

THE ORDNANCE SERGEANT

VOL. 2

AUGUST 1941

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Published by the Ordnance School in the interest of Ordnance Sergeants

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HIGHLIGHTS

This issue of THE ORDNANCE SERGEANT brings to its readers a study of the Ordnance District Office, one of the essential phases of Ordnance activity which is vitally important but not well understood. This study is intended to broaden your general knowledge, and to give you a better idea of the background necessary for the supply of those items in which you, as an individual, are most interested.

Of special interest to members of Ordnance Companies (Aviation) is the discussion of the Status of Stock Report, on page 84. Added to this discussion is a suggestion from the field which may reduce your work materially.

The cover picture for this month is called "Metropolis" by the photographer, E. R. Manfrin, Tech.Sgt., Ord. Dept. What could better illustrate business and industry, the essentials of any procurement program, than the skyline of New York?

Lieutenant Randel continues his discussion of the Development of Aircraft Bombs, under the general heading Aviation Ordnance Activities, on page 117.

Readers who are required to conduct schools or classes may find useful ideas in the article regarding Centralized Basic Training in the Ordnance Replacement Center, to be found on page 121.

Art of Loading Shells and Bombs, on page 134, is written by a newspaper writer who used plain language to describe a rather complicated process.

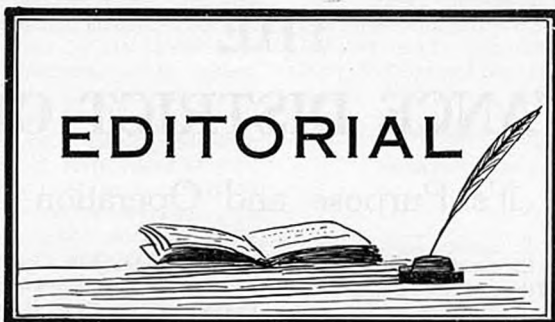
"Materials and Methods" is a new column which will appear in most issues for an indefinite period of time. The first installment appears on page 136. Read the announcement at the beginning, and you'll understand what we mean. Your time won't be wasted if you follow this column in later issues.

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

REPRODUCTION PLANT
THE ORDNANCE SCHOOL
ABERDEEN PROVING GROUND
MARYLAND

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"Do Ye Even So"

"Whatsoever ye would that men should do to you, do ye even so to them."

Ask your chaplain what this scripture passage means and he'll be able to offer several explanations, but I doubt if he'll even mention the one I want to call to your attention.

It is probable that never before in the history of the United States Army have so many inexperienced men been placed in positions requiring that they supervise the activities of others. Some of these men have proven to be miserable failures, some are plugging blindly along under a constant dread that the axe will get them before long, and some others have assumed their new responsibilities without fear of consequences, and with resultant success. Undoubtedly there is a reason for these differences. It should be worth looking for.

Have you tried applying the Golden Rule in your dealings with your subordinates? It's worth trying, if you have not. I don't mean that you should mollycoddle your subordinates, or that you should be unreasonably lenient with them. But I do mean that right is always right. We may be a long time in determining just what is right, but after we have made the discovery the fact remains that it was right all along. Its rightness didn't begin at the time of our discovery. And a thing which is right for one man is also right for another. That principle applies to both yourself and to your subordinate. Let's notice a couple of cases where the Golden Rule might be applied profitably.

Rarely does an individual act alone. Almost invariably several persons work in unison in order to accomplish a certain result. It follows, then, that cooperation between these persons is not only desirable, but an absolute necessity. If one person opposes another, if there is friction between two or more individuals, if there is not complete and plainly apparent cooperation, the result obtained by the entire group is far less impressive than it should be. The causes of opposition and friction make little difference. They can be determined by proper investigation, and then all that is required is a proper solution. Here is where the Golden Rule enters the picture. It has been said that there are at least two sides to every argument, two reasons for every disagreement. This is probably true, but the fact remains that only one solution is right. Others may be found which will solve the difficulty, but only one is just and equitable. Both the opponents may be partially right, but it is almost a cinch that one is more nearly right than the other. Both may have good reasoning to support their

theories, but undoubtedly the reasoning of one is more justifiable than that of the other. If you expect to realize maximum results from your subordinates, make just decisions. You would insist upon a fair decision by a superior if you found yourself in opposition with another. "Do ye even so."

This discussion has brought up another angle. How about the two people in opposition? Common sense certainly tells each of them that they cannot both be right in every detail of their disagreement. When the motives for disagreement, the causes for friction, and the elements of dissension are carefully examined, one person will surely be found to be more nearly right than the other. Put yourself successively in the positions of your opposing subordinates. If you find yourself most nearly right you have every right to expect your cause to be considered favorably. On the other hand, if you are not most nearly right, have you any logical reason to expect that you will be supported in your contentions? Of course not, why should you? Here is another place for application of the Golden Rule. If you are in opposition with a fellow worker; if a lack of proper cooperation exists between you, endangering the results obtained by other workers as well as the total result obtained by the entire group; if there is friction for which you might be partially to blame; then you owe it to yourself, as well as to others, to examine your own case just as critically as you examine that of your opponent. And if you find yourself wrong, admit it. You would demand just such an admission from your opponent under similar conditions. "Do ye even so."

An army, and every individual associated with it in its activities, must be regarded as one unit. It is working to obtain certain results by certain groups of individuals, adding up a final result for the entire unit. The failure of one group endangers that total result. The individual who lets minor personal likes or dislikes influence the performance of duty is a detriment. The individual who promotes rather than discourages friction with others is a saboteur just as surely as the individual who destroys a factory or a ship. The individual who will not consent to an examination of causes of disagreement is a broken cog in the wheel, and should be repaired or replaced.

(Continued on page 91)

THE ORDNANCE DISTRICT OFFICE

It's Purpose and Operation

It is probable that one of the most important but least understood of the branches of the Ordnance Department is the Ordnance District Office. This essential phase of Ordnance activity gains but little publicity among average citizens, for it seeks not publicity, but results. In time of peace its activities attract little attention because they are little more than preparatory activities related to a future extensive system of industrial management and coordination. Later, when war conditions materialize, the Ordnance District swings into intense action, it becomes one of the most important and effective of our wartime organizations, yet because of all the excitement of the time the average citizen never hears of it. To avoid the possibility of the average Ordnance Sergeant sharing this excusable ignorance of the average citizen, this brief study of the Ordnance District Office is presented. The reader who desires more detailed information is referred to Special Text No. 42, Army Extension Courses, "Ordnance District Organization", 1938 Edition, procurable from the United States Government Printing Office (15¢). This study is based upon the above mentioned text.

Success in modern warfare demands highly complicated mechanized equipment, automatic weapons, motorized vehicles, fire-control robots, and vast quantities of ammunition, fuel, and countless other supplies. Modern fighting forces must be well supplied initially and careful provision made to meet adequately and continuously the replacement demands caused by the rapid consumption of both materiel and ammunition.

The storage, in time of peace, of adequate reserve supplies to meet the needs of war, is obviously impracticable. Initial requirements and a small supply of replacement materiel are the maximum that may be hoped for in the war reserve.

This means that enormous demands will be made upon the industry of the Nation to satisfy promptly the immediate requirements of the fighting force, and to continue to satisfy its requirements throughout the duration of the war. In addition to this exceptional wartime load the Nation must continue to provide all the material things upon which the health and well-being of its population depend.

Prior to 1914 the tremendous influence that industrial and economic factors would exert in modern war was not appreciated. Extraordinary demands for certain types of materials and services occasioned violent disturbances in industry; price levels increased enormously; costly delays in procurement occurred; and a lack of knowledge concerning the real needs of the fighting forces resulted in overproduction and waste on the one hand, and a shortage of essential war material on the other.

The necessity for government control of raw materials, labor, power, transportation, and production facilities

was quickly recognized. Each government rapidly adopted the necessary measures to fix or control prices, and to guide and direct the Nation's industrial effort. These methods, extemporized in the heat of conflict, were not always successful. Adequate industrial preparedness would have been of inestimable advantage to either side during the early stages of the World War.

Ignoring the experiences of the warring nations, the United States had no industrial program when, on April 6, 1917, it was eventually involved in the war. Grave consequences for this failure to be prepared were avoided in this instance by the protection given by the armies and navies of our allies. Methods for the control of industry were hurriedly improvised, but were insufficient to prevent extravagance and delay in procuring munitions, or to prevent profiteering in some quarters and unnecessary suffering in others.

When the United States entered the World War, the Ordnance Department organization was based upon the principle of centralization. The office of the Chief of Ordnance entered into contracts with the manufacturers to supply the necessary ordnance materiel, supplies and equipment. Government functions pertaining to these contracts, such as the provision of new facilities, inspection, shipment of materiel, and financial transactions involved, fell almost exclusively upon the central office. Arsenal and inspectors of ordnance, in the field, accomplished some of these functions at irregular intervals. The unprecedented demands of war for materiel, supplies, and equipment led to so rapid an expansion of all activities that the centralized administration was not practicable.

By the latter part of 1917 the delay and interference with munition supply had become so great, due to the requirement that the office of the Chief of Ordnance control all matters pertaining to procurement, that it was necessary to find an immediate solution to the problem. It was then proposed to relieve the burden upon this office by decentralizing as many of its activities as possible, thus placing control nearer the source of supply.

The first actual steps toward decentralization occurred early in 1918. Representative business men of various industrial districts were selected by the Chief of Ordnance and appointed production managers for their districts. These managers, employed as civilians, were made responsible to the Chief of Ordnance for all matters in their district which pertained to the production of ordnance, except that of design. Offices of production managers were established in Boston, Bridgeport, Chicago, Cincinnati, Cleveland, Detroit, New York, Philadelphia, Pittsburgh, Rochester, and St. Louis.

The value of decentralization soon became apparent. As a result, the representatives of other divisions of

the ordnance office were sent out and the district ordnance offices were organized. The production managers became the district chiefs with power to act for and in the name of the Chief of Ordnance in all matters, except design, affecting the successful functioning of the districts.

At the end of the war the chief duty imposed upon the district offices was the task of terminating existing contracts in a manner which would have the least harmful effect upon the economic welfare of the country. This included the settlement of claims, demobilization of district activities, and the demobilization of district personnel. One after another they were consolidated or closed, and by February 1, 1924, they were all out of existence. The last step was shipping the consolidated records of the Rochester, New York, Pittsburgh, Baltimore, and Philadelphia records from the Philadelphia district office to Frankford Arsenal.

The Act of Congress of June 3, 1916, as amended by the Act of June 4, 1920, known as the National Defense Act, formulated a policy of national defense and indicated that the procurement of munitions for a possible future emergency would rest, as in the past, upon the commercial manufacturers of the Nation.

The National Defense Act of June 4, 1920, provides that the Assistant Secretary of War, under the direction of the Secretary of War, shall be charged with the supervision of the procurement of all military supplies and other business of the War Department pertaining thereto and the assurance of adequate provisions for the mobilization of materiel and industrial organizations essential to wartime needs.

It further provides that under the direction of the Secretary of War the chiefs of arms and services of the Army shall report direct to the Assistant Secretary of War regarding all matters pertaining to procurement. As the office of the Assistant Secretary of War is not an operating office, but rather one of supervision and coordination, the responsibility for procurement rests directly upon the chief of the arm or service responsible for the procurement of a particular item.

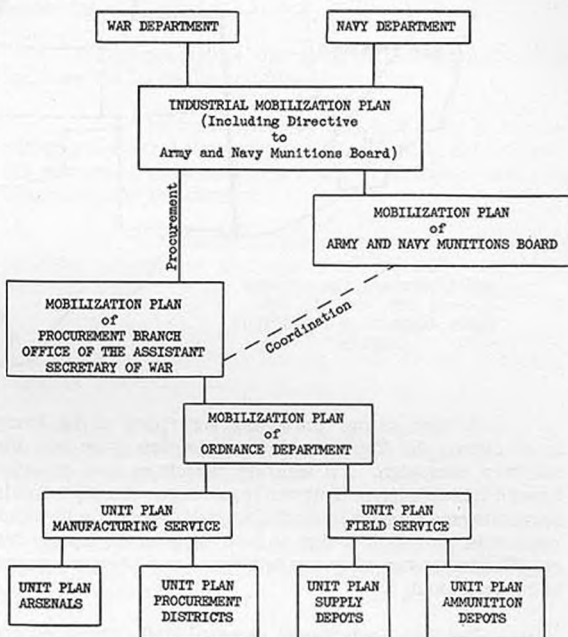
Although by legal inference the Assistant Secretary of War is solely responsible for "the assurance of adequate provisions for the mobilization of material and industrial organizations essential to wartime needs," the necessity for cooperation between the War Department and the Navy Department has been recognized, and both departments participate jointly in planning activities relating to industrial mobilization.

The problem is complex, and subject to many ramifications. The needs of the Army and Navy, based upon their respective mobilization plans, the needs of the civilian population of the Nation, and the views and limitations of industry, must all be considered and coordinated. The system evolved must meet the approval of Congress and of the President.

The Army and Navy Munitions Board, which consists of the Assistant Secretaries of War and Navy, assisted by an executive committee and a number of divisions, has been created to coordinate the requirements of the Army and Navy.

Based upon the War Department Mobilization Plan; the Industrial Mobilization Plan; and the Mobilization Plan; Procurement Branch, Office of the Assistant Secretary of War, the Ordnance Department Mobilization Plan was prepared. This plan is in turn the base upon which all unit

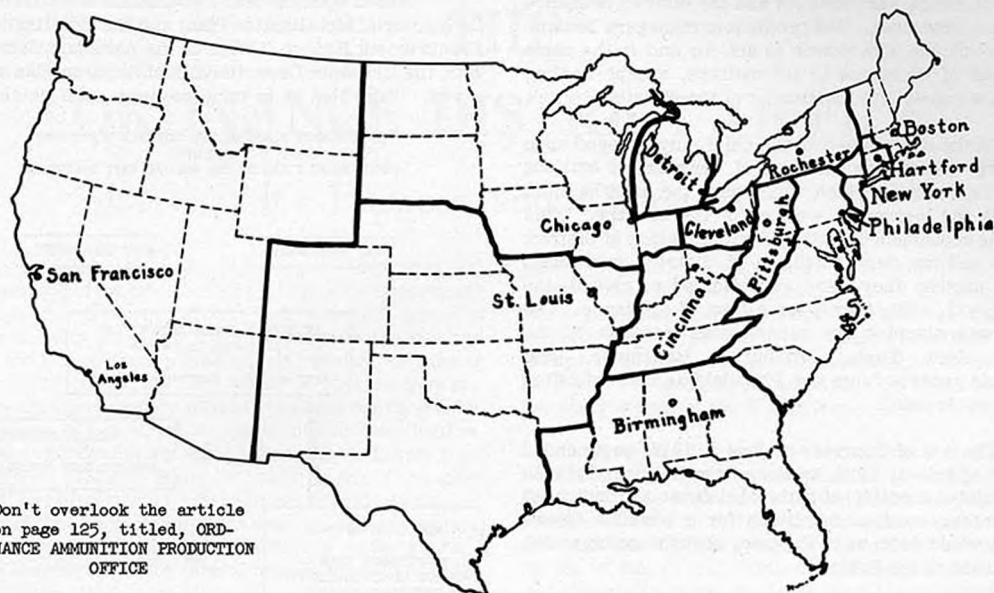
PROCUREMENT PLANS OF THE ORDNANCE DEPARTMENT
BASED UPON
PROCUREMENT PLANS OF THE WAR AND NAVY DEPARTMENT



plans of the services, divisions, arsenals, procurement districts, etc., are formed. Decentralization of procurement was one of the major lessons learned during the World War, and this policy is followed in the present planning system of the Ordnance Department.

The merits of decentralization of control, as evidenced by the experiences of the World War, and the period immediately following, demonstrated that the fundamentals of this system were sound, although the practical details left much to be desired. The Ordnance Department was convinced that due to the complexity and magnitude of its procurement problem, decentralization should be developed as a procurement policy in the event of an emergency, and the details of this system worked out along business lines in time of peace. The only practical way this could be done was to create an organization and establish contacts and methods of procedure which would serve as a foundation for the probable wartime system.

On May 17, 1922, the Chief of Ordnance, by an office order, created thirteen of the now existing ordnance district offices. The fourteenth, Birmingham, was created by an office order dated August 13, 1923. This same order, issued at the direction of the Assistant Secretary of War (July 31, 1923) established the existing district boundaries to conform to War Department procurement districts. The other supply arms and services of the army were required to establish a similar system, using such district boundaries as would best meet their requirements.



Don't overlook the article on page 125, titled, ORDNANCE AMMUNITION PRODUCTION OFFICE

In time of war the primary purpose of the Army is to defend the Nation, and its objective is to win the military campaign. All military activities are directed toward this objective. But war is no longer simply a battle between armed forces in the field. It is a struggle in which each side strives to bring to bear against the enemy the coordinated power of every individual and every resource at its command.

The War Department General Staff prepares the War Department Mobilization Plan and determines the requirements of the Army in equipment, materiel, ammunition, and other supplies. The Assistant Secretary of War allocates these requirements to the supply arm or service that is responsible for their procurement. Based upon these requirements the various supply arms and services prepare their plans.

The supply arms and services, of which the Ordnance Department is one, are, under the National Defense Act, charged by law with the procurement of supplies, under the supervision of the Assistant Secretary of War. Under this authority the Ordnance Department determines from the General Mobilization Plan, equipment charts, Tables of Organization, and other pertinent data, the quantities of all items to be furnished by the Ordnance Department that will be needed each month to equip the manpower to be mobilized.

These predetermined requirements are called the mobilization requirements, and are distributed by the Chief of Ordnance to the several ordnance procurement districts in the form of apportionments. The general mission of an ordnance procurement district is to supervise and direct, within a specified area, the actual procurement of the requirements apportioned to it.

The basic peacetime function of any military organization is to prepare for its wartime mission. In the ordnance procurement district this function is best represented by organization, planning, and training.

The wartime function of the ordnance procurement district is to direct and supervise procurement, production, inspection, acceptance of, and payment for such ordnance material as may be apportioned to the district. The manner in which each of these steps is performed and the extent to which supervision is necessary will depend upon conditions and must be adapted to individual cases.

These functions include:

- (1) The negotiating and signing of contracts for the production of the items which have been apportioned to the district, in accordance with drawings and specifications furnished by the Chief of Ordnance.
- (2) Providing the contractor with manufacturing information, interpretation of drawings and specifications; aid in procuring machine tools, materials, or labor; and such other assistance as may be required for early production.
- (3) Inspection of the product for agreement with drawings and specifications.
- (4) Provision for prompt acceptance of and payment for the product, and, if necessary, investigation of and recommendations for equitable settlement of any claims which might arise under the contract.
- (5) The recruiting and training of the personnel necessary to perform the above duties, and such other auxiliary duties as may arise.

Design, especially of ordnance materiel, where interchangeability, safety in use, and uniformity of functioning are paramount, cannot be left to the control of a large number of groups of engineers located at widely separated points. For this reason, the responsibility for design of ordnance materiel was not decentralized but was retained as a function of the Office of the Chief of Ordnance.

Suggestions as to design or the modification of approved designs should be made by the decentralized agents, but the final control must rest in the central office. Regardless of how effective a change or redesign may be, the using troops have a right to expect uniformity of action in a given item, until changed by proper authority and with due notice.

From the date of their reestablishment until 1936, each district was permitted to organize and train in a manner deemed most suitable by its district chief. The result was that, while the district organizations paralleled in general the organization of the ordnance office as to functional divisions, there was considerable difference, even in the framework upon which the details of organization were to be hung. Gradually several of the district organizations began to assume definite characteristics, especially as their mission became better understood. Finally standardization was thought possible, at least as to the general framework of the organization, and on August 12, 1935, a board of officers, consisting of five district executive assistants, was appointed by the Chief of Ordnance for the purpose of preparing a basic organization chart for ordnance district offices, and also preparing job specifications covering the principal positions shown thereon.

On October 1, 1935, the board submitted a basic district organization chart which was approved by the Chief of Ordnance. This organization chart was not made mandatory for the districts but was to be used as a guide, outlining the functions which the district organization would be required to perform on M-day, as far as those functions could be visualized at that time.

This organization chart is shown at the top of the following page.

In general the approved district organization parallels that of the office of the Chief of Ordnance, but more particularly it is patterned after the organization of the Manufacturing Service, Office of the Chief of Ordnance, under whose jurisdiction the ordnance districts operate. This paralleling of functions in the three organizations should facilitate liaison between the offices and control of district activities.

To give the district chief the broadest possible authority in the organization of his district, the basic chart does not go into details of organization, since there are matters which only the district can determine. The commodity of materiel divisions are designated on the basic chart as Division A, B, C, etc., but are shown on the organization chart of a particular district as Ammunition Division, Artillery Division, etc., depending upon the commodities or materiel procured by the district. As these divisions are recognized as the most important elements of the district, the chart has been arranged to include in each of these divisions all of the functions which pertain directly to its mission of procuring its commodity promptly and efficiently. The remainder of the district organization exists chiefly to meet the various auxiliary needs of the operating divisions and is therefore shown on the chart as staff positions, as distinguished from the commodity or line divisions.

The peacetime personnel of the ordnance district consists of the district chief, who is a civilian holding an appointment under the civil service and who is of out-

standing prominence in business and civic activities of his district; the executive assistant, who is a Regular Army officer of the Ordnance Department assigned to carry out the details of peacetime administration; Reserve officers of the Ordnance and the Specialist Reserve specially selected and assigned and serving on an inactive status; key civilians who have been selected by the district chief but who have no status except a verbal agreement with the chief to render service in case of emergency; and such civilian personnel as may be authorized for appointment under the civil service.

The peacetime operation of the district office includes the following activities:

(1) The formulation of complete plans of organization and control for carrying into effect, in time of war, the processes necessary to procure the ordnance materiel apportioned to the district.

(2) The training, as far as practicable, of Reserve officers through the medium of active duty, extension courses, and assignment of specific district problems.

(3) The survey of facilities with a view to determining the best use that can be made of the industrial capacity of the district.

(4) The assignment of production orders to specific factories, based upon a definite schedule of procurement requirements.

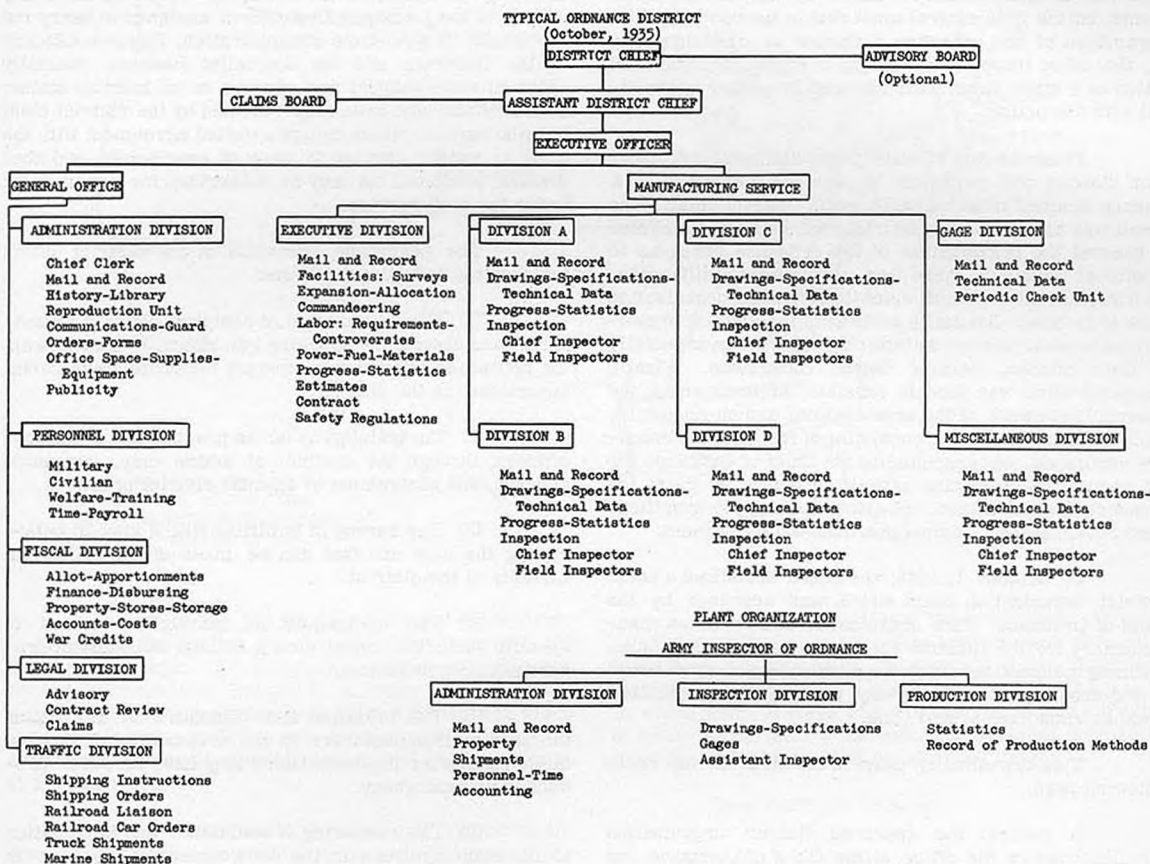
(5) The initiation and stimulation of interest on the part of manufacturers in the preparation of concise factory plans for the items which they have agreed to produce in an emergency.

(6) The rendering of assistance and information to the manufacturers in the development of plans or in matters of current ordnance business, when and if called upon.

The district chief is responsible to the Assistant Chief of Ordnance in charge of manufacture for the successful administration of his district. He formulates the policies of operation and establishes, through his wide acquaintance, contact between his executive assistant and the directing heads of industrial plants for the purpose of furthering the problems of industrial preparedness. He promulgates all orders necessary in the internal operation of his district.

The executive assistant carries out the details of administration of the district under the direction of the district chief, placing in effect the policies of the War Department and the ordnance office in general matters and those of the district chief in specific district problems. He is the operating head of the district in time of peace, since the district chief normally cannot devote much time to the actual details of work at hand and is not concerned with the part of the office business which is of a strictly military nature.

Reserve officers participate in the work of the district office to varying degrees, depending upon the particular nature of the problems involved and on numerous other conditions. They cooperate with the executive assistant individually, on inactive status, in many matters,



depending upon the time, interest, and qualifications of the officer and the nature of the problems to be solved. They may prepare surveys of factories with which they are familiar, review factory plans, work out details of office organization, and in some cases deliver lectures to promote interest in the planning program or some of its phases. In nearly every district the time and thought given by Reserve officers in assisting the program has been of great value. In many instances the particular work involved could not be done without this assistance.

One of the most important peacetime duties of the ordnance procurement district is the training of its Reserve officers. In time of war the district must procure vast quantities of supplies, which are, in most districts, entirely different from the items produced by the industry of that district in time of peace. As but one Regular Army officer can be assigned each district, and the qualified civilians who will be available are extremely limited, the responsibility for the proper functioning of the district will rest upon the Reserve officers.

The objectives of individual training of the Reserve Officer, in time of peace, are to prepare him for his particular mobilization assignment and to prepare him for promotion to the next higher grade. The executive assistant of each district is responsible to his chief and to the Chief

of Ordnance that his personnel receives the training necessary to perform their mission.

