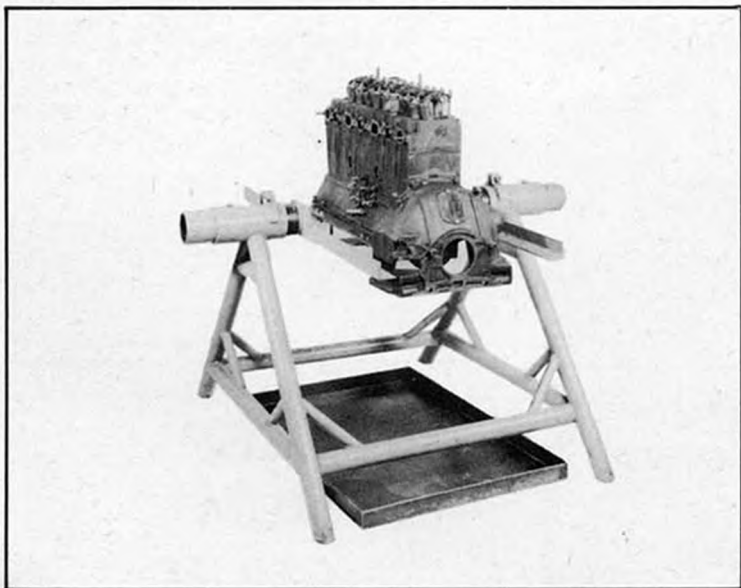


Fig. 2.

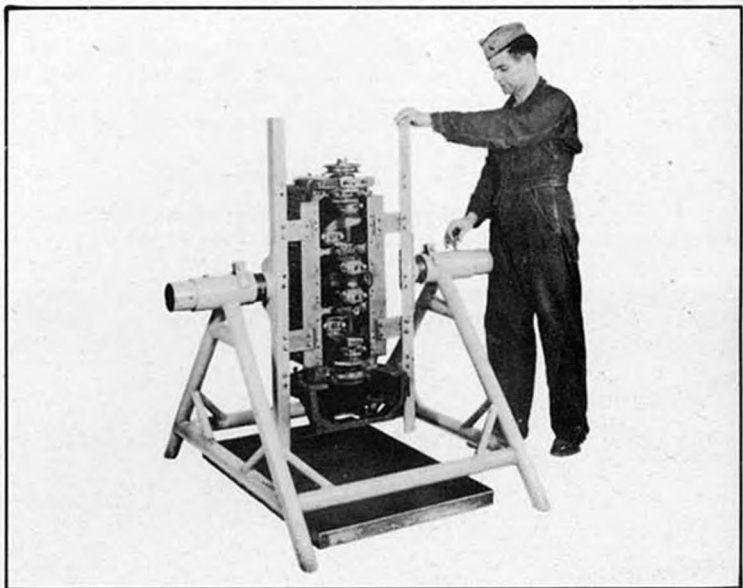


Fig. 4.

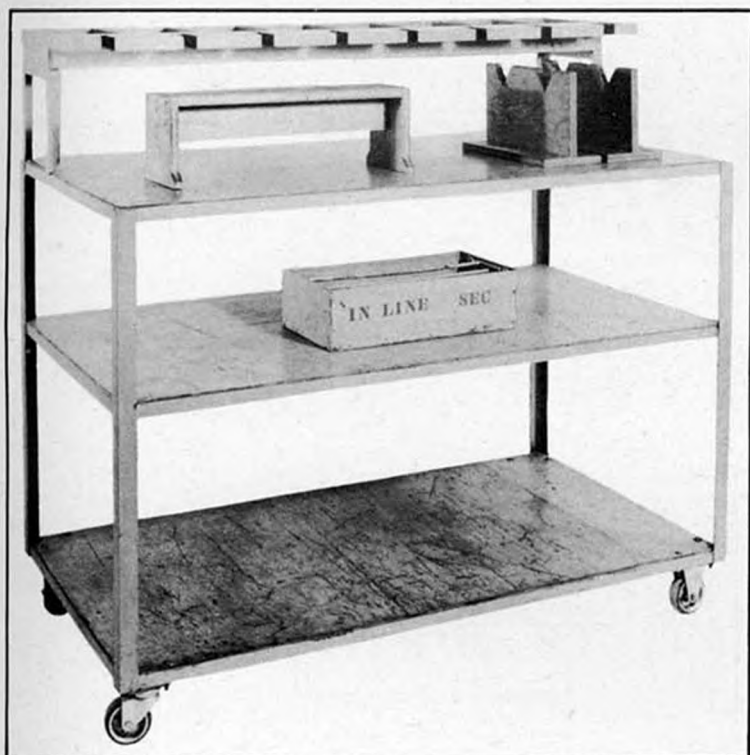


Fig. 5.

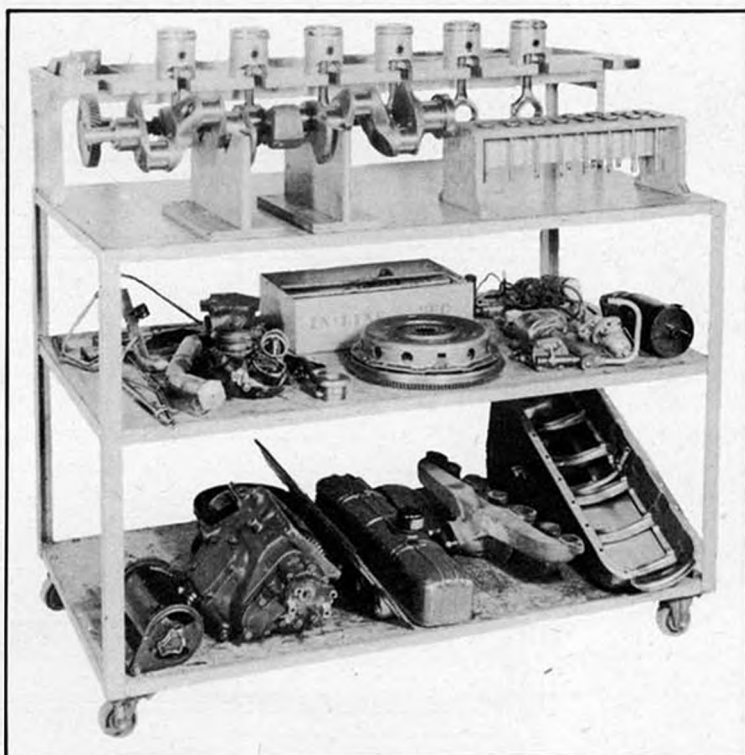
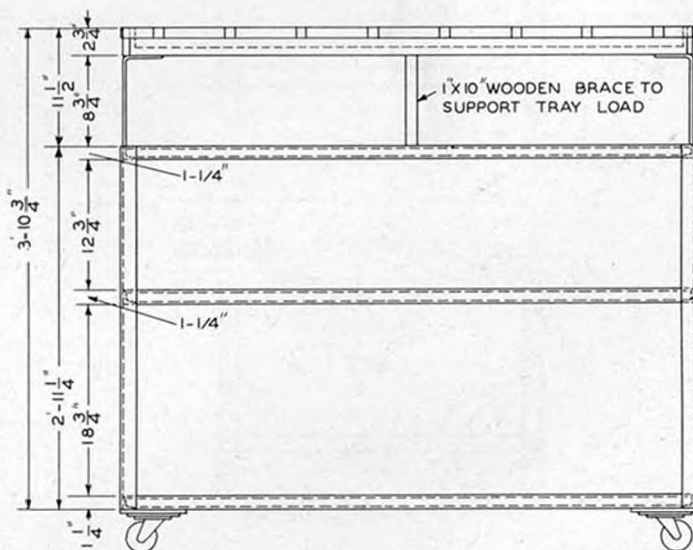
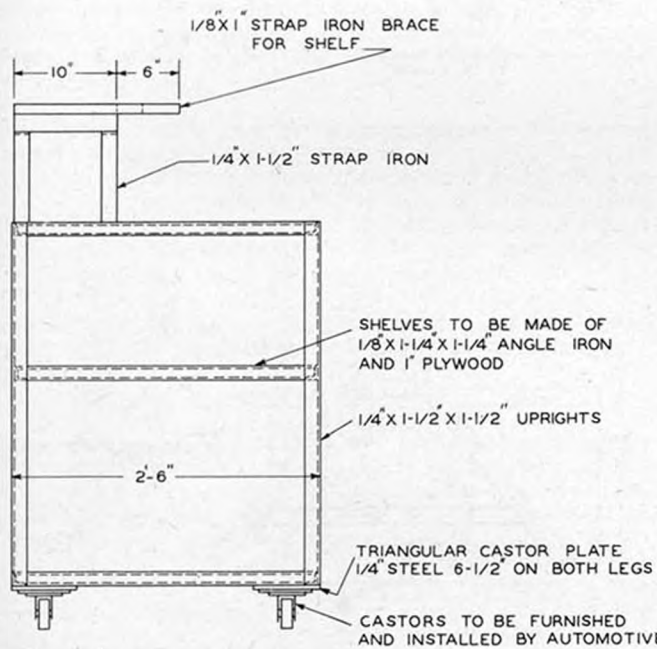
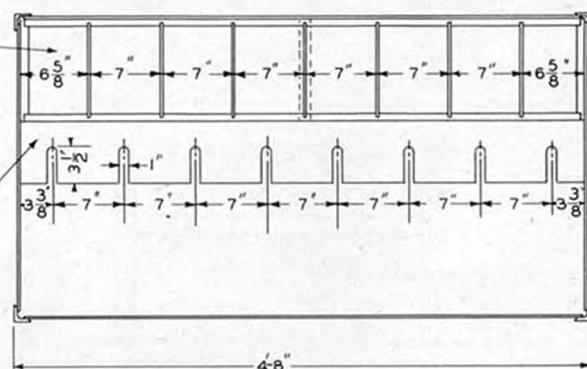


Fig. 6.

NOTE:
WELDED CONSTRUCTION WHERE POSSIBLE

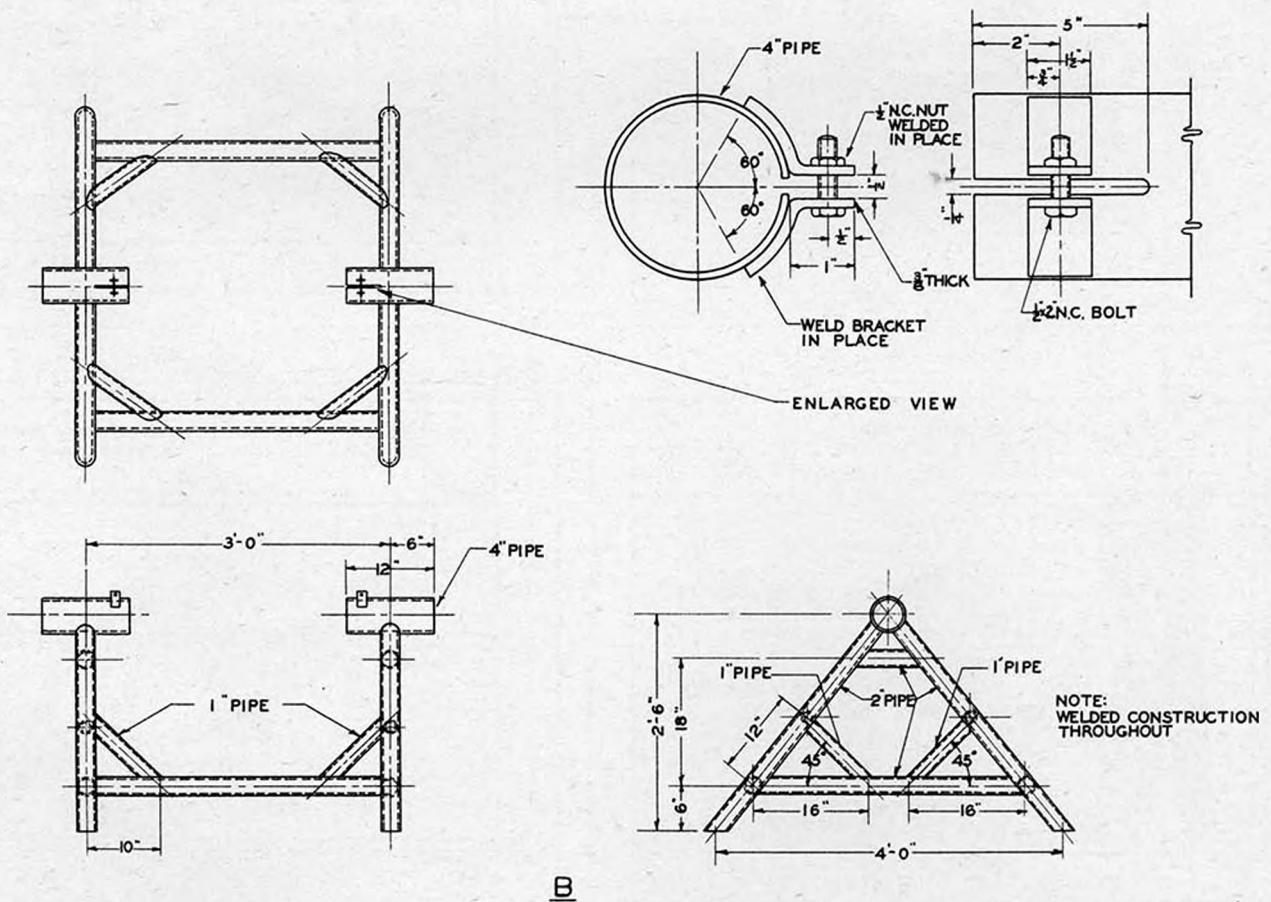
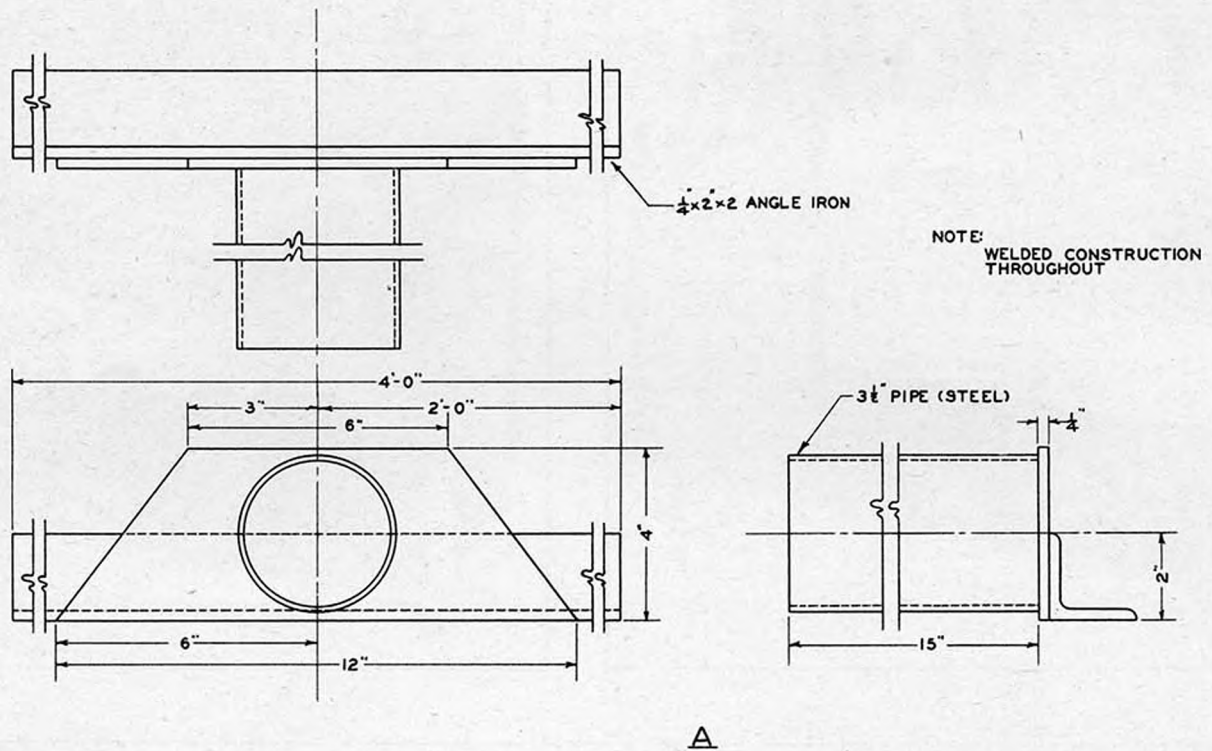
CONSTRUCTION OF TRAY
SIDES 3/4" PINE
BOTTOM 3/4" PLYWOOD
PARTITIONS 1/4" PLYWOOD

1'x6" HARDWOOD SHELF



DRAWN BY P.B.R.
REQUESTED BY W.B.R.
APPROVED BY

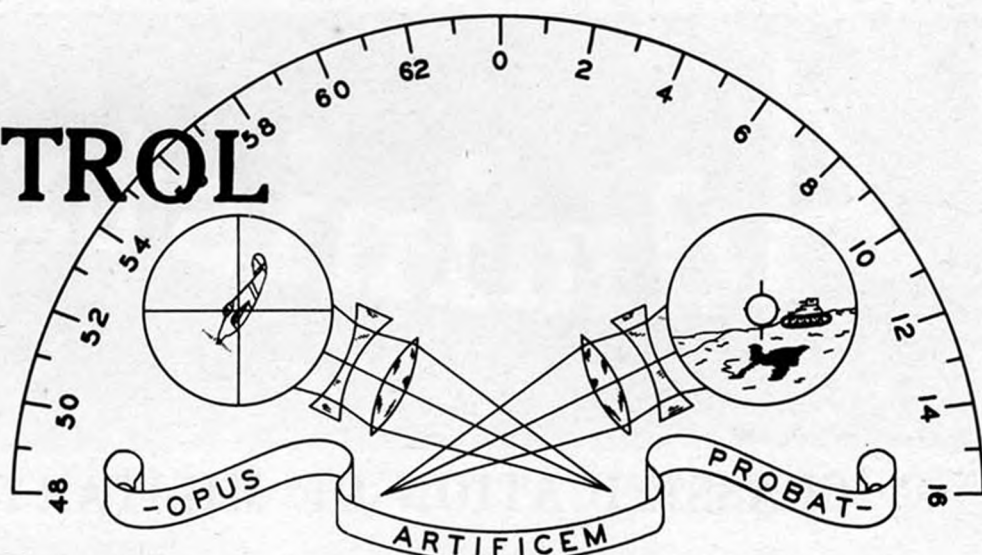
THE ORDNANCE SCHOOL
AUTOMOTIVE SECTION
IN LINE ENGINE INSPECTION STAND
SCALE 1-1/2"=1'-0" DATE 10-24-41 DRG. NO. 1A



THE ORDNANCE SCHOOL
AUTOMOTIVE SECTION
BASE FOR ENGINE STAND
DATE: 11/13/41 SCALE: (A) 6"=1'-0" (B) 1"=1'-0"

FIRE CONTROL

Conducted by:
R. L. JOHNSON,
Captain, Ord. Dept.



REMOTE CONTROL SYSTEM, M2 AND ASSOCIATED EQUIPMENT

Inquiries reaching the Fire Control Section of The Ordnance School indicate that a considerable number of 90mm AA guns equipped with the M2 Remote Control System are reaching the field. Graduates of current classes on the maintenance of this equipment will not be available in numbers for some time. In view of these circumstances it is believed that an article covering tests and adjustments of the remote control system and associated equipment may be of value at the present time.

General

The remote control system, M2, (F-207) is used in conjunction with the Cable System, M1 or M2, (F-207) and the Generating Unit, M7 (F-226). The complete equipment, consisting of the above units, is used to transmit firing data and power to the gun mounts, so that the guns may be controlled in azimuth and elevation by the output data of a remotely located director.

The cable systems, M1 and M2, are identical in all components, except that the M1 system is for use with a battery of four guns, while the M2 serves a two gun battery. This difference involves only the number of 21-conductor cables in each system. Both systems are covered in "Notes on Materiel, Cable Systems M1 & M2", dated Feb. 15, 1942.

These systems differ from the M4 data transmission system in that 21-conductor cables are used to connect the main junction box to the guns, and 3-conductor cables to connect the generating unit to the main junction box. The indicator-regulators differ from the indicators of the M4 system only in that they contain certain devices necessary for adjustment and operation of the remote control system. Of these, only the lagmeter and manual cutout switch will be discussed herein.

The generating unit, M7, is a large three-phase generator powered by a gasoline engine. The complete unit is mounted on a trailer.

Troubles in Newly-Issued Systems.

In general, a system received from the issuing agency, should be in proper adjustment. The procedure outlined below will determine whether or not this is the case. Since the various components are received from different manufacturers, there is a possibility that one or more of the following troubles may be encountered in new systems:

(1) Phase sequence of three-phase generator incorrect. - This trouble may be detected during the checks described below. If encountered it may be corrected by interchanging any two of the power leads marked A, B and C, at the rear of the generator control panel.

(2) Improper wiring connections, usually in the gun junction box. This particular defect is unlikely, except in replacement boxes.

By

J. P. Rigg, 1st Lt., Ord. Dept.

and

G. A. Ralph, 2nd Lt., Ord. Dept.

CAUTION: Personnel who are not thoroughly familiar with this equipment are warned not to attempt any adjustment or disassembly beyond that specifically mentioned in the procedure outlined below.

Procedure for Testing and Adjusting

Preliminary - Power "Off"

- (1) After checking the battery, radiator, oil and fuel, start the generator and allow it to warm up. Make sure that the main power switch is "off".
- (2) Connect the cable system, leaving the generating unit disconnected from the main junction box.
- (3) While the generator is warming up perform the following checks and adjustments. The procedure is described for one gun, but must be followed for all guns of the battery:
 - a. Adjust the lagmeter at each indicator-regulator so that the needle is over the center mark of the scale. This is done by removing the small plug under the left sliding cover of the indicator and rotating the slotted shaft with a screwdriver. There is small likelihood that this adjustment will be necessary.
 - b. Check the oil level at the A-end housing, and add oil if necessary. (See Note on "Hydraulic Oil" below.)
 - c. Check the orientation, leveling, and equilibrator adjustment of the gun.
 - d. Turn motor switch at gun junction box "off".
 - e. Pull both transfer valves "out".
 - f. Set manual cutout switches to "automatic".
 - g. Put handwheels in the manual position.
- (4) Connect the generator to the main junction box.
- (5) Push in the generator throttle and adjust engine speed to 1200 r.p.m. by means of the governor adjustment.

(Continued on page 69)



CLASSIFICATION OF MILITARY INFORMATION

By R. J. Maxwell
S. Sgt., Ord. Dept.

One of the important principles of strategy is surprise. To accomplish this, military information must be safeguarded. Enemy agents collect scraps of information here and there, and when these scraps are assembled at a central location they may indicate a strategic move and the battle may be lost. To prevent this, military information is classified, and this article is written to help explain this classification.

Important military information is divided into three classes: secret, confidential, and restricted. All other military information is regarded as unclassified. The safe-guarding of classified military information is the responsibility of all military personnel, civilian employees of the War Department, and of the management and employees of all commercial firms engaged in classified work or projects for the War Department.

A military document or article of materiel will not be assigned more than one of the three classifications - secret, confidential, or restricted - but should this happen through some error the more restrictive classification will apply. For example, should plans of a new piece of ordnance materiel be classified as both secret and confidential, this information should be treated as secret since it is the more restrictive.

"Secret"

Information is classed as secret when disclosure of the information or its relative features might endanger national security, cause serious injury to the interest or prestige of the Nation or any governmental activity, or would be of great advantage to a foreign nation. Examples of matter classified as secret are war plans or documents relating to the design and the development of new materiel. Matters may be classified as secret only by or under authority of the Secretary of War; the Under Secretary of War; an Assistant Secretary of War; the Chief of Staff, or an assistant Chief of Staff on the War Department General Staff; a chief of arm, service, or the National Guard Bureau; a general officer; the commanding officer of a depot, post, camp, or station; the commandant of a general or special service school; or a military attache. The dissemination of secret matter will be held to the absolute minimum. Information as to the contents or whereabouts of secret matter will be disclosed only to those persons whose duties require such knowledge. It is exclusively for the official use of the person to whom it is divulged or issued. He will be responsible for its safe custody and security.

"Confidential"

Information is classified as confidential when disclosure of the information - although not endangering the national security - might be prejudicial to the interest or prestige of the United States, a governmental activity, or an individual, or be of advantage to a foreign nation. Examples of confidential matter are technical information, such as research of processes of manufacture which may be a distinct military asset and not a matter of general knowledge; certain reports, orders, or instructions

pertaining to individuals, including those relating to investigations and special assignments. Any commissioned officer may classify documents, development projects, materiel, or technical information as confidential.

"Restricted"

Matter is classed as restricted when the information is for official use only, or when its disclosure should be limited for reasons of administration privacy or denied the general public. Included in this class are certain parts of mobilization plans and regulations, certain training and technical regulations and photographs, photostats, diagrams, or models of any restricted document or essential part of restricted materiel. This type of information may be classified as restricted by any commissioned officer. Information contained in restricted documents and the essential characteristics of restricted materiel will not be communicated to the public or to the press, but may be given to any person known to be in the service of the United States and to persons of undoubted loyalty and discretion who are cooperating in government work.

The classification of all classified documents is marked on the document itself. If the pages of the document are permanently and securely fastened together, secret, confidential, or restricted will be plainly and conspicuously marked or stamped on the cover, the title page, and the first page. If the pages are not permanently and securely fastened together, the appropriate classification will be marked or stamped on every page at both top and bottom in such a manner that the marking at the top will not be hidden from view if the pages are clipped or stapled together. All secret documents will also show the authority for the classification and the date on which it was classified.

Except when delivered in person by authorized personnel, secret documents transmitted from one person to another will be inclosed in an inner and an outer cover. Typewritten matter in the document will be protected by a cover sheet, or by a method of folding, from direct contact with the inner cover. The inner cover will be a sealed wrapper or envelope addressed in the usual way but plainly marked secret so that the notation will be seen when the outer cover is removed. It will contain a receipt form which will identify the addressor, the addressee, and the document. The outer cover will be sealed and addressed in the ordinary manner with no notation to indicate its secret classification.

Upon receipt of a sealed package or letter it will be carefully inspected to determine whether there has been any tampering with the seals or wrappers. The inner cover, marked secret, will be opened only by the person to whom addressed or by personnel specifically designated by him. The receipt form will be dated and signed and immediately returned to the sender. In some cases the Chief of the Mail and Record Section may sign the receipt but as a matter of practice it should be signed by the person to whom the secret document is addressed. The inner cover will be destroyed by burning if the subject matter of the inclosure has been in contact with it.

Confidential documents will be transmitted by an authorized messenger by means of insured express or registered mail to any point in the United States and its possessions, provided they do not pass through a foreign postal system and are carried in ships of United States registry. Confidential documents pertaining to military intelligence may be trans-

mitted by ordinary mail when in the opinion of the forwarding officer no serious consequences would be entailed by their loss. A confidential document will be prepared for transmission in the same manner as a secret document except that the inner cover will contain a receipt form only when the sender deems it necessary and may be opened by any responsible person authorized by the addressee.

Restricted documents may be transmitted by any authorized messenger, or by ordinary mail, express, or freight to any point in the United States and its possessions, provided they do not pass through a foreign postal system and are carried on ships of United States registry.

Secret and confidential documents, other than registered documents, will be stored in the most secure files available in a room that is kept locked when not in use. Restricted documents will be stored and handled in such a manner as to insure a reasonable degree of security. Registered documents will be stored in the most secure space available, preferably the equivalent of a three-combination safe. Only commissioned officers, warrant officers, and specially trusted enlisted men and civilian employees will be permitted to have access to the containers of registered documents.

Officers authorized to originate and issue secret or confidential documents will designate as registered such secret and confidential documents issued by them as they deem necessary in the interest of national defense. Only documents of exceptional importance will be registered. In addition to the marking secret or confidential, the title page or inside front cover of a registered document will ordinarily show the register number, the short title, the office of record to which returns will be made, and instructions covering the returns for its accounting and for its ultimate disposal. In reference to a short title, it is a designation applied to a registered document for purposes of security and brevity. It consists of figures, letters, words, or combinations thereof, and an abbreviated designation of the office of origin without giving any information relative to classification or content of the document. If this method of marking is not practicable, the required data will accompany the registered document on a separate sheet.

When a document ceases to be secret its marking may be cancelled by the authority which affixed or authorized it or by higher authority by writing or stamping "Cancelled by _____" or "Cancelled by authority of _____" over the secret mark on the top of the first page of the document. This cancellation will be dated and initialed by the officer making it. Any other secret marks on such a document will then be stricken out. Confidential and restricted documents will be cancelled in the same way.

When competent authority directs the destruction of secret or confidential documents, they will be burned in the presence of an officer, who will submit a certificate of destruction to the headquarters concerned. If the documents are registered, the certificate will be sent to the officer directing the destruction, who will forward it to the office of record indicated in the registered document. Restricted documents will be destroyed in any convenient way which will render them useless.

If all these points are observed the amount of valuable military information that leaks out to the enemy will be cut to a minimum and the movements of our troops and the use of our materiel will be more successful.



REMOTE CONTROL SYSTEM, M2

(Continued from page 67)

Tests and Adjustments — Power "On".

(6) Turn the main power switch at the generator control panel "on"; adjust the output voltage by means of the rheostat at the generator to 115 V. at the Director, and set the manual cutout switches at the indicator-regulators slowly to "manual". This should be done slowly in order to permit the fin repeater to synchronize with its transmitter at reduced voltage.

(7) Check synchronism of all electrical dials with corresponding transmitters. If only a small adjustment is required for fine dials, synchronize by means of the appropriate slotted adjusting shafts. Do not adjust the position of the coarse dials in this manner. To do so may upset the synchronizer adjustment, causing improper operation.

(8) Set the gun about 400 mils off synchronism in elevation and azimuth.

(9) Turn the power motor switch at the gun junction box "on". If the phase sequence of the M7 generator is correct, the noise heard will be a high-pitched whine, muffled by the oil. If incorrect, the noise will be less muffled, and will sound somewhat like a power saw cutting hard wood. If the latter sound is heard shut the motor off. Set the elevation handwheels to the automatic position. Depress the transfer valve, set the cutout switch to "automatic" and turn the motor on for only a few seconds. If the gun fails to move, or moves jerkily a few times and stops, the motor is running in the wrong direction, indicating improper phase sequence of the M7 generator. Refer to the paragraph headed "phase sequence" above. Change the phase sequence and repeat the check. If the gun now moves smoothly, the fault has been corrected. Pull the transfer valve out.

If the trouble is not remedied, reconnect the power leads at the generator control panel as they were at first, and call for a trained man.

(10) If no trouble is evident, allow the motor to run a few minutes to warm up the oil.

CAUTION: While a gun is being operated automatically, clear the gun platform of unnecessary personnel and all movable equipment.

(11) Disengage both handwheels and set both cutout switches to "automatic".

(12) Depress one transfer valve.

(13) The gun should come to rest not more than a few mils from the synchronous position (i.e., synchronized with output data of the director).

(14) After the gun comes to rest, check the lagmeter at the indicator-regulator concerned. If the needle is not over the center mark, remove the amplifier cover cap, exposing two slotted shafts marked "AE" and "EL". Turn the proper shaft until the lagmeter needle is directly over the center mark. (The gun will be seen to creep a few mils while this is being done.)

(15) Note the position of the fine mechanical pointer. If it is not in synchronism with the output data of the director, turn the upper slotted shaft under the left sliding cover of the indicator-regulator until the mechanical pointer is synchronized. (Again, the gun will creep a few mils in order to come into synchronism.)

(16) Test the operation, pulling the transfer valve out, setting the director output data at various values, then depressing the valve. Note how the gun moves into synchronism. It should move at about twelve degrees per second in elevation and about twenty degrees per second in azimuth. It should move smoothly, overshooting the synchronous point not more than three times and finally settling into the synchronous position with the lagmeter needle on the center mark.

(17) Finally, with the transfer valve depressed, operate the gun from the director, observing the manner in which the gun responds to various rates.

(18) Repeat steps 10 to 17 for the other axis.

(19) Test the operation of the elevation limit stop valve. The gun should go into the stop without bumping, and should move away from the stop readily.

CAUTION: Don't leave the gun at either stop more than a few seconds while the system is in automatic operation.

(20) If trouble is encountered at any point during the above procedure, shut the power off, and call for a maintenance man authorized to work on this equipment.

Note on Hydraulic Oils

The oil now authorized for this system is that procured under U.S. Army Specification No. 2-79A, and should be so marked.

When adding oil to the system, make sure no water or foreign matter is allowed to contaminate the oil. Do not use a cloth strainer for oil. Use a fine wire mesh screen.



SIMPLIFIED ACCOUNTING PROCEDURE FOR ORGANIZATION PROPERTY

By E. F. Murray,

T. Sgt., Ord. Dept.

The simplified system of accounting as contained in War Department Circular No. 105, dated April 10, 1942, is established for use within the continental limits of the United States with a view to reducing the confusion incident to the changing of accounting procedure when an organization enters a Theater of Operations. Commands outside the United States will adopt this system so far as is feasible according to conditions which exist in their areas.

This circular will govern in all cases where there is conflict with Army Regulations.

Under this system, when an issue of equipment authorized by a Table of Basic Allowances is made to a unit or organization the articles so issued will be dropped from accountability by the post, camp or station property officer issuing them, but formal accountability will not be maintained by the unit or organization receiving the equipment.

The Regimental or similar unit supply officer will furnish the company or organization commander a "Property Book". This book will show all articles of T/BA equipment the company or organization should have in its possession in serviceable condition. If the organization does not have all the equipment authorized them by T/BA they will submit requisitions for that which they do not have. The Property Book will show, initially, the equipment on hand in the organization as indicated by the memorandum receipt account of the unit supply officer. The Property Book will show serial numbered items, items listed as Supervised, items listed as Controlled, items not in serviceable condition, items on requisition, disposition made of unserviceable items, the quantity of each item authorized by T/BA, and any excess authorized by higher authority. The giving of memorandum receipts for T/BA equipment issued them is not required of organization commanders; however, for their own protection, organization commanders may receive memorandum receipts for property and equipment issued by them. Organization commanders continue to be responsible for all public property held by their organizations.

Prior to the publication of this circular Table of Allowance property (Garrison Equipment) was issued to unit and organization commanders on memorandum receipt by the post, camp or station property officer. Now this equipment is issued to the organization by a "Custodial Officer" who is appointed for each regiment or similar unit by the post, camp or station commander. When this equipment is no longer needed by the organization it will be returned to the Custodial Officer who will make any necessary adjustment for shortages or damage. Thus an organization commander is relieved of the time and labor incident to a property settlement in case his organization is ordered to change station on short notice.

A stock record account is no longer kept by the unit supply officer. Upon initiating the Property Book for an organization, the unit supply officer will prepare a Shipping Ticket in duplicate listing all the property held by that organization on the memorandum receipt account. One copy, receipted by the organization commander, is used by the unit supply officer as a voucher to drop that property from his stock record account. The other copy is delivered to the organization commander. The receipt on the shipping ticket by the organization commander will operate to can-

cel his memorandum receipt account for the items listed on that Shipping Ticket.

[CIL 105]

26. Regimental and similar organization commanders, by frequent inspection and check, either personally or by members of their staffs, will assure themselves that the company property books reflect the true status of the equipment within each company, that the prescribed conditions of the unit is or are in serviceable condition.

a. damaged, or unserviceable articles.

b. A sample transfer of company responsibility is shown below.

STOCK RECORD

**TRANSFERS OF COMPANY PROPERTY
RESPONSIBILITY**

I hereby assume responsibility for the property of this organization in the quantities shown on each page of this book as on hand per joint inventory

I hereby assume responsibility for the property of this organization in the quantities shown on each page of this book as on hand per joint inventory

I hereby assume responsibility for the property of this organization in the quantities shown on each page of this book as on hand per joint inventory

I hereby assume responsibility for the property of this organization in the quantities shown on each page of this book as on hand per joint inventory

28. Transfer of property with enlisted men changing station.—a.
enlisted men on transfer from one unit to another are authorized
property list property book (n

Type certificate on one or more sheets of W. D. Q. M. C. Form No. 424, and bind in "Company Property Book."

Unit supply officers will keep a jacket file for each organization, containing requisitions, Shipping Tickets and other papers pertaining to property. These papers will be withdrawn and destroyed one year from the date of the transaction. These files are not subject to audit by property auditors but may be used for check purposes or to establish or re-establish the organization commander's responsibility for T/BA property.

This streamlined system is used to eliminate extra administrative and paper work. It is not correct to assume that, because formal accounting has been eliminated, care and upkeep of the property has also been eliminated. Inspections and checks will be made by organization and unit commanders, or members of their staffs, to see that the Property Book is being kept correctly, that the prescribed equipment is complete, and that there is no wastage, misuse or accumulation of excess property. Disciplinary action will still be taken and pecuniary responsibility will be

[CIR. 105]

6

Alter to read—
"On Req."

Alter to read—
"Turned in"

Make inventory entries in red ink.

Quantity on requisition to bring total to maximum allowance.

Quantity received as per requisition of 4-1-42.

Joint inventory. Make inventory entries in red ink.

Maximum quantity authorized by competent authority.

Quantity on Memorandum Receipt and Shipping Ticket.

Quantity found to be in serviceable condition as a result of inventory.

Quantity in unserviceable condition placed on I & I report.

Quantity missing and for which report of survey is submitted.

Quantity prescribed by T/B.A.

STOCK RECORD

Date	Part	Received	Balance
3/31/42	Per M/R & S/T		30
4/1/42	Per Inventory		28
4/1/42	Per I & I	1	29
4/1/42	Per R/S	1	30
4/1/42	12		42
5/3/42	12		40
6/30/42	Per joint inventory		40

Article Container, water

Description 5 Gallon

Unit each

Maximum 40 Minimum 30

Unit cost

Stock No.

Sheet No.

War Department
Q. M. C. Form No. 424
Revised April 6, 1931

(1) On Req.

(2) Turned in

Date received	Balance
3/31/42 Per M/R & S/T	30
4/1/42 Per Inventory	28
4/1/42 Per I & I	1
4/1/42 Per R/S	1
4/1/42 12	42
5/3/42 12	40
6/30/42 Per joint inventory	40

Article Container (water) 5-gallon

Description

Unit each

Maximum 40 Minimum 30

Unit cost

Stock No.

Sheet No.

War Department
Q. M. C. Form No. 424
Revised April 6, 1931

(1) Alter to read "On Req."

(2) Alter to read "Turned in"

(3) Quantity on memorandum receipt and on shipping ticket.

(4) Quantity in serviceable condition.

(5) Quantity in unserviceable condition placed on I & I report.

(6) Quantity missing and for which report of survey is submitted.

(7) Quantity on requisition to bring total to maximum allowance.

(8) Quantity received as per requisition of 4-1-42.

(9) Joint inventory.

(10) Make inventory entries in red ink.

(11) Quantity prescribed by T/B.A.

(12) Maximum quantity authorized by competent authority.

enforced by Statement of Charges or Report of Survey in case of individual responsibility. It will be brought to the attention of unit supply officers if organizations use an excess of supplies. In such cases investigations will be made and corrective steps taken.

After steps have been taken to close the unit stock record account, the stock record account, with all cards showing a zero balance, will be turned over, along with all papers pertaining thereto, to the post, camp or station Quartermaster for storage. Before storing, these records will be wrapped and marked with the designation of the accountable officer, the inclusive period covered, the serial number of the first and last vouchers.

After the stock record account has been closed out and stored, the unit supply officer will transmit the Property Book to the organization. The unit supply officer will then prepare a report to the Chief of Finance, Washington, D. C., giving the following information: Designation of the account; name, grade, organization and serial number of the officer accountable on the date the account was closed; date and number of the last Certificate of Audit and station where accounting office was then located, name, grade and organization of each accountable officer accountable for the property and the inclusive dates when each was accountable; address and designation of the officer having custody of the stored records. Copies of this report will be furnished to the Corps Area Finance Officer who issued the last Certificate of Audit and to the Finance Officer of the Corps Area in which the organization is located at the time the account is closed.

When a company commander is transferred, a joint inventory will be taken under the supervision of the unit supply officer. The new company commander will receipt the property book for all serviceable articles and the old company commander will prepare Reports of Survey, if any are necessary, for unserviceable articles. The certificate to be signed by the new company commander is as follows:

"I hereby assume responsibility for the property of this organization in the quantities shown on each page of this book as on hand per joint inventory.

Signature _____

Several of these certificates should be typed and bound with the property book so that each succeeding company commander may sign the next certificate in the property book.

When an enlisted man, on transfer from one organization to another, is authorized to take with him property listed on the company property book (Property other than that individual equipment authorized by paragraph 14, AR 35-6580, as amended, to be dropped from accountability when issued and entered on the individual's Clothing and Equipment Record), Individual Clothing Slip (W.D., A.G.O. Form 35) will be prepared in duplicate listing the articles taken. The enlisted man and the company commander will sign both copies, one copy will be bound with the company property book and the other copy will be sent to the new station with the enlisted man's Service Record.

When a company or unit of a station complement is detached for a change of station, the regimental or station supply officer, as the case may be, will prepare a list of all the T/B.A. property that the organization or detachment will need. This list may be prepared on a copy of the applicable Table of Basic Allowances or on Shipping Ticket and will be sent to the new station property officer along with other property papers.

Organizations will submit requisitions for T/B.A. equipment, except individual clothing and equipment, in triplicate to the regimental or unit supply officer, who will acknowledge receipt by signing one copy and returning it to the organization.

The unit supply officer will consolidate requisitions received from the organization of his unit and submit a requisition in triplicate to the division supply officer, who will sign one copy and return to show acknowledgment of receipt. The division supply officer will edit the requisition and determine whether or not the articles may be obtained through the post, camp or station property office, and then will submit a consolidated requisition in triplicate to the station property officer who will then issue the articles in bulk for distribution. Upon receipt of this bulk issue the division supply officer, or one of his commissioned assistants, will receipt one copy of the requisition, which will be used as a credit voucher to the station property officer's stock record account.

The division supply officer will then segregate the articles and deliver them to the units. If there is no difference between the articles requisitioned and the articles delivered the unit supply officer will receipt on a copy of the requisition. If there is a slight difference, the requisition will be amended and receipted. But if there is a great difference the articles issued will be listed on a Shipping Ticket prepared in duplicate, the supply officer receipting and returning one copy and retaining the other.

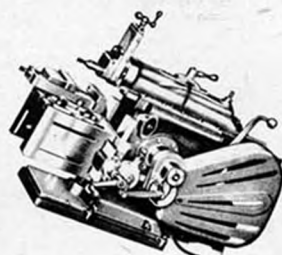
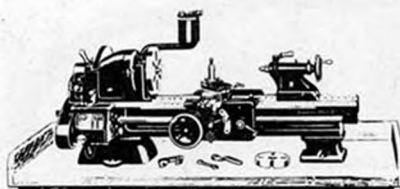
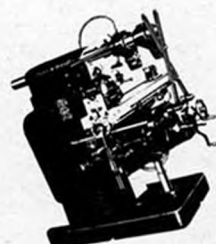
Organizations not a part of a division will prepare the requisition in triplicate to the unit supply officer, who will, in turn, prepare a consolidated requisition in triplicate and forward it to the proper post, camp or station property officer. If the property officer cannot supply the articles from his stock he will prepare a requisition in quadruplicate, retaining one copy and forwarding three copies direct to the supply point. Upon receipt of the three copies at the supply point, the requisition will be edited and one copy signed to acknowledge receipt and returned to the station property officer.

Depots and other supply agencies making shipments on requisitions received by them will prepare seven copies of the Shipping Ticket (eight copies when the articles listed thereon are serial numbered articles of which the Chief of Ordnance keeps a record). These copies will be distributed as follows: One copy filed at the supply point pending the return of the copy receipted by the consignee; two copies to the consignee; two copies to the Finance Officer of the Corps Area in which the consignee is located, one copy to Headquarters of the consignor's Corps Area, and one copy to the Headquarters of the consignee's Corps Area.

Articles of clothing and equipment authorized for free issue by T/B.A. and such other articles as may be authorized for issue by the War

(Continued on page 73)

THE MACHINE SHOP



Conducted by: F. P. Bingert, T. Sgt., Ord. Dept.

TRAINING THE ORDNANCE MACHINIST

By

F. P. Bingert and G. E. Tibbetts,
Technical Sergeants, Ord. Dept.

OPERATIONS

In the June issue we completed the phase of our course which covered the Milling Machine. In this article we will cover the Shaper discussing nomenclature, function, care and maintenance, and safety precautions.

As the students are introduced to the shaper, it signifies that the course is drawing to a close at The Ordnance School Machine Shop.