The district office is fundamentally a military agency--a definite unit in the organization of the Ordnance Department. By virtue of this fact there are certain administrative functions of a strictly military nature which the office must perform. As a field agency of the Ordnance Department there are other functions which the office may perform to advantage and which are becoming increasingly a part of its activities. These functions are in addition to the actual business of procurement planning but are appropriate adjuncts thereto.

The district office is classed as an exempted station in regard to military control, which signifies that, except for the administrative routine personnel matters, the office is under the supervision and control of the Office of the Chief of Ordnance. The administration of military personnel (not the training) comes under the headquarters of the corps area within which the district office is located. Reserve officers receive their assignments, promotion, etc., and are supervised in matters of training directly from the ordnance office, but all other administrative control is exercised by the corps area.

The second class of activities of the district office

includes functions which fall to ordnance arsenals in particular and which are falling more and more into the sphere of district operations as these offices become more fully developed. In a general way they include assistance in inspection of current procurement, various types of contact work for other ordnance establishments, and experimental projects.

Instructions from the Chief of Ordnance have provided that when an order for the current manufacture of supplies in which the districts may be interested is placed, a copy of the order shall be sent to the district office to which the factory concerned is allocated. In this way the district is informed of all important ordnance procurement projects within its limits, and the factory may call upon the district office for information or to act as liaison with the Ordnance Department. In this way the district office may be able to take advantage of current procurement to gain entry into factories and to secure the interest of factories in war procurement.

In several instances the executive assistant of a district has been called upon to inspect and accept ordnance materiel on current procurement contracts, in order to relieve the arsenal concerned of the burden of frequent and excessive travel. The peacetime personnel of the district office is not sufficient, however, to undertake all of this business. The advantage of incorporating this work as a specific duty at some near future date is obvious.

A number of arsenals make regular use of the district offices as sources of manufacturing information on plants with which there is no past record of performance available. This is a duty which the district is well qualified to perform and should be developed to the mutual advantage of the Ordnance Department and of industry.

A number of valuable experiments in the development of new processes or materials for ordnance uses have been carried on under the guidance and encouragement of the district offices. If in the course of planning or survey a new idea comes to the attention of the executive assistant, the matter is referred to the Ordnance Department to determine the value of research along the indicated lines. There is no doubt that important strides in the development of ordnance materiel and methods will be made in this manner as the manufacturers become more interested in the procurement planning work and more familiar with the needs of the department.

The status of a district office materially changes upon the declaration of war. From a planning and training organization it rapidly evolves into an active supervising procurement organization.

For the efficient and smooth transition to a war status it is essential there be no basic change in the control system of the peace and war organization. This transition should simply be the expansion and strengthening of the peacetime organization and the putting into effect of prepared plans.

Under wartime conditions the district office organization must supervise the procurement, production, inspection, acceptance of, and payment for certain definite items. This implies several very distinct functions for which each organization must have a definite group of trained executives. The major duty of the entire force is

to inspect and accept ordnance materiel, since the main purpose of the district is to get finished and useful materiel into the hands of troops. About 75 percent of the district personnel will be engaged in inspection and acceptance work. However, it should be noted also that the only difference between the district organization in general and a commercial organization of similar scope and character in the absence of a sales force. The function of design control is also withheld from the district, but the interpretation of designs and the recommendation for modifications may be required.

In operating a purely overhead organization of this kind, which is superimposed upon an active industrial territory, an advisory board composed of executives who are actively interested in the territory is a desirable asset to harmonious functioning. Much valuable assistance can be given to the district in the development of its planning, training, and operating program by a carefully selected and interested advisory board.

The claims board provided is more in the nature of a provision for demobilization, although its functioning in time of war might lessen the subsequent confusion. Its purpose is to adjust differences between the Government and the contractor on all matters affecting financial relations. The legal division of the general office handles major law matters, including those occurring under claims. It acts as liaison with the Attorney General, the Judge Advocate General, and the Comptroller General with respect to opinions and decisions of these officers and in connection with war transactions and claims.

The executive group comprises the personal offices of the district chief and the executive assistant and exercises general control and coordination of all operations. It is also in charge of all matters affecting transactions outside the district.

The general office supervises all purely administrative routine activities within the district with a view to relieving the other subdivisions of the details of office routine as far as possible.

The manufacturing service is the part of the district organization which is in charge of converting the schedules into completed articles. This group will have to supervise the flow of production to see that all is going according to schedule and will have to anticipate probable delays in time to provide against them. It must see also that the finished product is suitable for service. These two functions constitute production and inspection. The actual organization of the manufacturing service may separate or combine the two functions, but the group as a whole must provide for them both.

The manufacturing service is the operating unit which actually carries out the details for which the district office is established. It ordinarily negotiates the contracts and follows production from the time the contract is let until the finished articles are accepted and turned over to some other group or actually shipped out of the district. This group has the direct contact with the factories under supervision of the district chief and keeps him constantly informed of what is going on in these factories. The work of inspection and acceptance is the chief function of this group.

Subdivision of the manufacturing service should be based upon the production schedules apportioned by the Office of the Chief of Ordnance and will parallel the divisions of that office. This leads to simplicity of liaison in peacetime planning and during an emergency.

It should be borne in mind the production functions of a district are limited to those cases where drastic action is required due to the failure of a manufacturer to produce according to the requirements of his contract. It is not the function of district personnel to prescribe or interfere in any way with production methods of manufacture as long as acceptable materiel is being produced in accordance with the contract. Whenever possible, descriptions of the manufacture of an item will be supplied to the manufacturer, and upon his request, all possible assistance and advice will be given to him by the manufacturing service of the district. However, the responsibility for production under the contract rests wholly on the manufacturer. Inspectors or other Government agents will not assume any of this responsibility.

The district office has certain wartime duties of a nature auxiliary to procurement which are specifically delegated to the Executive Division of the manufacturing service. Chief among these are the coordination of action and procedure of the various commodity divisions, the supervision of new facilities, the securing and installing of special machinery, the control of labor, power, fuels, progress, statistics, estimates, contracts, etc.

As previously mentioned, the manufacturing service is organized into commodity or materiel divisions based on the material to be procured in the district. These divisions are the most important organizations within the district and are organized by the division chief to accomplish his mission in the best manner. Each division established should have its own mail and record section; should maintain files of all drawings, specifications, and technical data pertaining to its type of materiel; should maintain progress and statistical records; and should control its own inspection force.

The district chief is the inspector of ordnance for his district and is responsible that each article made or otherwise procured and all work performed for the Ordnance Department comply, when accepted, with the drawings, specifications, and other requirements. The personnel necessary to discharge this responsibility shall be organized, under the chief of the manufacturing service, into an inspection group for each commodity division organized within the district.

The inspection group, within the commodity division, will consist of a chief inspector, field inspectors, and the additional technical and clerical assistants required for the proper performance of its duties.

At each plant or group of plants producing ordnance materiel or supplies for the district, a commissioned officer will be designated as the Army inspector of ordnance. This officer will organize a field office consisting of sufficient personnel for the proper discharge of his duties. Assistant inspectors assigned to this field force may be commissioned officers or qualified civilian employees. In the smaller plants where the production problem is either too small or too temporary to justify plant inspectors, the inspection functions will be conducted by personnel

sent out from the commodity division of the district office which controls the item manufactured, or will be sent from neighboring plants where an inspection service is organized.

Procurement will be undertaken in the typical district organization by the divisions of the manufacturing service. In some districts there is a procurement service and the chief of this service, in addition to the district chief, will be made a contracting officer, with authority under the direction of the district chief to sign and complete contracts. In time of peace the procurement section or service should study contract forms and, so far as practicable, actually pave the way for firm contracts by discussing contracts and contract forms with prospective contractors.

One thought should be borne in mind in studying or developing any district organization--namely, that the mission of the district is to get the most production with the least delay. Time is the most important factor to be considered in planning for production. Decentralization and the factory planning are designed to accomplish these objectives.

Unquestionably the district office will have to operate some plants, but the peacetime planning should tend to reduce this type of business to a minimum. The setting up of a large and able group to handle actual plant operations tends to invite this necessity in an emergency; yet, on the other hand, the possible need for such a group should not be overlooked.

Army Regulations provide that all public property of the War Department or the Army, regardless of how acquired, must be accounted for on an appropriate property account. It further provides that a commissioned officer be charged with and accountable for this property. Hence, in each district war organization there is one commissioned officer assigned to the fiscal division, who is known as the District Ordnance Property Officer. This officer establishes and maintains a stock record account for all ordnance property and material in the district. This officer is accountable for all property, equipment, supplies, or manufactured products of the Ordnance Department that are under district control, whether in the office or at a manufacturing plant.

At each plant or group of plants an ordnance officer, designated by the Army inspector of ordnance, or ordnance representative, receives all manufactured products, component parts, Government furniture and equipment, etc., for the accountable officer in the district office, and is responsible for the proper care and disposition of this property.

Thus far we have considered in a general way the organization and functions of the Ordnance District Office, in peace and in war, without considering in detail the mechanics of procurement. Procurement planning is a business within itself, and will be the subject of a future article to appear in THE ORDNANCE SERGEANT.

We have discovered, however, that while the Ordnance District Office is extremely flexible in many ways, it is based upon solid facts derived from experience, rather than upon theory alone. It plans quietly; yet carefully, in time of peace, for any situation which may arise in time of war.

The district chief, upon receipt of the necessary orders, takes immediate steps, through his executive assistant, to bring together the personnel of his organization. Active duty orders for the Reserve Officers are requested at the rate planned, the shortages being recruited and commissioned as rapidly as necessary.

The contractors will be notified by the district chief to prepare for production of their allotted task and to report at the office for the purpose of negotiating the formal contract for the work to be done.

The district chief, in these activities and in all others acts for and in the name of the Chief of Ordnance. He thus assumes actively the responsibility and authority of commanding officer of his district.

It is not difficult to imagine that innumerable problems arise and are solved in the several district offices. No fixed pattern could be devised for the solution of these problems; each has its own peculiar characteristics, each must have its own solution. All the many industries of the Nation are involved in these problems. Large and small enterprises must be guided, trained, controlled and encouraged. All types of labor, materials, and methods are encountered. The finished products cover the entire range of the capabilities of American industry, and thus does the problem constantly vary.

The short articles which follow are intended to bring to our readers "close up" versions of the operations of the several Ordnance District Offices.

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THEORETICAL PEACE-TIME AND WAR-TIME SET-UP of the HARTFORD ORDNANCE DISTRICT

By: E. M. Ayer, Lt. Col., Ord. Dept.

NOTE: This same description could be just as well applied to any of the fourteen existing Ordnance Districts.

The Ordnance Department as a unit in the present Defense Program is functioning substantially differently from the theoretical plan. These differences, however, are being modified as rapidly as possible and eventually will conform to the ideal situation. The latter will consequently be considered in the following statements and such variations as affect serious differences will be indicated.

The peace-time and war-time set-up of the Ordnance District are so different that it is necessary to consider the two situations separately. The Ordnance District is the fruit of experiences from the first World War. Prior to 1917 procurement and inspection of War Department purchases were handled under the General Staff and through central procurement offices in Washington. The system did not work well after the stupendous requirements of our war-time needs began to take form, and a decentralization of those functions was effected by the War Industries Board in the latter part of 1917.

The Ordnance Department is one of seven divisions of the War Department responsible for the procurement of characteristic items. These seven supply divisions include Ordnance Department, Air Corps, Chemical Warfare

Service, Engineer Corps, Medical Corps, Quartermaster Corps, and Signal Corps. All of the above divisions have procurement districts, although the districts of the different divisions do not coincide. The Navy Department is another organization with heavy procurement requirements and in order that the demands on manufacturers from all of these groups may be adequately met, a system of allocation of facilities which will be considered later has been set up.

During peace-times the Ordnance District is manned by a skeleton organization, usually consisting of a regular Army Officer as Executive Officer and two or three clerks and stenographers. This force is augmented periodically by Reserve Officers who go to the District Office for two weeks for training. With such a force, the Executive Officer is expected to make surveys of the plants of all the prominent manufacturers in his district, to earmark those that will be of help in his program, to obtain an inventory of the machine tools and other productive facilities of such plants and to arrange with designated plants for the production of war-time requirements in the event of a major emergency. These arrangements take the form of Accepted Schedules of Production. They are informal agreements between the District Office and the manufacturer, and provide that, in the event of a major emergency, the manufacturer will contract to undertake the production of certain specified items at specified rates of delivery. No price is mentioned in these Schedules of Production.

The demands that will be made on the District are indicated to the Executive Officer by the Chief of Ordnance through a series of requirements known as apportionments. These apportionments are the authority under which the Executive Officer formulates his Schedules of Production and they represent the War Department's expectancy of such items from the District if an emergency develops.

Reports of the foregoing plant surveys and schedules of production are sent by the District Office to Washington and there kept on file as a guide to the sufficiency of the war plans of the Ordnance Department.

It has been noted that the seven divisions of the War Department, the Navy Department, and a third division not previously mentioned, the Maritime Commission, are all in the market under an emergency situation to procure necessary items. It is apparent under these conditions that there would be much over-lapping of demand on the various plants and competitive bidding by various contracting officers for the product of the same plant. This condition has been met by a system of allocation of facilities. In the peace-time planning, those plants whose output is deemed necessary to its program by more than one claimant are considered by an appropriate committee. If the claimants are all within the War Department, a committee in the Office of the Assistant Secretary of War con-



siders the claims of the various divisions concerned and allocates the plant in part or as a whole to that division of the War Department whose product it is best equipped to produce.

If the Navy Department enters a claim, the plant is considered by the Army and Navy Munitions Board set up by the Secretaries of War and the Navy, who allocate to the respective service either as a whole or in part as the needs of the service and the character of the product that can be produced seems to warrant. This same allocation will presumably be followed under an ideal set-up in the emergency situation.

Under emergency conditions or, as it is colloquially known, after "M Day", the functions of the Ordnance District change materially. A substantial personnel for carrying on its various functions, including both Reserve Officers on extended active duty and civilian employees operating under Civil Service regulations, are brought into the office. Requirements of Ordnance items are indicated to the District for procurement by the Chief of Ordnance and the Contracting Officer of the District negotiates contracts with manufacturers within his District for the desired items. He is not permitted to place prime contracts outside of his own District. The mechanics of the above procedure are a bit more involved than the above statement might indicate.

With a knowledge of the capabilities of plants within his District, the Executive Officer, through his negotiating engineers, endeavors to find plants that not only are able to make the items he needs but who are not so tied up with other work that they cannot undertake such production. The Schedules of Production worked out in the peace-time period are an invaluable guide to the Executive Officer when and if the theoretical procedure is followed. It so happens that during the present emergency there was no sudden change from a condition of peace to war and the requirements of the Preparedness Program have involved manufacturers in the various districts with items for which they had made no plans of production or had anticipated that they would undertake. As a consequence, the results of peace-time planning over the last twenty years have not been used to the best effect. However, the program has steadily advanced and, in the course of time, will probably adjust itself much along the same line as the planning indicated.

Contracts having been made with facilities, the District Office must next set up an inspection program to cover acceptance inspection of all items being procured. This inspection is ordinarily done at the plant of the manufacturer and requires, when practicable, a resident inspector of Ordnance with as many assistants as the job requires. Sometimes a single inspector is able to cover more than a single plant and thus becomes a travelling inspector. In order to coordinate the activities of inspectors and be able to give close attention to the acceptance and shipment of the items being produced, it has been found advisable in the Hartford Ordnance District and more recently, in other Ordnance Districts, to set up a system of Sub-Offices. These offices are located at places within the District where the density of the contracts is greatest and they include personnel for the administration of the Sub-Office as well as inspection and shipment of the items being produced. In the Hartford District five such Sub-Offices are now being operated.

The Ordnance District Office under the theoretical emergency program is practically autonomous. It is operated under the direction of the District Chief, who is usually a civilian appointee, and carries out its mission with a minimum amount of assistance from any outside source. Its self-sufficiency requires a number of additional functions not previously mentioned: for instance, a complete service for taking over items produced for it by manufacturers, accounting for these items under the War Department's system of accountability, for shipping them as directed by the Chief of Ordnance, for checking and rendering invoices either to its own disbursing officer or to such other disbursement center as has been provided, a provision for keeping an accurate detailed account of District activities for use in a subsequent history of the District, and a highly trained group of engineers who not only can assist in the negotiation of contracts but also render such aid as is necessary to contractors who may have difficulty in getting started or who may encounter troubles in producing work to meet the inspection standards. All of these functions must be provided for in order to carry on the District Office during an emergency. It is to be expected that there is an increase in personnel which matches the increase in requirements. It has been previously indicated that the peace-time force of the District Office will probably not exceed six persons. The war-time force of the Bridgeport Ordnance District, which was the World War name for the present Hartford District, was approximately 3,500 persons and it is not unlikely that the Hartford District may reach these proportions under the present Preparedness and Lease-Lend Programs.

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THE ST. LOUIS ORDNANCE DISTRICT

By Lieut. H. R. Thielecke, Ord. Dept.,
Adjutant and Public Relations Officer,
St. Louis Ordnance District.

The St. Louis Ordnance District is composed of the States of Missouri, Arkansas, Nebraska, Kansas, Oklahoma, Texas, Colorado, New Mexico, and the southern half of Illinois--in all about 788,000 square miles containing 18,500,000 persons.

It would be a misstatement if we said that the St. Louis Ordnance District is a typical district, as it is one which is unusual in its economic and geographic aspects.

The eight and one-half states it embraces are predominantly agricultural. The industry contained may be classified as of the "light manufacturing" rather than "heavy" industry type.

The district does not enjoy highly specialized industries, such as optical goods, precision tool, machine tool, diecasting or gage-making, in any great quantity. Perhaps some of our readers will object to this statement, as we have in Missouri two very highly specialized industries; namely, what is reputed to be the only "zither" factory in the country, and the largest "corn cob pipe" factory in the world. But I do not believe that even the most enthusiastic boosters of this state would take us to task for the above assertion.

As the district geographically embraces a lot of territory, the problem of administration of distant sub-

offices and the administration of contracts with facilities many miles away is one to be reckoned with, and one which is not shared by other districts.

What items of ordnance material, then, can be procured from industry in this district, this "breadbasket" of the United States? At present the district is now producing tanks, TNT, fuzes, boosters, forgings, shell from 20mm to 155mm, belt links, lathes, millers, machine gun mounts, gunners' quadrants, instrument lights, arming wire assemblies, bombs, anti-tank mines, mortar shell, small arms ammunition, shapers, firing pin assemblies, and a host of small machined parts, heavy castings and cast armor plate. This procurement would probably not have been possible but for the intelligent planning of the district and the ability of industry in the area to adjust itself to new conditions. It is a tribute to the district system of procurement established since the First World War.

The active district personnel at the present time is composed of its Executive Officer, Major Randall J. Hogan, twenty-four reserve officers on extended active duty, and approximately 320 civilian employees.

As in any well-regulated business, the district is operated on a functional basis. It is divided into three services, viz., Procurement, Production and Administrative.

The Procurement Service is charged with the responsibility of surveying existing industry in the area, which we call "facilities". Upon completion of surveys, data is compiled and classified, such as information on logical product, normal product, machine tools owned, specialized equipment on hand, and general information on source of power, number of skilled and unskilled employees, etc. It is then the further function of this service to bring the product desired and the prospective contractor together. This service, in connection with the contracting officer, enters into, draws up, and administers the contract up to the point of production, where the other services tie in.

The Production Service is charged with the primary responsibility of inspection. Inspection may be of the final product contracted for, or of a component at the plant of a subcontractor in the district. The sub-contract material may or may not be furnished to one of this district's prime contractors, as inspection is performed for other districts on material made in this territory. It is to this service that technical questions are submitted by prospective con-

tractors during the "negotiating" period, and by contractors after contracts are in force. Any questions regarding tolerances or specifications are either answered or referred to higher authority for opinion. This service is responsible for the adequacy of inspection gages, both in number and quality, and supervises the Gage Laboratory which is maintained at Washington University in St. Louis. Although once a contract is signed, it is the contractor's responsibility to fulfill it, the production service assists the contractor in executing the contract in any way possible. This assistance is, of course, restricted to help in those situations which might result in a delay in or prevention of production. This may entail assistance in obtaining deliveries of tools, materials, or manufacturing aids with the resultant enforcement of priorities, or may, on the other hand, involve assistance to contractors in ironing out production problems.

The Administrative Service, as its name implies, administers the affairs of the office. It secures the necessary personnel for the operation of the organization, has jurisdiction over conduct of office business, and in general is the "housekeeper" of the organization. A very important function which is performed is that of receipt, shipping, and accounting for property. As material is inspected, accepted, and received, this service is held accountable until relieved by shipment, expenditure, or some other authorized method. As contractors seem to insist that they be paid for goods produced, the very important function of payment is handled by the administrative service. Here, properly supported vouchers are prepared for ultimate payment by the finance officer involved. Of course, vouchers for travel and payrolls are also prepared, and these functions involve the keeping of the district's books so that accurate balances may be known at all times.

Four sub-offices are maintained, at Houston, Texas, (816 miles), Denver, Colorado, (915 miles), Omaha, Nebraska, (414 miles), and Kansas City, Missouri (279 miles). While sub-offices are not uncommon, far removed ones such as these are very unusual. The district has a real problem in adequately disseminating information to these offices and in collecting data for reports. Military and civilian personnel cannot "run in" to the home office whenever a problem presents itself, and at times they have to solve problems themselves.

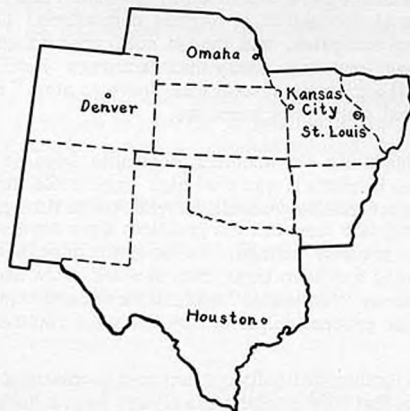
"Production" has been, and will continue to be the by-word of the district. Fancy frills, such as collection of useless statistical data on overhead operations, are taboo. If they are not directly connected with production, they are eliminated. To quote the words of our Executive Officer at a recent Army Ordnance Day Dinner, "The St. Louis District will deliver the goods----and on time."

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SOME SPECIAL ASPECTS OF THE BOSTON ORDNANCE DISTRICT

By: E. R. Sargent, 2nd Lt., Ord. Dept

Looking at the present Ordnance problem from a broad viewpoint, it is appropriate to remind ourselves that the basic functions of each and every procurement district are identical, in that the goal to be reached is common to all District Ordnance Establishments. The task of attaining a vast, yet well-ordered schedule of production and delivery, and of utilizing every possible and potential con-



tribution of America's private industry for the best results obtainable, is a task shared no less by one district than another.

Generally speaking, each procurement district must service, in addition to its own contracts, those of other districts and manufacturing arsenals. District responsibility for these contracts varies as do peculiar local conditions in respective district territories.

Insofar as the Boston Ordnance District is concerned covering as it does the States of Maine, New Hampshire, Vermont, Rhode Island, and all except the four western counties of Massachusetts, there are certain local conditions, which, by virtue of past history and physical geography, are out of the ordinary and as such are worthy of special mention.

The first of these local conditions, the lack of raw materials within this district, has not as yet presented any real difficulty with respect to normal district operations, although it may very easily develop into a serious problem as the "all-out" program continues. If it should develop to such an extent that production would be seriously impaired, this lack of strategic and even common raw materials would show up first of all as a grave situation for the district's traffic division to handle. It always has been necessary for manufacturers located in this New England area to go outside for their raw materials, and as the present program continues at an even more rapid pace than heretofore, it will be absolutely essential for this office to come to their aid so that freight facilities are on hand to bring in whatever is needed, from wherever the source may be. Needless to say, this situation can become a country-wide problem, increasing in its ramifications as the need for additional raw material grows. As stated above, however, this problem has not as yet been encountered, but is merely anticipated as one for which it would be wise to prepare.

The fact that New England has always been the "job lot" manufacturing center of the nation is a condition which affects the Boston Ordnance District most profoundly. This district now, as a fully activated War Department Organization, has inherited a part that New England has always played to a greater extent than any other area in this country. Here are the many facilities and establishments which for many years have been the backbone of the small tool, machine tool, and gage manufacturing industries. To be sure, there are many other manufacturers of this sort of material in other parts of the country, but by and large the machine tool industry has its origin, and continues to be concentrated for the most part, in New England. Here are no great assembly lines, no mass production, such as may be found in our automobile manufacturing centers and in the heavily industrialized Middle West. Here, rather, are congregated great numbers of small manufacturing establishments, ranging from medium-sized plants to small machine shops, maintenance and repair shops. Very often a "plant", so called, turns out to be a small basement shop or attic workroom.

This state of affairs should not give the impression that this area has nothing to offer. On the contrary, it should serve to show that there are any number of different kinds of manufactured small items and parts being turned out in this district, this with no sameness as to product, but rather like a display of many odd items in a hardware window.

With productive facilities such as these the difficulty of standard methods of survey can be easily seen. Each plant constitutes a special case unto itself, more so than a series of large establishments, where necessarily different production engineering methods and building design have been utilized, which would incline to lend a standard formality to survey methods. For anyone who would survey a half dozen New England plants selected at random, broad experience in as many fields is a prerequisite.

The same holds true for the problem of lending engineering assistance to this type of facility. In large mass production plants there is comparatively little else but routine assistance in order. Each plant of this type has its own engineering staff, its own maintenance and repair staff, and when there is any question involving engineering aid or repairs to a temporarily out-of-order machine, the solution more often than not can be reached on the spot. Small plants, on the other hand, with anywhere from three to three hundred employees, are likely to be entirely without production for a considerable period until such time as they can obtain outside assistance. In such a case, when repair of a disabled machine is necessary, the operator himself is more than likely expected to make such repair, or production ceases while the machine is sent to the manufacturer for overhauling.

As far as contract awards are concerned, this district has its share, but time and again a situation has been encountered where machinery applicable to ammunition and components production could not be used for that purpose, because that same machinery was being used at the time for production of machine tools for other manufacturers and for other districts. In other words, many entirely suitable plants which were looked to for the production of defense material were found to be using vital productive machinery one hundred percent for the purpose of tooling up other manufacturing establishments.

It must be remembered that some of these plants had had a normal peace-time trade, both domestic and foreign, before the National Defense program began, and were determined to continue on in that vein, paying scant attention to the possibility of securing a Government contract, feeling that normal trade was desirable and sufficient.

It soon became apparent, however, that foreign trade, at least, was to be a lost business, and normal domestic trade was to become largely dependent on whether or not manufacturers could obtain raw materials to carry on. Normal production of normal commercial products became an exception, and though not forced to enter into Government contracts, many manufacturers clearly realized that the priority system was "here to stay," at least for national emergency purposes.

Gradually Government contracts became highly desirable, because it was well nigh impossible for manufacturers to continue producing normal peace time products if the materials used in their products were covered elsewhere by priority ratings. By so doing they keep their plants going and keep their men at work. Now more and more of these "peacetime" manufacturers are coming into the defense production picture by the same routine.

A further difficulty encountered in obtaining awards is the fact that New England has always been a high-priced

area. In addition to the fact that it is a considerable distance from the sources of raw materials, which in turn tends to raise the prices, New England is more costly. Inasmuch as the work which is to be turned out in this area is of such an exacting nature, with a premium on accuracy and precision, the labor to accomplish this kind of work must necessarily be highly skilled. By this is not meant that prices of finished products or hourly wages here are extraordinarily out of line, but simply that labor in this area is trained for and accustomed to doing the design and development work so that articles so designed and developed may be turned over to the more heavily industrialized Middle West for mass production purposes. Needless to say, once a machine has been perfected and proven workable through considerable time, effort, and expense by skilled labor, this same machine can in turn be manufactured by unskilled labor at less expense when mass production facilities are at hand.