The students are again broken down into small groups, with an instructor attached to each. The instructor then proceeds to cover the following:

1. a. Nomenclature
- b. Feeds and Speeds
- c. Attachments
- d. Safety precautions toward students and machine
- e. Proper methods for grinding shaper tool bits
- f. Mounting of work
- g. Function of machine
- h. Capacity of machine
2. Operations
 - a. Horizontal shaping
 - b. Vertical shaping
 - c. Angular shaping
 - d. Shaping to a layout
 - e. Shaping on centers

The following is a detailed description of the Shaper.

PURPOSE

A machine for producing flat or angular surfaces and grooves in metal.

DESCRIPTION

The "backbone" of the shaper is the column which rests upon the base. On top of the column is the ram which carries the tool head. On the front of the column is the cross rail which carries the table and vise for holding the work. The ram is moved back and forth by a rotating crank. The length of its stroke and the number of strokes per minute may be set as desired by positioning the appropriate controls. The crossrail may be raised or lowered to the height best suited to the work. The rate and direction of feed of the table along the crossrail may also be selected. In some makes of shapers the tool head may be set at any angle and fed by power. In others, hand feed is required.

As in the lathe, the shaper is capable of many kinds of work but has several basic operations.

a. Horizontal Shaping. - The cutting of the work by feeding the table along the cross rail so as to produce a plane surface.

b. Vertical or angular shaping. - The cutting of the work by feeding the tool head down so as to produce the required vertical or angular plane surface.

c. Irregular Shaping. - Sometimes known as "shaping to a layout". It is accomplished by feeding the table along the cross rail by power and at the same time moving the tool head up or down by hand in such a manner as to cause the tool to cut along the desired scribed line. The number of shapes that may be produced by this method is limited only by the skill of the operator.

d. Shaping on centers. - By mounting the work on index centers various types of circular work may be done. Gears may be cut by this method.

CUTTING

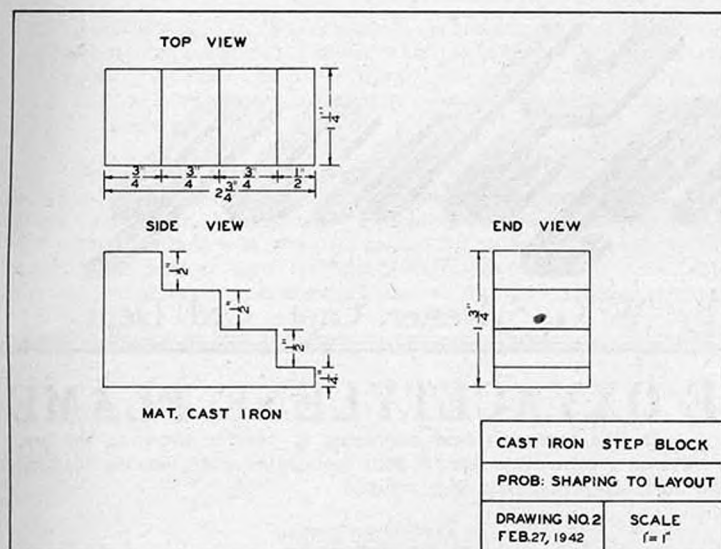
Cutting is accomplished by moving the tool back and forth over the work, the tool cutting on the forward stroke only. On the back stroke the work is fed along the cross rail so as to be in position in front of the tool for the next cut. In vertical or angular shaping the work remains stationary and the tool is fed on the back stroke.

SIZE

The size of a shaper is designated by the length of its longest stroke in inches. A standard shaper will handle a cube of metal the size of its longest stroke.

Most work that can be completed on the shaper can also be completed on the milling machine, but for practical reasons, such as speed and economy, the shaper is employed. To prove this point, consider the cost of milling machine arbors and cutters as compared to the ordinary high speed steel tool bit used on the shaper. It can plainly be seen that the work produced by the shaper is much more economical than the work produced by the milling machine. As an example, refer to the June issue and observe two problems that are completed by the milling machine, these problems will also be illustrated in this article as shaper problems. These problems are the cast iron step block, and the cast iron "V" block, verifying the fact that some work produced on the milling machine can be done on the shaper.

The shaper is used as a two-way advantage for both the students and the shop. The students first problem is plain shaping, by trueing up two ends and two sides, leaving two unfinished sides which the bench



students chip and file square with the machined surfaces. This problem being elementary, the student becomes acquainted with the controls of the machine and also furnishes the shop with cast iron blocks necessary for the bench course.

Since we began writing these articles for THE ORDNANCE SERGEANT, the machinist course has been lengthened and altered slightly. The change has been a short course in shop sketching and shop mathematics, which has been added to blue print reading. This additional theory assists the students to better understand the practical work given them in the shop.

As a brief review of the articles that we have written, we have covered the following:

- Bench work
- Lathe work
- Milling Machine
- Shaper

Now that the students are about to graduate, we do not want the readers to believe that we produced a finished machinist, for that would take years; but we do give the students enough theory and practical work so that each can form for himself a very fine basis from which he can develop into a machinist, and with a minimum of assistance he should be able to handle any work given him.



PROPERTY ACCOUNTING PROCEDURE

(Continued from page 71)

Department or by the commanding generals of the several defense commands, may be issued to officers, army nurses, or warrant officers who are assigned or attached to regiments, battalions or similar units, and the accountability for such property will be terminated as follows: Such accountability will be dropped by means of a Shipping Ticket if the individual already holds the articles on memorandum receipt. The articles will be listed on a Shipping Ticket bearing the following certificate:

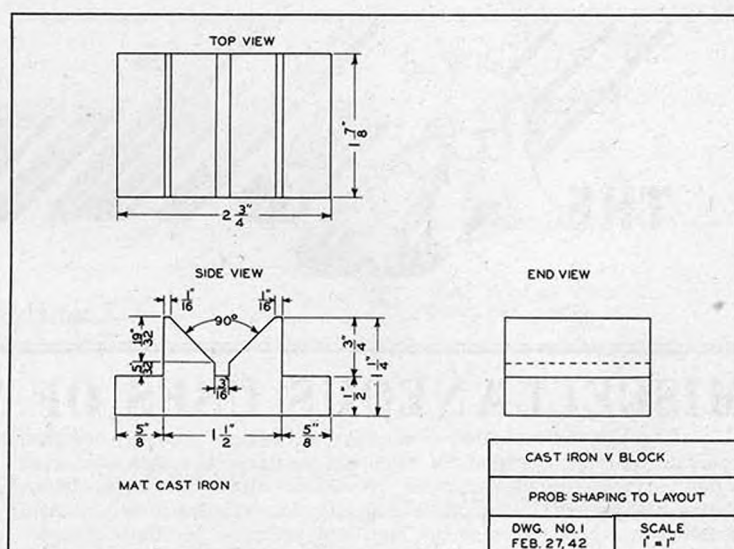
"I certify that the articles listed hereon * (have not been previously issued to me) * (were previously issued to me at (station) but were turned in by me at (station) and have not been replaced) * (were previously issued to me at (station) but were lost or were rendered unserviceable through means other than fair wear and tear; that the proper adjustment has been affected and no replacement of any of these articles has been received).

(Signature)

(name, grade, organization,
serial number)

* use only the appropriate phrase.

I certify that I have this date issued the items listed



hereon to the person who accomplished the foregoing certificate.

(Signature)

(name, grade, organization
of accountable officer)

One copy of the shipping ticket will be given to the person receiving the property along with his memorandum receipt.

Articles of clothing and equipment issued to casual enlisted men going on secret missions will be dropped from the stock record account on a shipping ticket prepared in duplicate. A certificate will be entered on the shipping ticket stating that the articles listed thereon have been issued to the enlisted man who accomplished the receipt therefor, signed by the accountable officer. The duplicate copy will be filed by the accountable officer as a credit voucher and the original will be forwarded with the Service Record, and Clothing and Equipment Record, if they are present. If the Service Record and the Clothing and Equipment Record are not present the Shipping Ticket will be forwarded to The Adjutant General with a cover letter setting forth the circumstances, requesting that the Shipping Ticket be forwarded to the enlisted man's commanding Officer at his ultimate destination.



IT CAN'T BE POSSIBLE

You will find brief mention of a subject closely related to this on another page of this issue, but the idea is worth repeating.

During the collection of material for this issue the Editor found it advisable to ask numerous offices in the field for information or articles. In most cases these requests were met, for the benefit of all concerned. But in several cases it was stated that no one was available who could prepare an article for publication. In at least one case this sort of a reply came from a post where it is known that a large number of Ordnance officers and men are serving. It can't be possible that not a single individual there possessed knowledge which would be of benefit to other men.

Another office replied that no person capable of writing an article was available there—but a few days later a letter was received from the same office asking that additional copies of future issues be furnished, in order that each officer might have a copy. It can't be possible that among half a dozen Ordnance Officers not one possessed ideas or knowledge which would help other men.

Material for publication in THE ORDNANCE SERGEANT need not possess literary excellence. It must possess excellence in that it presents Ordnance knowledge which is not known to a majority of Ordnance men. That requirement is easy to meet, because that group of Ordnance men who know it all in these days is a very small minority. Considering the present size of the Ordnance Department, and assuming that each individual is learning something about his work every day or so, a lot of good ideas should be developing. Why not pass them on to others?



Conducted by: W. G. Sylvester, Capt., Ord. Dept.

MISCELLANEOUS USES OF THE OXYACETYLENE FLAME

Through the expedient of standard as well as specially designed apparatus, the versatility of the oxyacetylene flame has been expressed in the performance of numerous operations other than oxyacetylene welding, heating and cutting. In the majority of these operations, principal advantage has been taken of the high temperatures developed with the oxyacetylene flame (5700 to 6300° F, depending upon flame adjustment).

Some of the more important applications successfully accomplished with the oxyacetylene flame are as follows:

FLAME HARDENING

The oxyacetylene flame can be used to harden the surface of heavier sections or the entire thickness of lighter sections of heat treatable steels to produce better wearing qualities. This process consists of selectively heating the surface of steels whose carbon content is .40% or higher up to their critical temperature, and quenching in water. Steels containing .70% or higher can be handled in the same manner except that compressed air or compressed air and water mixtures in the form of a spray are used to quench the heated parts less rapidly, thus preventing surface checking or cracking. In flame hardening the oxyacetylene flame is used merely as a source of heat and does not add carbon to the surface when used for this process. The depth of surface hardness produced in a hardenable steel is no greater than the depth of the surface layer which has been heated up to its critical temperature and quenched by using any of the above quenching media.

In this respect flame hardening differs from case hardening, in that the latter requires the addition of carbon to the surface to be hardened by the process of case carburizing before the steel is heated to its critical temperature and quenched. Consequently, the depth of hardness obtained by case hardening is no greater than the depth or thickness of the high carbon layer on the steel, regardless of the depth of heat penetration before quenching. There exists a notable exception, however, in that the oxyacetylene flame can be adjusted to obtain a highly carburizing flame for introducing carbon into the surface of steels whose carbon content is below .40%. In this manner the carbon content in a superficial surface layer of the steel is increased to a level required for response to heat treatment.

By quenching this piece after heating to its critical temperature, a thin layer of hard surface is formed on top of a base of soft low carbon steel. The first step in this particular application is similar to the case carburizing operation used in case hardening.

The flame hardening process is a useful tool of the maintenance welder in that only those areas of hardenable steels which are subjected to the greatest wear can be selectively hardened, while the remainder of the piece is caused to retain its original structure. Figure 1 shows a flame hardening operation as applied to rail ends. This operation is performed with a tip of special design and produces a hard layer at the surface of the rail ends which are normally subjected to severe wear due to rail end batter by the railroad car wheels.

The tip used enables heating of the surface of the rails until the required depth has been uniformly raised to its critical temperature. At this point the heating flames are extinguished by turning off the gas supply and the quenching water turned on. After uniformly quenching to a black heat, the heat absorbed by the ball of the rail is permitted to flow back to the surface to draw or temper the hard surface layer. Temperizing is controlled by rubbing a bar of 50-50 lead solder (melting point 437° F) until melting occurs. At this point further quench water is applied to completely cool the rails.

In like manner flame hardening is used to increase the wear resistance of contact surfaces of gear teeth, lathe ways, bearing housings, saw teeth and for similar applications.

FLAME SOFTENING

Certain steels on being cooled rapidly from a red hot condition become hard and brittle. Where it is necessary to further machine a flame cut or arc welded surface of these steels, the hardness should be decreased to permit easier removal of metal. The oxyacetylene flame adjusted to neutral and used as a heating flame is a convenient means of heating the hardened surface to softening temperatures, particularly

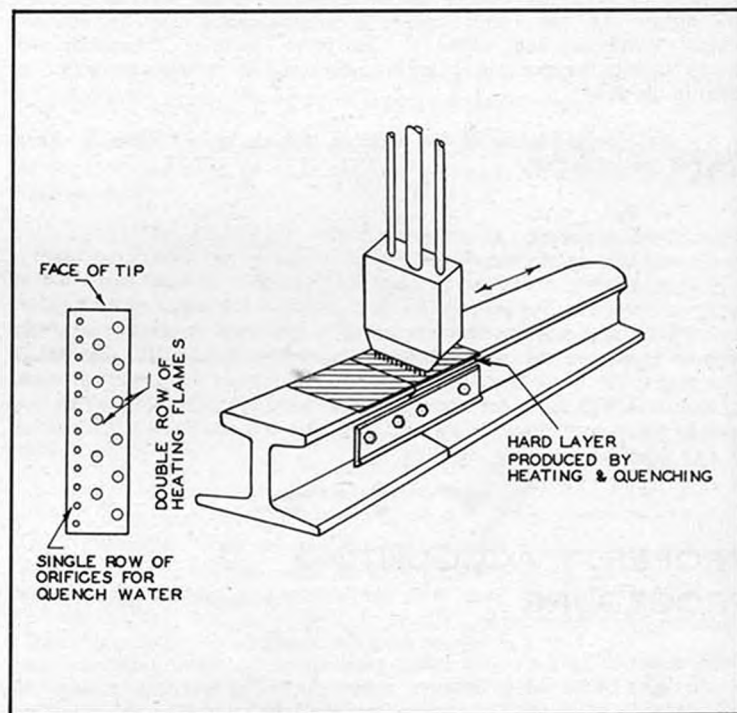


Fig. 1.

where only small areas of large objects are to be treated. On slow cooling from these softening temperatures, the original softness of the metal is restored. Flame softening can be done by hand or by mounting a heating torch on a standard cutting machine and progressing it slowly across the area to be softened. This process is frequently used after cutting silicon structural steels and other low alloy steels of medium carbon content.

FLAME STRAIGHTENING

It is often desirable to straighten steels which have taken a permanent set due to uneven heat or have otherwise been distorted from their original shape. This is especially true if the steel is restrained from expanding uniformly by adjacent cold metal, such as when a spot is heated on the surface of a steel plate. The hot metal at the center of the heated zone expands in all directions, and "upsets" itself by pressing against the colder plate. The metal adjacent to the colder plate is plastic and therefore, during the "up-setting" action, a slight ridge may be formed

along the outside edges of the heated spot. On cooling, the metal contracts, tending to shorten the surface dimensions of the heated portion of the plate. Since some of the metal has been "upset" permanently, the plate cannot return to its original dimensions and therefore becomes "dished" or forms a concave surface.

Since it is known that heat affects metal in this manner, this principle can be used to remove a warped section, buckles, and other irregularities from plate, damaged structural members, and other parts. These irregularities will often be caused by improper allowances for expansion and contraction in welding, by improper alignment of the parts to be welded, or by physical damage from outside forces. Raised portions

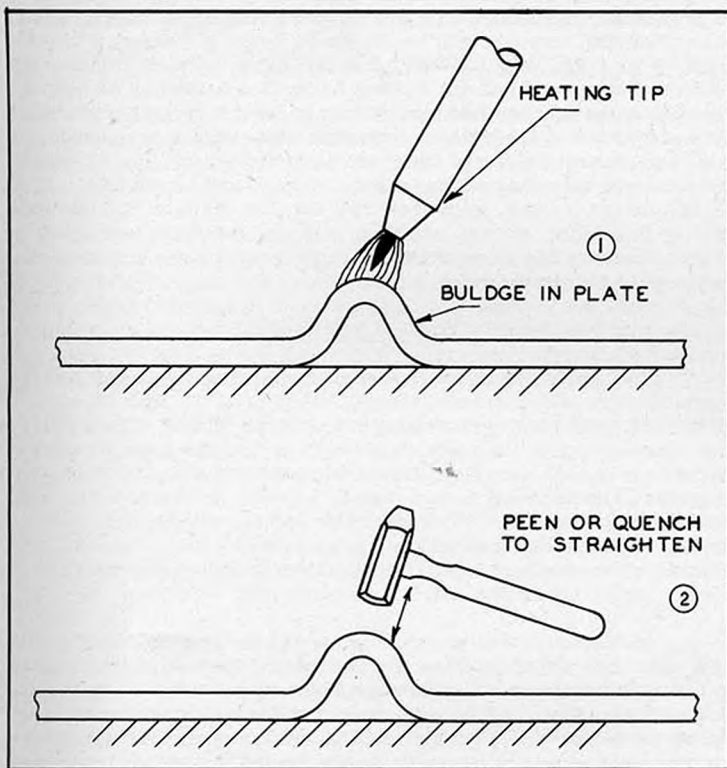


FIG 2

of a sheet or plate can be locally heated to "upset" the metal by expansion, followed by peening or quenching. This operation is shown in Figure 2. On cooling, the metal will draw down the raised sections due to contraction of an area whose original dimensions have been decreased. By repeating this process and by carefully applying heat to the proper sections, surface irregularities can be easily removed. Figure 3 illustrates flame straightening as applied to shafts.

FLAME STRENGTHENING

The oxyacetylene flame can be used in certain special cases to strengthen a piece which has been affected by the heat of a welding flame, using the principle of flame hardening. Where a piece is machined with sharp corners or fillets, or there are severe changes in section, flame strengthening can be used to remove the stress concentration at these sharp corners. The part of the section which is to be hardened or strengthened is selectively heated up to the hardening temperature with the oxyacetylene flame and quenched with water, a water-air mixture, or air, depending upon the composition of the steel being treated. In this manner, a thin hard layer of metal is formed in a smooth contour at the base of the sharp fillets. This hardened section, as shown in Figure 4, helps to carry the load placed on the members away from these notches, and thus reduces the notch sensitivity and the danger of the part breaking.

FLAME DESCALING

Before the surface of heavy steel sections can be removed by machining, it is often desirable to remove any scale, rust, and other surface irregularities that may be present. This can be accomplished by passing the high temperature oxyacetylene flame or a group of oxyacetylene flames over the scale, thus causing it to expand rapidly and flake off. This process is also applied to sections which are badly scaled and which are to be flame cut. Under these conditions, the flame is passed

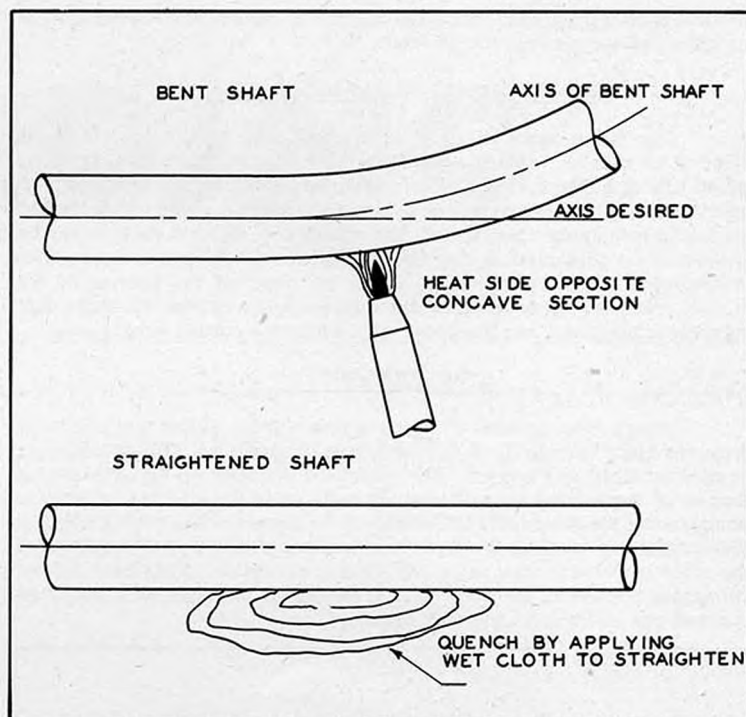


FIG 3

along the line of the intended cut to clean the surface of scale and to permit more efficient cutting.

FLAME MACHINING

In many cases, it is desirable to remove surface defects such as cracks, seams, or pits, defective sections of welds, and other surface irregularities from steel. This can be accomplished by flame machining; that is, an operation in which a cutting torch operating at low oxygen pressures is held at an angle to the steel surface and moved slowly either by hand or by a machine over the defective section. The surface is grooved by this operation and can be re-welded to restore the desired surface dimensions. Defects in welds or in the steel plate show up in the reaction zone in the form of bright spots or lines. The slag produced

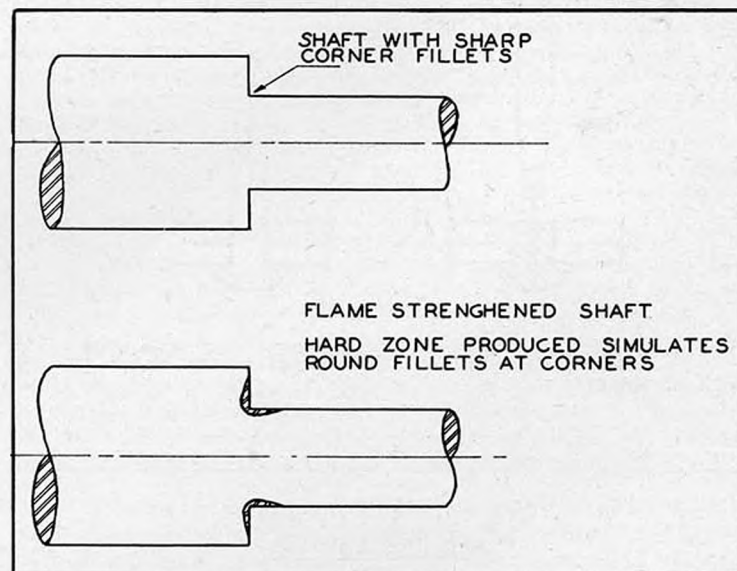


FIG 4

by the cutting is washed up and out of the groove by the oxyacetylene flame. This slag can then be removed from the surface by wire brushing or light grinding. In this manner, sections that have already been welded and cracked can be easily repaired. For many flame machining operations, the standard cutting tips can be used satisfactorily. However, special tips are commercially available which can be used to make deep, narrow

grooves sufficiently wide at the top to permit re-welding either by oxy-acetylene or the electric arc process.

FLAME GOUGING OR FLAME PLANING

One of the applications of the oxyacetylene torch consists of the removal of wide and relatively shallow surface cuts from steel sections which are to be further rolled or machined. Cutting tips designed with special cutting orifices are used in much the same manner as described for flame machining operations. The speed with which a surface can be processed by this method may be as high as 15 ft. per minute. The cutting operator can control the width and depth of the portion of the surface removed by controlling the oxygen pressure, the tip angle with relation to the plate, and the speed with which the cutting progresses.

RIVET CUTTING

Where it is desired to remove rivets from plates that are to be disassembled, the standard cutting torch can be used with satisfactory results as shown in Figure 5. The rivet head is heated by the pre-heating flames of the cutting tip and when brought up to its kindling or ignition temperature the rivet head is washed off by means of the cutting oxygen. The cutting tip can then be held in a vertical position and the shank of the rivet can be cut thru as in any cutting operation. This permits the remaining portion of the rivet to be free enough to either drop out or be punched out with a light hammer blow.

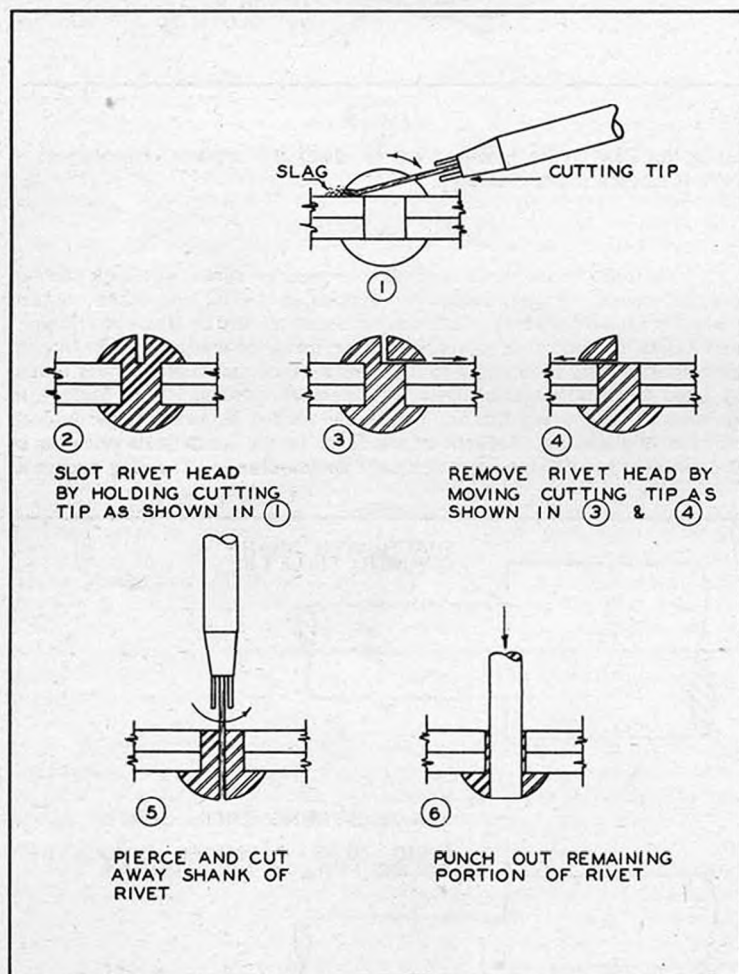


Fig. 5.

FLAME DEHYDRATING

In certain cases, it may be desirable to paint sections that have become heavily rusted or badly scaled. In order to obtain a good bond between the steel surface and the paint film, the steel must be clean and dry. Steel surfaces are easily cleaned by passing an oxyacetylene flame over the surface, using either a welding tip or special tips with a row of heating flames designed for this purpose. The intense localized heat of the oxyacetylene flame causes the surface scale to flake off while the more adhering scale is loosened when the moisture it contains is changed rapidly into steam. The rust and scale can then be easily removed by

means of wire brushing and the surface should be painted while the plate is still warm to the hand.

STRESS RELIEVING

When metal is added in the form of weld metal to the base metal being welded, it is essentially cast metal. Upon cooling, the metal shrinks, and because it is firmly welded to the base metal, it exerts a drawing action on it. This drawing action produces stresses in the weld which may cause warping or buckling of the parts being welded. These stresses are known as residual stresses due to welding and the process which removes these stresses or decreases their intensity is known as a stress relieving process. Where the parts being welded are firmly fixed to prevent any movement or where the parts are not uniformly heated during welding, stresses will be developed by the shrinking of the weld metal at the joint. It is necessary, therefore, that the parts being welded be free to move and that the heating be applied uniformly to keep the stresses in the finished weld low and thus prevent distortion or cracking. This precaution is particularly important when welding aluminum, cast iron, high-carbon steel, and other brittle or "hot-short" (low strength at temperatures below the melting point) metals. Ductile materials such as bronze, brass, copper, mild steel and the like, yield or stretch while still in the plastic or soft condition, and are therefore less likely to crack. However, they may still retain stresses which are undesirable as they tend to weaken the finished weld.

METHODS OF STRESS RELIEF

Steel welds may be stress-relieved by heating the welded sections symmetrically and uniformly from 1100° to 1250° F. whereas special alloy steels may require heating up to as high as 1600° F. The temperature must be applied for a sufficient length of time for these stresses to be relieved and will vary for different thicknesses of the parts so treated. In stress relieving steel a good rule to follow is to heat the completed weld one hour per inch of thickness at the stress relieving temperature. On this basis, steels 1/4 inch in thickness should be heated for fifteen minutes at the stress relieving temperature. Local stress relief should not be used except on symmetrical sections.

Another method of stress relieving is peening of the finished weld with an air hammer, if possible. By this method the weld metal is caused to flow or expand, thus relieving some of the stresses due to contraction. However, excessive peening may cause brittleness or hardening of the finished weld due to cold working or may actually cause cracking. Peening, wherever necessary, should be done by means of other than hand tools.

In some applications of welding, it is desirable to preheat the parts to be welded, so that on cooling the soaking temperature prevents rapid cooling, and, therefore, the formation of high contraction stresses. This method should be very carefully controlled in order not to excessively heat the piece and thereby cause other welding difficulties or otherwise injure the parts to be welded.



THE BACK COVER

It was originally intended to reproduce a considerable number of Field Artillery insignia on the back cover of this issue, and provide a guide sheet inside the magazine. The insignia have been reproduced on the back cover. A large number of Field Artillery organizations generously cooperated by furnishing copies of their insignia. However, since this plan was made discussion has arisen regarding the military value of insignia. Possibly some of the units whose insignia we have reproduced are already on foreign soil. By the time this issue is distributed it may be possible that an insignia could be a dangerous thing to some people. For this reason no insignia is identified in this issue. Our thanks, nevertheless, to every organization which cooperated.



FORGING

Conducted by: B. L. B. Allen, 2nd Lt., Ord. Dept.

Upsetting is a forging operation used extensively by the blacksmith. The effect of upsetting a piece of steel is opposite to that of drawing down. Upsetting is a slow and laborious process requiring skill in handling the piece of work to be upset and in the delivery of the proper blow.

There are several methods of upsetting. The proper method to be used depends largely upon the shape and size of the work. If the piece is short, as for making a small bolt or rivet, only that part, the head, which is to be upset is heated in the forge fire. The piece is then stood on end on the anvil and struck with a hammer. The heated portion is placed downward and the cold end struck with the hammer. This allows a more uniform upsetting action than when the heated end is struck.

A piece which is small in cross-section, relative to its length, such as a piece of $3/8$ " round 18" long, which is to be upset on the end, is held with tongs so that the heated end projects just over the outside edge of the face of the anvil. The hot end of the stock is then struck sharp blows with the hand hammer. The handle of the tongs should be pressed tightly against the left leg. This increases the efficiency of the blows by making the piece more rigid and prevents the backward movement of the piece when struck.

Pieces larger in length or in cross section are upset by grasping the cold portion of the stock by hand and bumping the hot end on the face of the anvil. Longer pieces are upset in the same manner, except that they are bumped on a bumping block while keeping the stock vertical. The bumping block is a block of cast iron or steel placed on the floor near the anvil. If the piece of work being upset is so heavy that it is impracticable to bump it on the bumping block it may be held so that the heated end projects over the edge of the anvil, where it may be struck by a helper with a sledge hammer.

Many heats are often required to upset a moderate mass of metal, and the result is that the dimensions are not very nearly exact. The upset metal does not have sharp shoulders but is uneven in spite of much care in localizing the heat to the section desired. During the process of upsetting, the metal cannot be made to retain a desired shape, therefore, the piece is upset to a dimension larger than the finish size in order to allow for hammering it to the desired shape and size.

If, in upsetting a bar, it begins to bend after a few blows have been struck, the piece must be straightened at once. Any blows struck on the end of a bent bar will have little effect in upsetting it, but will only bend the bar more and make the straightening more difficult. For best results, always strike the stock with a solid, square blow, hard enough to affect the metal throughout the portion to be upset.

A good heat is required for upsetting; in fact, it is well to make the final heat a welding heat. This is important, for upsetting often separates some of the fibers of the stock, and by taking a welding heat over the piece and hammering it on the sides a little, all loose fibers will be welded together.

Bending is another forging operation that is used extensively. Curves and rings of light section are easily bent over the horn or round edge of the anvil. The hardie hole and pritchel hole may be utilized for bending, or a piece may be bent around a suitable mandrel. It is more difficult to bend bar iron edgewise than flatwise. Along the center of the bar (a-a Fig. 1), or the neutral axis, the bending is performed without stretching or shortening the fibers. On the convex side of the neutral axis all the fibers are stretched, while on the concave side of the axis all the fibers are compressed or upset. The greater the distance "B" in Figure 1, the more the work that must be done in the extension and com-

FORGING OPERATIONS

pression of the fibers. Also, on thin wide pieces the metal tends to wrinkle or buckle and must be kept straight by frequent hammering on the flat surface.



Fig. 1.

The radius may be forged in a piece as in Figure 1, by working it over the horn of the anvil or by placing the piece over two blocks and striking it as shown in Figure 2.

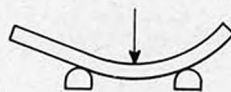


Fig. 2.

Bending a piece of bar iron the flat way to some angle is the most simple case of bending. If a piece of rectangular iron is to be bent to a right angle, the piece is center punched at the point to be bent. The piece is then heated and the punch mark placed over the edge of the anvil as shown in Figure 3. Blows are then struck at "A" and "B" with the hand hammer, until the correct angle is obtained. The piece is then trued up on the face of the anvil, using the flatter. A sledge hammer placed on the piece at "C" in Figure 3 helps to keep the piece from bending out of shape at that point.

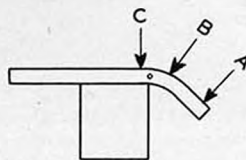


Fig. 3.

Small round stock to be bent in a U-shape is heated in the middle and one end inserted in the pritchel hole or the hardie hole of the anvil. The other end is bent over until a bend of approximately 180° is made. The piece is then formed to shape on the horn of the anvil.

A very good method of bending either flat or round stock into a circle of any radius is to make a simple bending tool. This tool can be made by bending a piece of $3/4$ ", or larger, round iron into a U-shape, as shown in Figure 4. This piece is clamped in the vise with the open end up, and the iron to be bent is placed between the projecting ends and bent to the desired radius by pressing the end sideways, as shown in "B" in Figure 4. A fork that has a square shank to fit the hardie hole of the anvil, as shown in "C" in Figure 4, may be used in the same manner.

Twisting is a comparatively simple forging operation. It is essentially the same for all shapes of iron. That portion of the piece to be

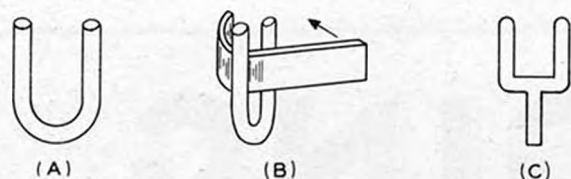


Fig. 4.

twisted is first marked with a center punch. That part between the punch marks is then heated to an even red heat and twisted. To do this the piece is clamped vertically in the vise, with the lower punch mark at the top edge of the vise jaw. A monkey wrench or a pair of strong tongs is fitted to the piece immediately above the upper punch mark. Then by turning the wrench or tongs clockwise or counterclockwise, the piece may be twisted the desired amount.

This operation should be carried out as fast as possible because the vise jaws and the wrench or tongs will extract heat from the stock near the place where it is held. The result is an uneven twist, since the hotter portion will turn more easily than the cooled portion.

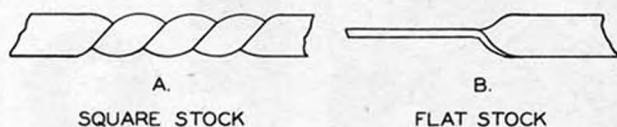


Fig. 5.

A piece of square stock which has become bent while twisting may be straightened by hammering it between two blocks of wood on the anvil so as to avoid battering the sharp edges.

Round bars are twisted without a change in shape of the piece. An object of twisting a round bar would be to position flat or square ends, or objects which may be attached or welded to the bar to a different angle or position relative to each other.

Figure 5 shows examples of twisting square and flat stock.

AMMUNITION

Conducted by: L. I. Dance, 2nd Lt., Ord. Dept.

CONSTRUCTION OF A PORTABLE STEEL IGLOO TYPE MAGAZINE

By J. A. Thomas 2nd Lt., Ord. Dept.

What would you do if some day you were given a few drawings and a carload of strange looking pieces of steel and were told to build an Explosives Magazine?

Recently, the Ammunition Section of the Ordnance School was given a similar problem. Magazines were needed for storing bulk explosives and ammunition, and it was necessary to round up the material, choose a site, and build the structures.

Let's follow through the building of one of these magazines from start to finish and see how the different phases of construction may be handled.

What might have been a routine job for the Corps of Engineers or the Construction Quartermaster was turned into an instructive field problem, directed by the staff and faculty of the Ammunition Section, for the benefit of the Officer Ammunition Students, the Officer Candidates in the Ammunition Section, the Munition Specialists from the Ordnance Replacement Training Center, and personnel furnished by the Military Section of the Ordnance School.

The Property Officer of the Ordnance Training Center gave the Ammunition Section shipping tickets from the manufacturer which listed the parts for two magazines, one 20 feet x 20 feet, and one 10 feet x 20 feet. At the same time there were received Ordnance Department blue prints pertaining to this type of structure.

The box car containing the material was spotted at the Ordnance Training Center loading platform. A preliminary check showed several differences between the material and the blue prints, indicating that some cutting and trying would be required in fitting the parts together.

In choosing a location for the magazines it was necessary to consider the type and amount of explosives to be stored, the safety distances from other buildings, the location of existing training areas, and the availability of access roads.

These problems were worked out by conferring with the S-3 of the Ordnance Training Center, the Safety Officer of the Proving Ground, the Property Officer, and by reference to the Ordnance Safety Manual, which contains Quantity-Distance tables and other safety requirements for storage of explosives and ammunition.

A magazine area was chosen and the material delivered, using a 2-1/2-ton 6 x 6 truck, from which the cover and bows had been removed.

The ground spaces to be occupied by the two magazines were marked off, being located 300 feet apart and 100 feet back from the existing hard surface road.

Timber footers, or supporting blocks, were placed, one at each corner of the base, and intermediate blocks spaced four feet apart along the sides and ends. These blocks were leveled up by use of a carpenter's level, cutting or filling the earth with shovels until all blocks were on a horizontal plane. (See Figure 1.)



The baseframe was next bolted together in place on the foundation blocks. This frame is made up of 8" steel channels, fastened at the corners by angle clips, with the flanges of the channels resting on the blocks. To the upper surface of the channels were bolted 3 x 3 x 1/4 angles to provide a rim around the base for fastening the arches and end sections. (See Figure 2.) After completing the base frame, the front wall was assembled on the ground. (See Figure 3.) 5/8" x 1-1/2" galvanized machine bolts and nuts were used for assembling all parts, with 13/16"

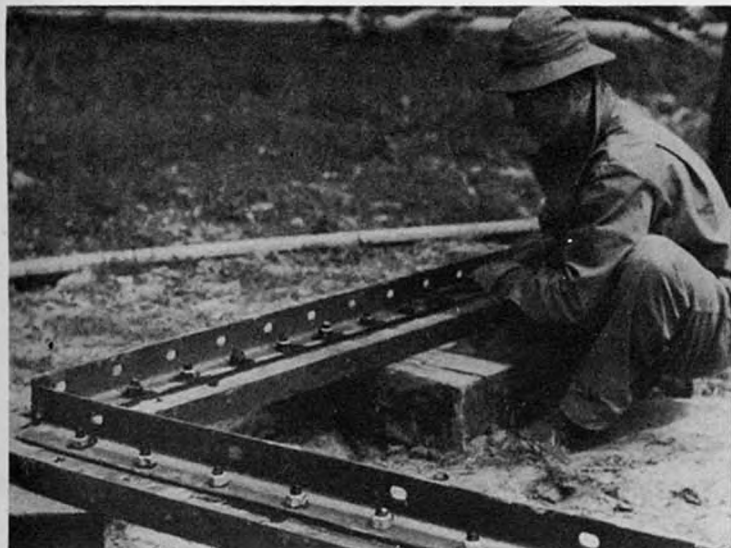


Fig. 2.

washers on the exposed side of the structure. The bolts and washers were coated with asphalt cement to prevent leakage through the bolt holes. When assembling the sections of the front wall, the joints were first coated with asphalt cement.

After assembly, the front wall was raised and bolted in position to the base frame. Immediately, the first arch was erected in order to support the front wall.



Fig. 3.

The arch assemblies were put together on level ground inside the base frame when possible, to avoid extra handling (See Figure 6.) The arches were made up of four sections of #7 gage (approximately 1/4" thick) corrugated plate, rolled to the proper curvature. Three of the sections were of equal length, 8'6", and the fourth section was half this length, or 4'3". All sections were 3' - 10-3/8" wide, with the exception of the end arches which were slightly narrower. Each was marked with a reference number to assist in assembly. (See Figure 4.) The short sections of adjacent arches were located on opposite sides of the magazine so that joints would be offset, reducing the possibility of leakage.



Fig. 4.

As in the case of the end wall, all lapped joints between arch sections and adjacent arches were coated with plastic asphalt cement before assembly. (See Figure 5.) The practice followed was to insert all bolts with the head on the concave side of the corrugation and the nut on the convex, or peak, side.

All lap joints between arch sections were provided with two rows of bolt holes for increased rigidity.

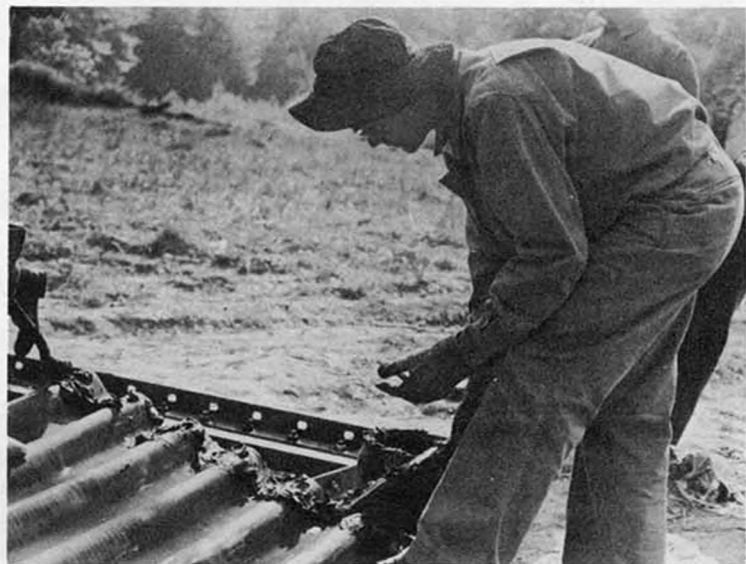


Fig. 5.

In assembling plates, the bolt holes were lined up by use of spud wrenches furnished with the shipment (see Figure 7), and at times by using hammers and drift pins. At first this seemed like a pretty tough job. Most of the men had little or no experience in steel work, but after they learned that the plates would stand a little hammering and stretching, the work progressed more rapidly.

While the arches were being assembled and erected, five turn-buckle tie rods were being connected between the front wall and the first arch. These rods were provided to counteract the pressure of the earth with which the igloo was to be covered after assembly. (See Figure 8.)

The assembly and erection of succeeding arches proceeded as shown in Figures 9, 10, 11, 12, and 13.

It should be noted that the upper sections of the arches were lapped over the lower sections, to give the effect of ship-lapped siding and prevent leakage of water. It was found that the bolt holes of adjacent arches



Fig. 6.

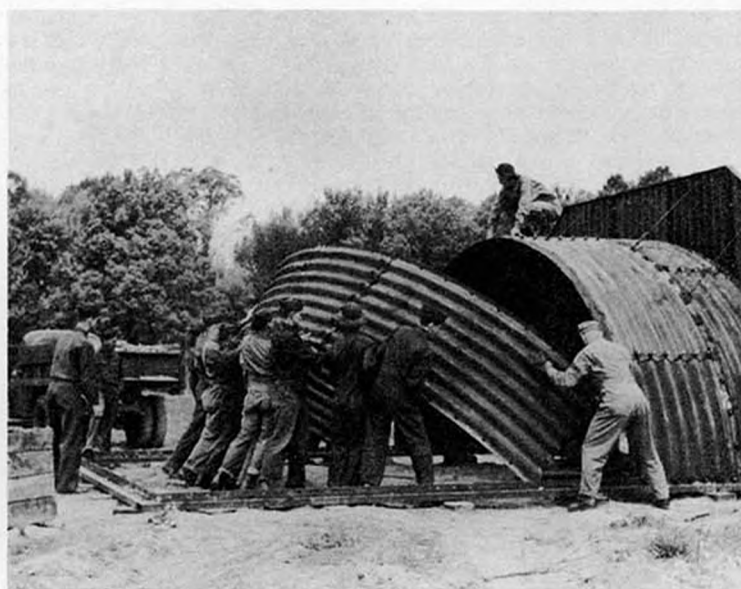


Fig. 9.



Fig. 7.



Fig. 10.



Fig. 8.



Fig. 11.



Fig. 12.

were lined up more readily if the splice bolts between sections were left loose, making it easier to shift the sections one way or the other. Succeeding arches were set in place more easily if the bolts fastening the bottom of the preceding arch to the base angle were left loose. In the case of one rather stubborn arch, a truck was backed gently against it to spring it in place on the inside of the base angle.