In summary then, the Boston Ordnance District shows a large number of industrial units both relatively and absolutely as its main constituent elements.

The facilities of these units, in themselves suitable for the manufacture of Ordnance items, are necessarily largely used for machine tools and parts, due to the importance of that program. The consequence is the existence of a restricted field for Ordnance items proper.

The above situation and the above restriction make clear one special aspect of the Ordnance problem in this district, which is the relatively few prime contracts and the multitudinous secondary and subsidiary contracts and orders.

Further: The use of numerous small industrial units, each without the volume of normal raw material requirements that would guarantee preferred treatment, even under present conditions, requires contract service as to priorities, likewise relatively and absolutely numerous.

Another special aspect of the problem in this district is thereby apparent.

Furthermore: This district is without any raw materials of its own and like the rest of New England must rely on rail, truck, and water transportation for its supplies.

The traffic problem, which exists as a result of geography is enhanced to make another special aspect of the problem by this character of the district's industrial constitution, which again is in the main a great number of small units.

It is obvious that these general aspects of this district's problem require for their solution the application of administrative control which takes the local nature of the general problem into account.

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THE LOS ANGELES ORDNANCE REGION

by

Captain F. H. Starr, Ord. Dept.

and

1st Lieutenant Daniel W. Allison, Ord. Dept.

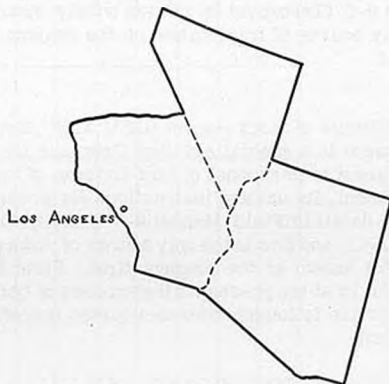
The Los Angeles Ordnance Region is unique in

several respects. It is the only existing regional office, and in distance is one of the most remote district office installations from the Office of the Chief of Ordnance. Further, while it includes within its jurisdiction the Los Angeles Industrial Area, the fifth in the United States in value of manufactured products, a great part of its manufacturing capacity consists of a large number of relatively small plants. This statement, however, is not to gainsay the existence of many quite large plants in the area. Another problem peculiar to the Los Angeles Ordnance Region is the great distance from the source of some materials and from the destination of the finished items.

It might be well at this point to develop a brief geographical and functional picture of the San Francisco Ordnance District and of the Los Angeles Ordnance Region.

The entire continental United States is divided into fourteen Ordnance Districts for the purpose of Ordnance procurement. Eleven of these districts comprise roughly the area east of the Mississippi River, or less than one-third of the area of the United States. The remaining three, the Chicago Ordnance District, the St. Louis Ordnance District, and the San Francisco Ordnance District, cover the entire area west of the Mississippi River with the exception of the State of Louisiana, while the Chicago District extends also east of the river. Of this area, comprising over two-thirds of the country and consisting of approximately twenty-four states, the San Francisco District is the largest, consisting of the nine western states, Washington, Oregon, California, Idaho, Montana, Wyoming, Nevada, Utah and Arizona.

The Los Angeles Ordnance Region office is a branch of the San Francisco Ordnance District. It is administratively semi-independent, but all its functions are closely correlated with and subject to the approval of the District Office. The Commanding Officer of the Region is the Executive Assistant of the District, and all other officers in the Region are his Assistants.



Approximately ninety percent of the potential manufacturing capacity of the district is contained in the three coastal states, Washington, Oregon, and California, and about half of this ninety percent is contained in the Los Angeles Industrial Area. Therefore, the Los Angeles Ordnance Region, comprising roughly the southern half of California and Nevada and the state of Arizona, contains as much potential Ordnance manufacturing capacity as the rest of the district. Practically all of this capacity within

(Continued on page 91)

STATUS OF STOCK REPORT

By coincidence THE ORDNANCE SERGEANT recently received two communications regarding the "Status of Stock Report," one from Mitchel Field, New York, and a few days later one from March Field, California. In each case the correspondence was submitted to the Depot and Supply Section of The Ordnance School for comment. For the information of all Aviation Ordnance men who may be interested, all the material mentioned above is published.

"There's also another thing I think would be very helpful to future students, and that is if you could arrange to teach them something about the Status of Stock Report which the Ordnance must submit every month on major items. At present I am making out this report for this station, and had considerable trouble computing the requirements and figures for this report. Just by luck, my former company commander is stationed in the District Office and he helped me with my first report. I know other men will not have the assistance that was offered me and if you can arrange to include this in the course of studies, I know it will be very helpful to everyone."

WILLIAM GERLACH, JR.,

683rd Ord. Co. (Avn),
Mitchel Field, N. Y.

With reference to attached inquiry from the field the following information is furnished on the subject. It is suggested that reply be published as quoted here as the Field Manual 9-6 (Tentative) is not too widely distributed and is the only source of information on the subject known at the present.

The "Status of Stock Report (OFM 313)" (See form on opposite page) is a special Aviation Ordnance form and is only of interest to personnel of that division of the Ordnance Department. Its use and instructions for preparation is covered in detail in Field Manual 9-6 (Tentative), published May, 1941, and this is the only source of information on this subject known at the present time. Field Manual 9-6 (Tentative) is at the present in the process of being revised, however the following reference quoted therefrom is to date relevant.

"STATUS OF STOCK REPORT (OFM 313)" a. A report submitted periodically as directed by distributing points to base, and by base to air force. When used by distributing points for ammunition only columns 1,2,7,8, and 10 are used. The consolidation of changes in stock (OFM 312) provides the data for this report. The D.P. (Distributing Point) (?) reports are used by Base in preparing its consolidated report. The report shows the status of stocks on hand at each ammunition supply point at the end of the reporting period. The report is submitted by teletype to higher headquarters and is followed by a confirming copy.

b. A description of the use of the various columns of the form follows:

"(1) "Code Symbol" in col. 1, refers to the code symbols used for the identification of ammunition as published in this manual.

"(2) In col. 2 (Item) list, using standard nomenclature and in the same order as in S.N.L., all complete rounds of ammunition of which there are any on hand, or of which there have been any receipts or issues during the period covered by the report; all items for which an Ammunition Supply Credit has been received, and all items due in on an approved requisition.

"(3) In col. 7, enter all receipts of items listed in col. 2 during the period covered by the report.

"(4) In col. 8, enter all issues of each item listed in column 2 during the period covered by the report.

"(5) In col. 9, enter the quantity of each item in storage at the air base R.P. (Refilling Point) (?) at the close of the period covered by the report.

"(6) In cols. 10, 11, 12, and in additional columns if necessary, enter for each column, the D.P. number, location, and the amount of each item on hand at each D.P. at the close of the period covered by the report.

"(7) In col. 13, enter the sum of the amounts shown in cols. 9 to 12 inclusive for each item.

"(8) In col. 14 enter the quantity of each item which is due in on an approved requisition, but not received during the period covered by the report.

"(9) In col. 15, enter the unobligated balance for each item; i.e., the total of all supply credits received, less the total quantity requisitioned."

It may be wisely suggested here that personnel of the Ordnance Department assigned to Aviation Ordnance units, who are concerned with the supply of Ordnance material to Air Corps units make an effort to obtain Field Manual 9-6 (Tentative) as it covers all special Aviation Ordnance forms and instructions connected therewith.

WILLIAM L. WISE,
Staff Sergeant,
Ordnance Department
Instructor D. & S.

THE ORDNANCE SERGEANT
Aberdeen Proving Ground,
Maryland

Gentlemen:

Inclosed is a form devised by Mr. Luther J. Tobias,

*Ammunition --**General Supplies.

[illegible]

**Major items of SNL Groups A,B,F, and G only

Air Base Ordnance Officer

a civilian employee of this office, to show at a glance the status of any item of stock. (See form on opposite page). This was drawn up primarily as an Abstract of Memorandum Receipt Form in lieu of QMC Form No. 488 and the recommended QMC Form No. 424, as shown in Paragraph 35 c, TM 10-310.

Mr. Tobias, in his capacity as Stock Record Clerk, went even further. He added the last section, "Shipping Tickets," so that there would be an accurate check on the stock on hand. It is now possible to check an inventory simply by an actual count in the warehouse checked against the last figure on the page.

The following is an explanation of each column:

Date - Self explanatory.

M/R No. - In order to save space and typing, every organization with items on memorandum receipt is given a code number. This code is kept at the beginning of the book. The code number is followed by a dash, followed by the letter "C" or a number. The letter "C" indicates a consolidated memorandum receipt. The numbers indicate the transactions after the consolidation, No. 1 the first, No. 2 the second, No. 3 the third, etc. When a new consolidation is made, the letter "C" follows the code number once more, and the subsequent transactions are serially numbered from 1 again. As some memorandum receipt transactions with an organization do not pertain to all items, the numbers will not run consecutively. On the sample form, No. 21 jumps from 21-2 to 21-6. The three missing transactions did not include this item.

Cr. Rec. - Credit, Received. This column shows the credits given the organizations for items turned in to the warehouse. The "Received" indicates that it is to be added to the last column.

Dr. Issue - Debits, Issued. The organization is debited all issues in this column. The "Issued" indicates that the number is to be subtracted from the last column.

Org. Bal. - Organization Balance. This column shows after each transaction amount of the item on memorandum receipt to one particular organization. The last transaction for each unit shows its actual standing.

Total on M/R - Total on Memorandum Receipt. This column shows the total number of an item out on memorandum receipt. It is a true abstract.

Date - Self explanatory.

Vou. No. - Voucher Number. Self explanatory.

Dr. Rec. - Debit Received. Whenever any stocks are shipped in they are carried as a debit in the stock record account. The "Received" indicates that the figure should be added to the last column.

Cr. Issue. - Credit, Issued. An item shipped out is a credit to the stock record account. "Issued" indicates that the figure is subtracted from the last column.

Stock in Whse. - Stock in Warehouse. This column shows what should be in the warehouse. It should agree with the number on the bin card and with the number of items actually in the bin.

By using this form it is possible by looking only on one sheet to find out for one item the memorandum receipt status of each organization, the total out on memorandum receipt, and the number in stock. By adding the total on memorandum receipt to the stock in warehouse one knows how many of any article is on his stock record account.

This form is of great value to a property office having a great many memorandum receipt accounts, such as those offices dealing with the Air Corps. It is also of great assistance in preparing the monthly Status of Stock Report.

I am submitting this form with the hope that it may prove helpful to other units. We have been using it here at March Field for about two months, during which time we have had many memorandum receipt transactions. It has proved a great help to us and I hope it proves of value to others.

SAMUEL SMELLOW
Captain, Ordnance Department
Base Ordnance Officer

Incl.

Abstract of Memorandum
Receipts and Shipping Tickets

With reference to the attached communication it is suggested that the form and explanation thereof be published as a matter of interest and what appears to be a possible solution to somewhat of a problem to property men in Aviation Ordnance.

The following is a suggestion in the form of a comment from the Depot & Supply Section:

Commendations to the March Field Ordnance Office, and in particular to Mr. Luther J. Tobias, civilian employee, and Captain Samuel Smellow, Base Ordnance Officer. Mr. Tobias for his conscientious brain work and to Capt. Smellow for recognition of a good possible solution and willingness to extend aid in problems of others.

The form may present argument in that it is additional work and requires another transfer of figures in posting which allows possibility of human errors. To this the questions might be asked -- Had you rather do a bit of additional work and have this essential information immediately available when time comes to submit Status of Stock Report (OFM 313), or had you rather wait and dig and pull hair when this report must be submitted? - and - Who isn't subject to make errors??????????

How about it fellows, can you use this form to an advantage? Lets have some comments and more suggestions for a solution to this problem.

WILLIAM L. WISE
Staff Sergeant,
Ordnance Department
Instructor, D. & S.

THE ORDNANCE VIEWPOINT

A Thought Provoking Article

Supply Lines Guaranteed

WASHINGTON, July 8—(U. P.).—President Roosevelt took over the military protection of Iceland after reports reached him that the German General Staff was considering attacking it to obtain a base from which to control North Atlantic shipping lanes, a usually well-informed Congressional source said today.

PANAMA CITY, July 8—(U. P.).—Stringent new regulations for the protection of the Panama Canal were enforced by the Army.

Work of fortifying the Arctic island has been moving at a swift pace ever since Britain took it into protective custody following the German invasion of Denmark.

For more than a year Canadian and other Empire troops have been busily engaged in constructing military landing fields, gun emplacements, bases for smaller naval craft, communications and barracks for soldiers garrisoned there. It is assumed by Government officials that these facilities will be turned over to the American occupying forces.

the order... you may fire when ready, Gridley," where hostile sea action was encountered. Another moot point was whether positive action of the Iceland variety might be expected in the future from the "substantial forces" which Mr. Roosevelt announced had been dispatched to the bases acquired from Britain in Trinidad and British Guiana.

IN BLOCKADE ZONE

the present this... United States

sion of the Senate Committee that a base built in Northern Ireland by Americans under the Lease-Lend Act.

By ARTHUR F. HERMANN
International News Service Staff Correspondent.

WASHINGTON, July 12.—United States Army and Navy officers, as well as workmen and materials, are aiding Great Britain to construct bases in both the Eastern and Western Hemispheres, informed Washington sources disclosed today.

At some bases in Britain, Canada and at outposts of the Empire, United States officers are acting in an advisory and quasi-supervisory capacity, in order that the completed bases will be able to accommodate lease-lend guns and other fighting equipment, these sources said.

President Roosevelt, at a press conference yesterday, disclosed that American workmen and materials were probably being utilized by the British in constructing many as 50 bases throughout Canada, Britain and other parts of Empire.

made no...

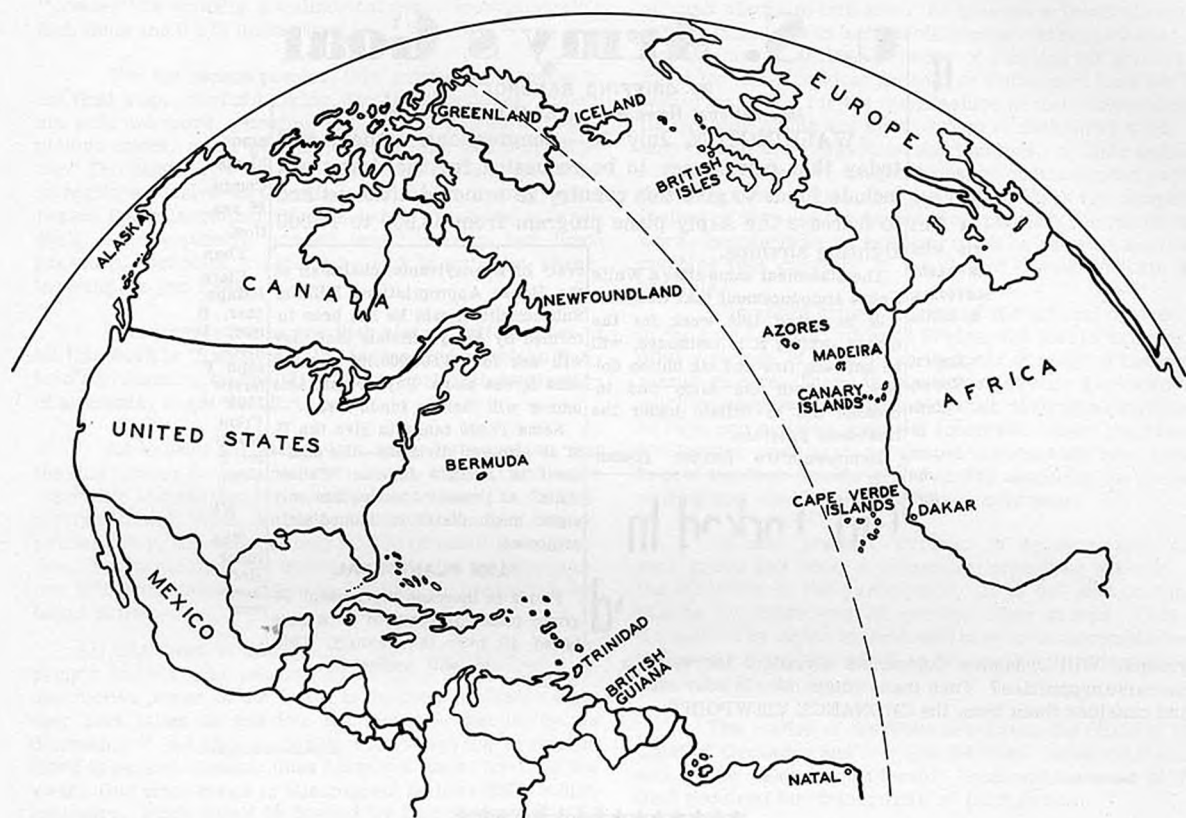
Take a glance at the four clippings reproduced above. They are reproduced merely as a basis for thought. We, as soldiers, are not interested in the causes of such events. Matters such as these are decided upon by the civil leaders of the Nation. But -- as soldiers -- it is our duty to prepare ourselves for any eventuality resulting from the decisions or the policies of our civil leaders.

It is rapidly becoming apparent that the Army must prepare itself for new adventures. For many years we had our farthest outposts across the broad Pacific. The not-so-broad Atlantic now appears to demand its share of importance in interest if not in distance.

The new military sites mentioned in these clippings

are going to demand resourcefulness on the part of ordnance personnel. The problems to be met will vary greatly. Trinidad and British Guiana are very near to the equator. There we will find rapid deterioration of many of the articles of our profession, along with many other difficulties and inconveniences. And far to the north, near the arctic circle, in Iceland, the world's oldest republic, other ordnance men will encounter problems which are very different.

Garrisons in both of these extreme points not only will require ordnance service; they will get it. Notice that one clipping refers to establishments and installations already constructed in Iceland by British Empire troops. These include "gun emplacements." This thought attracts our attention to another of the clippings.



"In order that the completed bases will be able to accommodate the lease-lend guns."

The lease-lend program, by the way, is a policy adopted by our civil leaders. It is our duty to accomplish it successfully. It is a plan comparatively easy to devise; its successful completion calls for something more than a plan. That is our task, or the task of the Army as a whole. Acts, based upon careful thought, are necessary. If we merely manufactured materials to fill British orders, it might be possible to manufacture them to meet British specifications. But such is not the case under the lease-lend program. Britain needs bases; any armament available must be used to defend them under this program; and for that reason it will be necessary, in many cases, for these bases to be constructed to conform to American armament, and to American specifications. Otherwise, both the bases and the armament would be useless.

These factors render it a certainty that the influence of the Ordnance Department of the United States Army will be felt far and wide. This is food for thought.

Hemisphere lines have attracted considerable attention during recent weeks. The eastern limits of the western hemisphere, as generally accepted by the Government, are shown by the dotted line on the map. But of what importance is such a line? Someone has said that the best "defense" is often "offense". In innumerable instances military commanders have been charged with the defense of certain given lines; yet they deliberately advanced beyond those lines. This was the best means of accomplish-

ing their missions. Perhaps our occupation of Iceland is our best means of defense of the northern end of this particular line.

Carry this ORDNANCE VIEWPOINT in your mind when you read of these things in the papers, as all men will. Troops of the line are trained to fight, and they actually do our fighting for us. In return, we keep their fighting tools and supplies available in sufficient quantities and in proper condition. It is a matter of each helping the other; it requires never faltering cooperation. Our fighting troops will establish themselves at any point required by the policies of our civil leaders. At that same point ordnance men will find their duty. There must their services be performed. This is the ORDNANCE VIEWPOINT.

Now let's consider briefly another sort of expansion of ordnance possibilities. Read the clipping at the top of the next page.

At the present time we have one Ordnance Battalion (Armored) for each of the four armored divisions now organized. Are we to look forward to the formation of an additional twenty-one Ordnance Battalions (Armored)? A total of 10,000 tanks means a lot of tank mechanics, a lot of work, a lot of training. It's a big figure to contemplate, but it's food for thought.

That other figure mentioned in the clipping -- 70,000 planes -- is no small item either. We don't have to build them or operate them, but they will be used for military purposes. They will increase the Air Corps from 54 to 90

U. S. Army's Goal

By GRIFFING BANCROFT

International News Service Staff Correspondent.

WASHINGTON, July 10.—Congressional leaders said today that new money to be requested for the Army will include funds to give this country 25 armored divisions and to increase the Army plane program from 48,000 to 70,000 fighting airships.

The statement came after a White House announcement that Congress will be asked this week for the money, which, it is estimated, will be between five and six billion dollars for both the Army and increased aid to Britain under the lease-lend program.

Representative Snyder (Demo-

crat) of Pennsylvania, chairman of the House Appropriations Military Subcommittee, said he has been informed by Army officials that they will ask for \$4,500,000,000 for the land forces alone. Snyder said this money will include funds for:

Some 10,000 tanks to give the U. S. 25 armored divisions—the equivalent of Hitler's famous "Panzer units." At present America has only eight such divisions immediately projected.

70,000 PLANE GOAL

Funds to increase the present 54-group plane program to 90 groups based all over the country. This,

said, will necessitate

Girl Locked In

groups. Will Ordnance Companies (Aviation) increase in the same proportion? Turn these things over in your mind, and consider them from the ORDNANCE VIEWPOINT.

POWDER FOR THE ARMY IN A HURRY!

by Mark S. Watson

Reprinted with permission of The (Baltimore) Sunday Sun Magazine.

(Continued from the July issue)

Then the mixture is "wrung out" in centrifugal wringers very much like that in a home electric washer. All the chemical so eliminated is carefully sent back to the tanks for separation and re-use. The percentage of this recovery, and others in later processes, determine the economical efficiency of the plant.

Already the cotton has become nitro-cellulose, but this is only the start. The solution moves by gravity through a flume to twenty-foot wooden vats, where it is again washed and boiled; then to the "beating" mill, where it is shredded and sluiced until the cotton fiber is indistinguishable to the eye; then to an alkali-water bath to free it of the ultimate sulphuric acid residue, then to blending tanks for a union of needed elements and unifying of the whole mixture; then to more wringers and presses to remove water mechanically, and then -- off the "cotton area" at last -- to an admixture with alcohol and ether and diphenylamin, both to add to powder's longevity and to displace the residual water.

Now the "green" powder emerges from a further pressing looking very much like a succession of large cylindrical cheeses, and in another preparation is mightily

squeezed through the "macaroni press," so called because from it the powder emerges looking exactly like macaroni.

Again it is pressed into blocks, and again through other macaroni presses, this time gauged to the exact dimension needed for the specified grain.

Dimensions vary widely. If it is to be powder for rifle or machine gun, the "macaroni" is the thickness of a fine pencil lead, and is traversed through its length by a single fine hole. This is because the speed of powder's ignition is a matter of the relationship of exposed surface to total bulk; small-arms powder must burn very swiftly to be effective, and hence in this case the small grain with proportionately large surface area. A subsequent cutting machine nips the "macaroni" off into lengths of one-eighth inch.

If for the .50 caliber machine guns, the "macaroni" is thicker, and its cut-up lengths are longer. If for a 75 millimeter cannon, it is the thickness of the pencil itself, and is traversed by an extrusion pattern of seven tiny holes, instead of a single hole. If for a great 16 inch gun, the

"powder" is actually a cylindrical grain approximately 1 inch thick and 2 1/2 inches long.

For the cannon powder, this cutting into lengths is the final step, short of bagging. For the rifle powder, there are still two more, a coating with DNT to increase its explosive power, and a glazing with graphite to aid in packing. The cannon powder, one may note here, must not be so highly explosive as the rifle powder, for the very good reason that in large quantities needed for propelling a large shell, a too explosive powder would develop too much pressure, corroding the gun tube and, in extreme cases, bursting the gun itself.

It is interesting to see that almost half the cost of all this work is in an item which is disposed of before Radford's processing begins. That is in the original oxidation of ammonia, to get the nitric acid.

As to work within the plant, it can be surmised that the fine powder for small arms is more difficult and more expensive to make than is the heavy cannon powder. In fact, a given "line," which can turn out 100,000 pounds of cannon powder daily, can turn out only 65,000 of small arms powder. Yet so nicely is the machinery adjusted that the plant can shift from one set of dies to the other on literally a few hours notice.

All this keep in mind, is the mere propellant for the army's bullets and heavier projectiles. The principal destructive power of the latter is in their explosion after they have fallen on and into the target -- that is, by the detonation of the high explosive with which the projectile itself is packed. Powder does not serve there, for it is too weak. Our chief needs in this respect include TNT, a high explosive, which itself is ignited by tiny charges of still more violent explosives, such as fulminate of mercury - but all that is another and very long story.

It happens that at the moment the army needs smokeless powder more than almost anything else. That is now on the way, thanks to the speed made at Radford.

★★★★★★★★★★★★★★★★

THE ORDNANCE DISTRICT OFFICE

(Begins on page 72)

THE LOS ANGELES ORDNANCE REGION

(Continued from page 83)

the region is concentrated in the Los Angeles Industrial Area. The difficulty is that this potential capacity is distributed among a large number of comparatively small plants.

As might be expected, many of the comparatively small Southern California plants in which the Ordnance Department is interested are the outgrowth of local needs and opportunities, such, for instance, as the design and manufacture of equipment and tools for the petroleum industry, and the manufacture of furnaces and engines for the burning of natural gas. A third and newer group of shops has grown up because of the concentration of major

aircraft plants in this area. At present a trend of involuntary transition is noticeable among several classes of manufacturers. Either because of a falling off in the demand for their original product or because of inability to obtain materials for the manufacture of their commercial lines, these plants are being forced to seek other work, if only to hold their organizations together. In their search for work, many have sought Ordnance contracts; but owing to the fact that the smaller shops either lack the complete tooling or have not the degree of adaptability for munitions work, awards have so far been much below what the total machine tool capacity of the Region would indicate as possible.

The above brings out one of the critical objectives of the Los Angeles Ordnance Region, and that is to accomplish a change of attitude on the part of many of the local manufacturers. There is known to exist here a substantial machine shop capacity, including such desirable equipment as light and medium presses, automatic screw machines, and forging equipment; yet almost no steps have been taken to pool together functionally selected shops for the underwriting and execution of Ordnance contracts.

At the present writing, it appears that one such group has been successfully organized entirely on the initiative of the participants. It is believed that this will be the forerunner of various other groups. This is the method by which the task will have to be accomplished, as the organizational work is not considered a function of the Ordnance Region.

The matter of the distance between the office of the Chief of Ordnance and the Los Angeles Ordnance Region was in the past a considerable handicap, because of the time required for transmittal of information.

Another problem peculiar to the Los Angeles Region, is the distance from the sources of supplies of many of the raw materials used such as steel, pig iron, copper and other metals. The problem of distance also applies to securing machine tools, although some machine tools are now being manufactured in this area.

This article is necessarily brief and sketchy but it does indicate what some of the particular problems are in the Los Angeles Ordnance Region. It is believed that many, if not all, of these will eventually be overcome, and the full productive capacity of the Region realized.