Fig. 13.

Before all the arches were erected, sufficient clay was dumped inside the base frame, to be spread, leveled and tamped flush with the top of the base channels to provide a suitable floor in the magazine.

After the arches were all in place, the rear wall was erected. It was found advisable to put this in place, one section at a time, for easier handling and lining up of bolt holes. Next the ventilator stack was raised to position and fastened on, using the bolts and braces provided. (See Figure 14.)

Next, the magazine door was hung in place. Some difficulty was experienced in this operation, as the hinges did not line up properly with the supporting pins. Evidently the pins had been bent out of shape in shipment and they had to be hammered back in line while the heavy door was held up in position. To provide secure locking of the door, new sliding bars and guides were made and welded to the door, replacing those furnished. (See Figure 16.)

With the major part of the magazine assembled, (see Figure 15), all bolts were tightened and the sealing of joints completed. Special attention was paid to the sealing at the junction of the arches and the base



Fig. 14.

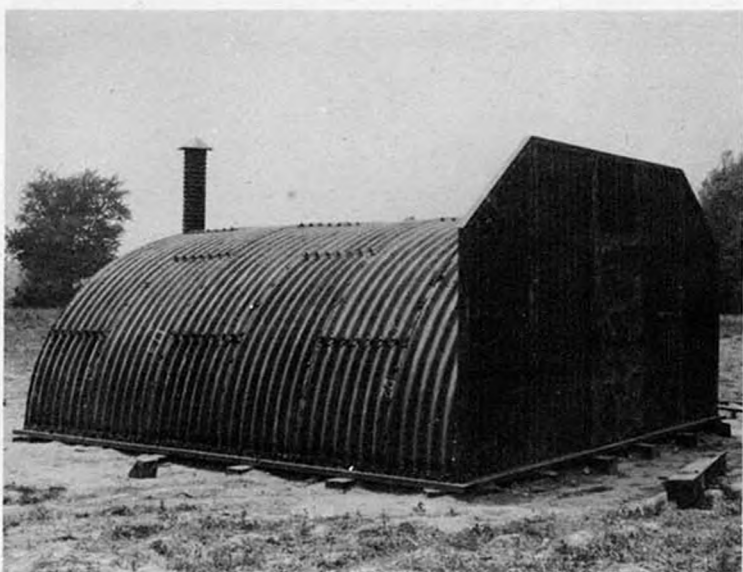


Fig. 15.



Fig. 16.

angle. The cavities left by the corrugated surfaces of the arch plates were filled with asphalt cement, to make sure that drainage from the roof would not reach the floor.

A drainage ditch about one foot wide and two feet deep was dug around all four sides 8" drain tile was laid and back filled with gravel. This tile was connected to the side drainage of the entrance drive which was completed later.

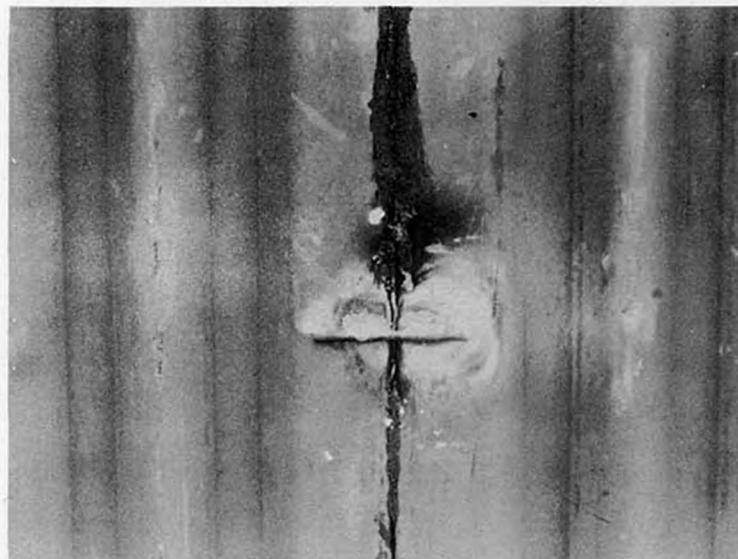


Fig. 17.

The next step, an important one from the safety standpoint, was the installation of lightning protection. The information given on the drawing was rather lacking in detail, simply indicating that the steel igloo was to be equipped with lightning rods and the corners on the structure grounded. The Post Utility Office furnished some good advice on a suitable lightning protection system. As the asphalt cement used for sealing the joints between plates prevented a good electrical contact, it was felt advisable to connect all parts of the magazine by use of 1/2"-diameter steel rods 6 inches long, with the ends brazed to adjacent sections in such a way as to insure a complete electrical circuit through the whole structure. (See Figure 17.) The welding, as well as necessary repair work, was done by the Service Section.

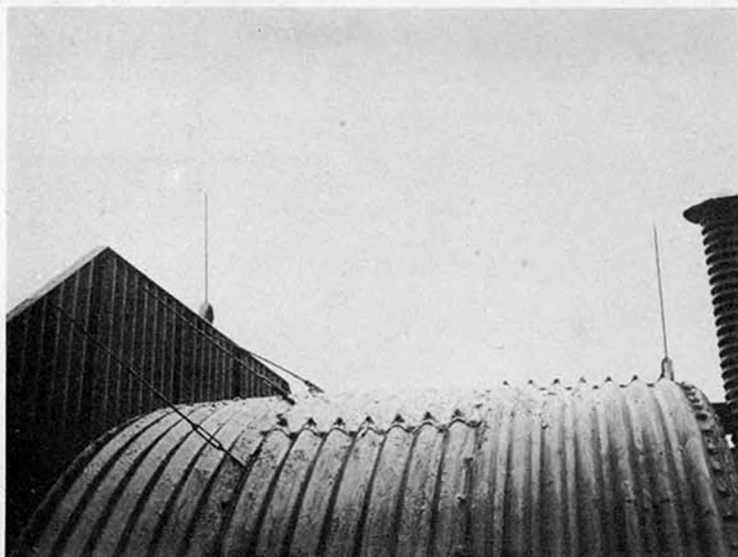


Fig. 18.

Next, two 6-foot Copperweld lightning rods were supported in brackets at the top of the roof, one at each end, with the lower ends brazed to the building. (See Figure 18.)

To provide a good ground connection, three ditches about one foot wide and 18 inches deep were dug, two of them running out diagonally from the front corners of the igloo for 30 feet and the third ditch running

straight back from the center of the rear wall of the igloo. At the end of these ditches, a 1/2"-diameter Copperweld ground rod 10 feet long was driven into the ground with the lower end sloping away from the igloo. These rods were connected to the igloo with lengths of 1/2"-diameter pure copper cable, fastened to the rods and to the igloo with the special clamps and plates provided. (See Figure 19.) The cables were laid on the bottoms of the ditches, and the ditches filled up. To complete the protection of the igloo, a piece of 1/0 (1/2"-diameter) copper cable was used to connect

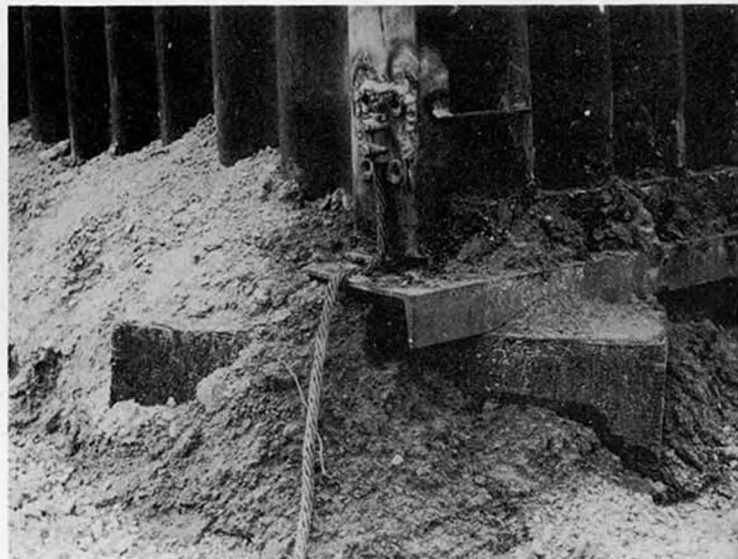


Fig. 19.

the door to the front wall. This piece was left long enough to flex with the movement of the door. (See Figure 20.)

The specifications required that the outer surface of the igloo be coated with asphalt emulsion to prevent rust and leakage.

This coating was completed by use of old paint brushes and push brooms. The asphalt emulsion dried rapidly and provided a good protective covering on the outside surfaces of the igloo. (See Figure 21.)

The igloos were now ready to be covered with earth. Calculations showed that the 10 foot x 20 foot igloo would require about 100 cubic

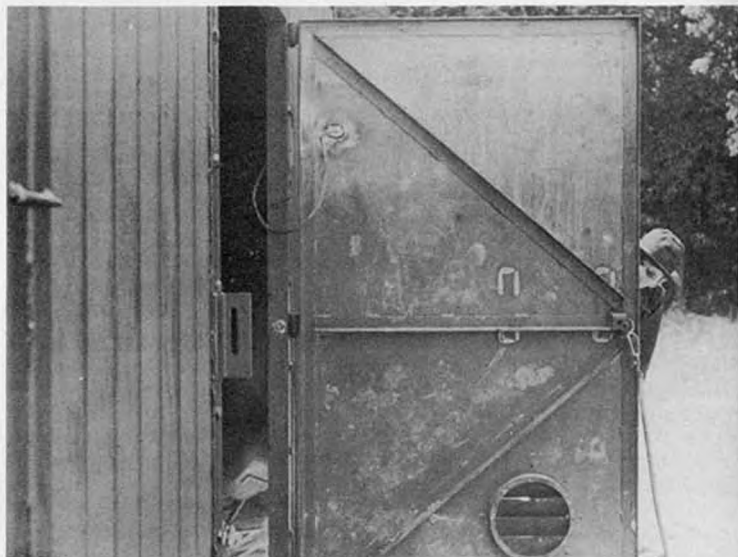


Fig. 20.

yards of earth and the 20 foot x 20 foot igloo, 150 cubic yards. (Allowing 15% for shrinkage.)

While the covering was being placed, 4" x 6" timber columns and knee braces on 4-foot centers were placed inside the magazine to prevent distortion due to unequal load. (See Figure 22.) At no time was the elevation of the earth on either side allowed to vary more than one foot.



Fig. - 21



Fig. - 23

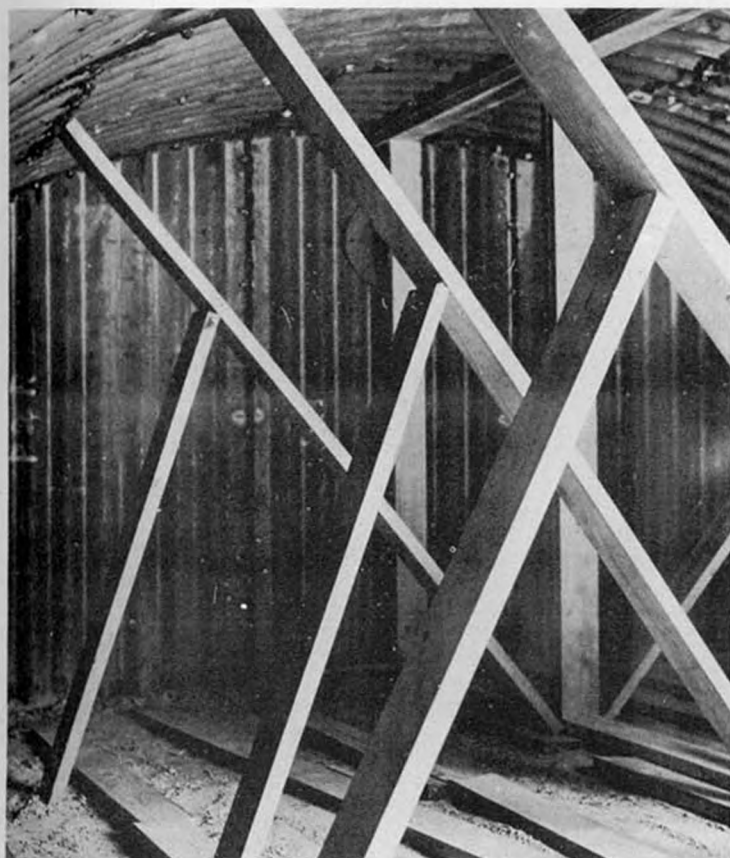


Fig. - 22



Fig. - 24



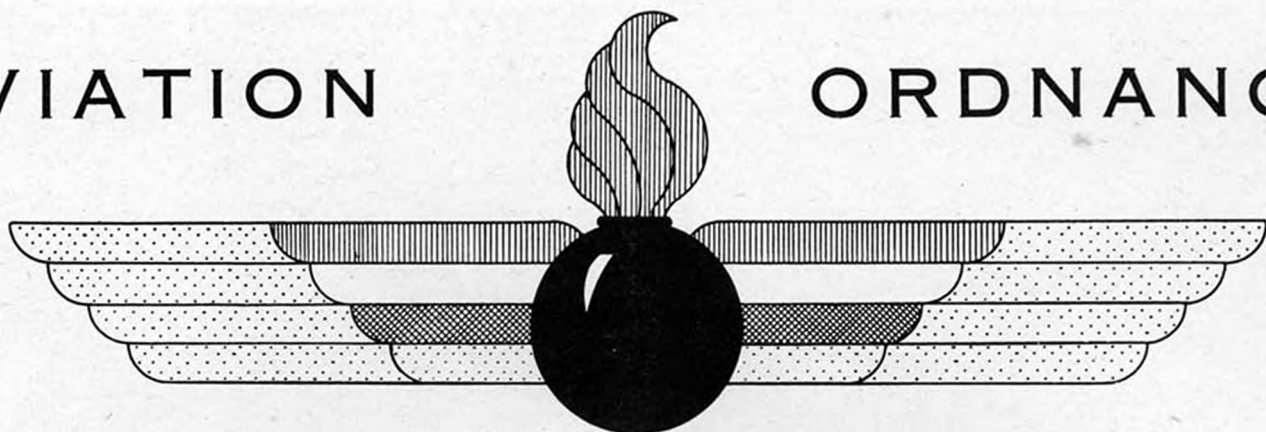
Fig. - 25

The earth covering was built up so that the thickness at the top of the roof was at least 2 feet, and with a 1-1/2 to 1 slope down each side and to their rear. The front wall of the magazine was left uncovered, as no entrance tunnel was used. (See Figure 23.) A gravel driveway from the hard-surface access road was provided for each magazine, with side ditches for drainage.

The magazines were now completed and ready for storage, having been assembled, protected against rust, dampness, and lightning, and properly barricaded with an earth covering. (See Figures 24 and 25.)

This construction job was handled more or less intermittently, working whenever time could be spared from other duties of the Ammunition Section. Under these conditions, the progress would have been much slower, had it not been for the excellent cooperation of the different agencies called upon to furnish labor, material, tools, and advice.

AVIATION



ORDNANCE

Conducted by: Glenn H. Staley, 2nd Lieut., Ord. Dept.

RECOMMENDED SPECIAL TOOLS

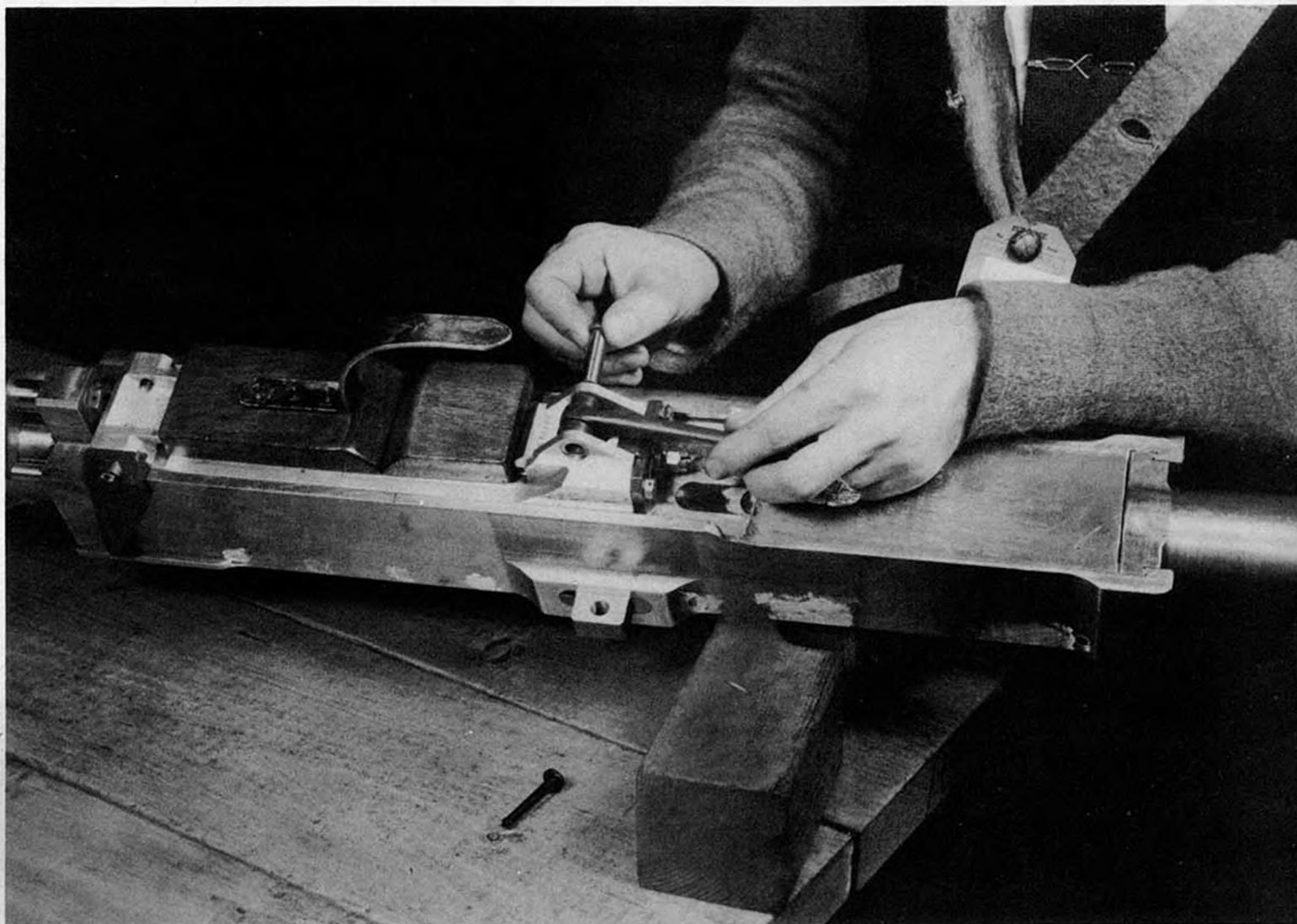
FOR THE

20-MM AIRCRAFT GUN M1 & M2

By J. W. Simpson,
2nd Lt., Ord. Dept.

There are four (4) special tools for the 20mm gun aircraft, which may be used to supplement those authorized for use in the field by SNL A-47. These tools can be made in field shops and reduce the difficulty of some phases of assembly and disassembly.

1. Magazine latch tool (Figs. 12 and 13). - This tool was designed to force the magazine latch to the rear against the pressure of the magazine latch springs in order to remove the magazine slide lever pin, bushing and magazine slide lever. The tool consists basically of two rectangular



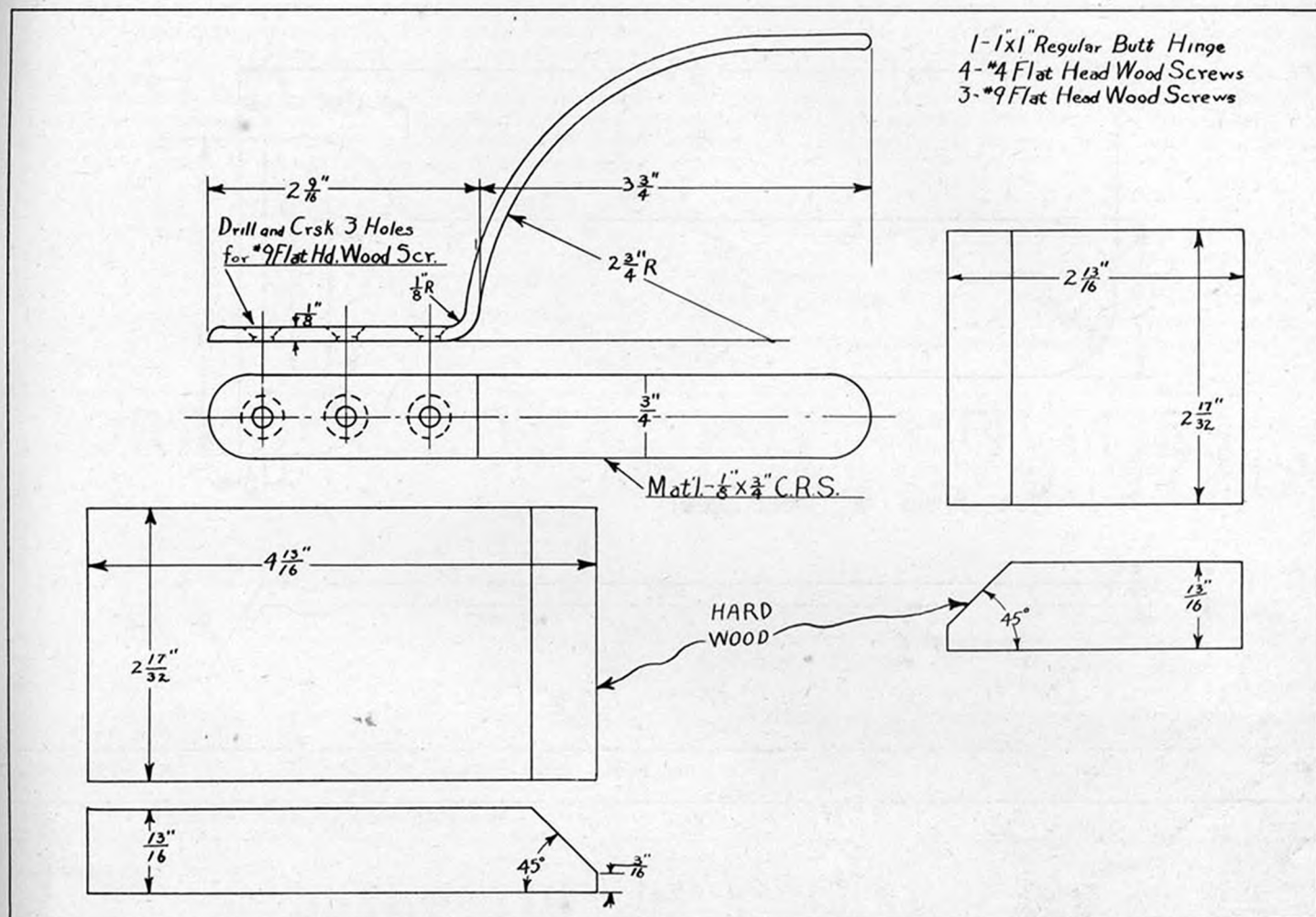


Fig. 13.

pieces of hard wood and a piece of strap iron. The pieces of wood are of different lengths and have a 45 degree bevel on one end. They are connected with beveled ends together by a small butt hinge. The tool is placed on top of the magazine slide with the long section of the tool against the hooks on the front end of the slide. The short or rear section of the tool is against the front end of the magazine latch. In this position the tool forms an inverted "V", so that when the strap iron handle is pushed down, the tool is straightened, forcing the magazine latch to the rear against the magazine latch springs. The magazine slide lever pin and bushing may now be easily removed, freeing the magazine slide lever. The handle of the tool is pulled upward, allowing the magazine latch to move forward.

The tool, magazine latch and the magazine latch springs may then be removed from the magazine slide. It is difficult to remove the magazine slide lever pin bushing unless this or some other improvised tool is used.

2. Sear assembly tool - Type A - (Fig. 14). - This tool is used to facilitate the assembly and disassembly of the sear and sear block assembly in the receiver plate. A 5/16 inch diameter steel rod, 5 inches long, is used in conjunction with the tool. The tool consists of three parts: the body, handle and a dowel pin 3/16 inch in diameter. The body is a rectangular piece slotted axially at its forward end to accommodate the handle. The forward end is also drilled transversely to receive the dowel

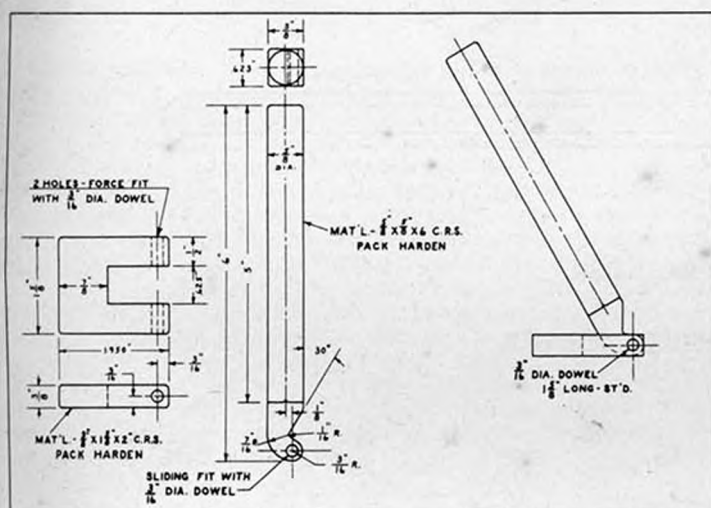


Fig. 14.

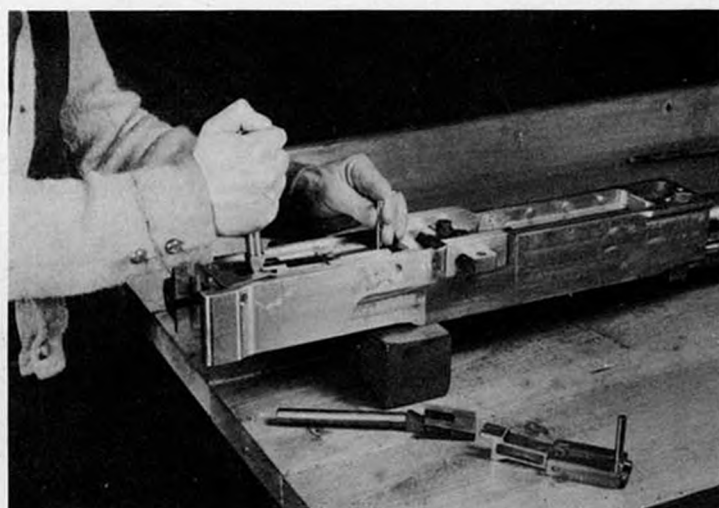
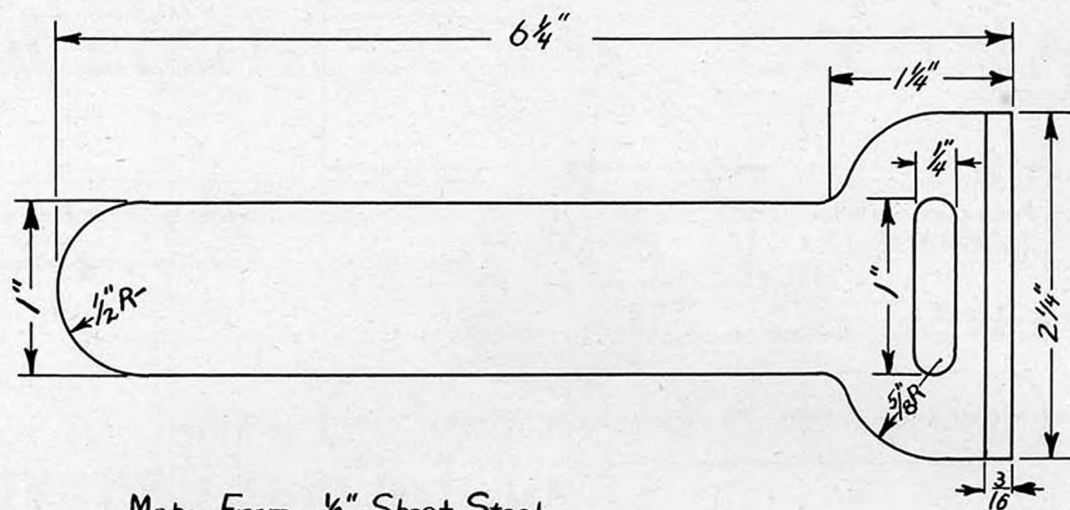
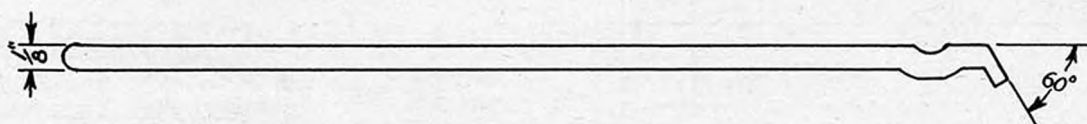


Fig. 15.

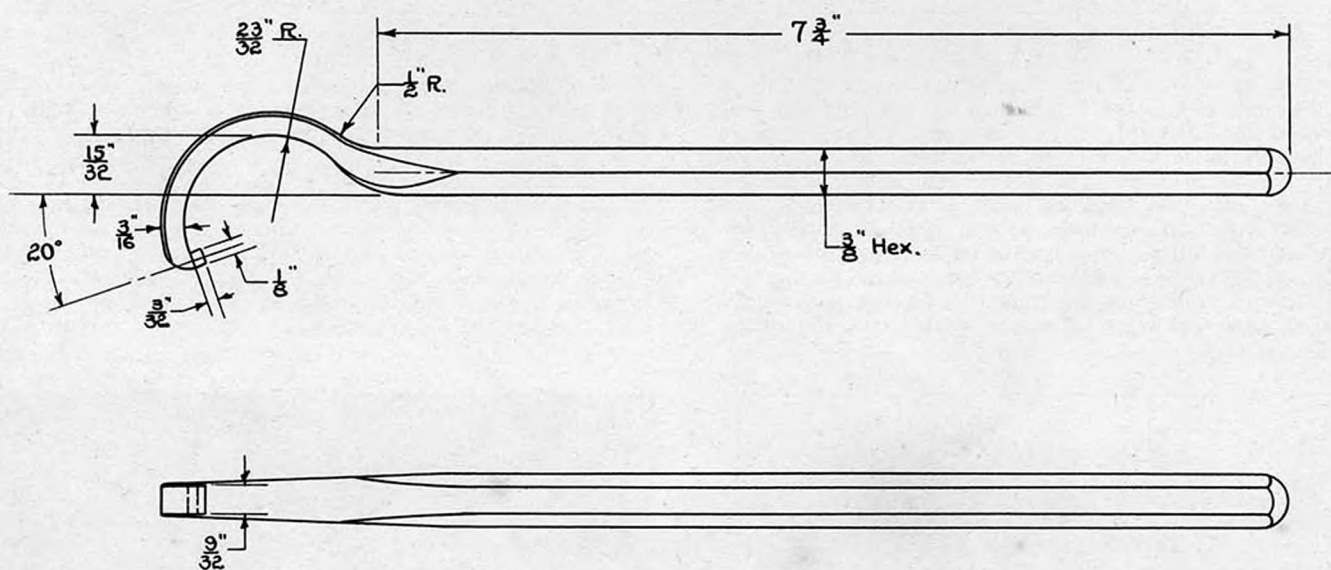


Make From $\frac{1}{8}$ " Sheet Steel



Tool, Sear Assembly - Type B

Fig. 16.



Mat'l. - $\frac{3}{8}$ " Hex. C.R.S.

WRENCH, CHARGER - SPANNER

Fig. 17.

pin. The handle is a cylindrically shaped piece with a rectangular section at one end. The rectangular section is drilled transversely to accommodate the dowel pin and has a 30 degree angle notch in its forward face. The parts are assembled as shown in Figure 15. The body of the tool is placed in the recess in the rear of the receiver plate so that the 30 degree notch in the handle bears against the rear of the sear. The handle is pushed forward forcing the sear and sear block forward against the sear buffer springs and plungers. The steel rod can be inserted in the hole in the forward end of the sear block, holding the sear buffer spring plungers to the rear. The sear and sear block assembly may then be removed from the receiver plate. The assembly may be replaced by inserting it in the receiver plate and forcing it forward by means of the tool until the rod can be removed.

3. Sear assembly tool - Type B. - This tool is to be used for the same purpose as the "Type A" tool described in Paragraph 2. It is much simpler in design and therefore much easier to make. The tool can be

made out of a piece of sheet steel. A sketch of the tool is shown in Figure 16. The beveled edge of the tool is hooked over the third rivet from the rear on each side of the receiver plate. The rear end of the sear fits into the recess in the lower end of the tool. The tool is pivoted forward around its lower end, forcing the sear and sear block assembly forward until the rod can be inserted in the hole at the forward end of the sear block. The remainder of the operation is the same as in Paragraph 2 above.

4. Charger spanner wrench (Figure 17). - This wrench is only necessary when the gun is equipped with a hydraulic charger installed in the cylindrical section on the right side of the receiver body. The wrench is made from a piece of hex bar stock that is bent at one end to form a radius with a lug on the end. This lug fits into notches on the front end of the charger cylinder so that the cylinder may be screwed in and out of the charger housing.

ORDNANCE TRAINING ACTIVITIES



Conducted by: G. D. Meixel, 1st Lieut., Ord. Dept.
Secretary, The Ordnance School

CONSTRUCTION OF A PLEXI-GLASS MACHINE GUN 14 CAL. .30, M2

By C. P. Vansant

Major, Ord. Dept.

Ordnance Officer

Hickam Field, T. H.

The idea for a glass machine gun is not a new one. Until recently, classes on small arms were stretched over a period of six to eight weeks. This was sufficient time to allow the student to learn the guns thoroughly, through trial and error and diligent study of manuals. As the training periods were shortened, it became increasingly difficult for the students to absorb a working knowledge of the necessary weapons. When the number of students increased and the classes were shortened from eight weeks to four weeks, it was decided that something had to be done.

The plexi-glass used in the training gun were scraps discarded by the Air Corps. After enough pieces of glass sufficient in size were accumulated, it was necessary to obtain templates, or patterns. A salvage gun was obtained and completely broken down. Rivets were chiseled off, and the side, top and bottom plates were disassembled from the trunnion block. After careful measuring and tracing, the glass side plates were ready to be cut. One of the fine points of plexi-glass is the fact that it can either be sawed or drilled, and will take screws in the same manner as wood. The cams and guides were removed from the original gun, and in order to fix them in their proper places on the glass plates, it was necessary to file the heads off from the inside, leaving a smooth surface for certain parts of the gun to work on. The breech lock cam was bolted in place on the bottom plate. The cover was stripped of all cams and springs; the flat surface was removed and replaced by glass. The cover was then assembled, using nuts and bolts instead of rivets. It was necessary to mill grooves in the side plates at the rear, to take the back plate assembly.

When all the plates, side, top and bottom were ready for assembly, the measuring and drilling began. After careful drilling, the side plates were fastened to the top and bottom plates by .099 machine screws.

The original trunnion block and barrel jacket were used because of the difficulty in obtaining a piece of glass of sufficient size to carve a trunnion block from. The side plates were attached to the trunnion block by long bolts. In order to have the cover fit the side plates, it was necessary to mill grooves into the side plates to take care of the difference in thickness of the glass plates and the regular steel plates.

Real difficulty was encountered now in making the barrel extensions, lock frame, and bolt fit easily and snugly. Cutting, filing and milling were necessary in order to make all the parts fit properly. The original feedway was put in the gun as too much trouble was encountered in trying to cut and fit one from glass. Small plates were fastened on

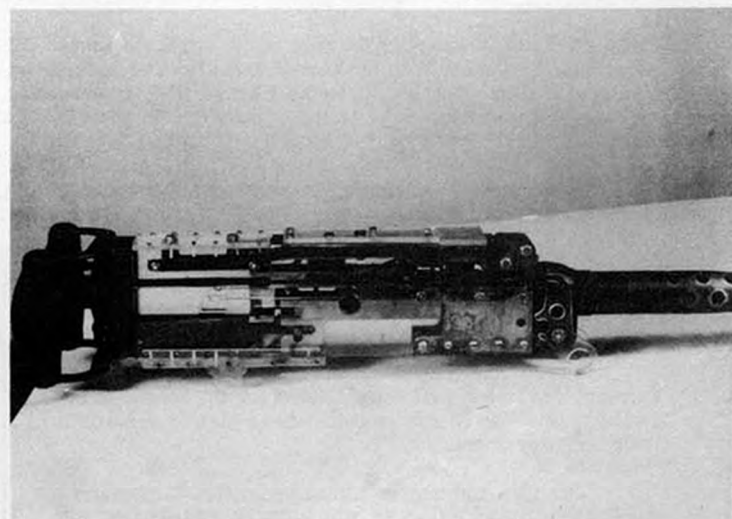
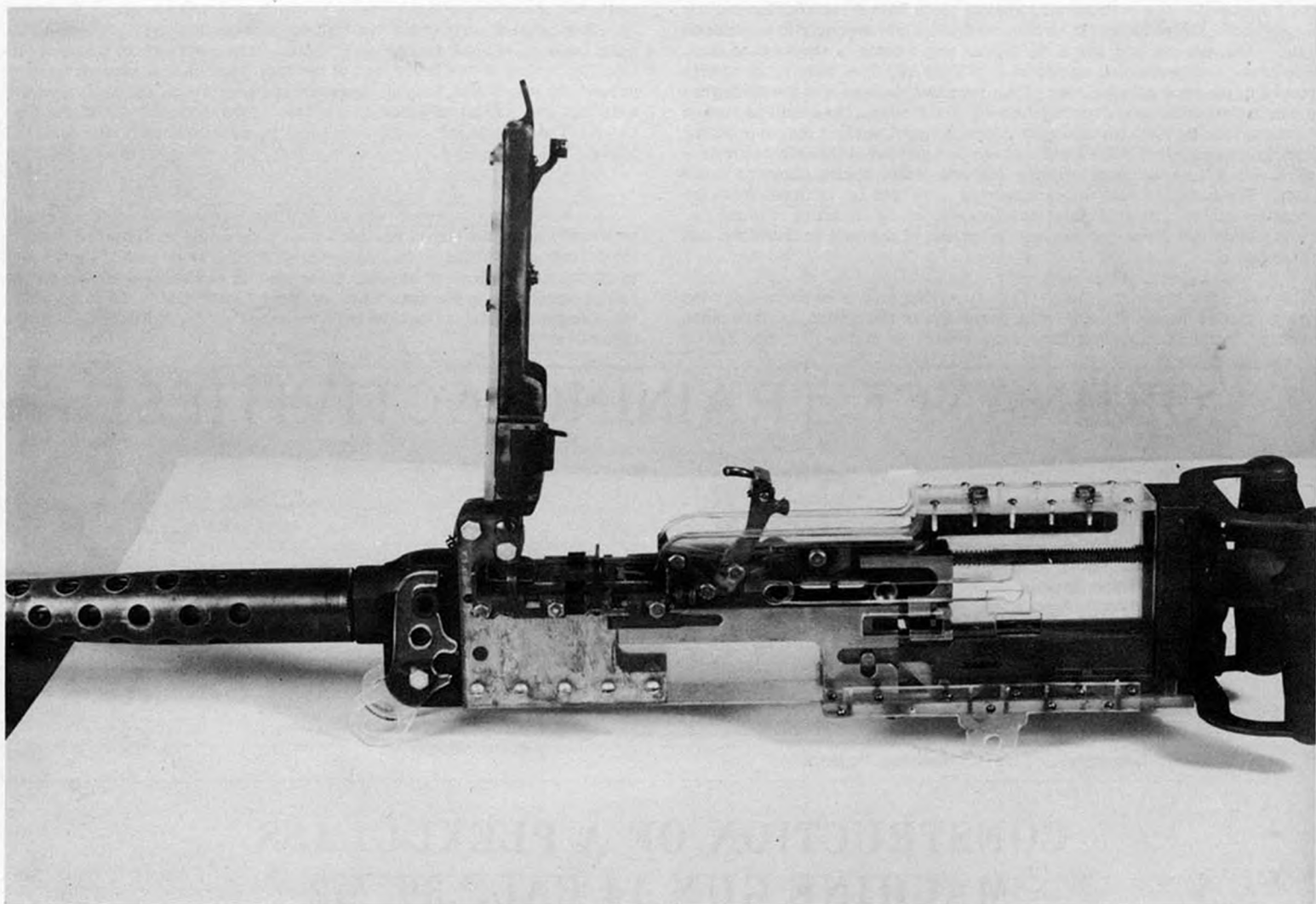


PHOTO BY BASE PHOTOGRAPHIC LABORATORY
HICKAM FIELD, T. H.



the sides, cut to serve as rear adapters and give added strength to the bottom plate.

The driving spring was weakened by heat in order to relieve the shock of the bolt going into battery position. The following actions can be clearly seen: feeding, extracting and ejecting, along with the actions of the accelerator, breech lock, breech lock cam, barrel extension, cocking lever, extractor, trigger, trigger bar and sear. It was necessary to make a glass front adapter in order to keep the gun level and distribute its weight evenly.

It is advisable to keep a light film of oil on all the parts. Oil clouds the glass slightly, but does not detract from its usefulness as an excellent class weapon. The gun must be handled with a reasonable amount of care, and it should not be stripped more than is necessary to keep it oiled.

This gun has enabled instructors to teach a class in half the time normally required. The men responsible for the work on the gun are Privates Ernest W. Grosskop and Earl Martell.

Plans for a glass pistol are now being formulated and will soon be accomplished.

The article beginning in the next column is the fourth of a series of articles published for the benefit of individuals who may be assigned to duty as instructors within their own organizations.

The fifth, and last, of this series, titled "Demonstrations", will appear in THE ORDNANCE SERGEANT for August.

ORDNANCE TRAINING METHODS

By: P. J. Phillips, Major, Ord. Dept.
Director of Training Methods, The Ordnance School

Part IV SUGGESTIONS ON LECTURE TECHNIQUE

There are some specific techniques that any young instructor can profitably use in his work. Some of the suggestions to be given have been established experimentally. Others are given because they are being used by the "best" teachers. In either case, they seem to be rooted in sound psychology.

The first is the principle of change. The moving object has an advantage over the still. Of all the toys in the show window, it is the jumping jack that arrests the eye. The use of camouflage in war is a recognition of this principle. The ships and guns that are made to blend with their surroundings escape the notice of the enemy. It is being different that attracts attention. The man whose actions can always be predicted is not interesting. The conversationalist who tells the same threadbare jokes and stories is a bore. It is the same with the lecturer. If he manifests no variety, he fails to capture the attention of his class. But if he unexpectedly lowers his voice, or if he gives a short incisive sentence in the midst of long involved ones, your attention is automatically enlisted. If he changes from exposition to narration or description, you follow with increased interest. If he turns aside from the abstract, "gets down to cases," or tells a story appropriate to the line of thought, you respond agreeably to the change.

The strength or intensity of the presentation is a second factor of advantage. The response called forth seems roughly proportionate to the strength of the presentation. It is the headlines of the daily paper that first attract the reader's attention. Large type may, in fact, be four times

as effective as type one-half as large. The positive command rather than the timid suggestion is carried out. The sentence pronounced with emphasis has more effect than one lamely put. The homely Anglo-Saxon words whose connotations root deep in human experience have the greater attention-value. The concrete noun is usually more effective than the abstract; the active form of the verb more forcible than the passive. "Remember," says Arthur Quiller-Couch, "that the first virtue, the touchstone of masculine style, is the use of the active verb and the concrete noun." The vigor of the presentation determines the depth and permanence of the impression.

Repetition. - Repetition is also a factor of advantage. It is the repeated idea that sticks. This technique accounts for most of the success of the advertiser and the propagandist.

Results of tests to determine the effectiveness of speech for retentive purposes (memory) are interesting. A representative group of college students of average ability was employed. Methods of all sorts were used to stress certain points, including repetitions, direct statements, warnings to the students that certain things were to be remembered, etc. The methods used and results obtained were as follows:

Method	Result
Five repetitions -----	315
Four repetitions -----	246
Three repetitions -----	197
"Now get this" -----	191
The first statement made -----	175
Two repetitions -----	167
The second statement made -----	163
"Did you get that?" -----	154
A pause before the statement -----	153
The last statement made -----	138
The impressive banging of the fist -----	115
Dropping speech rate to one-half of normal -----	79

This tends to indicate that the effect of repetition is most important.

Definite form has advantage over the vague in getting attention. The idea must be carried in a neat packet. Strict adherence to the motif is the secret of effect in interior decoration. All the articles in a display window can be taken in at a glance by the passerby if they are grouped by their relevancy to a central theme - for example, all of the articles needed for camping may be arranged to represent the layout of a camp in the woods. The lecturer must make the elements of his sentences hang together so as to present a unified concept. Consider the forthrightness of the sentence: "The right is more precious than peace." The speaker should take counsel from the better class of "sloganeers" and become a maker of phrases.