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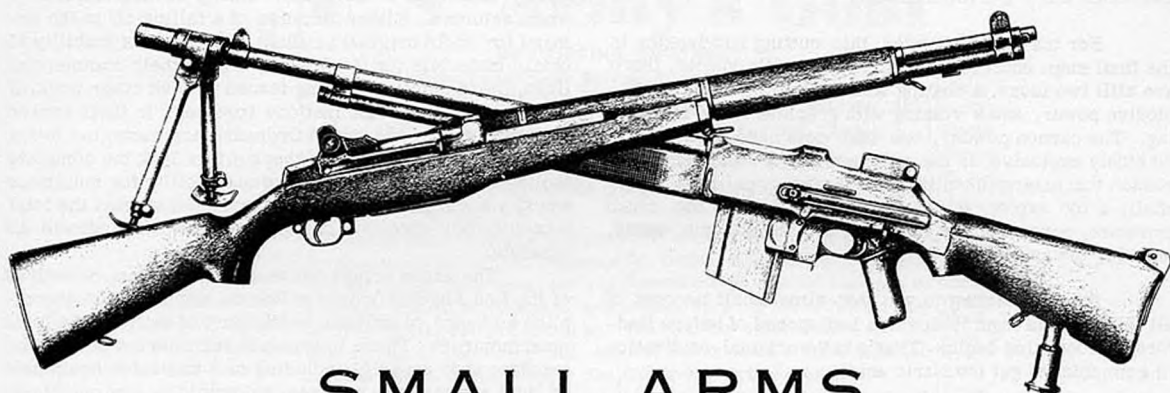
"Do Ye Even So"

(Continued from page 71)

If you have subordinates under your control, or if you are one of the subordinates yourself under the control of another, figure out what you honestly think the other fellow should do if he were in your place, leaving no "if" or alibi in your decision. Then "Do ye even so." You'll find that it produces excellent results, it breeds closer and more congenial companionships, it brings about a closer degree of cooperation, it gets the job done.

★★★★★★★★★★★★★★★★

Don't overlook the fact that when your address changes we won't know it unless you notify us.



SMALL ARMS

Conducted by: C. B. Goodman, 1st Lt., Ord. Dept.

SMITH AND WESSON REVOLVER

This is the first of a series of articles on revolvers and shotguns. In this article we shall discuss the disassembly, assembly, construction, operation, malfunctions, inspection and repair of the Smith and Wesson Revolver, Cal. .45, M1917.

DISASSEMBLY AND ASSEMBLY

Remove the parts in the following order: (See Figure 1 for identification of parts using the identification numbers shown.)

Stock screw (55); stocks (52, 53); forward side plate screw (51); crane (7) with cylinder (10) and ejector plunger (18), being careful to prevent the crane stop pin (8) and crane stop pin spring (9) from flying out; side plate screws (50); side plate (49); strain screw (56); mainspring (44); hammer (26), by pulling back to position of full cock, holding back latch (38), and lifting the hammer out; rebound slide (45) with rebound slide spring (47), by prying rear end of slide away from frame, being careful to prevent the spring from flying out; trigger (59), with hand (33), hand lever (35), hand lever spring (37) and trigger level (61), by rotating the top of the hand to the rear far enough to clear its cut in the frame and lifting the trigger from its pin; cylinder bolt (11), by pressing it away from the frame and prying out with a small screwdriver; cylinder bolt plunger screw (15); cylinder bolt plunger (13); cylinder bolt plunger spring (14); thumb piece nut (58); thumb piece (57); latch (38); locking bolt pin (42); locking bolt (41), with locking bolt spring (43); butt swivel pin (4), butt swivel (3).

The crane and cylinder are disassembled as follows; Unscrew ejector plunger (18) and remove from cylinder (10),

remove center rod (5) and center rod spring (6), remove cylinder (10) from crane arbor, remove ejector (16) and ejector spring (19).

The various parts of the hammer group and the trigger group may be disassembled by removing their respective pins.

To remove the barrel from the frame drive out the barrel pin (2) and unscrew the barrel from the frame.

NOTE: THE BARREL SHOULD BE REMOVED FROM THE FRAME ONLY FOR THE PURPOSE OF TIGHTENING OR REPLACEMENT.

The hammer pin, trigger pin, rebound slide pin and cylinder bolt pin are screwed into recesses in the frame, and the ends which may be seen on the left side of the frame are slightly upset to prevent loosening. In order to remove or tighten these pins, it is necessary to improvise wrenches which will slip over each pin, and which have projections which will enter the slots in the shoulders of the pins.

To assemble the parts, reverse the foregoing order.

MECHANICAL OPERATION AND MALFUNCTIONS

In order to inspect the piece, or to make repairs, a thorough knowledge of the construction and operation of all parts is necessary. The operation of all parts can be seen clearly by removing the side plate and pressing the trigger for double action, also by cocking the hammer by hand and pressing the trigger for single action. After becoming familiar with the construction and location of the various parts and assemblies when assembled in the weapon, let us proceed with a study of their operation, together with the causes for various malfunctions.

Remove the side plate and carefully note the position of each part, then apply pressure to the trigger. You will note that when the rotation of the trigger about its pin begins, the operation of several other parts begins simul-

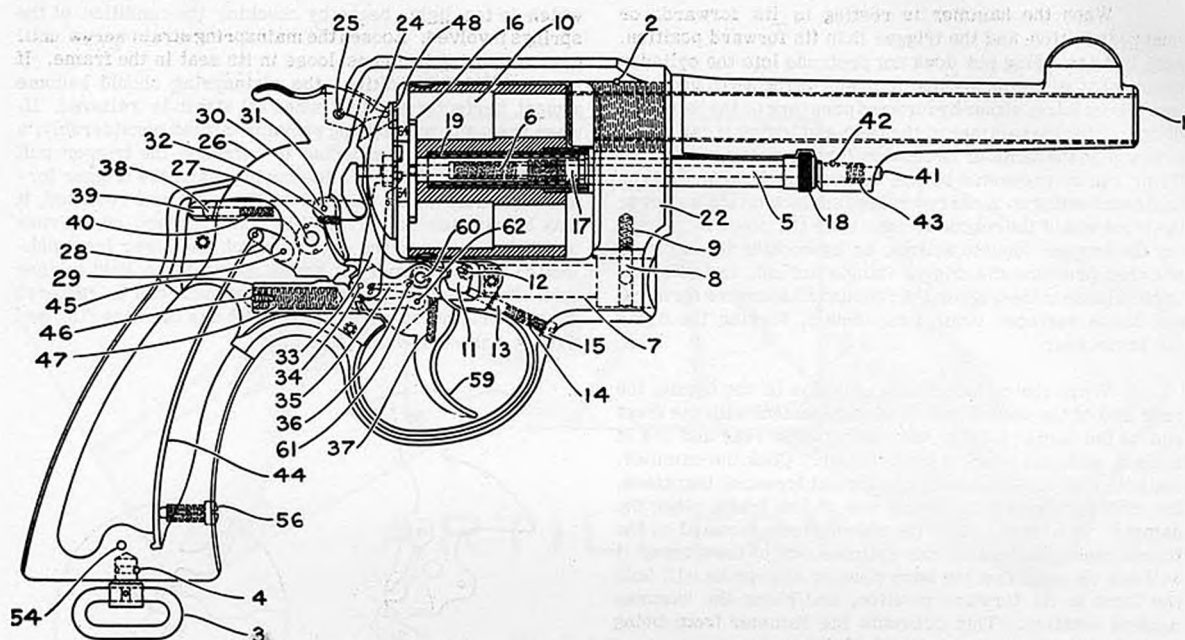


Figure 1

taneously. So let us begin with the cylinder bolt and observe the movement of the other parts in turn. As the trigger rotates about its pin a projection in front of, and in line with, the trigger pin causes the rotation of the cylinder bolt, disengaging the cylinder.

The hand is lifted by the rear of the trigger, and the point on its upper end engages the ratchet and rotates the cylinder. The projection on the extreme rear of the trigger lifts the stirrup, thus rotating the hammer to the rear against the tension of the mainspring. As the hammer rotates to the rear, the projection on the front of the trigger passes out of its notch in the cylinder bolt, and the cylinder bolt plunger spring expands, forcing the rear end of the cylinder bolt up to bear against the cylinder, and finally forcing it into a notch in the rear of the cylinder as the cartridge to be fired is brought into alignment with the bore. As the movement of the trigger continues to the rear, and the hammer is rotated far enough that it will fall with sufficient force to ignite the primer of the cartridge, the projection on the rear of the trigger slips out of engagement with the stirrup, and the hammer, driven by the mainspring, is rotated forward for firing. During this rotation of the trigger, the trigger lever has forced the rebound slide to the rear, compressing the rebound slide spring against the rebound slide pin which upon release of the trigger, will force the trigger forward to its original position. The operation of the parts in this manner is known as double action.

In the operation of the piece for single action, the hammer is rotated to the rear by pressure applied to the tang on the top rear of the hammer. Note that in the rotation of the hammer the operation of parts is exactly as described for double action, except that as the hammer is rotated to the rear a projection on the lower front of the hammer is lifting the rear of the trigger, therefore the stirrup is inactive, so in this movement of the hammer, it

is rotated farther to the rear than in double action, dropping the projection on rear of the trigger into the full cock notch of the hammer, and blocking the hammer in the cocked position. To fire the piece, the trigger is pressed. The projection on the rear of the trigger moves out of engagement with the hammer and slips between the projection on the hammer and the lower end of the stirrup.

It can be seen that in the operations described, perfect timing as regards rotation of the cylinder, the cylinder bolt, and release of the hammer is highly important. With this in mind let us see how the wearing away of various surfaces, and the weakening, or breaking of springs, will affect the operations described.

Wear on the top surface of the hand at the point, wear of the notches of the ratchet, and the weakening of the hand lever spring, may result in the hand slipping out of engagement with the ratchet, and its subsequent failure to rotate the cylinder. The wearing away of the top surface of the hand naturally tends to shorten its stroke, therefore, the wearing away of the surfaces which control the rotation of the cylinder may result in failure of the bore of the cylinder to line up properly with the bore of the barrel. A weak cylinder bolt plunger spring, or burrs on the cylinder bolt notches on the cylinder, may result in the failure of the cylinder bolt to engage the cylinder and hold it in proper alignment for firing. Wear of the projection on rear of trigger, and on the lower end of the hammer stirrup, or a weak hammer stirrup spring, may result in the failure of the trigger to lift the stirrup, or cock the hammer in double action. (This will not affect single action.) A weak or broken rebound slide spring may fail to return the trigger to its original position.

Let us continue with the study of the functioning of the remaining parts, which may be seen from the right side of the frame.

When the hammer is resting in its forward, or snapped position, and the trigger is in its forward position, note that the firing pin does not protrude into the cylinder opening in the frame, and that it cannot be forced to protrude into this opening, either by forward pressure on the hammer, or by pulling the hammer to the rear and letting it fall. The rotation of the hammer necessary for the protrusion of the firing pin is prevented by the bottom-most surface of the hammer resting on a narrow raised surface on top and near the front end of the rebound slide. Snap the piece by pressing the trigger (double action), or by cocking the hammer and then pressing the trigger (single action), and note that upon release of the trigger, the rebound slide moves forward, and these surfaces come into contact, forcing the firing pin to the rear.

When the cylinder is in position in the frame, the rear end of the center rod is in engagement with the front end of the latch, holding the latch to the rear and out of contact with the rear of the hammer. Cock the hammer, and note that the latch cannot be forced forward, therefore, the cylinder cannot be swung out of the frame when the hammer is cocked. Snap the piece, press forward on the thumb piece, and swing the cylinder out of the frame. It will now be noted that the latch plunger and spring will hold the latch in its forward position, and block the hammer against rotation. This prevents the hammer from being cocked while the cylinder is out of the frame.

INSPECTION

See paragraph 7, TR 1400-45A.

REPAIRS

It is obvious that the proper method for correcting malfunctions caused by the weakening of springs, is the replacement of the spring involved. The stretching of springs to increase tension will sometimes correct a defect temporarily, but the condition will invariably soon become worse than ever, so it stands to reason that such repairs are a waste of time.

Screw heads which have become deformed by the improper use of screwdrivers should, if not too badly deformed, be reshaped by the use of a fine file.

If the operating parts of the revolver are kept lubricated, it will seldom fail to function, except for the occasional breaking of small parts, the most of which are easily replaced. It is believed that the majority of the malfunctions are the result of curiosity leading inexperienced persons to explore the inside of the frame, wherein the most of the parts are housed. In an attempt to reassemble the parts, they were forced together in such a manner as to bend or break small parts, and cause burrs on surfaces which must operate in close contact. In such cases it is necessary to disassemble the piece, and carefully remove all burrs and scratches, lightly polishing all bearing surfaces with a fine stone. Check all assemblies for correct assembly of component parts, lubricate all parts, and reassemble.

The careful polishing and lubrication of parts, as described above, if the original shape of parts is maintained, will usually produce a satisfactory trigger pull. In fact, this is the prescribed method for correcting a trigger pull which has become too heavy and rough. To correct a trigger pull

which is too light, begin by checking the condition of the springs involved. Loosen the mainspring strain screw until the mainspring becomes loose in its seat in the frame. If in serviceable condition, the mainspring should become almost perfectly straight when all strain is relieved. If, when free, the mainspring remains curved considerably, a new spring can be expected to increase the trigger pull slightly. If the rebound slide spring snaps the trigger forward smartly when pressed to the rear and released, it may be considered serviceable. The surface on the rear of the trigger, and the cock notch on the lower front projection of the hammer, if worn, may cause a light trigger pull. These surfaces, if not worn too much, can be restored to their original shape by the careful use of a fine file, and then by polishing with a fine stone.

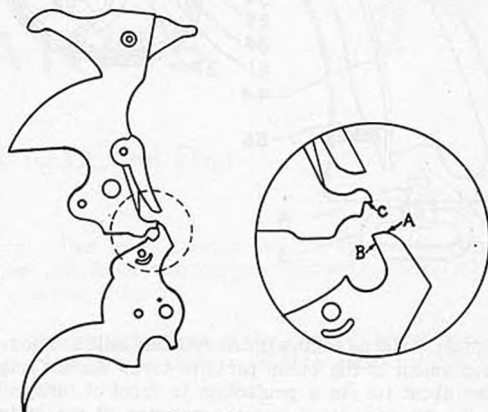


Figure 2

The sketch in Figure 2 shows the relative position of the hammer and trigger in the cocked position. In the circle is an enlargement of the surfaces that are in contact when the piece is cocked. Polish surfaces A & B on the trigger, and surface C on the hammer, by stoning, being careful not to remove too much metal.

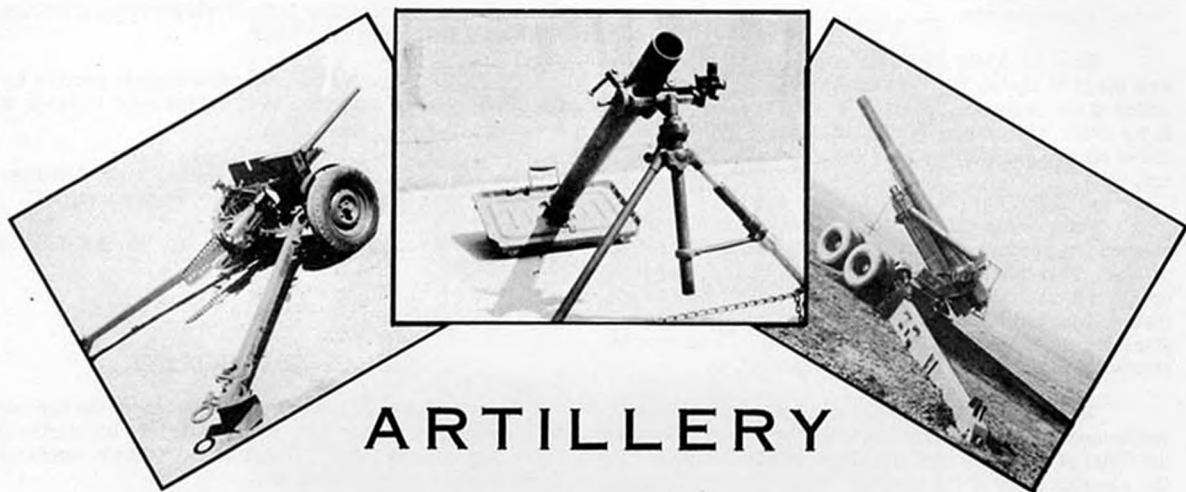
The trigger pull in single action should be between 5 and 6-1/2 pounds.

The slight rotational play of the cylinder which develops after considerable firing, is caused by wear of the cylinder bolt, and the wear, or increase in width, of the locking notches around the rear of the cylinder. The replacement of the cylinder bolt will aid in reducing this play. The locking notches may also be reshaped by light peening on the contact sides; however, peening at this point must be limited to the replacement of metal pushed out to the side.

It is seldom necessary to replace the crane, but it is frequently necessary to remove burrs from the edges of the crane and the frame which might interfere with the latching of the cylinder in the firing position. This can be accomplished by stoning. In order to fit a new crane, it is sometimes necessary to do considerable stoning on the surface of the crane which fits against the frame, in order to line the cylinder up with the bore.

To tighten a loose barrel, remove the barrel pin and unscrew the barrel. Clean the threads in the frame and on the barrel, lightly peen the shoulder of the barrel

(Continued on page 96)



ARTILLERY

Conducted by: W. C. Minshaw, 1st Lt., Ord. Dept.

PROCUREMENT OF A FIELD ARTILLERY WEAPON

By: O. A. Ramnes, 2nd Lieut., Ord. Dept.

When the field artillery decides upon the need for a new or improved weapon, the Field Artillery Board submits a recommendation to the Chief of Field Artillery, who, in turn, submits it to the Secretary of War, setting forth the need of the weapon and indicating the military characteristics it should possess. The military characteristics are those essential qualities which the weapon must possess in order to fulfill a definite military purpose.

The formulation of these characteristics or basic specifications are coordinated through the Ordnance Technical Committee, an agency of the Technical Staff.

The need for the weapon and the specification of its military characteristics having received favorable consideration, it is approved by the Secretary of War, who authorizes the development.

All papers are forwarded to the Chief of Ordnance, where, in the Technical Staff, a development project is set up.

Study designs are then prepared under the supervision of the Artillery Division of the Manufacturing Service. The design work may be accomplished either in the Ordnance Office or at a manufacturing arsenal.

When studies or proposed designs have been completed in the Artillery Division of the Manufacturing Service, they are furnished the Technical Staff where they are reviewed, first by a sub-committee and then by the Ordnance Technical Committee. With members of the Com-

mittee from the Manufacturing Service, the Field Artillery, and the Technical Staff, the designs are carefully scrutinized, inconsistencies between tactical requirements, engineering capabilities, and manufacturing limitations pointed out, and compromises effected that are satisfactory to the Field Artillery.

When the design, modified as may have been necessary, is thus approved, the next step is the setting up of funds for the manufacture of a pilot development model. It frequently happens that funds appropriated for experiment, research, and development are available and may be applied to this construction. In this case, the funds are made available by the Fiscal Division of the General Office to the Artillery Division of the Manufacturing Service. In case there are no funds available, then the time consuming method of estimates, budgetary hearings, Congressional hearings, Congressional action, etc., leading up to legislation and appropriation, must be followed before any further work can be done. This latter procedure can seldom be accomplished in less than a year and a half.

When the funds actually become available, the pilot model is manufactured under the supervision of the Manufacturing Service in Rock Island Arsenal, or by a commercial firm under contract.

The pilot model, after having passed shop tests at the place of manufacture, is tested by the Ordnance Department at Aberdeen Proving Ground to determine its technical suitability. If it passes the Proving Ground tests satisfactorily, it is submitted to the Field Artillery for a ser-

vice test, under the supervision of the Field Artillery Board. If, during the service test, deficiencies develop, all the steps from the design through the test are repeated until a model is produced which is technically suitable and meets tactical requirements.

When the Field Artillery indicates its satisfaction with the pilot model, the Technical Staff, as a result of the action of the Ordnance Technical Committee, recommends to the Chief of Ordnance the classification of the weapon as one of the several adopted types (standard, substitute standard, etc.).

Prior to the classification of the weapon it must be cleared for procurement through the Assistant Secretary of War. Personnel in his office review the design and specifications from the viewpoint of war-time procurement, that is, adaptability to commercial production, the use of strategic materials, and the employment of commercial standards in materials and manufacture.

When the weapon has been cleared for procurement, recommendations are submitted to the Secretary of War by the Chief of Ordnance and the Chief of Field Artillery for the classification of the weapon as an adopted type, indicating the priority which it should be given for procurement.

When the recommendations as to classification are approved by the Secretary of War, the Technical Staff records the weapon in the "Book of Standards" with essential information concerning its classification.

The weapon having been adopted as either a standard type or substitute standard type, the Artillery Division of the Manufacturing Service next completes all the drawings and specifications, designs the necessary manufacturing gages, and prepares a detailed description of manufacture.

If it is decided by the War Department to issue the weapon to the Field Artillery, the Chief of Ordnance so informs the Fiscal Division of his General Office, the Manufacturing Service, and the Field Service. The Artillery Division of the Manufacturing Service prepares estimates for the funds necessary to the program. These are included in the estimates for inclusion in the War Department estimates for submission to Congress.

Meanwhile, the Technical Staff directs Aberdeen Proving Ground to conduct the necessary range firings and to prepare firing tables as required. The Executive Division, Field Service, also prepares Technical Regulations or Manuals for issue to the service, governing the care and functioning of the weapon.

At the same time, the Field Service has been preparing a list of spare parts necessary for the maintenance of a particular number of pieces over a definite period of time, in order that these parts may be stocked and sets issued maintenance companies for their maintenance work.

When funds have been appropriated for the procurement of the weapons for issue to the Field Artillery, they are apportioned to the Manufacturing Service. Procurement authorities are then issued and the items are manufactured at Rock Island Arsenal, or contracted by the Arsenal for production by a commercial firm.

Inspection gages are procured under the supervision of the Gage Section.

When the manufacture of the weapons has been completed they are turned over to the Field Service for storage and supply to the Field Artillery.

The Maintenance Division takes steps to provide for the inspection and maintenance of the materiel in hands of troops.

The Executive Division prepares a Standard Nomenclature List of all parts pertaining to the new weapon.

(Reference: Special Text No. 41, Army Extension Courses)

GERMAN LONG RANGE GUN

A reader who noticed a discussion of the German long-range gun (sometimes referred to as "Big Bertha") in the July issue of THE ORDNANCE SERGEANT, sends us the following interesting facts:

"The famous German gun used to bombard Paris in the First World War had a range of 80 miles. It cost \$8,000 to fire a single shell."

SMITH AND WESSON REVOLVER

(Continued from page 94)

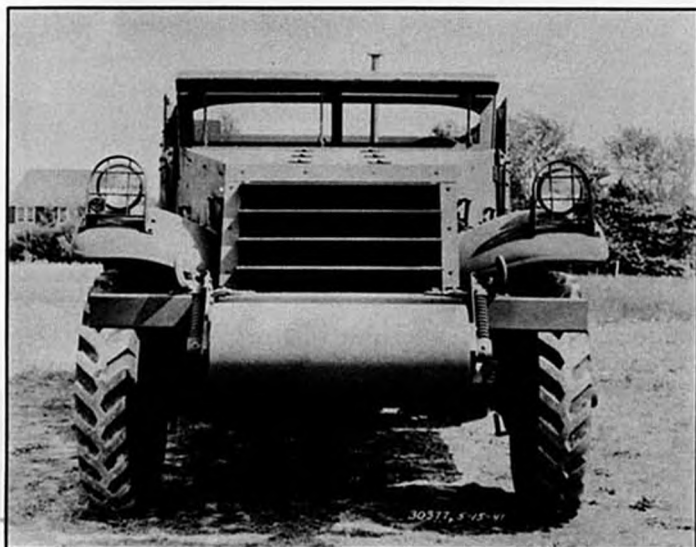
which fits against the frame, sufficiently to tighten the barrel when it is screwed in to its original position.

To replace a barrel, one should be selected which requires the least amount of fitting in order to obtain the proper alignment. It is sometimes necessary to remove a small amount of metal from the shoulder of the barrel in order to draw it up to alignment. This can be done by lathe, or by filing. In the replacement of a barrel it is sometimes necessary to stone the rear end of the barrel in order to obtain the proper clearance between the rear end of the barrel and the front end of the cylinder. This clearance should be between .002" and .006".

In the September issue of THE ORDNANCE SERGEANT we will discuss the Colt Revolver.

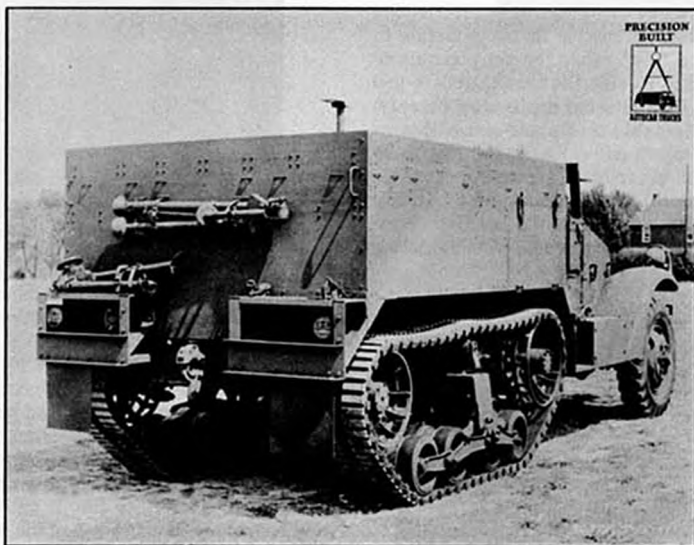
Has your organization been mentioned in THE ORDNANCE SERGEANT? We don't want to encourage Ordnance men to become publicity seekers, but organizational news items are interesting to other organizations. Familiar faces appear in pictures, familiar names appear in print, and our memories go back to other days and pleasant associations. Your organization should be represented in "Letters from the Field" now and then, but this will be possible only through the thoughtfulness of some individual.

CAR, HALF-TRACK, M2



This is the Car, Half-Track, M2, powered by a new type gasoline in-line 6 cylinder engine made by White Motor Company. Hydraulic valve lifters and an oil cooling system help raise the horsepower rating to 147. Engine is mounted 3 degrees lower at the rear, so that the crank-shaft and propeller shaft will rotate in the same horizontal plane. Front wheel drive can only be operated in first and reverse speeds. Transfer case is bolted to the transmission, thus eliminating the short coupling used in the earlier models. Suspension system employs volute springs and rubber tired bogie wheels. Track is the endless band type made up of rubber covered steel cables and steel cross members. Bronze adjusting nuts on idlers prevent seizure from rust and corrosion.

The Half Track Personnel Carrier, M3 and Half Track 81 mm Mortar Carrier, M4, differ from this vehicle only in design of the body and slight difference in length of frames.



--Photos released for publication by the Bureau of Public Relations, War Department, Washington.



Conducted by: J. W. Winslow, Master Sergeant, Ord. Dept.

THE M1 WRECKER

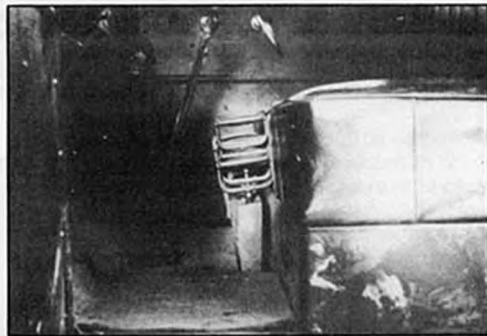
By: A. L. Hettrich,
2nd Lt., Ord. Dept.