The mind-set of the moment determines that to which a man will pay attention. The motorist driving a car through congested traffic is anxious above all else to avoid an accident. He has a "safety-first" mental-set. Likewise the lecturer must either fit his materials to the "prevail-

ing mind-set" of the class, or he must build up a new one appropriate for taking in his ideas. The lecturer that knows his business will introduce his facts only after a proper basis has been laid for receiving them.

Summary of practical hints. - The trend of opinion by authorities can be summarized as follows:

Express the main points in emphatic topic sentences. The key sentence, or what editorial writers call the "paragraph lead," should contain the gist of all that is said on a given point. The other statements center themselves around it and are subordinate to it.

Keep the thought constantly going forward. The skillful lecturer does not let himself get lost in the woods; he makes the class aware of continuity by relating to his central theme each unit group of facts with which he is dealing at the moment.

Indicate clearly the transition from one line of thought to another.

Summarize the lecture in a few clear-cut statements. A summary is usually but not always needed.

Make ideas clear and make them stick. Make the student think.

Strive to exemplify the scientific attitude.

Present conflicts - raise problems instead of handing down mere solutions.

Put a premium on the application of facts - not upon their mere acquisition. Facts are not an end in themselves. They are only tools. The acid test of whether a student comprehends a principle is his ability to apply it. If the student has properly interrelated his lectures and reference readings, he has a set of usable concepts.

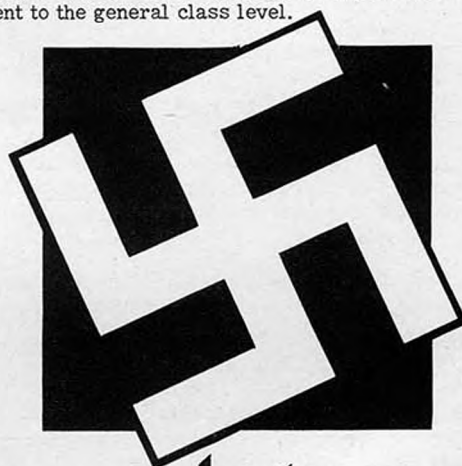
Make listening easy:

Get on good personal terms with the students. The emphasis, of course, seems misplaced; but for a long time good instructors have taken the initiative. The "barrier" between faculty and student body is not intrinsic. Some schools use the scheme of appointing each instructor as "faculty advisor" to a small student group; practice shows this to be an excellent "meeting ground."

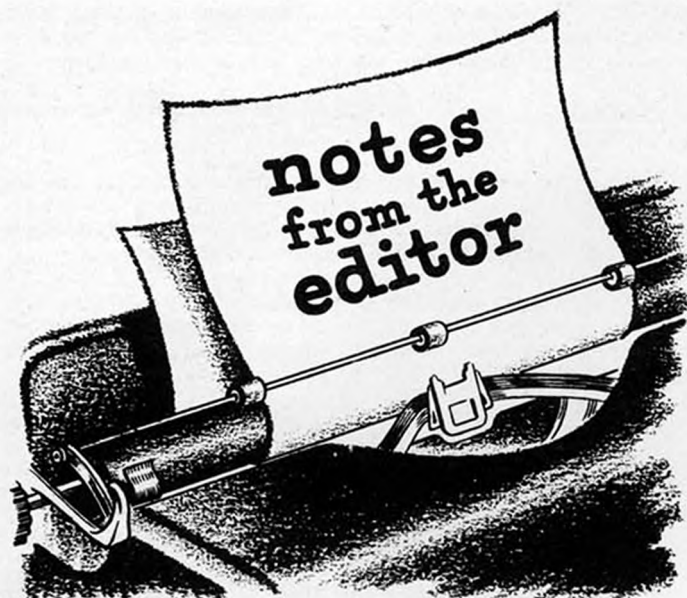
Talk at a moderate rate, not too fast - at an ordinary rate, about 120 words per minute. Lecturing is not dictation. Time is always a practical factor if one must compress a certain topic within a 45-minute period; the manuscript, if any of the conference can hardly exceed 20 to 22 pages, and, since the average typed page contains about 250 words, will require 45 to 50 minutes for delivery.

Don't try to dazzle the student with the profundity of your knowledge. Adapt your treatment to the general class level.

To be found in this issue are a number of ideas which have been tried and found satisfactory by individuals or organizations. There must be many others which should be passed on to our readers. Send them in - including description, drawings, or photographs.



**Just
A REMINDER!**
to Buy More
War Savings Bonds & Stamps



Among the many interesting items which come to the editor's desk are some which cannot be published. Some are used as suggestions for articles which appear later. Still others contain ideas of undoubted values to Ordnance personnel. They are presented here for your benefit.

Proving Ground, Illinois,
May 28, 1942

The Editor, THE ORDNANCE SERGEANT,
The Ordnance School,
Aberdeen Proving Ground, Md.

Allow me to be the first to point out an error in the May issue of THE ORDNANCE SERGEANT.

In the right-hand column on page 416, the following is printed: "Each SNL of Groups P, E, S, T (Ammunition) ****". A quick check of my carbon copy of the manuscript submitted to you saved me from embarrassment. The line should read: "**** Groups P,R,S,T **".

Yours very sincerely,

AMOS L. PROUTY,
M/Sgt. Ordnance Dept.

WAR DEPARTMENT
RARITAN ARSENAL
METUCHEN, N. J.

May 6, 1942

The Editor
THE ORDNANCE SERGEANT
The Ordnance School
Aberdeen Proving Ground, Md.

Dear Sir:

Inclosed is a clipping of page 5 of the "Hobart Arc Welding News" that I believe might be of interest to various Ordnance establishments, particularly most Ordnance shops that are being established or expanded. The article I refer to is the one headed "Unique Welding Positioner Table".

You will notice that the materials that they recommend to be used

You can't win a war by what you say — but you can lose it.

are practically all to be found in the average scrap pile, which should be an advantage to the average shop.

I believe that the item warrants republication in your magazine in order to bring the possibility of such a unit before the Ordnance personnel in the field.

Yours truly,

ELBERT A. NEWHOUSE
Major, Ordnance Dept.
Engineering Division

Incl. -
1 Clipping

HOBART ARC WELDING NEWS

UNIQUE WELDING POSITIONER TABLE

John S. Green, Cleveland, Ohio
Johnson & Jennings Co.

To successfully compete in fabricating the wide variety of jobs that are called for, the small jobbing shop must rely on imagination and ingenuity instead of capital investment for special and sometimes intricate tooling.

assembly of a discarded automobile truck. A trip to a graveyard of defunct automobiles disclosed an unlimited supply of such wheel assemblies that could be purchased at \$1.50 each.



With one of these wheel assemblies as a basis for design, it took but a short time to sketch the required tilting and revolving Positioner, that could be rotated easily with loads up to 1000 pounds.

When the sketch of this Positioner was sent to the welding shop, it was discovered that only the following material was required to be taken from stores material:

1 Steel Base Plate 1" x 34" dia.
1 Steel Table Top 1/2" x 36" dia.
1 Coil Spring 1/4" Wire 10" long
1 Steel Yoke Plate 3/4" x 12" x 16"

Balance of the material required was found in our steel scrap bins.

Little description of the photograph is required. A pin which registers with holes in the yoke, controlled by a foot pedal, gives the required angle at which to set the table; a pressure plate controlled by springs through levers to the foot pedal gives the operator full control of revolving the table as required. The table was drilled for suitable clamps to hold work in position.

Cost of one Positioner:

Material\$17.73
Productive Labor 16 hours at 90c. 14.40
Total\$32.13

Help Grind The Axis — Buy U. S. Defense Bonds and Stamps Today.

WAR DEPARTMENT
OFFICE OF THE CHIEF OF ORDNANCE
WASHINGTON

June 25, 1942

Subject: Material for Publication.
To : Commanding General
The Ordnance Training Center
Aberdeen Proving Ground, Md.

1. Inclosed is a copy of a letter and four photographs which may be of interest to the readers of THE ORDNANCE SERGEANT. If it is

desired to publish the information contained therein, it may be edited and published without further reference to this office.

By order of the Chief of Ordnance:

Jas. A. B. Gibson,
Colonel, Ordnance Department
Assistant

WATERVLIET ARSENAL
WATERVLIET, N. Y.

FMB/rmb

Tank Officer.

Major Beede
Field Service Maintenance Division
Automotive Section
Ordnance Department
Arlington, Virginia

Dear Major:

A short time ago I received a request from your office for information on the function and design of our power train break-in stand that we developed here at Watervliet. I believe the inclosed photographs are practically self-explanatory.

We utilized salvage materials from the Arsenal as follows. The base is an old planer bed from the Gun Shop, which allows versified mounting, and the electric motor, 15 h.p. and the mount upon which it is fastened were also surplus items at this Arsenal. To this we hooked up a Buick transmission and clutch housing assembly from a salvage automobile lot, and then through a common universal joint with a universal coupling we tied it into the transmission itself.

As you will note, through a lever arrangement we have a clutch pedal on each side, and we have also attached a tachometer and an oil pressure instrument on a small bracket. In addition to this, we used an oil flow meter in the form of a gallon can in which we check the capacity of the pump before the unit is approved.

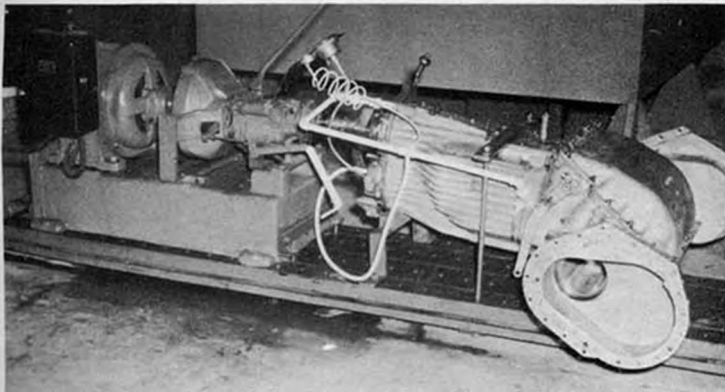
This equipment is all that a shop would need for this kind of work, and can be set up in so many ways where the materials that we were fortunate to find here cannot be had. Through its use one can test thoroughly cooling, quietness, and the feel of all of the shifting gears before the unit is sent out as approved.

Very truly yours,

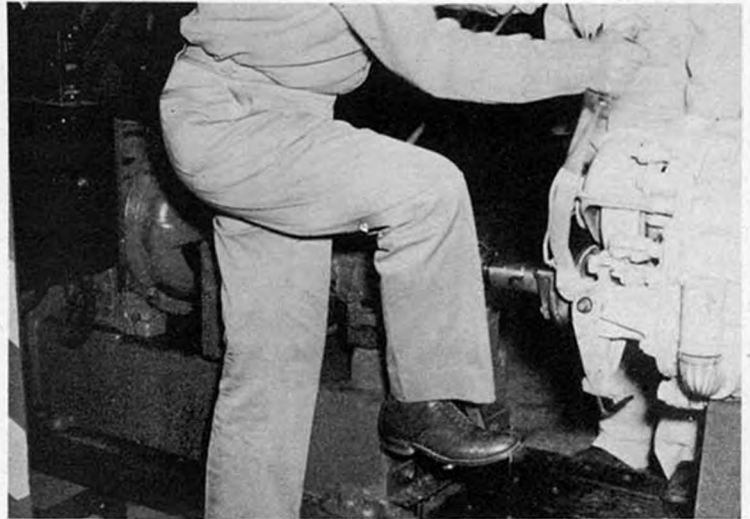
/s/ Frank M. Browning
Frank M. Browning
Major, Ordnance Dept.
Tank Officer

Incls. 4
-Photographs-

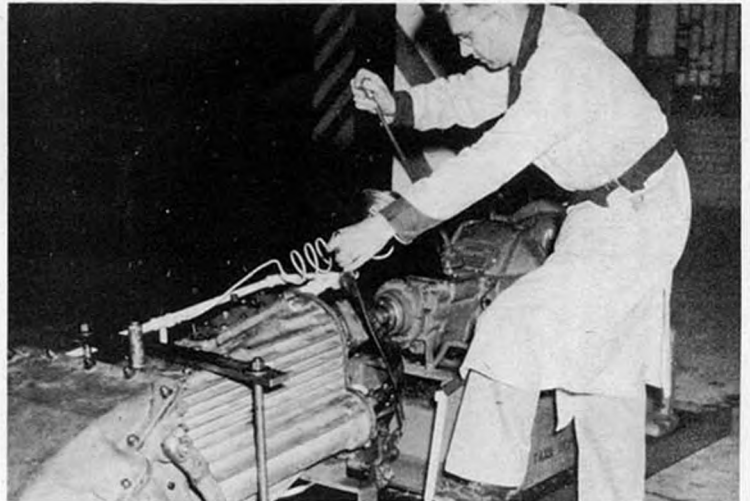
TESTING STAND DEVELOPED AT WATERVLIET
ARSENAL TANK SHOP



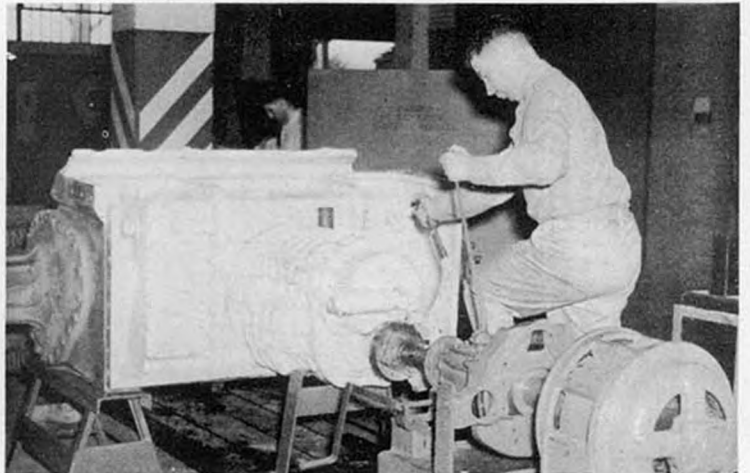
Power Train Test Fixture



Clutch Control



Light M3 Test



Medium M3-4 Test



May 5th, 1942

Enclosed is a copy of the song which Lt. Kuehne and I wrote entitled THE UNITED STATES ARMY IS GRAND. We both work in the Supply Section of The Ordnance School.

The song has been copyrighted and is scheduled to be played over radio station W.C.A.E. in Pittsburgh. The radio editor of the Pittsburgh

Press gave the song a nice write-up and mentioned the fact that Lt. Kuehne and I are both stationed at Aberdeen Proving Ground, Md.

The O.T.C. band is working up an arrangement and are going to play the song in the near future. We are sending the song out to leading publishers, radio stars, and etc, with the hope that it will be published.

Sincerely,

Staff Sergeant Reuben Katz

40th Ordnance Co. (Tng)
Aberdeen Proving Ground, Md.

This problem was encountered during actual overhaul and inspection procedure on M-3 Half Track booster in the ORDNANCE BASE SHOP SCHOOL.

Upon inspection, it was found that the linkage shaft which operates valves in booster was broken. This rendered the booster useless and necessitated the removal of shaft, so it could be welded together.

A simple sleeve puller was devised to remove sleeve, so shaft could be removed from main push rod.

This sleeve puller could also be used to pull sleeve when air and vacuum valves fail which necessitates removal of linkage shaft to replace valves.

The United States Army Is Grand

Words & Music by
Sgt. REUBEN KATZ

March Tempo

Chorus

THE U - NI - TED STATES ARMY IS GRAND De-fen-ders of lib-er - ty ve

stand. As rook-ies we were a sight, But now we're full of might, THE U -

NI-RED STATES AR-MY IS GRAND. We want the world to know, we're as

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proud as can be And now that the test has come, We'll de-fend our de-moc-ra-cy, We are

proud of the Red, White and Blue And all the things they stand for

too. So we will fight, fight, fight, For the things we know are right. THE U -

1st. 2nd.

- NI - RED STATES AR - MY IS GRAND The U - GRAND

HEADQUARTERS
ORDNANCE BASE SHOP SCHOOL
Aberdeen Proving Ground, Md.

MEMORANDUM:

May 20, 1942

TO : Editor, THE ORDNANCE SERGEANT

1. A simple puller for removing one of the sleeves on the Half-Track Vacuum Brake Booster unit has been designed for the Automotive Section of the Base Shop School by Pfc Robert P. Hale, of the 97th Ordnance Company. This puller was manufactured and has proven highly satisfactory in service.

2. In the hope that the drawings and description submitted by Pfc Hale may be of value to other Ordnance personnel, they have been inclosed as material perhaps suitable for publication in THE ORDNANCE SERGEANT.

DONALD W. CURTIS,
2nd Lt., Ord. Dept.,
Plans & Training.

TO REPLACE AIR AND VACUUM VALVES IN HALF TRACK BOOSTER

If the air or vacuum valve fails to seat properly in this type brake booster, the booster will be weak, causing "hard" brakes. The unit will fail to do its work, thus throwing the braking power completely on the physical effort of the operator.

Specifications call for removal and replacement of entire unit in case of failure of valves.

This is probably due to the fact that two pressed sleeves must be pulled from the main piston rod before the valves can be removed.

In the event of emergency or lack of unit replacement, these sleeves may be removed with this simple sleeve puller to actuate the removal of air and vacuum valves.

PROCEDURE

Shaded sleeves #1 and #2 (Fig. 1), must be removed to allow shaft and valves to slide from main rod.

1. Remove nut and cylinder plates

DESIGN FOR SLEEVE PULLER

THIS TYPE PULLER ASSURES EASY REMOVAL AND REPLACEMENT OF AIR AND VALVES IN HALF TRACK, VACUUM BRAKE BOOSTER.

NOTE:
SEE PAGE 10 SECTION S-46-T
OPERATOR'S MANUAL
HALF TRACK M2-M3

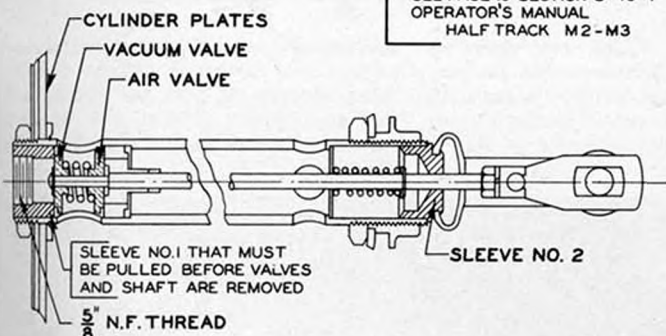
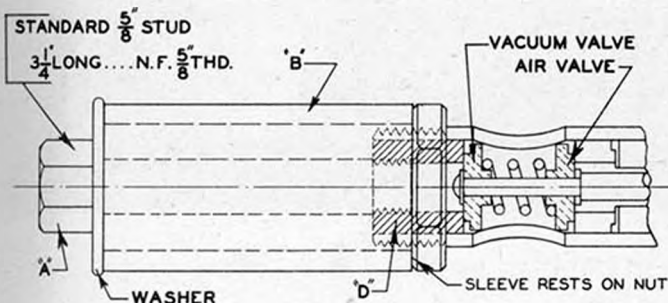


FIG. 1



SLEEVE PULLER CONSISTS OF $\frac{5}{8}$ \"/>

FIG. 2

2. Replace nut and tighten
3. Place sleeve "B" (Fig. 2) against nut
4. Place washer "C" (Fig. 2) on end of sleeve
5. Insert stud "A" through washer and sleeve and start threads of stud into threads of pressed sleeve (crosshatched as shown in Fig. 2).
6. Tighten stud into sleeve, which will pull same out of piston rod.
7. Be careful of sleeve when removed as its inside face is polished to form seat for vacuum valve.
8. Sleeve #2 may be removed by turning with pipe wrench on its exposed collar.
9. With both sleeves removed, shaft and valves may be removed easily.
10. When reassembling, be sure to tap sleeve #1 flush with piston rod to assure the proper seating of valve.

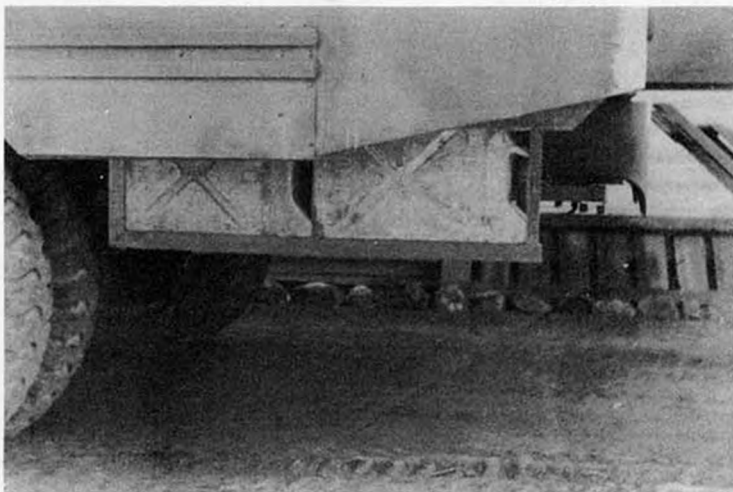
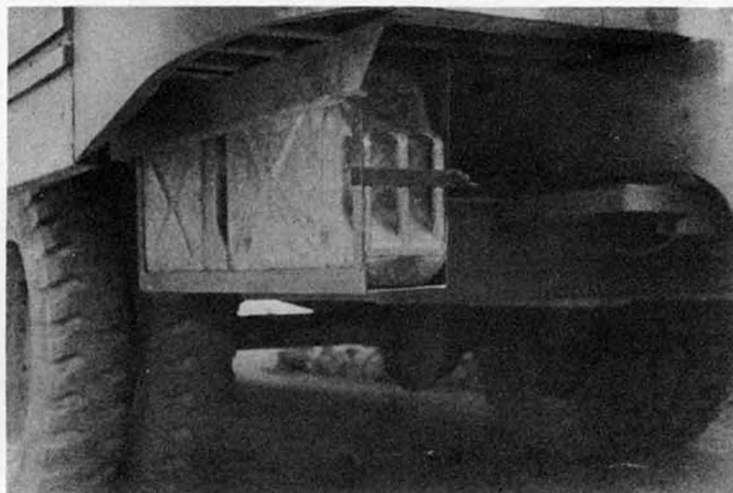
NOTE: This is why a puller is needed to pull sleeve, because it is flush with end of shaft, thus making it impossible to tap out.