The Ward LaFrance "Operations and Maintenance Manual" contains complete operation and maintenance instructions on the M1 Wrecker. Actual field operation has shown, however, that certain precautions in operation need to be further stressed. That, and placing emphasis on certain adjustments of the mechanical parts, will be covered in this article. This article is directed to you as an operator. In some respects it is undoubtedly incomplete, but it is hoped that it will aid you, whether you are a green or experienced operator, in keeping your wrecker 'rolling'.

You may find sometime that it is not possible to shift the transfer case into 'low' range, or not possible to take the front wheels 'out'. Resist the temptation to pry either of these handles up. Examine the cable (rod) closely, next to each shifting handle cable (rod), and you will very often find that one of the slots cut in the cable may have turned enough to prevent the other handle from being pulled up. The screwdriver slots in each cable must be parallel to each other, and generally parallel to the handles themselves. By loosening the lock nut on the cable, and rotating

the cable by means of a screwdriver, the slot can be turned so that it opposes the slot in the opposite cable. The slots must oppose each other, and must be parallel to each other, so that the steel ball in the interlock can move back and forth, which in turn allows either handle to be pulled up when the other handle is all the way down.

A precaution in the use of the transfer case shift handle can be added here. It is important that in shifting into 'low' range, the handle be pulled all the way up, approximately level with the top of the seat.



Approximately level with the top of the seat

This is necessary to completely engage the gears in low range. Partial engagement of the gears will cause them to chip off, or even strip if the wrecker should be placed under a heavy pulling strain.

Familiarity with the wrecker through use of it will give you skill, but when you discover that there is a neutral between H (high) and R (reverse) on the front winch power take off, don't use it. It is dangerous to use, and especially so when travelling. As it is a neutral that cannot be locked, it can easily jar either into H or R. This, you understand, would severely damage either the winch or cable before the wrecker could be stopped. Use only the six wheel running locked neutral as shown on the plate.

You may ask, "When should the wrecker be driven with front wheels 'out', and when should it be driven with



them 'in'." The advantage claimed that driving the wrecker with the front wheels 'out' increases road speed on smooth surface roads is doubtful. It is seldom necessary to drive the wrecker as fast as it will go, in fact, considering the weight of the wrecker, it isn't a good policy to drive it any faster than normal convoy speed. For normal convoy speed the wrecker has sufficient power to operate with the front wheels 'in'. In slightly hilly country, or in country with steep grades, driving with the front wheels 'in' would necessitate less shifting into lower ranges than if you were driving with the front wheels 'out'. With the front wheels 'in', these wheels are pulling all the time, and the pulling load is distributed to all wheels, which takes part of the driving strain off the rear wheels. If, under a heavy pull, the rear wheels are not aided by the front wheels, and they must therefore take the whole driving strain, including pushing the front wheels, serious damage will often result to parts of the rear wheel power train, or to the propeller shafts that drive the rear wheels. Leaving the front wheels 'in' all of the time the wrecker is being operated or driven, will often prevent stalling or miring in the mud, since the front wheels will be pulling instead of being pushed. There is also the added ease of shifting into 'low' range, since it is not necessary to shift the front wheels 'in' if they are kept 'in'. Undoubtedly driving the wrecker with the front wheels 'in' at all times can be considered as the most satisfactory manner of operating the wrecker.

During recovery operations, the hand brake should never be used to hold the wrecker. The air brakes can be applied and left applied during recovery operations if a simple expedient such as shown below is used.



A wooden cleat used to hold down foot brake

The operations and maintenance manual stresses the importance of winding the cable to get a good core, especially the first winding on the drum. When pulling in a load on the front winch, it is often possible to align the wrecker so that the bumper will be at a right angle to the line of pull. Doing this, and having a man guide the cable back and forth on the drum, is an effective combination in winding.

The manual also contains drawings of an attachment that can be hung on the bumper, and of a bar that can be used to keep the cables taut when the free cables are being wound on the winch drums. The use of the attachment on the front bumper is shown below.

If you wish to save yourself the time it takes to unwind the front winch cable by use of the power take off,



An attachment can be hung on the bumper

you can declutch the front winch and pull the cable out on a free drum.



Pull the cable out on a free drum

If you find that the cable is wound so tightly that it is difficult to remove the cable hook from the tow hook, a small jack handle can be used to turn the power take off shaft sufficiently to free the clutch. By sticking the jack handle through the universal joint on the power take off shaft, turning the shaft counter-clockwise as you face the rear of the wrecker, the drum can be turned enough to loosen the cable.



In a similar manner the cable can be tightened. Power may be used to wind the cable up to the point where the hook is to be securely fastened. The final tightening of the cable can be accomplished by using the jack handle turning the power take off shaft in a clockwise direction. This method of securing the chain hook and tightening the cable is very effective, and it prevents cutting 'shear pins', which often results when the cable is tightened and the hook secured by the use of power.

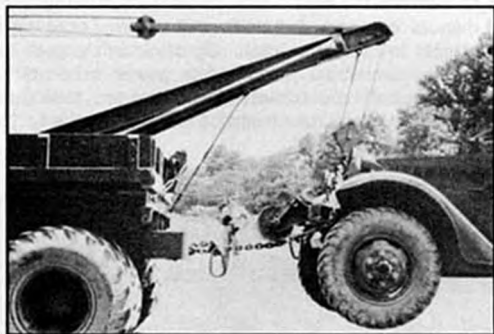
Instead of using the two hooks for recovery operations, it is advisable to use a chain to make a 'bridle' as demonstrated below in the picture.



Make a "bridle"

This 'bridle' if made with a heavy chain, is very satisfactory for recovery operations, and if used in place of the tow hooks, will prevent any damage to them as a result of a heavy recovery operation.

The tie rods on the crane boom have a very definite purpose for being there. They prevent lateral sway of the boom when travelling. Lateral sway of the boom, particularly if there is a load hanging on it, will damage the crane swinging worm gear by shearing the bolts in the worm gear, or even splitting the worm gear. Remember that when travelling, the tie rods should be used to prevent lateral sway of the boom.



When travelling the tie rods should be used

In order to operate the wrecker efficiently, that is, with the minimum amount of delay due to time lost in repairing the equipment on it, the wrecker must be operated within the safe limits of the equipment on it, and within its power. When these safety factors are disregarded, the

equipment will break down, some one may be hurt by a flying cable, and the recovery operation will be delayed during the period of time the equipment is being repaired. The power of the wrecker is there for you, as an operator, to use. Instructions are in the manual, and skill comes with practice. Skill in the use of the wrecker also means skill in the use of blocks. Blocks add to your leverage, that is, they increase the power you can use and still remain within the safe limits of your cables. Work by this rule: If in doubt about a single line handling a load, use a block and thereby double your line; if in doubt about one block, use two or more. Always work within the safe limits of your equipment on the wrecker, and use the power of the wrecker to handle your load, and not to wreck your wrecker.



Blocks add to your leverage

When doing a great deal of recovery work, and handling of loads, your clutch is used continuously. It is

therefore important to keep it adjusted and to check on this instrument at every opportunity. Instead of waiting until the 'lash' is half an inch, which is difficult to judge, it would be much better if you adjusted the clutch as soon as the 'lash' appeared to be less than one inch. This allows you to have a working margin which will keep your clutch adjusted to more than half an inch 'lash' all of the time. If you wait until the 'lash' is half an inch, you may make an error in judgment in believing it to be half an inch when it may be less. If you should then go out on a difficult recovery operation, you will find that your clutch will begin to slip. Remember, also, that in adjusting the clutch, the clutch is adjusted internally before the 'lash' adjustment is made.

The following service hints may help you. - Never fill the gas tanks completely, as the cap is designed to keep a constant pressure in the gas tank. If the tanks are filled to the top, raw gasoline will be forced out of the caps. - Tire pressure is 85 pounds. - The level plug for the front winch worm gear is behind the spring shackle, and it is very difficult to get this plug out. To determine the level of the lubricant in the worm gear housing, remove six stud bolts on the worm gear cover, remove the cover, and then the level of the lubricant may be checked easily. - The propeller shafts may be lubricated by placing the wrecker in 'low low' and moving the wrecker to allow the fittings to be reached.

This article is substituted for the third of the series of articles on "Characteristics of Generators, Batteries and Charging circuits." This series will be completed in the next issue of THE ORDNANCE SERGEANT.

Undoubtedly there are many helpful little 'kinks' and 'tricks' of operating the wrecker and its equipment that have been discovered and developed in the field. Information of such will be appreciated, and every effort will be made to pass on such information through the means of THE ORDNANCE SERGEANT.

UNITED STATES RUBBER COMPANY

660 East Jefferson Avenue

DETROIT, MICH.

The Ordnance Sergeant
The Ordnance School
Aberdeen Proving Ground
Maryland

July 3, 1941

Dear Sir:

I am sure it would interest you to know that we are actively promoting as a Tire Industry project the preparation and complete distribution to all branches of the armed forces an up-to-date manual on tire inspection, tire maintenance, and tire servicing. Your letter provides the further thought that such a manual should cover other rubber products than pneumatic tires and tubes.

The abuse of pneumatic truck tires and tubes by Army drivers is something that the nation needs to correct as quickly as possible because crude rubber is one of the most vital raw materials in our Defense Program, and one of the most obvious ways to conserve crude rubber is to see

that manufactured products of crude rubber are properly taken care of.

For example, checks at Army camps made by our Service Department and other Service Departments disclose that practically no attention is being paid to the proper inflation of tires. Adequate air pressure is as important to tires as adequate water is to the radiator of the truck. The Service Manual which the Industry will work up thru the Service Managers' Committee of the Rubber Manufacturers Association will cover all these elementary points as well as the proper dismounting and mounting of tires with ordinary tubes and with bullet sealing tubes; the various types of wheels and rims that are being used; the mounting and dismounting of these wheels both singles and duals; the inspection of tires for cuts, etc.; the proper matching of dual tires; the switching of wheel positions in order to equalize tread wear, etc., etc.

Very truly yours,

CC: F. L. Krause

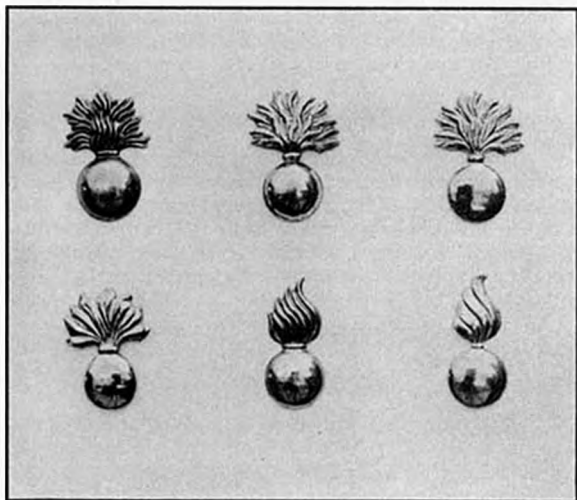
S. P. THACHER, Manager
Tire Engineering & Service Department

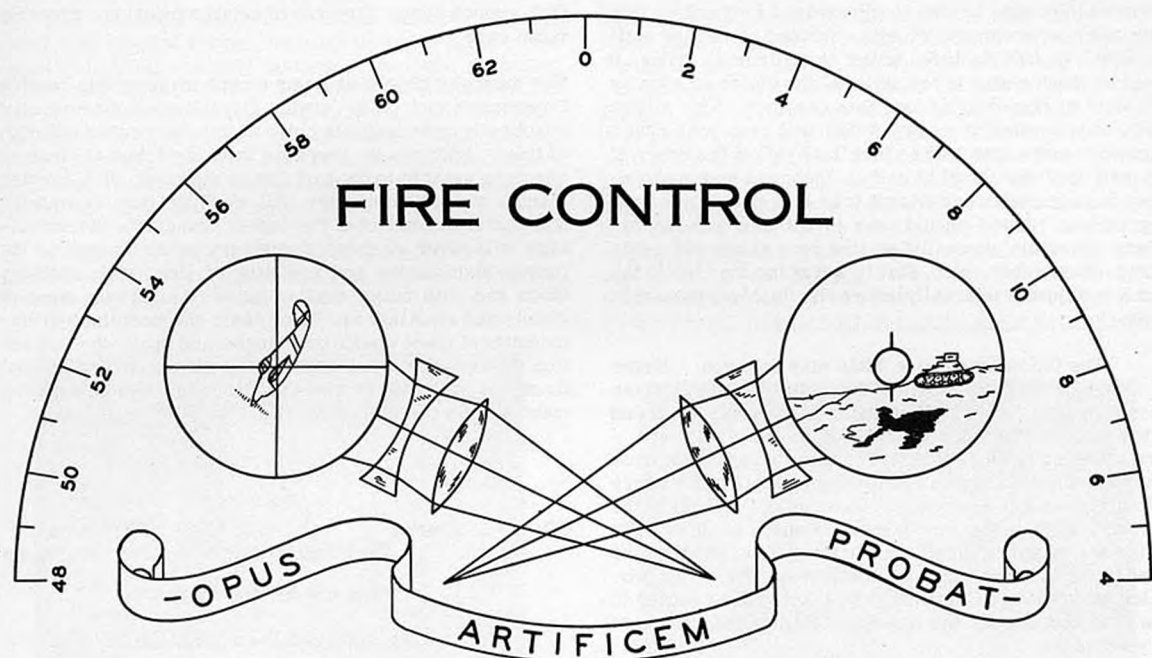
THE ORDNANCE INSIGNIA

The illustration below may be of interest both to "old-timers" and to recruits. It shows the evolution of the insignia of the Ordnance Department; from the bomb with its wide spread flame (which has remained substantially the same from the War of 1812 through World War I through the various modifications of the past decade to the modern "stream-lined" design.

The insignia shown in the lower right hand corner conforms to the present official pattern, and is now being produced in that form for the officers' insignia and for the lapel button of the enlisted man's blouse.

William I. Wilson
Lt. Col., Ord. Dept.
Commanding Officer,
Unit Training Center





Conducted by: R. L. Johnson, 2d Lt., Ord. Dept.

THE MIL SYSTEM OF MEASURING ANGLES

By: J. P. Rigg, Master Sergeant, Ord. Dept.

Definition

The use of the "mil" as a unit of angular measurement is peculiar to the military services of a few countries, it is not found in the civil professions. The system was developed to meet the particular needs of the soldier, and the specialized requirements of his trade. It affords him a means whereby he may perform computations involving small angles quite readily, usually mentally and without referring to tables or using complicated equipment.

Advantages of the mil system

The essential advantage of the mil system of angular measurement over the traditional degree - minute - second system is twofold. First, in any right triangle, such as that in figure 1, where a very small angle is involved, the following relation gives a solution for the side opposite the acute angle which is true within very small limits.

$$BT = \frac{1}{1000} \times OT \times \text{angle BOT (in mils)}$$

Degree System

The traditional system of measuring angles is familiar to everyone. In this system the unit is one degree, a circle being arbitrarily divided into 360 of these degrees. This angular unit of measurement, the degree, is further

subdivided into 60 smaller angular units called seconds.

Simplifying the Degree System

To facilitate computations, tables have been worked out, at considerable cost in time and labor, by means of

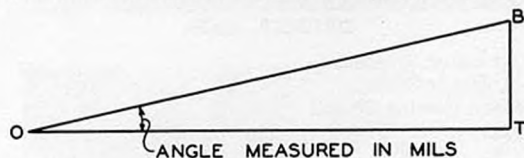


Figure 1

which distances may be computed from certain relations which exist among the angles and sides of triangles. The use of such tables shortens the time required for calculation to a very great extent. Such tables are indispensable articles of equipment for the surveyor, the navigator, and members of many other professions.

Disadvantages of the Degree System

The traditional method of angular measurement just discussed is not well adapted to the needs of the machine gunner and artilleryman during the heat of combat, where

the difference of a few seconds time in computing a correction to be applied to his weapon may win or lose a battle, or mean life or death to the gunner and his comrades. The soldier needs a system the use of which does not require him to refer to complicated tables, but one which is simple enough to be memorized and one in which computation may be done "in the head" to a degree of accuracy which will prove sufficient for the purpose at hand.

Origin of the Mil System

During the development of higher mathematics it was discovered that the angle subtended by an arc length equal to the radius has many properties which make it especially convenient and ideal for certain purposes. This angle is called a "radian." (See figure 2.)

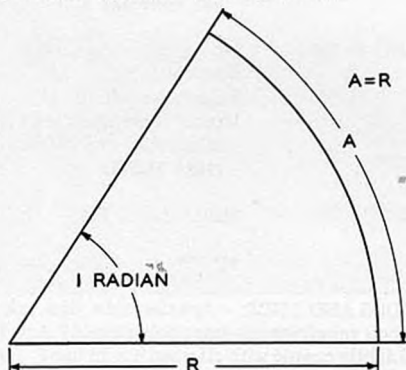


Figure 2

With the radian as a unit, and where the angle is small, computation is quite simple. For example: if an observer measures with an instrument the deviation between a shell burst and the target and finds it to be 6/1000 of a radian, he can easily compute mentally that the distance between burst and target is .006 x the range. (See figure 3)

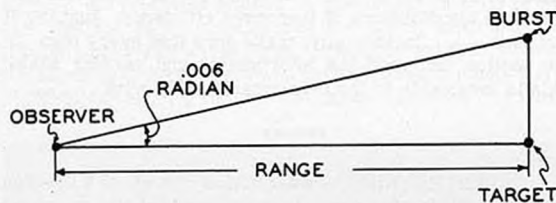


Figure 3

The Radian and the Circle

Since the length of the circumference of a circle is 2π times the radius, it follows that there are 2π or $2 \times 3.1416 (=6.2832)$ radians in full circle. The fact that this number is not an integer makes this unit, (the radian), rather inconvenient. For instance; to designate an angle of forty-five degrees we would write:

$$\frac{45}{360} \times 6.2832 \text{ or } 1/8 \times 6.2832 \text{ or } 0.7854 \text{ radian}$$

Therefore, using as a unit 1/1000 of a radian would scarcely improve matters.

The Solution

However, remembering that the angles used in this manner are usually quite small, and that the solution need only be approximate within small limits, we may use an angular unit approximately equal to 1/1000 of a radian. Such a unit is the "mil." There are 6400 mils in a full circle. It is easy to see that 1/6400 is approximately equal to 1/6283.2. In fact, we may readily compute the error introduced by using one mil instead of 1/1000 of a radian as our unit of angular measurement.

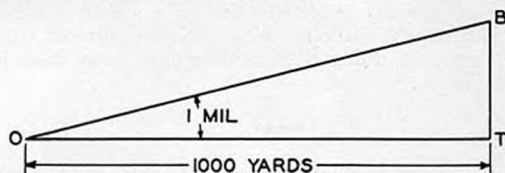


Figure 4

In Figure 4, using the approximate relationship that the distance which subtends one mil is equal to 1/1000 of the range, we obtain the approximate solution:

$$BT = 1 \text{ yard}$$

Since 1 mil equals $1/6400 \times 6.2832$ radians or 0.98175 radians, the distance BT is actually 0.982 yards, correct to the nearest thousandth of a yard. Converted to inches, this represents an error of 0.65 inch in the solution obtained by using the approximate relation mentioned above, rather than the exact relation afforded by the use of the radian as a unit.

Summary

From the foregoing discussion we find that the following is true:

- (a) The traditional degree system of angular measurement is unsatisfactory for military use where speed of measurements and settings is the prime requisite.
- (b) That the "mil" system, is used for military purposes where the measurement of angles is required.
- (c) That the mil system has a sound mathematical basis and is exceedingly accurate within certain limitations.
- (d) That any existing error could easily be estimated.
- (e) That the mil system of angular measurement can be calculated mentally in a minimum of time.
- (f) That a mil is equal to 1 yard at a range of 1000 yards for all practical purposes.

"NOTES IN BRIEF"

NOTE: - The complete list of references for the use of the instrument section, promised last month, is being postponed temporarily. It is expected that a large number of new publications on Fire Control maintenance activities will be available in the near future. To make the list con-

templated of as much value as possible it is considered advisable to wait until further information about these publications is available. The list will be published in the "Notes in Brief" column as soon as possible.

SUGGESTIONS: - If your post has been static in activity for the past few years, now is an excellent time to clean out, revise, and modernize your reference files. Particular attention should be paid the Standard Nomenclature List' section. SNL's are coming out thick and fast; new and revised editions being published almost daily. Check all your publications against their latest index for new dates and changes.

LUMINOUS PAINT: - Luminous paint possesses the remarkable quality of absorbing daylight or other strong light and re-emitting it in the dark. Contact with any material containing lead or iron destroys the luminous qualities. It is, therefore, necessary to first lay a coat of neutral base paint, a can of which usually accompanies each can of luminous paint.

In applying sight lines (or any task of a similar nature), the line is drawn first with the neutral base paint, which should be allowed to dry for at least 24 hours. Then follow with three coats of luminous paint, allowing each coat to dry thoroughly before applying the next.

The paints should be well stirred and, if too thick, thinned with a little turpentine. The thicker the coat of luminous paint, and the more intensely the light has acted upon it, the stronger and more durable will be the light emitted by the painted article.

CAMEL HAIR BRUSHES: - Camel hair brushes (used for painting) should be thoroughly cleaned after painting, with turpentine, and then laid flat on a horizontal surface (not in water). Camel hair brushes used for flicking dust off lenses and prisms must be kept clean at all times. These brushes may be cleaned in a small amount of alcohol (this should be done frequently), and waved in the air until dry. Never wipe dry with any material.

AA MAINTENANCE MEN: - Ordnance Field Service Circular #111, June 1, 1939, prohibiting the opening or breaking of the main seal of the Height Finders T9E1, M1, & M2, without prior approval of the Ordnance Office is rescinded. Change 1 to OFSC #111 is dated June 5, 1941. Your attention is invited to this change.

TEXT REFERENCES: - "Machine Tool Operation," Part 2, by Burghardt, and "American Machinists Handbook," by Colvin and Stanley, (both published by McGraw-Hill Publishing Company, New York City), contain much useful and practical information regarding shop practice with which every Ordnance Sergeant should be familiar. They are excellent texts for either actual shop work or instruction purposes. You can probably procure them at any local library. Why not look them over?

NEW PUBLICATIONS: - The following are now available, and contain useful and necessary information for the instrument section.

TM 9-1525 Instrument, angle of site, M1917 (Ordnance Maintenance)

SNL F-34 Glass, field, type EE (Revised edition incorporating previous changes)

SNL F-197 Mount, Tel., M21
Quadrant, range, M4
Telescope, elbow, M16
Mount, telescope, M23 (for elbow telescope) (for 105 mm. howitzer carriage M2)

SNL F-199 Mount, telescope, M22
Quadrant, range, M5
Telescope, elbow, M14
Mount, telescope, M23 (for elbow telescope) (for 75 mm. gun carriage M2A3)

SNL F-211 Setter, fuze, T15

ODDS AND ENDS: - Are the tools, jigs, and fixtures in your shop receiving the care they should? Are they kept clean? Lightly coated with oil when not in use? Lubricated according to specifications? Have the men of your section been instructed in safety precautions? There is food for thought in the questions above! Do the personnel of your section scribe reference lines as though they were digging ditches? Do your men handle the delicate optical and mechanical components of instruments with care and confidence? Is any phase of their education as an instrument specialist incomplete? If you cannot honestly answer "Yes" to all of the above questions, why not spend a few of those spare hours instructing your men in some of the miscellaneous phases of their work. The time will be well spent, and will pay off in big dividends of increased efficiency. Just try it and see!.....Incidentally, make sure that every man in the section can read the micrometer and vernier scale. This is invaluable to the repairman's daily work.....

PARTING HINT: - Ever notice how all of a sudden you just can't locate a screw in stock needed at the moment? Ever had your cleaning, lubricating, and preserving supplies run out suddenly, right in the midst of a rush series of jobs? These things are an indication of carelessness and sloppy supervision. Check those supplies.....now.....especially screws. Keep your stock in a condition to meet all normal conditions at all times.

If you would like to read an article on some particular subject, and think it would be helpful to yourself and to other men, tell us about it. We'll make every effort to meet the demand.

R. O. T. C. CAMP

ABERDEEN PROVING GROUND, MARYLAND

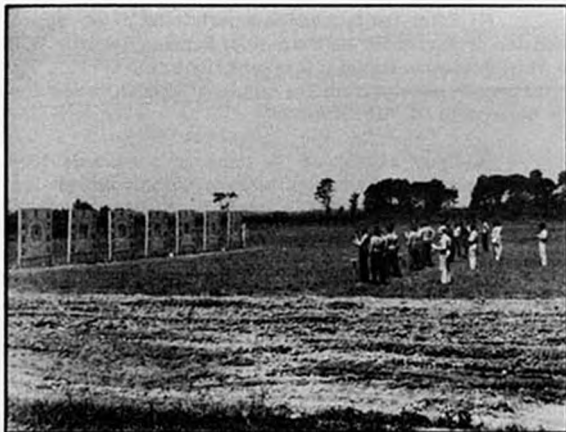
JUNE 19 TO JULY 30, 1941



Looking down the "street"

The R.O.T.C. Camp which opened at the Ordnance Training Center on June 19th, with 149 students enrolled, was quick to establish an instructive but interesting routine of camp and school activities. The students adapted themselves with apparent ease to the camp schedule in all its phases, instructional as well as recreational.

Probably the phase of instruction in which the class as a whole has exhibited the most interest has been pistol firing. Many of the students have experienced only limited opportunities to fire the pistol, and as a result they have enjoyed the facilities offered by the camp. In spite of the fact that the camp schedule, of necessity, allows only a limited time for practice firing, it is expected that approximately 85% of the students will qualify as marksman, sharpshooter, or expert, before the camp closes on July 30th.



On the pistol range



From the air

About two-thirds of the students had completed the course by July 15th.

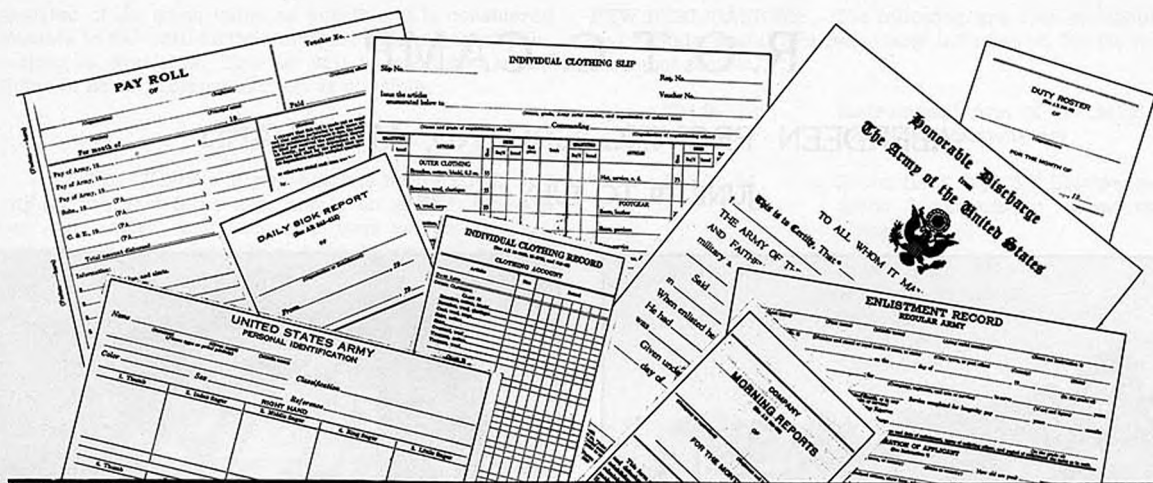
Another course of study in which considerable interest has been displayed is Automotive. In this course, too, the schedule limits the time available, but appreciable progress has been made. For automotive instruction the entire class is divided into three groups, each group receiving ten hours of instruction.



Automotive instruction

Recreational activities at the camp have not been neglected, for proper exercise and relaxation are considered an important factor in the development of the students. Almost every student has engaged in some form of athletics. The most popular sports have been baseball and softball.

(Continued on page 133)



ADMINISTRATION

Conducted by: J. E. Dempsey, 2nd Lt., Ord. Dept.

APPREHENSION OR SURRENDER OF DESERTERS

By: C. K. Harper,
Master Sergeant, Ord. Dept.

In order to complete the picture of the action to be taken in cases of desertion, as presented in the July, 1941, issue of THE ORDNANCE SERGEANT, we shall consider the action to be taken upon apprehension or surrender of a deserter.

Action to be Taken and Forms to be Accomplished upon Apprehension or Surrender of a Deserter. Several factors determine the specific action necessary in various cases, such as:—apprehension or surrender at the same post at which desertion occurred, apprehension or surrender at a different post, length of time since desertion (under three months, over three but under six months, over six months, etc.) It will, therefore, be necessary for us to consider each case separately.

Apprehension or Surrender at Station from Which Deserted.

a. After Absence of Over Six Months.

(1) Confine the deserter.

(2) Report the fact of apprehension or surrender of the deserter to The Adjutant General, Washington, D.C. According to regulations this action is accomplished by completing W.D., A.G.O. Form No. 46 (Report of Apprehension or Surrender of a Deserter) (See Figure 1), and forwarding it, in triplicate, to The Adjutant General. The same

regulations, however, provide for a slightly different action when more than twenty-four hours will elapse between date of mailing of Form 46 and date of its receipt by The Adjutant General. This condition will exist in nearly every post, camp, or station, as few are near enough to Washington to permit dependable twenty-four hour mail service. The action taken in a case of this kind consists of immediate notification of The Adjutant General of the fact of apprehension or surrender of the deserter by radiogram or telegram, furnishing sufficient information to enable The Adjutant General to identify the deserter and his records. (See Figure 2). Form 46 is accomplished but only the duplicate and triplicate carbon copies are forwarded to The Adjutant General. The original of the form is retained for pasting in the Service Record upon its receipt from The Adjutant General, as required by paragraphs 13a and c, AR 615-300.

(3) Have the deserter examined by a medical officer to determine his physical condition and fitness for military service, as required by paragraph 18, AR 615-300.

(4) Enter the fact and data pertaining to the apprehension or surrender on Extract of Service Record, W.D. A.G.O. Form 25, for later transcription to the Service Record upon its receipt from The Adjutant General, as required by paragraph 14, AR 615-300.

(5) Upon receipt of the deserter's records from The Adjutant General, report the case, with or without formal charges, on W.D., A.G.O. Form No. 115, to the officer exercising general court-martial jurisdiction over the command in which the deserter is held. The facts of the case based upon examination of the records, the results of the physical examination, and compliance with the requirements of Article of War 70, will determine the necessity for formal charges on Form 115 or recommending action under Section VII, AR 615-360.

b. After Absence of Over Three Months but Under Six Months.

To be forwarded in triplicate.

REPORT OF APPREHENSION OR SURRENDER OF A DESERTER
(See AR 615-300)

SMITH, HOMER C. 0000000001
(Last name) (First name) (Middle initial) (Army serial number)

Private 150th Ordnance Company (MM)
(Grade) (Company, regiment, and arm or service)

April 1, 1941
(Date of desertion)

an alleged deserter, ~~was apprehended~~
at Fort Blank, Maryland, surrendered himself

on Oct. 8, 1941, and was returned to military control at Fort Blank, Maryland, on October 8, 1941.

by HENRY C. ADAMS, Capt., Ord. Dept.
Reward for apprehension ~~has~~ not been paid.

Wade R. Roth
WADE R. ROTH, Capt., Ord. Dept. Adjutant
Place Fort Blank, Maryland, Personnel Officer

Date October 8, 1941
1st End.

WAR DEPARTMENT, A. G. O., 19...

To Service record, individual clothing record, certified copies of extract of morning report, list of abandoned clothing, and evidence gathered at desertion are furnished herewith.

enclosures.

Headquarters... Adjutant General.

FIGURE 1

(1) Take action as indicated in paragraphs (1) to (5), inclusive, under a, above.

(2) Notify the local Quartermaster of the fact of apprehension or surrender of the deserter to enable clothing abandoned by the deserter and turned in to the Quartermaster at time of desertion to be held pending outcome of the case and possible return to the deserter if he is returned to duty. The local Quartermaster normally holds this clothing intact for a period of six months and then makes disposition thereof under the provisions of paragraph 24d, AR 615-40.

c. After Absence of Less Than Three Months.

(1) Take action as indicated in paragraph a, above.

(2) Notify local Quartermaster as indicated in paragraph b (2), above.

(3) Recall deserter's supplemental payroll from local Finance Officer as required by paragraph 5d (3) (a), AR 345-155. This payroll, submitted at time of desertion, is held for three months by the Finance Officer before taking action to settle the accounts, and must be recalled when a deserter returns to military control before the three months period elapses. The ultimate disposition of this supplemental payroll is covered in paragraph 5d (3) (c), AR 345-155.

Apprehension or Surrender at Station Other Than That From Which Deserted. The apprehension or surrender of a deserter at some station other than the station from
(Continued on page 124)

STANDARD FORM NO. 14A
APPROVED BY THE PRESIDENT
MARCH 10, 1926

TELEGRAM WRR/aba

OFFICIAL BUSINESS—GOVERNMENT RATES

THE ADJUTANT GENERAL
WAR DEPARTMENT
WASHINGTON DC

PVT HOMER C SMITH ASN NAUGHT NAUGHT NAUGHT NAUGHT NAUGHT NAUGHT ONE ONE
HUNDRED FIFTIETH ORD CO WHO DESERTED THE SERVICE THIS STATION ON APRIL FIRST
NINETEEN FORTY ONE SURRENDERED TO MILITARY AUTHORITIES THIS STATION OCTOBER
EIGHTH NINETEEN FORTY ONE PERIOD DUPLICATE AND TRIPLICATE COPIES WDAGO FORM
FORTY SIX FOLLOW BY MAIL END

SMITH
COMMANDING

OFFICIAL BUSINESS:

"I certify that the above message is official business and properly chargeable to official funds."

Henry A. Adams
HENRY A. ADAMS,
Capt., Infantry,
Adjutant.

FIGURE 2



Conducted by: J. E. Dempsey, 2nd Lt., Ord. Dept.

"EXPERIENCE IS A DEAR TEACHER!"

The readers of the articles appearing under this heading every month in THE ORDNANCE SERGEANT may have formed the opinion that the writers of these articles never made a mistake in any of their work, nor ever erred in judgment, and that the solving of their daily problems while on duty in the field in connection with supply administration was always the correct solution.

However confirmed you are in such an opinion, I wish to state that it is entirely erroneous, and that the instructors in this department at the Ordnance School have had their "ups" and "downs". They have had their ears "chopped off" any number of times for some wrong act, or error in judgment. Some were legitimate errors, while the only excuse for others was that the writers were in a mental tailspin, to which we are all subject at one time or another.

With a view to showing how much additional work is required to correct some foolish error heedlessly made, the article for this month will deal with a few mistakes of the writer over a period of years, and the "sweating" it took to get everything straightened out or explained away, with the hope that the men in the field will profit by these mistakes, and in an effort to prove that it is best to be careful and painstaking in all our work. A job done correctly takes less time than a job done wrong, which must then be corrected.

Several years ago the writer was supply sergeant of a battery of field artillery in Texas. While on maneuvers the battery camped one night in a dry creek bed at the foot of a range of hills. This creek bed was quite sandy, there was an utter absence of vegetation within it, therefore the menace of wood ticks, spiders, and what-not was practically eliminated. Altogether it appeared to be a wonderful selection for a camp site.

However, about 12:00 o'clock that night the heavens turned loose with a mighty downpour of rain. In addition to the rain that fell on the battery's camp, this creek bed was the natural drainage for the rain that fell on the sides of the hills. As a result we were really flooded out, and equipment of all kinds was washed away or covered up by

the debris. It fell to my lot to place all the equipment lost on account of the flood on a Report of Survey. Among the many items lost was a 100-pound anvil from the blacksmith's set of equipment, harness equipment galore, and kitchen equipment, in addition to the personal equipment of the men. I placed all the quartermaster equipment on one Report of Survey, and in the column "Date and Circumstances" I stated that the equipment listed thereon was washed away in the flood at such and such a place on the date the battery camped at this place. I then made out affidavits and certificates for the men to sign, stating that their equipment was actually in their possession on the night in question, and that it was washed away in the flood; that they had made every effort to recover it, and that a thorough search had been made, but that it could not be found.

After the battery commander had signed the Report of Survey and the certificates I had prepared for his signature, all the men for whom I had prepared affidavits, including myself, went to regimental headquarters and had the affidavits sworn to before the Adjutant. I then turned the Report of Survey over to the sergeant-major, and in due time it was sent to the surveying officer for investigation. He called me as the first witness, and almost immediately blasted me out of my shoes by telling me that although the Report of Survey was quite complete, and the testimony in the "Date and Circumstances" and in the affidavits showed quite clearly how the property was lost, if I expected him to believe that a 100-pound anvil could be washed away in a flood of that size, I was very much mistaken in my judgment of his intelligence. Furthermore, since this statement had been sworn to, there was a question as to the veracity of the rest of the testimony, for since this was obviously an incorrect statement, but had been sworn to, then perhaps I did not properly appreciate the importance of the statements made in an affidavit, so he was raising the question as to the creditability of the rest of the evidence.

I hastened to explain to the surveying officer that it was intended to say that the anvil had been covered up with debris as a result of the flood, and could not be found, and had not necessarily "washed away" in the flood. The sur-

veying officer thereupon handed me back the Report of Survey and told me to correct both it and the affidavits to read that way, and in the future to give greater attention to the wording of the evidence in the preparation of Reports of Survey, and have the evidence fit the facts rather than to fabricate facts to fit the evidence.

As a result, I had to make out another Report of Survey, rewrite four or five affidavits and certificates, have the battery commander sign the new Report of Survey, have the new affidavits sworn to, and then have the survey sent through the administrative channels for the purpose of being referred to the surveying officer for investigation. All this extra work on my part, the taking of the time of the men to report to the adjutant to have their affidavits sworn to, the administrative action of the headquarters personnel to send the Report of Survey to the surveying officer for investigation, and his added work in interviewing witnesses twice, could have been avoided if I had just taken a little more time, and thought of the consequences of testimony which stated that a 100-pound anvil was "washed away" and could not be found.

Thereafter I was particularly careful in "writing up" Reports of Survey. I stuck to the facts, and if there were any exceptions to the general statement, these exceptions were made a part of the Report of Survey, and a part of the affidavits submitted as evidence.

Another case which I well recall occurred while I was on duty as post ordnance sergeant a few years ago. It came time to submit the Ammunition Report on Form 87 to the Corps Area Ordnance Officer. I had been on duty at this station only a short time when this ammunition report was due, so I made up the report from the records I had in the Ordnance Office, that is, the stock record cards and the lot number cards. The receipts and issues, and the totals on hand, checked out very well; the report was signed by the Ordnance Officer and forwarded to the Corps Area Ordnance Officer.

About a week later the Ordnance Officer received a letter from the Corps Area Ordnance Officer, stating that the Chief of Ordnance had recently placed in "Grade 3" one of the lots of ammunition I had listed on my ammunition report. The Corps Area Ordnance Officer stated that he had dropped from his Consolidated report the amount of ammunition I had reported under this particular lot, and gave us procurement authorities and shipping instructions to ship this ammunition to a designated depot. The letter was turned over to me to get the shipment ready, and I went to the magazine where the ammunition was stored, but could not find any ammunition of this lot number. I did find ammunition of a lot number exactly 100 larger than the lot I was looking for. Then I started taking inventory and checking to find out what was the matter. I found that the shipping ticket covering the receipt of this ammunition showed the same lot number as the ammunition in the magazine, but that the lot number cards in the Ordnance Office showed a different number. In other words, the ammunition lot number was actually FA 438, while the lot number cards showed FA 338. This error was evidently made by my predecessor, for he was on duty there at the time the shipment was received. But, since an inventory should have been made of the ammunition on hand before the report was made out, and since I did not do this, but relied solely upon the records in the Ordnance Office in preparing this Ammunition Report, the responsibility for

the incorrect Ammunition Report rested on me, and not on my predecessor who had made an incorrect entry on the ammunition lot number card.

Needless to say, it took plenty of explaining to get this mistake of mine straightened out. An indorsement was made to the Corps Area Ordnance Officer's letter, informing him of the mistake in my ammunition report. Then he in turn had to initiate correspondence with the Office of the Chief of Ordnance to have this ammunition included on his consolidated report. All of this extra work, by several administrative offices, was caused because I did not take a little extra time to inventory the ammunition on hand, rather than base the report on records in the Ordnance Office. I do not know what entries were made on my efficiency report for that period, but I very much doubt if my efficiency was raised in the estimation of the Ordnance Officer under whom I was serving at the time.

Another case I distinctly recall is also concerned with ammunition. Some years ago I was in charge of the ammunition magazines, and responsible for the receipt, shipment, and issue of all the ammunition for the post at which I was stationed. We had rather large amounts of ammunition of all calibers on hand, due to the fact that this post was the summer training camp for the CMTC, ROTC, ORC, and the National Guard of three states.

One day, about the middle of the week, we received notice from the Corps Area Ordnance Officer that several lot numbers of caliber .30 ammunition, which we had on hand, had been placed in "Grade 3" by the Chief of Ordnance. This notice gave us procurement authorities for packing, handling, and shipment of this unserviceable ammunition to a designated depot, and further directed that the shipment be expedited. As a result of the expediting of this shipment, it was necessary to load the unserviceable ammunition on freight cars at the end of the week, and as we were not finished by Saturday noon the detail had to return on Saturday afternoon to complete the loading. The men were not in the best of humor, having to work on Saturday afternoon, and did not pay close attention when I told them which lot numbers of ammunition had to be loaded. Neither did they give any great attention when I pointed out the different stacks of ammunition to be loaded. I was busy supervising the loading of the different cars, and making sure that the right lot numbers of ammunition were loaded.

It was necessary that I delegate much of this supervision to a responsible man in each group.

We finally completed the loading of the cars, and the detail was relieved from work. I then went back to the Office and prepared shipping tickets covering this shipment, the loaded cars being turned over to the quartermaster for shipment. I made distribution of the shipping tickets as required for this particular type of shipment, made the entries on my ammunition lot number cards, and thought I had done a very creditable job of "expediting" the shipment.

The next week I had occasion to make an issue of Caliber .30 ammunition, and went to the magazine prepared to make the issue from the lot number of ammunition from which I was currently making issues. To my amazement I could not find this lot number of ammunition, and further investigation disclosed the fact that a lot number of similar

size, which had been placed in "Grade 3" and should have been shipped the preceding week, was still in the magazine. I then quite rightly came to the conclusion that my loading detail had loaded the wrong lot number of ammunition, and the fact that this shipment was then on the way did not add to my peace of mind. Here I was with the unserviceable ammunition still on hand, after having made a shipment of some 200,000 rounds of serviceable ammunition. The freight cost of shipping this ammunition for a distance of some 200 miles amounts to a considerable sum of money, and I could very easily imagine myself footing this freight bill, due to my making an incorrect shipment of ammunition.

I could not bring myself to tell the Ordnance Officer what I had done, so I carried this burden around with me for three or four days without telling anyone about it.

On about the fourth day after I had discovered the error, the Ordnance Officer received notification from the Corps Area Ordnance office that certain additional lot numbers of caliber .30 ammunition had been placed in "Grade 3" by the Chief of Ordnance, and if any ammunition of these lot numbers was on hand at our station, to ship the ammunition to a designated depot. Imagine my relief when I checked through the letter and found that the lot number of the ammunition I had erroneously shipped was included in the list of "Grade 3" ammunition. Then I broke down and told the Ordnance Officer all the details of my incorrect shipment. All I had to do in this case was make corrected copies of the shipping tickets to cover the original shipment, substituting the lot number of the ammunition actually shipped for the lot number of ammunition which should have been shipped.

I felt that I got out of this case quite easily, but please try to visualize the mental burden I carried for four days, racking my mind for a plausible reason for making this wrong shipment of ammunition. I resolved then and there that I would not in the future depend on the Chief of Ordnance placing ammunition in "Grade 3" for my personal convenience to bring me out of the doghouse. And furthermore, I resolved that any shipments I made in the future, even though they required "expediting", would be made more with an intention of making a "correct" shipment than the "expediting" of a shipment. The fact that my detail was so large that I could not properly supervise the loading of all cars, from all stacks of ammunition, could possibly be considered a plausible excuse, although a very lame one. "Haste makes waste" was never more forcibly brought to my attention.

I recall another case while I was stationed at a manufacturing arsenal, on duty as sergeant-major. An equilibrator on one of the machines in the shop collapsed during the night, and as a consequence the machine fell and broke beyond repair. It was necessary to transfer this machine from the historical record to the stock record account, and then place the machine on a Report of Survey. Since the Shop Officer was the only person who knew a great deal about the machine becoming unserviceable, he was the only witness. It was my duty to prepare the Report of Survey for the signature of the Shop Officer. Because the Shop Officer's office was in another building and some distance from the Adjutant's office, it would be necessary that he make a special trip to the Adjutant's office for the purpose of swearing to the affidavit on the bottom of the Survey Form, I thought it would be a good idea if I were to change the "affidavit" on the survey form to a "certificate",

and in that way I could send the Report of Survey to the Shop Officer by messenger. He could sign it and send it back by messenger, thus avoiding making a special trip to the Adjutant's office just to swear to a Report of Survey. The Shop Officer signed the "certificate" which I had changed from the "affidavit" form, signed the accompanying certificate marked Exhibit "A", and returned the Survey to my office, where it was referred to a surveying officer who made his findings and recommendations. He recommended that the accountable and responsible officer be relieved of accountability and responsibility for the property listed on the Report of Survey, and that the damaged machine be turned in for salvage, these findings and recommendations being approved by the commanding officer. Proper distribution was then made of the copies of the Report of Survey, the property was dropped from accountability, and the case practically forgotten.

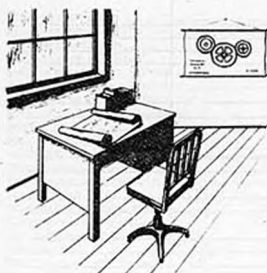
About two months later a communication was received from the Chief of Finance, Washington, D. C., enclosing the copy of the Report of Survey which had been transmitted to that office. The Report of Survey was returned without the approval of the Secretary of War for the reasons that the affidavit on the Report of Survey had been changed to a "certificate", that there was no evidence submitted in the form of an affidavit, and that a certain Act of Congress governing the relief of accountable or responsible officers for property lost or damaged states that responsible officers must "rely on evidence, part of which must be in the form of a sworn statement to be relieved of responsibility for the loss or damage to property in their possession". Since no affidavits were submitted with the Report of Survey, but only a certificate of the responsible officer, and the survey form had been amended to make the "affidavit" a "certificate", this Report of Survey did not meet the legal requirements on which a responsible officer could be relieved of responsibility.

As a result of this, it was necessary to make out a new Report of Survey, have the Shop Officer swear to the affidavit, refer the survey to a surveying officer, and go through all the other administrative acts necessary to complete the action on the survey. So instead of avoiding one trip to the Adjutant's office for the Shop Officer, I had just complicated matters, and caused about four times the work ordinarily required to complete a survey. This should prove to us that what we might at first think to be a "short cut" in supply administration often turns out to cause both our own office and the higher administrative offices a lot of unnecessary work.

The writer could continue with similar cases where thoughtlessness or carelessness in apparently very minor details can cause a great deal of grief and plenty of correspondence in order to explain away our errors. It is hoped that this confession of past sins will make the readers of this article more careful in the everyday work they are doing, and that it will impress upon them a proper appreciation of the necessity of giving their thorough attention to all the details of their work, however unimportant these details may seem at the time.

★★★★★★★★★★★★

Are you a photographer; are you a writer; or do you have friends in the Ordnance Department who are photographers or writers? Do your bit for THE ORDNANCE SERGEANT, and help it produce BIG results.



THE ORDNANCE SHOP

Conducted by: R. N. Rollason, Technical Sergeant, Ord. Dept.

THE MEDIUM MAINTENANCE COMPANY -- IT'S MISSION AND ORGANIZATION

ARTILLERY AND AUTOMOTIVE SECTION

The two officers and fifty-seven enlisted men of this section are divided into two functional units to facilitate inspection and repair of all artillery materiel and Ordnance vehicles of the organizations which it serves. Under certain conditions it may be called upon to service any motor vehicle in the organizations which it serves. AR 850-15 gives information concerning this.

In charge of the artillery unit is a 1st Lieutenant, whose duties include the supervision of all maintenance and repair work on artillery materiel, responsibility for the maintenance of records and stock levels, and the determination of work priority. The staff sergeant in charge of the artillery repair and spare parts trucks allocates and supervises the work of his eight mechanics. His group is charged with maintenance and repair of artillery materiel in the shop. Field inspections are the responsibility of the sergeant in charge of the emergency repair truck and his two mechanics. All records of inspections are maintained by this sergeant. The rigging and labor crew of thirteen

men are in charge of a corporal. They are responsible for the safe rigging of all hoisting, and the moving of materiel.

The personnel of the automotive unit are organized in essentially the same manner with corresponding duties. The 1st Lieutenant in charge of the unit has as his assistant a technical sergeant in charge of the automotive repair, wrecking, and spare parts trucks. Working with these trucks are fourteen privates. A sergeant and six privates handle field inspections with the emergency repair trucks. The labor detail of eight privates is in charge of a corporal.

For the maintenance of records of inspection and repair of artillery materiel, certain forms are suggested. Inasmuch as artillery weapons are usually inspected one at a time, the forms have been designed to cover the inspection of a single weapon. Directions for inspection procedure are contained in technical manuals pertaining to the various weapons. The forms shown on the following pages are self explanatory.

For the inspection of automotive vehicles WD QMC Form 26, "Technical Inspection Report of Motor Vehicles," is used. Technical manuals on tanks and combat cars, FM 25-10, AR 850-15, and Field Artillery School publication Mat - 58R, contain information regarding inspection and maintenance of automotive materiel.

INSPECTION OF ARTILLERY MATERIEL

37 mm. GUN MATERIEL, M1916 - M1916A1

Organization _____ Date _____

Gun No. _____ Carriage No. _____ Recoil Mech. No. _____

Parts Inspected	Condition	Action
Barrel		
General Condition		
Properly lubricated		
Condition of bore		
Breech housing		
Jacket shoe		
Front clip		
Breech mechanism		
Trigger		
Sear and sear plunger		
Striker rod and spring		
Rocker and plunger		
Firing pin and spring		
Gun book		
Carriage		
General condition		
Cradle		

Properly lubricated		
Recoil Mechanism		
Piston cross-head key		
Axle lock stop		
Axle and wheels		
Trails		
Pintle		
Pintle socket		
Elevating mechanism		
Traversing mechanism		
Sight		
Modifications		

INSPECTION OF ARTILLERY MATERIEL

Star Gage Record of Gun 37 mm, Model 1916

After _____ Rounds

Inches from Muzzle	Lands 1.4567 + .002-.001	Grooves 1.4882 + .000-.004	Inches from Breech	Chamber		No. _____
				Required + .006-.000	Actual	
1/8			3	1.569	1.	Manufacturer
1			3.5	1.5655	1.	Year
2			4	1.562	1.	
3			4.5	1.5585	1.	
4			5	1.555	1.	Serviceable

5		1.5515	1	
6		1.504	1	Nonrecoverable
7		1.504		
8		1.504	1	
9				Gaged by:
10		Clearance between face of		
11		Reach Block and face of		Date
12		tube	inch	Rings used
13				
14			Remarks	
15				
16		Advance of forcing cone (vert. inch - 20" allow		
17		as measured with gage, (Hor inch 20" allowed		
18		as measured using projectile inch .25 in. "		
19		Condition of origin of rifling		
20		Lands-Torn-Scored-Roughened, for		
21				inch
22				
23		Washed out for		
24			inch	
25		Grooves roughened for		
26			inch	
27		Pitting.		
28				
29				
30				
31		Erosion - Normal - Abnormal		
32				
33				
34				
35				
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INSPECTION OF ARTILLERY MATERIEL

75 MM GUN MATERIEL, M1897 - M1897M2

Organization _____ Date _____

Gun No. _____ Carriage No. _____ Recoil Mech. No. _____

Parts Inspected	Condition	Action
General Appearance		
Breech Mechanism		
Threads for burrs		
Safety piece		
Percussion hammer		
Breech block latch assembly		
Operating handle assembly		
Firing Pin		
Extractor mechanism		
Safety bolt assembly		
Barrel		
Visual inspection		
Pastilles (Limits (3) three)		
Chamber		
Advance of forcing cone (Limit .25)		
Star gauging (Limit .025" Oversize)		
Leveling plates		
Piston rod cushion		
Clearance between jacket rollers and lever roller path (must be .004" or more)		
Jacket roller		
Bearing jacket Roller		
Jacket slides		
Clearance between jacket cross piece and upper roller path (must be less than .004")		
Wear of sweeper guide (Not to exceed .06")		
Muzzle rollers		
Modifications		
Gun Book		
Recoil Mechanism		
Nitrogen pressure		
Friction of floating piston (Limits min. 10KG, 15 KG Nor. 30KG Max)		
Friction of piston, piston rod and piston rod stuffing box. (Limits: 40 KG Min. 48 KG Nor. 60 KG Max.)		
Three readings		
Stuffing box head threads (Min. width .040")		
INCLINE PLANES (WEAR)		READING
Distance from rear end of recoil mechanism	Normal depth	Right Left
20.16	.2747 + .01	
20.16	.2363 + .01	
32.16	.1979 + .01	
58.16	.1595 + .01	
44.16	.1211 + .01	
50.16	.0827 + .01	
56.16	.0443 + .01	
60.16	.0187 + .01	
Roller path		
Coupler and coupler key		
Piston rod stop washer		
Filling and drain valve		
Oil index and packing		
Respirator		
Trunnions (Dia. limits 2.0433" Max. 2.008" Min.)		