HEADQUARTERS 110TH ORDNANCE CO.
CAMP LUIS OBISPO, CALIFORNIA
March 13, 1942

The Editor
THE ORDNANCE SERGEANT
The Ordnance School
Aberdeen Proving Ground, Maryland

Dear Sir:

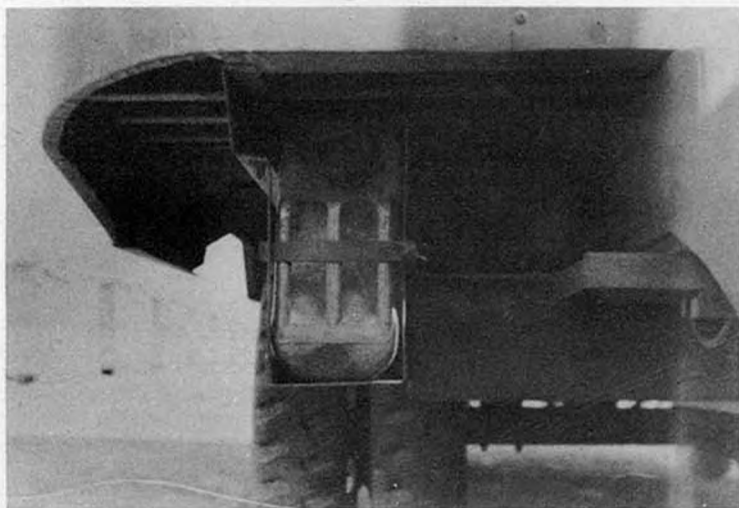
We are passing on for the information of others an answer to one of the problems we are having in the field.



All trucks are required to carry extra gasoline in containers of either 5 or 10 gallon capacity. If these are carried inside of the Ordnance Repair Buses the gasoline fumes cause a great fire hazard, and may cause much discomfort for the vehicle operators. Our Service Section designed and made the carrier as shown in the accompanying pictures. The racks were made to hold the GI gasoline containers of the 5 gallon capacity. They are made from 1-1/2" x 1/8" angle iron and 1" x 1/8" strap iron and fastened to the truck frames with 1/4" stove bolts 1" long. The containers are held in place by the keeper with a thumb screw which can be tightened without any wrenches or tools.

F. E. Bulman, 1st Sgt.
110th Ordnance Co.

FEB/he



A letter from the Adjutant of the 224th Field Artillery Battalion contains what may be considered a new word. So far as we can learn it is strictly military in application. He states that his organization recently came into existence through "triangularization". There are several similar words based upon the word "triangle", but this one is particularly interesting from a military point of view. The day will soon come when the old square division will be only a memory, and the triangular division will be in a position where it can be replaced by some even more modern organization. "Triangularization" will no longer be useful in our military language.



743RD ORDNANCE COMPANY, AVN. (AIR BASE)
Office of the Commanding Officer

France Field, C.Z.
May 7, 1942.

The Editor,
THE ORDNANCE SERGEANT,
Aberdeen Proving Ground, Maryland.

Dear Editor:

Read with enjoyment the April issue of THE ORDNANCE SERGEANT, however, reference to statement on article from 1st Platoon, 687th Ordnance Company, Avn. (PUR), Fort Richardson, Alaska. They mentioned about a crew of five men that belted 17,500 rounds of .30 Cal. Ammunition by hand in one day, which they believe is a record.

This organization has a two man crew which belted 20,500 rounds of .30 Cal. Ammunition in one day. They were using a hand operated belting machine. These men have belted 20,500 rounds or better for over a week at a time, also we do not think this is a record, but it will be something for other Ordnance crews to equal or better.

This organization will give any Ordnance crew of men a record to equal or better. There is a ten man crew in this organization which believe that they have set a record in belting 25,000 rounds of .50 Cal. Ammunition with six (6) hand operated belting machines in three (3) hours. They also sealed the ammunition in containers with masking tape.

Sincerely,

GARRITT W. LOYD,
T/Sgt. Ord. Dept.
Chief Clerk.



The group of enlisted men shown here are reading with interest the announcement that applications for Ordnance Officer Candidate School are now acceptable. These men are all from the Ordnance Replacement Training Center, Aberdeen Proving Ground, Md. where the school is conducted for eligible men at Aberdeen and elsewhere in the field.



5602-E A.P.O. 914
c/o Post Master
San Francisco, Cal.

Dear Editor:

I am forwarding you an account of an experience which seldom, if ever, occurred.

Through an unavoidable accident, a large number of U. S. Rifles, Cal. .30, M-1, were covered with salt water for approximately ten days; and, as a result, the wood of the stock expanded with enough force to break off approximately ten percent of the trigger group locking lugs.

No doubt, it is needless to state that a little rust was also present.

If possible, please forward copies of THE ORDNANCE SERGEANT to this detachment. All back copies for this year would be greatly appreciated.

Sincerely,

Gustin A. Hess
Technical Sergeant 5602-E
A.P.O. 914
c/o Post Master
San Francisco, Cal.

120TH ORDNANCE COMPANY
CAMP BARKELEY, TEXAS

.NEM/paw

June 19, 1942

SUBJECT: Cleaning Rod Puller

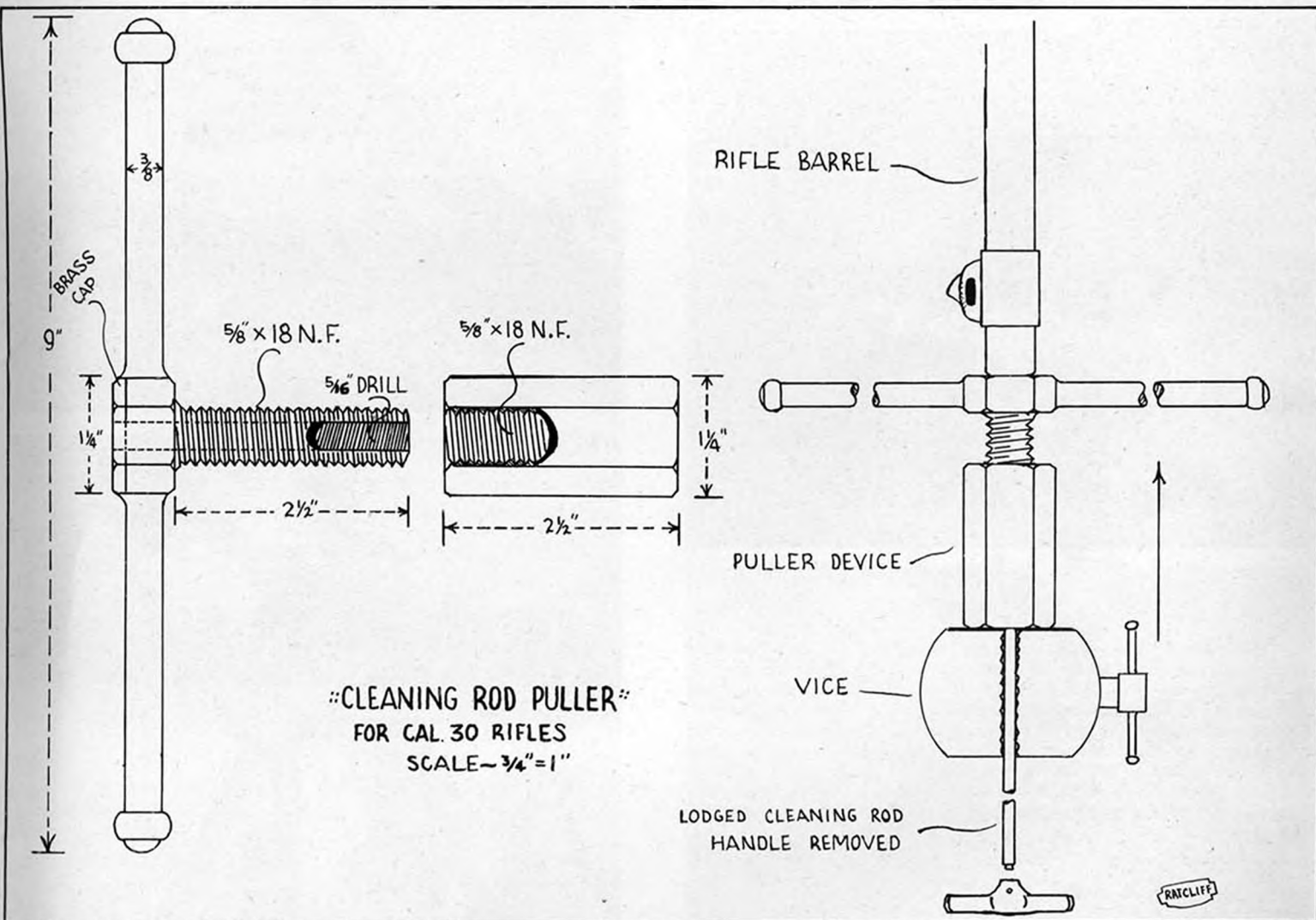
TO : THE ORDNANCE SERGEANT, Ordnance School, Ordnance
Training Center, Aberdeen Proving Ground, Maryland.

1. Please find attached drawing of a tool made by the Service
Section of this Unit, to remove cleaning rods from all caliber 30 rifles.

2. This tool has been a great help to us on the rifle range and in
the shop.

3. The screwaction insures removal of the rod without breaking.
The brass cap prevents damage to the end of the barrel.

NEVELLE E. MCKINNEY
Capt., Ord. Dept.
Commanding



HEADQUARTERS LADD FIELD
Office of the Ordnance Officer
Fairbanks, Alaska

March 3, 1942

THE ORDNANCE SERGEANT,
The Ordnance School,
Aberdeen Proving Ground, Maryland

Gentlemen:

Recently, at this post, it was required to mount all ground Machine
Guns for Antiaircraft fire.

Enclosed are front and side views of the two types of Mounts im-
provised, one for the Air cooled Cal. .30 and one for the Water cooled
Cal. .30.

The stand is a pipe frozen into the ground. For all around trav-



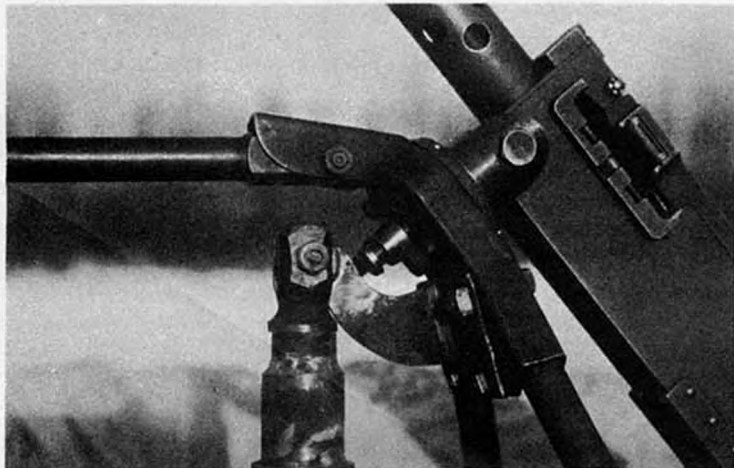
erse the Gun Mount is a smaller pipe inserted in the Stand. A Collar with set screw provides an adjustment for height. This Collar can be seen in the full view of the Air cooled Mount and is used on both Mounts.

It is believed no further description is necessary as the views show all detail.

Steps have already been taken to provide tripod supports when the thaw comes.

This matter is submitted to give you an idea of what the Ordnance Department is called upon to do in isolated locations. It should be mentioned that the .30 Cal. Water cooled Machine Guns were received at this Post with no Mounts at all.

HAROLD A. HUNTER
1st Lt., Ord. Dept.,
Post Ordnance Officer



ORDNANCE OFFICE
NEW ORLEANS ARMY AIR BASE

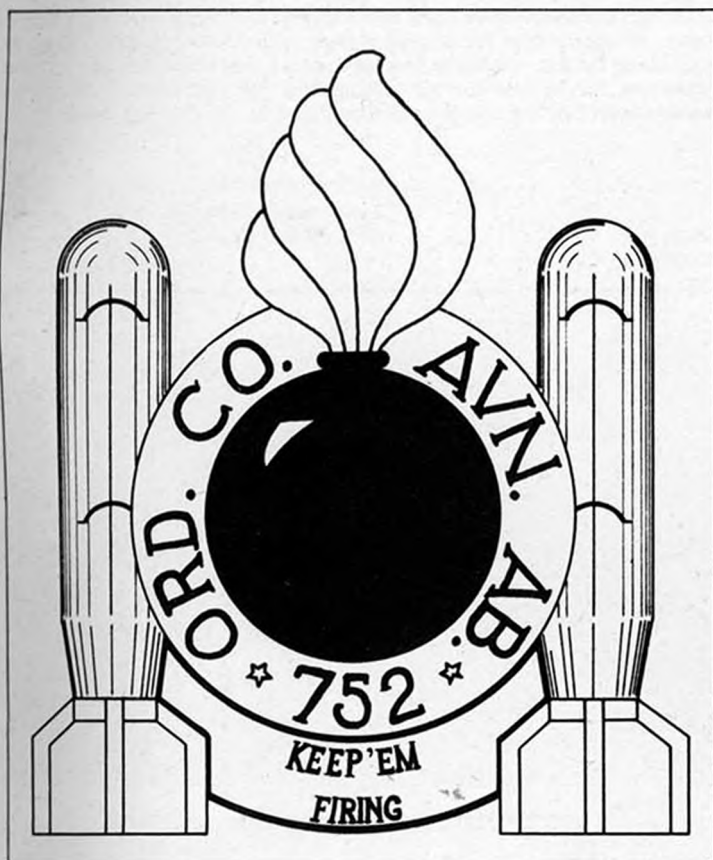
SUBJECT: A Motto Depicting Ordnance Work ... A Company Insignia.

TO : THE ORDNANCE SERGEANT,
The Ordnance School,
Aberdeen Proving Ground, Maryland.

Dear Sir:

After reading THE ORDNANCE SERGEANT for the month of March, and once again noticing the motto "Keep 'Em Firing", I can't help but think that the motto is an inspiring one and truly depicts Ordnance work.

It appeared to me that it would be a good idea to put that slogan "on the map" as far as Ordnance was concerned. I am of the opinion that



It would be a swell idea to have some sort of a pin made for each Ordnance Company with the said motto inscribed thereon. I have not, as yet, seen any Ordnance Company with their special insignia (such as the special insignia used by The Ordnance School.)

The enclosed insignia is my idea (sketchfully speaking) of what I would like our Company's pin to look like. This is merely a suggestion and does not necessarily express the views or opinions of Company personnel.

I would also like to mention that your publication THE ORDNANCE SERGEANT is truly a helpful magazine and I always await the printing of the next issue.

"KEEP 'EM FIRING"

M. M. NOWAK,
Sgt., 752nd Ordnance Company,
New Orleans Army Air Base,
New Orleans, La.

WAR DEPARTMENT
PHILADELPHIA ORDNANCE DISTRICT
Room 1300, Mitten Building
Broad and Locust Streets
Philadelphia, Pa.

March 28th, 1942

Editor,
THE ORDNANCE SERGEANT,
The Ordnance Training Center,
Aberdeen Proving Ground,
Maryland.

Dear Sir:

I am enclosing a picture of some of the girls of the Philadelphia Ordnance District, the first group of girls among the Ordnance Districts to go into uniform.

Since it has attracted so much publicity and furore, I thought perhaps you might like to put it in THE ORDNANCE SERGEANT.

The uniforms took like wildfire, due largely to the fact that since we have been working six days per week we have no time to shop and this solves the clothes problem.

Sincerely yours,

/s/ Pat Rayport
A. Patricia Rayport
Editor, Phila. Ord. Dist.
"TIME PHEWS"



HEADQUARTERS PUERTO RICAN DEPARTMENT
Office of the Department Ordnance Officer
San Juan, Puerto Rico

AHS/fh

April 27, 1942

Editor, THE ORDNANCE SERGEANT
Aberdeen Training Center
Aberdeen Proving Ground, Md.

Dear Mr. Editor:

Inclosed herewith is a letter and sketch forwarded me by Mr. Harry A. Schmucker, Automotive Mechanic, on duty at the Ordnance Shops, P. R. General Depot. I am forwarding this to you in hopes that, if it is not already in use, you will give some publicity to it through your very fine magazine, THE ORDNANCE SERGEANT.

For your information, THE ORDNANCE SERGEANT is not only circulated generally in this department among the Ordnance personnel, but is read and freely commented upon by them. Personally, I think it is a fine job and hope it will continue.

Yours very truly,

A. H. SKINNER
Lt. Col., Ord. Dept.
Dept. Ordnance Officer

1 Incl. -
(Ltr. w/sketch)

PUERTO RICAN GENERAL DEPOT
ORDNANCE SECTION"
Fort Buchanan, P. R.

HAS/mt

April 23, 1942

SUBJECT: Covers for Tractor Muffler Pipes.

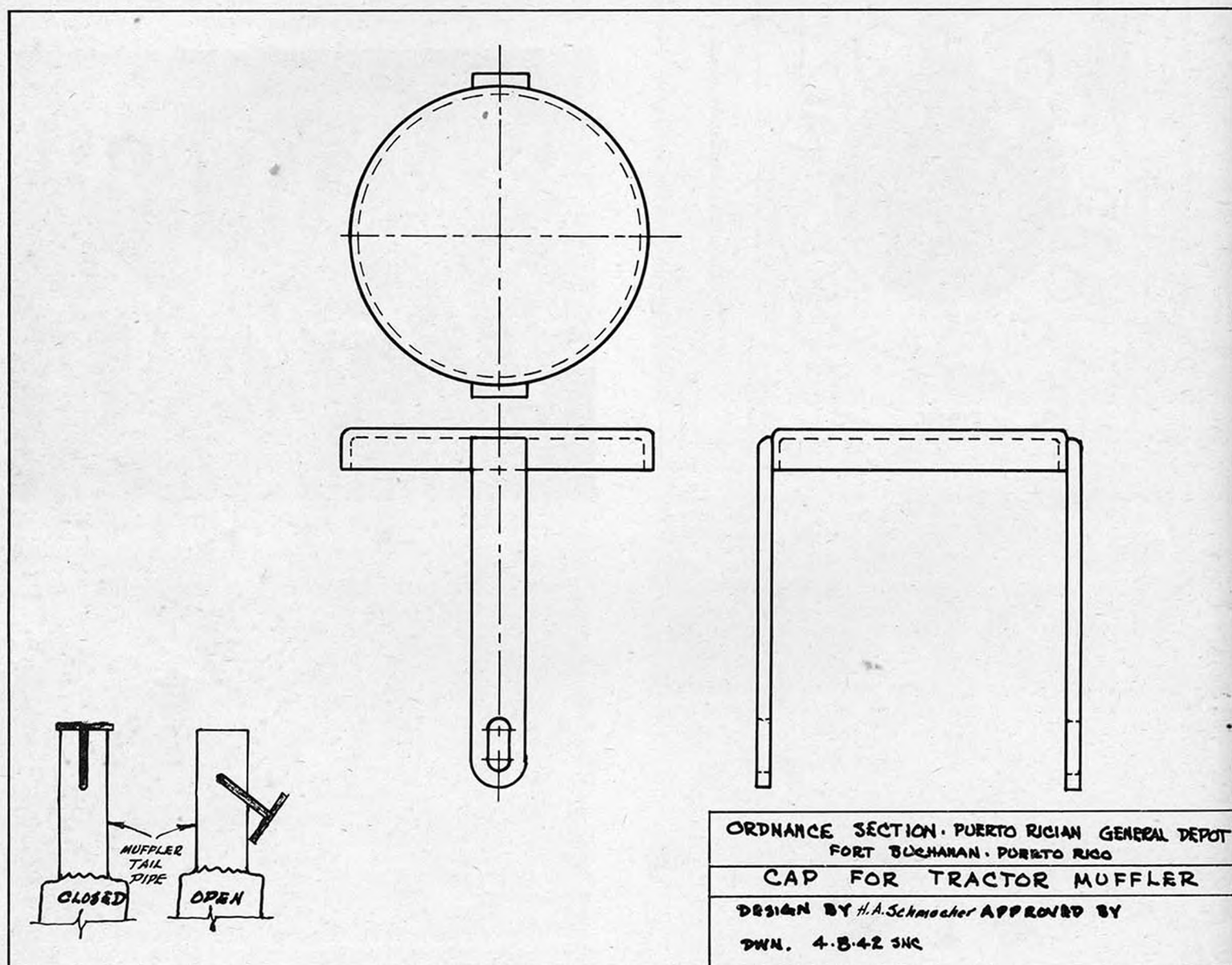
TO : Department Ordnance Officer,
Hq. Puerto Rican Department,
San Juan, Puerto Rico.

1. Several times tractors of all makes with vertical mufflers have been temporarily unserviceable due to water entering the motor through the muffler and exhaust system during heavy rains. This can be avoided by a mechanical device attached to the muffler tail pipe to be kept in the closed position at all times when the vehicle is not in motion. This cap will automatically open by the pressure of the first exhaust when the motor is started.

2. Instances have been noted of drivers being injured by heavy pieces of steel, (like old street plates), placed over muffler pipes to keep water out and not being removed before starting the motor. These plates are forced into the air endangering the operator. This danger can be avoided by the use of caps illustrated in the attached drawing.

HARRY A. SCHMUCKER,
Automotive Mechanic,
Ord. Shop, P.R.G.D.

1 Incl. -
Drawing



Now and then a disagreeable thing appears in the mail which comes to the editorial desk. "Please increase the number of copies you send us to ??, so that each officer can maintain a personal file".

Compliance with such requests is not possible for a number of reasons, reasons which make the current distribution policy necessary. Let's look at it from an unselfish viewpoint.

THE ORDNANCE SERGEANT, and every individual connected with it, wants to see every officer and enlisted man who wishes to do so maintain a personal file. But — it simply isn't possible. The Editor has written evidence which convinces him that if any reasonable subscription rate was charged for this magazine the circulation would be several times as large as it is under the present system. And we know

that if no limit was placed upon free distribution the circulation would amount to many thousands.

Facilities for reproduction are limited — and congested. It is very difficult to keep apace of demands even under the present system of distribution. A PERSONAL FILE ROBS OTHER INDIVIDUALS. It is intended that THE ORDNANCE SERGEANT be so distributed in each organization that every individual will be able to read every issue. The copies for the organization must, of course, be mailed to the commanding officer. It is his responsibility to see that proper distribution is made, that every man in his organization who wishes to do so will have an opportunity to read every issue, that no man under his command is robbed of this privilege in order that a few individuals may maintain personal files.