CARRIAGE

Elevating mechanism		
Range rack and guides		
Elevating yoke and bearings		
Elevating screw and pin		
Elevating nut and collar (Limits .040" clearance between collar and nut)		
Angle of sight mechanism		
Handwheel latch		
Lost motion (Limit 1/3 turn of handwheel)		
Traversing mechanism		
Lost motion (Limits 1/4 turn of handwheel)		
Hooker		
Trunnion bearings, caps		
Axle brackets		
Axle		
Wheels		
Shield		
Brake mechanism		
Trail		
Hydrite		

HIGH SPEED ADAPTER

Tires		
Brake mechanism		
Drop hub assembly		
Wishbone assembly		
Sighting equipment		
Elevation error (Limit - 3 Min)		
Deflection error (Limit - 2 Mils)		

INSPECTION OF ARTILLERY MATERIEL

75 MM PACK HOWITZER M2

Organization _____ Date _____

Gun No. _____ Carriage No. _____ Recoil Mech. No. _____

PARTS INSPECTED	CONDITION	ACTION
BARREL		
Bore		
Chamber		
Forcing cone		
Breech Mech.		
Firing Mech.		
Gun Book		
RECOIL MECHANISM		
Nitrogen pressure		
Friction of floating piston		
Friction of piston rod and stuffing box		
Filling valve		
Oil index		
Recoil cylinder rear head		
CARRIAGE		
Top sleigh		
Bottom sleigh		
Piston rod latch		
Rockers		
Elevating mech.		
Traversing Mech.		
Axle and wheels		
Front trail		
Equilibrator Mech.		
Rear trail		
SIGHTING EQUIPMENT		
Panoramic telescope		
Telescope mount		
Elevating mech.		
Deflection mech.		
Gunnery quadrant		
Angle of site mech.		

INSPECTION OF ARTILLERY MATERIEL

155 MM GUN

Organization _____ Date _____

Gun No. _____ Carriage No. _____ Recoil Mech. No. _____

PARTS INSPECTED	CONDITION	ACTION
Erosion and burrs in the bore		
Deformation of rifling at origin		
Star gauging		
Bore impressions		
Breech mechanism operation		
Burrs on breech threads		
Primer holder		
Obturator spindle plug		
Gas check pad		
Split rings and filling in disk		
Counter balance		
Open joints between hoops		

Nitrogen pressure		
Floating piston friction		
Combined friction		
Functioning of recoil mechanism at last firing		
Functioning of replenisher		
Functioning of oil index rod		
Free operation of elevating mechanism		
Lost motion in elevating mechanism		
Free operation of traversing mechanism		
Lost motion in traversing mechanism		
Clearance between top and bottom carriages		
Lubrication		
Condition of oil holes		
Gun axle springs		
Road brakes		
Wheels		
Limb		
Spades		
Bolts and rivets		
Sights and sight alignment		
Painting		
Modifications		
Remarks		

INSPECTION OF ARTILLERY MATERIEL

155 MM HOWITZER MATERIEL M1917 and M1918

Organization _____ Date _____

Gun No. _____ Carriage No. _____ Recoil Mech. No. _____

PARTS INSPECTED	CONDITION	ACTION
Bore		
Chambers		
Gas check seat		
Gun body opening at joint		
Clips		
Breech block and gear tests		
Rack		
Spindle		
Split rings		
Filling in disc		
Gas check pad		
Block carrier		
Operating lever and catch		
Block safety latch		
Firing mechanism		
Any other parts		
Operation of mechanism		
Condition of cradle slaps as to scoring or defects		
Piston rod lock mechanism		
Recoil indicator		
FIRING MECHANISM		
Condition		
Operation		
TRAIL		
Riveting		
Trail box		
Handspike		
Accessory fastenings		
Traveling lock mechanism		
Spade		
Spade latch		
Float		
Lunette		
ELEVATING MECHANISM		
Condition		
Lost motion		
TRAVERSING MECHANISM		
Condition		
Lost motion		
Axle traveling lock		
Shield and hood		
WHEELS		
Hub bolt nuts		
Tight		
Play on axle		
Tires		
BRAKE MECHANISM		
Condition		
Operation		
RECOIL MECHANISM		
Recoil cylinders emptied and buffer and counter recoil cylinder rods and cylinders inspected for scoring and defects		
Condition of all interior parts		
Liners		

Dormant packers		
Oil lubricators		
Springs		
Rubber packings		
Leakage if any at cylinder heads, filling plugs, and all stuffing boxes, etc.		
Action of recoil mechanism during last previous firing		

AIR PUMP

Operation		
Condition		

LIQUID PUMP

Operation		
Condition		
Compressed gas reservoir		
Filling pipes		
Pressure gauges		

SIGHT

Condition		
Verification		
Error		

Any loose rivets in carriage		
Paint		
Lubrication		
Tools and accessories		

STAR GAUGE RECORD

H.D. of C.B.,
Date _____

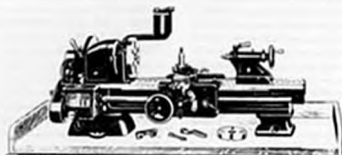
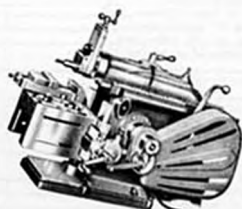
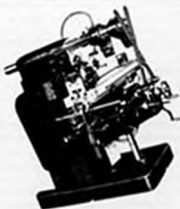
BATTERY

Caliber	Model	Tactical No.
Mfr.	Serial No.	Yr. of mfr.
No. or rds. fired to date		Distance of forcing cone from
Face of breech	REMARKS	

Dist. fr. muzzle (in.)	Error of diam. (in/1000)	Dist. fr. muzzle (in.)	Error of diam. (in/1000)	Dist. fr. muzzle (in.)	Error of diam. (in/1000)	Dist. fr. muzzle (in.)	Error of diam. (in/1000)
0	26	172	258	0	26	172	258
2	28	174	260	2	28	174	260
4	30	176	262	4	30	176	262
6	32	178	264	6	32	178	264
8	34	180	266	8	34	180	266
10	36	182	268	10	36	182	268
12	38	184	270	12	38	184	270
14	40	186	272	14	40	186	272
16	42	188	274	16	42	188	274
18	44	190	276	18	44	190	276
20	46	192	278	20	46	192	278
22	48	194	280	22	48	194	280
24	50	196	282	24	50	196	282
26	52	198	284	26	52	198	284
28	54	200	286	28	54	200	286
30	56	202	288	30	56	202	288
32	58	204	290	32	58	204	290
34	60	206	292	34	60	206	292
36	62	208	294	36	62	208	294
38	64	210	296	38	64	210	296
40	66	212	298	40	66	212	298
42	68	214	300	42	68	214	300
44	70	216	302	44	70	216	302
46	72	218	304	46	72	218	304
48	74	220	306	48	74	220	306
50	76	222	308	50	76	222	308
52	78	224	310	52	78	224	310
54	80	226	312	54	80	226	312
56	82	228	314	56	82	228	314
58	84	230	316	58	84	230	316
60	86	232	318	60	86	232	318
62	88	234	320	62	88	234	320
64	90	236	322	64	90	236	322
66	92	238	324	66	92	238	324
68	94	240	326	68	94	240	326
70	96	242	328	70	96	242	328
72	98	244	330	72	98	244	330
74	100	246	332	74	100	246	332
76	102	248	334	76	102	248	334
78	104	250	336	78	104	250	336
80	106	252	338	80	106	252	338
82	108	254	340	82	108	254	340
84	110	256	342	84	110	256	342

The forms shown here are not available for distribution, but must be procured, or reproduced, locally. They are offered here simply as a guide in the preparation of useful forms.

THE MACHINE SHOP



Conducted by: L. Kaldizar, Master Sergeant, Ord. Dept.

TRAINING THE ORDNANCE MACHINIST

TEAMWORK -- A BASIC FUNDAMENTAL

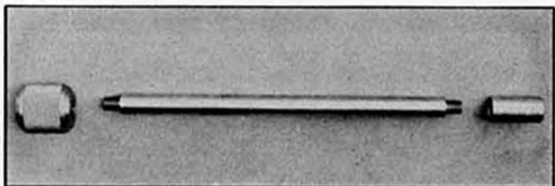
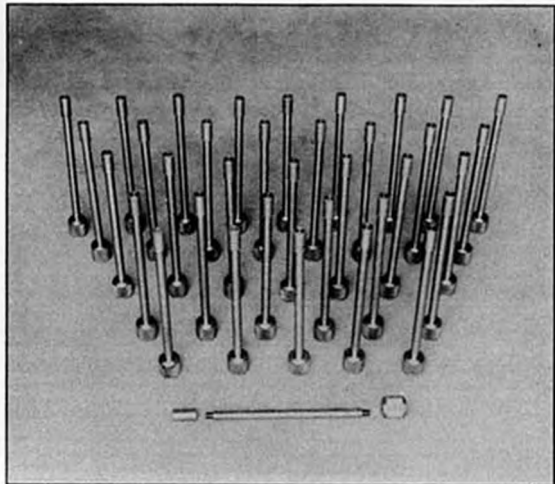
The field operations of a Maintenance Company require an organization of trained personnel capable of co-operating and performing their various duties in accordance with the functional training they have received. Recognizing this as an accomplished fact, the scope of the machinists course at the Ordnance School is governed and guided toward that end.

To physically accomplish this end the students are grouped, given an intensive course of training, and individually they attain the standards required of the Ordnance Machinist. Peculiar to the machinist trade is individuality; the student or machinist will operate the machine and produce work as an individual. His training is such that while early in his course he is closely supervised, but this supervision becomes less as he progresses and gains skill. As previously mentioned, the student is urged to think for himself and exhibit a certain amount of initiative. All of this serves the admirable purpose of producing a reasonably trained individual in the time allotted.

However, this part of our endeavor is only the beginning; any military success can be won only by absolute teamwork of all concerned. Our individual trained as a machinist must have his horizon broadened in order to perceive the ultimate objective - Teamwork - a basic fundamental, just as important to the ordnance man as it is to the combat soldier. A description of the method available to the machine shop to emphasize this principle follows.

A simple application problem was selected which required bench and lathe operations, but did not require training beyond that which the students had already received. The class at this time had been undergoing training for one month. The practical problem shown below is a knock-out bar, the exploded view shows the components and the other

view shows the assembly. It is used to remove the live center, or any attachment that is seated in the headstock spindle nose of a lathe.



The purpose of the problem was brought up during the weekly conference of instructors; the knock-out bar was selected because there were only a few on hand, none on order, and to stop the wastage of time by students in

hunting for the ones available. Detail master operation sheets were drawn up and distributed to all instructors, showing sequence of operations, number of machine and hand tools required, inspection stations, and an estimate of time for each operation. The tool crib was furnished a copy in order to prepare material and assemble tools. Students were assembled in class, and the problem and its purpose introduced, with emphasis placed on the fact that the individual skill and knowledge to produce this knock-out bar was merely a means to an end, that end being teamwork.

The thirty students present were divided into three groups, each group acting as a team under its instructors. Each team was to complete twelve assemblies, the three teams to compete against time and quality of work produced. Instructors assembled their groups, and with the master operation sheet as a guide, assigned detail operations to each student. Free hand sketches were made by each student of his particular job, and used by him as a guide in producing the work. Individuals, while working, were closely observed in order to detect any tendency, while under competitive conditions, to degenerate and backslide into the "salt water" class of machinists.

Production was started early in the morning and moved along smoothly and somewhat faster than estimated time. Supervision of individuals was very limited, as the instructors were inspectors of work in their groups. Definite limits and tolerances were adhered to, and rejected work was returned to the operator. Early that afternoon all thirty-six of the bars were completed, assembled, inspected and accepted. Actual working time expended by the three teams amounted to eleven hours, thirty-five minutes. This produced one bar every nineteen minutes, three seconds. Man-hours of labor totaled 117 hours, 30 minutes, for the entire class. This latter figure shows that each individual working in a team, required only three hours, sixteen minutes, to produce one bar. A total of thirty-six separate operations and five inspections were required from rough stock to finished tool. Working as individuals without the benefit of teamwork would have required the expenditure of two to two and one-half days per student to produce the same result. Students were reassembled in class, with the knock-out bars on hand as concrete evidence that TEAMWORK is a basic military fundamental.

To conclude this article, it might be mentioned that one other objective was in view; the desire to honestly examine ourselves as instructors, to see whether or not we were able to direct effort in order to produce results, and to satisfy ourselves that we are instructors, which the final analysis means ability to teach and impart knowledge to others.

"MACHINE SHOP NOTES"

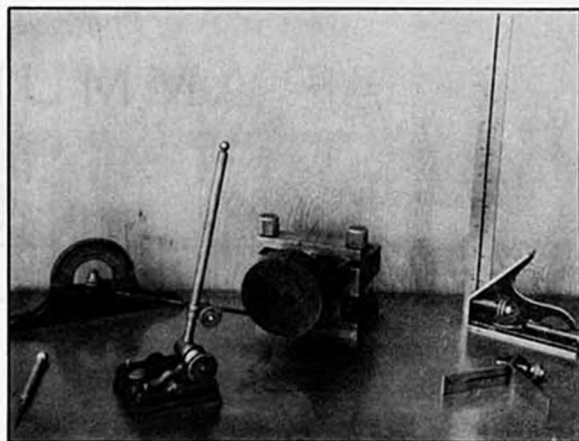
(Continued from the July issue)

By R. N. Rollason, Technical Sergeant, Ord. Dept.

(The material for Section III, Simple Layout, was compiled by D. P. Patterson, Pvt., 40th Ord. Co.)

Section III - Simple Layout.

There are many contributing factors that must go into a job to bring about a final product that is tops in work-



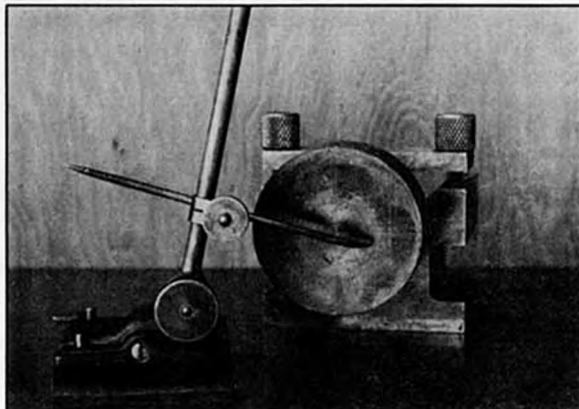
manship in any machine shop. All the factors combined make the final product possible and all are of equal importance.

One of these factors, and usually the first operation on a job, is "layout" or the transfer of a pattern from a print or drawing to a piece of stock, in the guise of lines, cross-lines, circles, and radii scribed or drawn on a background of some suitable applied colored material such as chalk or layout dye. These lines then form a pattern on the metal surfaces, either curved or flat, rough or finished, for the machinist to follow in his ensuing operations. Layout is valuable in drill press, shaper, planer, and milling machine work.

The layout, to be of any value, must conform to certain rules. First, it must fit the job on hand. If the job is a rough casting it need not be kept to thousandths tolerances, but must be drawn to give the machinist enough leeway if the casting is skimpy. If the layout is drawn on a finished surface it should be drawn accurately. With care, lines can be placed within a few thousandths of an inch. Third, the lines should be drawn clearly and distinctly and in such a manner that they will be preserved throughout the ensuing operations.

Only a few ordinary tools are really necessary to layout a job successfully. First, a bench plate or surface plate, which is a cast iron plate of any convenient size, ma-

(Continued on page 133)





Conducted by: L. I. Dance, Master Sergeant, Ord Dept.

NOTICE

The article on Depot operation which was scheduled to appear in this issue of the Ordnance Sergeant has been postponed pending the printing of FM 9-6. This publication should be in the hands of troops at an early date.

NOTICE

-NOTES-

The projectile described and shown hereon has recently been standardized for antitank use. There has also been a 3" Armor Piercing Shot standardized for antitank use in 3" AA guns. The shot is designated M62. It is identical to the M61 for the 75-mm guns, except for caliber.

COMPLETE ROUND, ARMOR PIERCING SHOT, M61, for 75-mm guns.

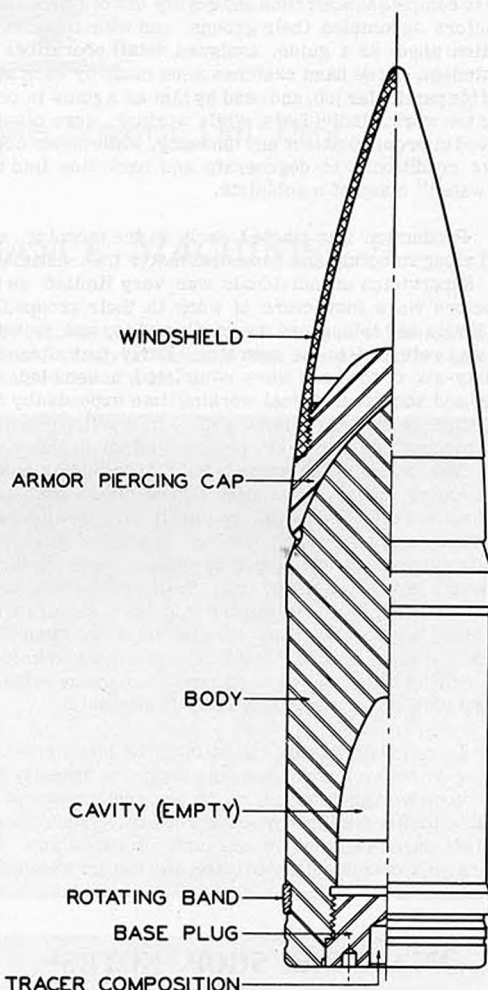
AP Shot, M61, complete. The components of the complete round consist of the M61 shot and the M18 cartridge case containing an M31 primer and a loose supercharge loading of the standard FNH propelling charge. No fuze or booster is used as there is no explosive in the projectile. The components of the round which differ from the round of HE shell, M48, are the projectile and the propelling charge. In the following paragraphs, only these components will be described.

Projectile, AP, M61. The body of this projectile contains a cavity that is closed with a base plug. This base plug contains a tracer composition that is ignited by the propellant. To the nose of the body is soldered a mild steel armor piercing cap to which is screwed a die-cast ballistic cap or "windshield" of aluminum alloy. The overall length of the projectile is 13.22 inches and it is painted black from the nose to the rotating band. It may be possible to convert this projectile to an explosive type by filling the cavity with a high explosive and substituting a base fuze for the present tracer carrying base plug.

Propelling charge. The propelling charge consists of FNH powder accurately weighed and poured loosely into the case in only one weight. The nominal weight is about 2 pounds, the exact weight being determined by proving-ground tests. This is the same as the supercharge loading for the M48 HE shell.

Charge Total weight of Muzzle velocity Pressure (lbs.
charge (pounds) (Feet per second) per square inch)

Super.....2.00.....1,950.....33,800



PROJECTILE, A. P., M61



AVIATION ORDNANCE

Conducted by: H. M. Randel, 2d Lt., Ord Dept.

THE DEVELOPMENT OF AIRCRAFT BOMBS

(Continued from the July issue)

This, the third and last article of our current series dealing with the history and development of aircraft bombs, will be devoted to incendiary bombs, which we merely mentioned last month, and European bombs.

INCENDIARY BOMBS

The war-time use of incendiaries has long been known. Centuries ago, back in the days of bow and arrows, the use of the "flaming arrow" was well known. This crude incendiary "bomb", an arrow with its point wrapped in an inflammable substance, set fire to many an enemy's stronghold, and undoubtedly made many of the great episodes in history which we so casually overlook today.

Another interesting era with its particular version of incendiaries, was that of the armored knights of the Medieval Era. During this period of time the flaming arrows of the defenders did little to the metal covered soldier and his metal clad steed. These metal coverings were flexible however, and it was not long before boiling lead and boiling oils were sent down from the battlements to literally burn out the enemy from his cover, since these seething liquids flowed freely past every joint in the metallic shields used by the soldiers of that era.

The arts of war changed as man became more civilized, and fire and flame faded into the background, as powder and projectiles came into the "limelight". And then our histories relate how man conquered man by killing him, not by burning him or his house. Of course, powder plants were destroyed and the enemy's property was burned, but most of these acts were done by saboteurs, not by the intelligence of man to devise a fire bomb to be dropped from the air.

Then came World War I. Man had the aeroplane, and man had the explosive bomb to destroy his enemy's buildings--why shouldn't he have a fire bomb to burn them? And thus man's ingenuity gave birth to another fiendish invention--the aerial bomb of fire.

The French developed an incendiary bomb known as the "Chanard" bomb. This bomb was one of the most widely used incendiary bombs of the first World War. The bomb body consisted of an extremely thin metal case, streamlined to lessen wind resistance. The filler of this bomb may be divided into two parts:

1. A highly inflammable mixture composed of nitrate, cellulose and resin.
2. Three charges of a Thermit composition which gave the bomb an extremely high burning temperature.

Extending through the center of the bomb body was one of the three Thermit charges. This charge insured the complete ignition of the inflammable mixture of nitrate, cellulose, and resin. The other two Thermit charges were located on opposite sides of the bomb body. These two charges served to cut the bomb in half, so that the inflammable mixture inside of the bomb could spread itself about the target, and thereby insure positive ignition of the target, providing the target was constructed of some combustible material.

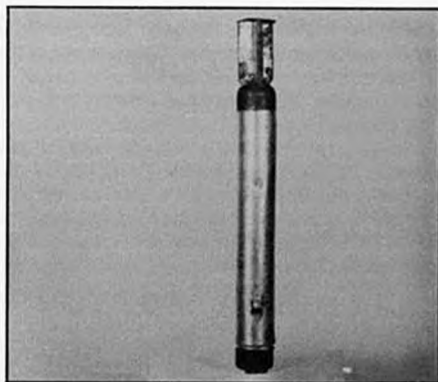
The "Chanard" bomb was fuzed with an arming vane tail fuze. As the bomb was dropped, the arming wire was withdrawn from the fuze, permitting the rotation of the arming vane. After the arming vane had rotated for approximately five seconds, a spring impelled firing pin was released which struck a primer. The flash of the primer ignited a powder train which burned for approximately five seconds, and then flashed into a powder igniting charge. This igniting charge ignited the inflammable nitrate, cellulose and resin mixture, and the three Thermit charges. Thus, approximately ten seconds after release, the "Chanard" bomb burst into flames, the bomb itself shortly thereafter broke into two parts, and each of these parts combined the intense heat and melting power of a Thermit charge and the spreading ability of the inflammable mixture of resin, nitrate, and cellulose.

Another interesting incendiary bomb used by the Allies of the World War I era, was the 8-oz. incendiary bomb Mk I. This bomb was constructed of a tin tubular body approximately 1 inch in diameter and 8 inches in length. At one end of this tubular body a steel plug was crimped into position, and this plug had a small firing pin located in its center. The other end of the tubular body was closed



Photograph of the 8-ounce Mk I Incendiary Bomb of the World War. Note the heavy steel nose plug with the firing pin in its center. The 12-gauge shot gun shell filled with Thermit is resting on the two tin "ears", a close-up of which is shown below.

by a small metal cap, on which was soldered four fins to stabilize the bomb in its flight. Placed within this tubular body, resting on a pair of "ears", was a twelve-gauge shot gun shell containing a primer, a small igniting charge, and a charge of Thermit. The weight of the nose plug and the



A close-up of the 8-ounce Mk I Incendiary Bomb. Note the "ear" punched into the side of the bomb body, on which rests the shot gun shell containing the Thermit charge.

stabilizing effect of the fins usually caused the bomb to fall vertically. Upon impact with the target, the inertia of the shot gun shell bent back the tin ears and caused the primer to be functioned against the firing pin. The Thermit was then ignited, and the combined action of the primer, the igniter charge, and the Thermit, blew off the fin assembly of the bomb permitting the burning Thermit to shower itself about the target, setting fire to any inflammable composition with which it came in contact.

We had two interesting ways of releasing these bombs. The first was by means of vertical tubes within Allied bombers or other aircraft. These tubes were capable of carrying approximately 250 of these 8-oz. incendiary bombs. As the aeroplane flew over the target the

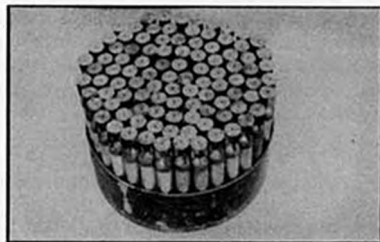
bottom of the tube was opened and the bombs "poured" forth, giving a wide amount of dispersion. The second, and probably the more interesting method of release for these particular bombs, was our World War I version of the Molotov's Breadbasket".



A photograph of the bomb body which held approximately 300 of the 8-ounce Mk I Incendiaries. Note that this bomb body is in two halves, the halves being held together by three metal lugs. At the right one half of the bomb body is removed to show the packing of approximately 150 of the 8-ounce Mk I Incendiaries.

This bomb body consisted of two half shells, the two parts of which were held together by two wire "belly bands". These bands had eyelets on each end and after the bomb body had been filled with the small 8-oz. incendiaries, the two parts were placed together and the "belly bands" looped around the body. The eyelets were placed in the metal clips shown at each end of the bomb body and the arming wire run through the eyelets, securing the bomb body together.

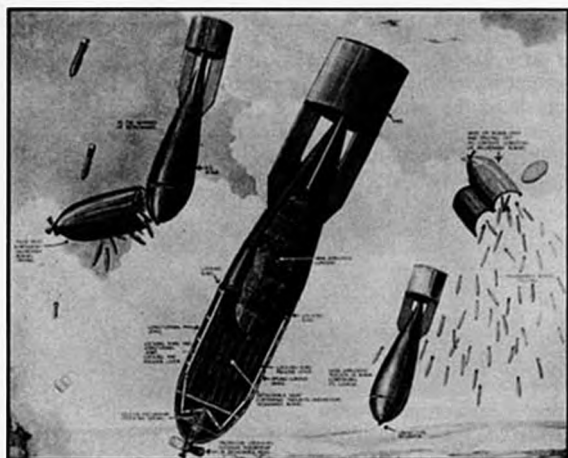
The bomb itself contained approximately 300 of the 8-oz. incendiary bombs. The large bomb was suspended from the bomb racks in the same manner as was a demolition bomb. Upon release from the rack, the arming wire was withdrawn, and the bomb fell, the two halves opening



One of the packing trays containing approximately 100 of the 8-ounce Mk I Incendiaries.

as it fell. As the bomb opened, the incendiaries fell out or were forced out by three wires within the bomb body. This type of bomb gave the individual incendiaries a great deal of dispersion, and was probably the germ of the idea of "Molotov's Breadbasket".

As the war developed, man developed his ambition for more complete destruction, and thus, out of this development, came the 40-pound Mk I incendiary bomb of the



An artist's conception of the Russian "Molotov's Breadbasket or Cocktail". The idea shown in this drawing is one of two that the Russians have used. The Russians have also used a huge bomb body with the tail fin assembly so twisted that the bomb will spin in the air. After a specific length of time has passed, a clockwork fuze arrangement opens the sides of the bomb, and the spinning motion throws outward hundreds of small incendiary bombs which were attached inside of the huge bomb body.

scatter type, and the Mk II, 40-pound incendiary bomb, of the intensive type.

The 40-pound Mk I incendiary bomb consisted of a sheet metal case divided into three compartments. In the larger of the three compartments, approximately 19 pounds of cotton waste or burlap, in the form of small balls, were placed. This waste or burlap was thoroughly soaked in either turpentine or oil. In each of the smaller compartments, separated from the inflammable waste by a very thin metal diaphragm, was a charge of black powder.

The bomb was equipped with either a nose or tail fuze. The nose fuze, which was to be used if extremely rapid action was desired, consisted of a firing pin and a primer. Upon impact with a target, the firing pin was driven into the primer, whose flash in turn ignited the black powder, which burst the bomb, scattering the flaming balls of inflammable material about the target.

The tail fuze was almost as simple, consisting of a firing pin, a spring, and a .30 cal. service cartridge. This fuze was to be used if the radius of scatter for the inflammable material was to be a maximum. Upon impact, the firing pin, which was held away from the primer of the .30 cal. service cartridge by a light spring, was driven into this primer. This ignited the propelling charge of the cartridge, sending the bullet through the length of the incendiary bomb, rupturing both thin metal diaphragms, and igniting both powder charges simultaneously. This simultaneous ignition of both the nose and tail powder charges burst the bomb case, and gave the inflammable material the greatest amount of scatter.

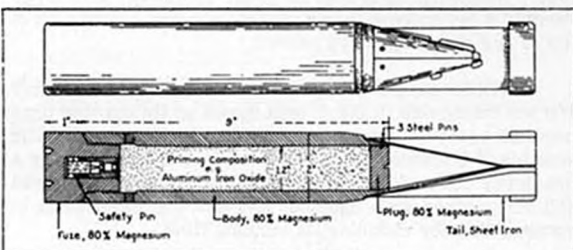
The Mk II bomb was designed to set almost any inflammable target afire, and to do a most complete job of it. The bomb consisted of a thin metal case divided into three compartments. At the nose end of the bomb there

was a compartment containing approximately 16 pounds of oil emulsion. In the central section of the bomb, a small compartment contained a charge of black powder, and in the tail end of the bomb a compartment contained approximately 10 pounds of Thermit. The bomb was functioned by a tail fuze.

Upon impact with the target, the firing pin, held away from the primer of a cal. .30 service cartridge by a light spring, was driven into the primer. The bullet from the cartridge went through the length of the bomb rupturing all compartments and igniting the black powder charge. The ignition of the black powder charge split the bomb open, and ignited both the Thermit charge and the inflammable oil emulsion.

From the four incendiary bombs described in the preceding paragraphs, we can receive some idea of the incendiary attempts of the First World War. These bombs were crude, but they were effective. Proof of this statement will be found in the comparison of these bombs with those used in the present war. Today's incendiary bombs are slightly different, but in each one we can see some reflection of the incendiary bombs of World War I.

The German one-kilogram "Elektron" bomb is probably the most famous of today's incendiary bombs. It consists of a shell which is approximately one-half inch thick, composed of an alloy containing approximately 80%



Air Raid Precaution Handbook No. 9, British Government.

Drawing and cross-sectional view of a typical one-kilogram Elektron bomb. Note blunt nose and awkward streamlining. With the exception of the sheet iron tail and firing mechanism, the bomb is constructed entirely of incendiary materials.

A drawing from the British Air Raid Precaution Handbook showing in detail the construction of the German "Elektron" bomb.

magnesium. The bomb body is approximately ten inches in length and two inches in diameter. The entire bomb, which consists of fuze, bomb body, and tail fin assembly, is approximately fourteen inches in length. The fuze for this bomb is a simple arming pin fuze, consisting of a steel firing pin, a primer, and a starter composition which is held away from the firing pin by the arming pin. Upon release of the bomb, the arming pin is withdrawn under pressure of the arming pin spring. This will permit the primer and igniting composition to drop upon the firing pin upon impact with the target. The flash of the primer will ignite the igniting composition, and in turn will ignite a Thermit charge which forms the filler for the bomb body. The Thermit charge, which consists of iron oxide and powdered aluminum, will burn for approximately one minute at a temperature of over 4500° F. The reaction that takes place may be written as:



This reaction of the Thermit will ignite the magnesium

bomb body and the bomb will continue to burn from 10 to 15 minutes at a temperature of approximately 2300° F.

During the first phase of the burning, that of the Thermit, it will be impossible to stop this reaction or even to approach closely to the bomb. It will be noted that the Thermit reaction requires no oxygen from the air, the oxygen required for the reaction being supplied by the iron oxide. Thus it will be impossible to snuff out this violent reaction by ordinary fire fighting means. It will be impossible to approach the bomb during this phase, because hot molten iron is forcefully emitted through several holes in the magnesium bomb body. This molten iron may be spattered about the target for a radius of approximately fifty feet, and it will probably set fire to any combustible material with which it comes in contact.

After the violent reaction of the first phase of burning has subsided, the bomb will burn with a steady intense heat as the magnesium is consumed. It is during this phase of burning that the attempts should be made to extinguish the "Elektron" bomb. If water is to be used to extinguish the bomb, it must be used with great care, since the water coming in contact with the molten metal will instantly turn into steam. If a stream of water from a large size hose is played upon the burning incendiary, an explosion will result. The reaction for this explosion may be written as $Mg + 2H_2O \rightarrow Mg(OH)_2 + H_2$. This means that water coming in contact with the molten magnesium will rapidly disintegrate, liberating hydrogen in great volumes. This large volume of hydrogen will mix with the air, and thereby form one of our most explosive gasses.

Water properly applied to the burning incendiary will not extinguish it, but it will speed up its burning time from 10 to 15 minutes to from 2 to 3 minutes. This is possible if the water is sprayed on the burning bomb by a fine spray nozzle. The limited quantity of hydrogen formed will burn rather than explode, and aid the magnesium in burning, thereby reducing its burning time.

If a fine spray of water cannot be directed on the burning incendiary, the next best measure is to cover the bomb with dry sand. This dry sand, applied by a long handled shovel, will not stop the bomb's burning, but it will reduce the heat and spattering effect of the bomb, and concentrate the heat in one spot. If it is at all possible, the bomb should be removed from the target by the long handled shovel, and permitted to burn itself out in some suitable non-inflammable container.

Fire extinguishing liquids such as carbon dioxide (CO_2) and acid foam are useless against these "Elektron" bombs. Carbon tetrachloride fire extinguishers are extremely dangerous if used against "Elektron" bombs. This is true because the carbon tetrachloride combines with the burning incendiary to form the deadly gas, phosgene.

It is interesting to note that, because of the great success achieved by the British civilian fire fighting units in extinguishing these "Elektron" bombs, the Germans have now added a small explosive charge to the bomb. After the incendiary has been functioned, and the Thermit starter charge has been expended, the bomb settles into the phase of burning which permits its removal or extinguishing by fire fighting units. In the "Elektron" bombs which contain the explosive charge, an interval of time ranging from approximately one minute to three minutes will pass before

a detonator, which is sensitive to heat, is set off, detonating the small explosive charge. This charge is not intended to do great material damage, but it is highly effective against those who attempt to remove the bomb. The bombs containing the explosive charge are identical in physical appearance to the original "Elektron" bomb, but they do however, have a small letter "A" stamped on the fuze in brilliant red paint.

At this time it is important to mention that for every incendiary bomb dropped, a fire is not started. In the present war the practice has been to scatter the incendiary bombs over the heart of the enemy's cities. The average city, however, has about 85% of its area devoted to parks, roads, alleys, back yards, and front yards, leaving only approximately 15% of the average city composed of some incendiary composition. Now, if we assume that the average bomber can carry 2000 of these small 2-pound "Elektron" bombs, and that it is flying at an altitude of 5,000 feet with a speed of 200 miles per hour, and dropping 20 "Elektron" bombs per second; the bomber would travel 6 miles before it had expended its cargo of incendiaries. It may be expected that of the 2,000 bombs dropped, only about 300 will strike a house, a building or other combustible target. Of the 300 bombs which strike possible targets, approximately half will harmlessly glance off the roofs or will fail to find combustible roofs. Thus, we see that for every 2,000 bombs dropped over the average modern city, only approximately 150 bombs will find suitable targets.

The English have an incendiary bomb whose operations and reactions are similar to those of the German "Elektron" bomb. The British bomb is hexagonal in shape and approximately twenty inches long and approximately two inches from one face to the opposite face of the hexagon. This bomb consists of a heavy steel nose plug, which serves to make the bomb fall nose first, and a magnesium alloy bomb body. It will be noted that this bomb has no tail fin assembly to stabilize it in its earthward flight.

Another British incendiary which has its origin in the present war, is the incendiary known as the "Calling Card". This incendiary consists of an absorbent paper saturated with a mixture of gun cotton and phosphorus. These cards are carried aloft in the bombers in a moist state and are released while still moist. The small cards flutter earthward and upon drying out, the phosphorus spontaneously ignites setting fire to the gun cotton which burns for a few moments. These incendiary cards start few fires when dropped over the modern city; their greatest value is that of destroying fields of dry grain and starting large grass fires. If, however, the cards are printed with some attractive design on them, and the population is ignorant of their use, the cards will be picked up as curiosities, and the number of casualties will greatly increase. These "Calling Cards" incendiaries will be left in pockets, will be taken home and put in drawers, or will be placed in some other unusual place, and upon drying out they will burst into flame.

Liquid and solid oils have, as in World War I, once again found their place in the present war. The Germans have developed what is sometimes known as the "oil drum" bomb. This bomb consists simply of a huge oil drum filled with either liquid or solid oils and some convenient fuze arrangement. These bombs are much larger than any of

(Continued on page 125)

ORDNANCE TRAINING ACTIVITIES

Prepared by: W. S. Johnson, 2nd Lt., Ord. Dept.

Secretary, The Ordnance School

ORDNANCE SCHOOL

On June 28, graduation exercises were held for officer students completing courses of instruction at The Ordnance School. Major John D. Billingsley addressed the graduating officers and presented them with certificates of proficiency. Diplomas were presented to the officers for courses as follows:

General Refresher	27
Automotive	1
Artillery	4
Ammunition	3
Small Arms	4
	39

On July 8th, the Officer Candidate Course opened at The Ordnance School, with 50 specially selected enlisted men as students. These students were chosen from enlisted men on active duty who had served at least six months in active Federal service, who had shown ability to lead men, and had satisfactory educational qualifications. Successful graduates will be commissioned as Second Lieutenants, Ordnance Reserve, and will be placed on active duty in that capacity for one year after receiving their commissions.

UNIT TRAINING CENTER ACTIVITIES

The month of June saw the first thirteen Ordnance Companies formed at the Unit Training Center wind up their training, assemble for inspection by Major General Wesson, and depart for their permanent stations. Toward the latter part of the month, the advance cadre of the new companies moved in, and were organized by their respective company commanders.

Two days before the first thirteen companies were scheduled to leave, Major General Wesson, as part of his inspection of the entire Ordnance Training Center, made an inspection of the Unit Training Center. All twenty-six companies were inspected in ranks by Major General

Wesson, as soon as he arrived at the Ordnance Training Center. These newly activated companies looked as fine on their first major inspection as most old time units accustomed to inspections. The inspecting party later returned, reviewed training methods of shop instruction, and observed both indoor and outdoor displays of equipment.

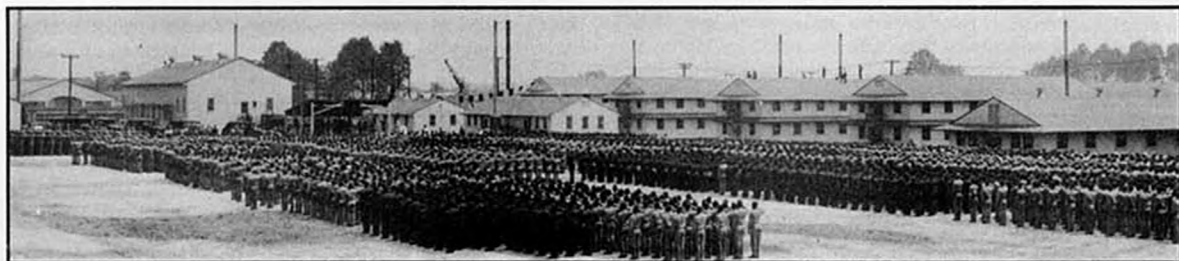
Early in the morning of the 26th the truck convoys of the old companies left the Unit Training Center and started on their way. According to the Maryland State Police, the convoys sped down U. S. 40, setting an example for any outfit. Then all during the day and evening of the 26th, trains pulled into the Proving Ground, and rolled away carrying the troops that did not go by motor. As the trains pulled away, the Unit Training Center bade them goodbye with a farewell band concert. By this time these companies have arrived and are firmly established at their respective home stations.

As soon as the old companies left, the new companies took over the Unit Training Center and organized themselves to receive their fillers. On July 1st, each company received enough fillers to bring it to about 90% strength. That same afternoon they commenced their company military training in anticipation of the day when they, too, would take the field.

CENTRALIZED BASIC TRAINING IN THE ORDNANCE REPLACEMENT TRAINING CENTER

By: W. R. Churchill,
1st Lt., Ord. Dept., Asst. D. M. T.

The Selective Service Trainee coming to the Ordnance Training Center will spend his first thirteen weeks after induction in the training program at the Ordnance Replacement Training Center. This thirteen-week program is in two parts: basic training for the first four weeks and



After General Wesson inspected the Unit Training Center he addressed the remainder of the troops, 5054 Ordnance men of the Ordnance Training Center, the Ordnance Replacement Training Center, and the Ordnance School.

advanced or specialist training for the next period of nine weeks. During the period of basic training, all trainees follow the same program regardless of previous experience or special abilities. During the nine week period, the trainees are divided into specialist groups and given advanced training to fit them for the various kinds of specialized duties in Ordnance Field Service work. At the end of the thirteen-week training course at the Ordnance Replacement Training Center, the trainees are ready to serve in the field as replacements for Ordnance mechanics, armorers, munitions workers, etc.

For approximately ninety hours, or one-half of the four-week period, the trainee receives basic training in both military and technical subjects, planned and conducted by a central organization known as the Department of Military Training. This is centralized training, for which the Department provides the instructing personnel and the facilities.

The remainder of the four-week period is devoted to such training activities as Dismounted Drill, Inspections, Practice Marches, Physical Training and Pistol Marksmanship, which are conducted by personnel of the respective training battalions. For these decentralized activities the Department of Military Training serves to coordinate schedules and facilities.

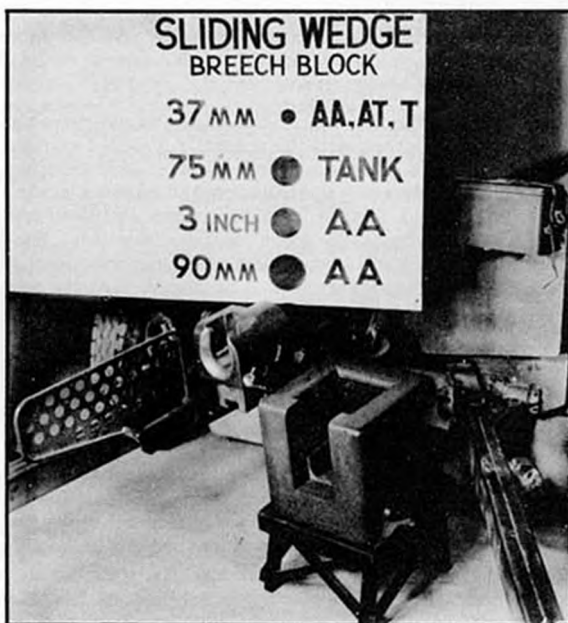
Resources of the Department of Military Training are its instructing and overhead personnel, and its training facilities and equipment. The instructing personnel are specialists in their respective subjects, for the purpose of achieving uniformity and a high standard of instruction. The overhead personnel are also specialists in work such as supply and clerical service, and the production of charts, models, and other training aids, but their specialties serve the instruction for all subjects. Personnel of the Department are officers and enlisted men, together with some trainees who have demonstrated special abilities along these lines. Finally, the training facilities and equipment are partly used in common for all courses of instruction, and partly restricted to the particular courses where they are needed. In this way all resources of the Department are best used to serve both the common and special requirements of the basic training program, which ranges from strictly military subjects such as the Articles of War and Interior Guard Duty to the technical subjects such as Artillery and Automotive Materiel.

Centralized training, with which this article is concerned, is mass training, and its efficiency is to be measured in relation to the number of men who can be taught by this method, better, and at less expense, than by group instruction conducted wholly within each battalion or company organization. For example, the usual instruction group for centralized training has been an entire company of 229 trainees. There are certain courses, such as Motor Vehicle Operation, where the group is broken down for practical instruction. However, in many other courses the instruction group has recently been enlarged to four companies or about 900 trainees, and, at the same time, instruction methods have been improved to give better training to the larger group. This is being achieved mainly by improvement of visual training aids, some of which are shown in the accompanying illustrations and explained below. Also better selection and training of the specialist instructors and their growing experience, together with the development of a more dynamic instruction technique, will result in

continued improvement of centralized training.

Mass training requires more of the instructor than a thorough knowledge of his subject and good organization of his material in correct sequence, to include all the essential points within the required scope of the course. To be effective, mass training also requires that the instructor present his subject so forcefully and interestingly and, indeed, so simply, that he will not forfeit the attention or understanding of the group at any time. Unless he holds their complete interest and attention, he is teaching nothing. And, in this respect, the task becomes more difficult with larger groups.

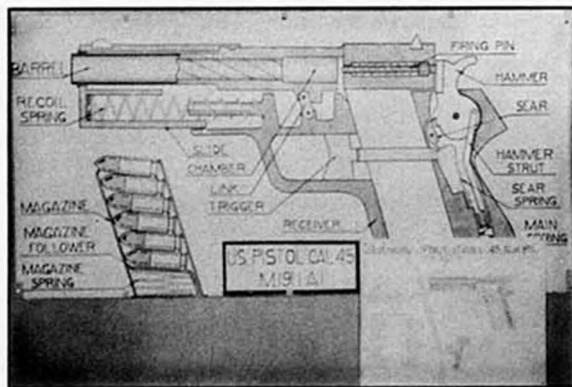
The visual training aids illustrated here show some of the means used to increase the efficiency of mass training. For example, the wooden model, greatly enlarged, shows the operation of the Sliding Wedge Breech Block. The mechanism is simple, yet, before a large group, no amount of oral explanation or sketches can show the operating principle as quickly and thoroughly as the model.



Operating wooden model of sliding-wedge breech block

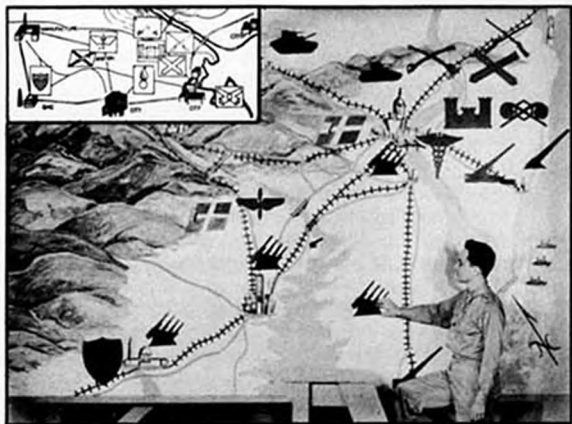
In the basic instruction in Small Arms, the objective is to teach the simple nomenclature and functioning of the most important parts. In this course the visual training aids consist of a series of large schematic charts of the various weapons, similar to the one illustrated of the cal. .45 Automatic Pistol. This is pictured together with the small detailed drawing from which it was prepared. This chart is 4 ft. by 8 ft. in size, and it clearly shows the parts essential for an understanding of the basic principles of functioning. All the parts shown are colored, for easy separation by the eye. This chart can be used effectively in a hall accommodating 500 men.

Another course of instruction by centralized training is the Organization of the Army. One of the objectives of this course is to teach the branch insignia, the mission,



Schematic chart: Cal. .45 Automatic Pistol

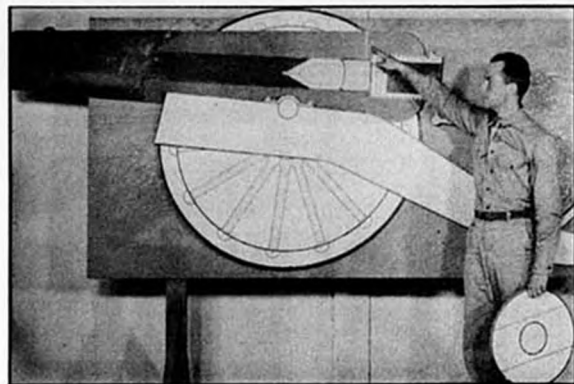
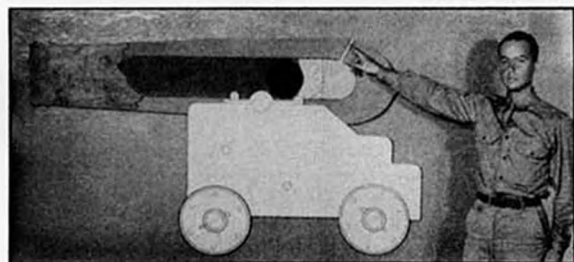
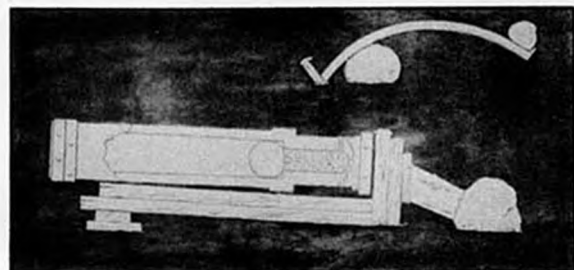
weapons and field of operation for each of the Arms and Service Branches. This involves teaching not only certain facts regarding the branches, but also the relationships among them, which is very important. For this task, no better visual aid has been developed than the general situation map, on which are placed, one by one with proper explanation, enlarged models of the branch insignia, together with special symbols, such as the coast defense gun, to illustrate the special missions of certain branches. This gives a pictorial demonstration of the basic facts in army branch organization. The map illustrated is colored and is 8' by 12' in size. It is used before an instruction group of 1,000 trainees. The insert shows an earlier map, much smaller, that formerly served for this course.



Pictorial demonstration of Army Branch Organization and Insignia

In teaching Artillery, great emphasis is placed on nomenclature and principles of operation that are common to all Artillery weapons. The subject is developed on the basis of learning: What is a "cannon", what are its principal parts, how does it operate? This is a method of teaching artillery which the Ordnance School long ago found to be very successful for elementary instruction. The same method is used in the Replacement Training Center, before proceeding to more detailed instruction in various types of artillery, and there has been developed a progressive series of visual aids, some of which are illustrated here. The series consists of schematic models, full scale, to show

the development of artillery, from the catapult to the 75-mm gun. Each important advance in the development of artillery is illustrated in the series, and discussed by the instructor as he builds up the modern gun, piece by piece: tube, carriage, recoil mechanism, breech and firing mech-



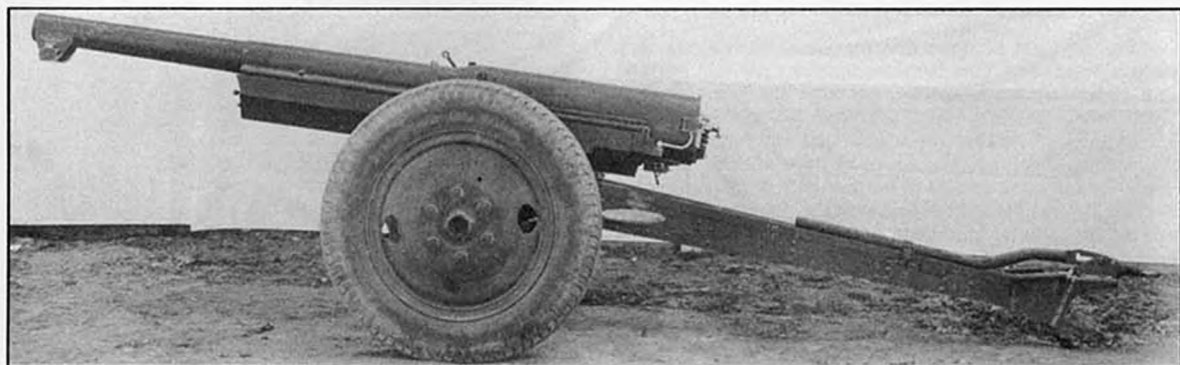
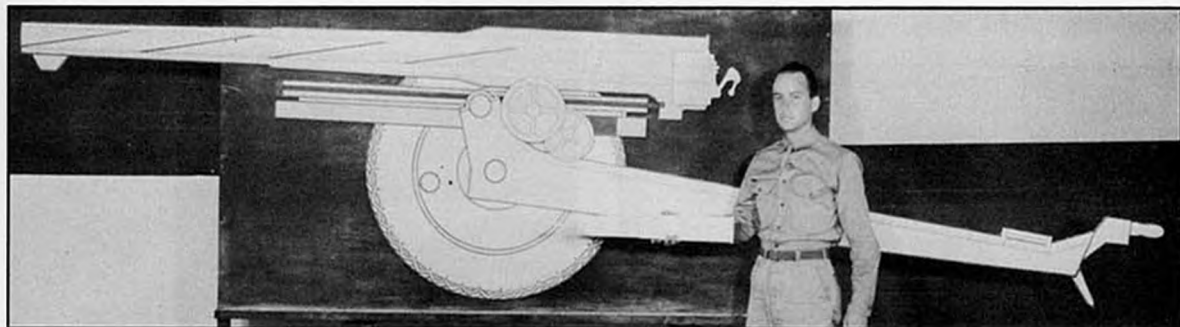
Beginning with the catapult

anism, etc. The details of other types and models are then taken up with additional training aids, including charts and models, training films, and a firing demonstration with the Field Artillery Trainer. The course concludes with an inspection of the weapons discussed.

This review briefly summarizes the instruction methods employed in centralized Basic Training at the Ordnance Replacement Training Center. In addition to extensive use of appropriate visual aids, as described, many courses include demonstrations and practical training. In fact, whenever time and facilities permit, the trainees are exercised in a practical demonstration of the knowledge they have acquired. For example, there are practical exercises on Interior Guard Duty, Defense against Chemical Warfare, Camouflage, Map Reading, and allied subjects.

It should be added that instruction methods have not crystallized, for efforts are continually being made to im-

prove the presentation of each subject in order to attain greater training efficiency.



75-mm Gun with full scale schematic model

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DESERTERS

(Continued from page 107)

which he deserted requires the same action in each case as the apprehension or surrender at the same station from which he deserted, as outlined in paragraphs a, (1), (2), (3) and (5), above, and in addition: --

a. Notification, by radiogram, of the commanding officer of the station from which the soldier deserted of the fact of his apprehension or surrender as required by paragraph 15, AR 615-300.

b. Upon receipt of the above notification the post commander must take action to: -

(1) Recall the supplemental payroll and transmit all copies to the station at which the deserter is held.

(2) Notify the local Quartermaster of the fact of apprehension or surrender so that clothing being held will not be disposed of without further instructions.

(3) Notify the commanding officer of the organization from which soldier deserted, who then suspends any action he may have been taking to dispose of personal effects of the deserter under paragraph 5d, AR 615-300, and takes action instead to determine whether or not the deserter de-

sires these effects sent to him under the provisions of paragraph 5g, AR 615-300.

(4) Take action necessary to determine whether any additional charges should be preferred against the deserter due to developments since forwarding his reports to The Adjutant General. If other charges should be preferred, action must be taken to inform the post commander of the station at which the deserter is held of additional charges, and supply him with evidence or take steps to have the deserter returned to the station from which he deserted in order to try him under any and all charges necessary.

Application of Statute of Limitations (AW 39). - All action just covered in regard to action to be taken, and forms to be accomplished, are based upon the presupposition that trial of the deserter is NOT barred by the application of the provisions of Article of War 39. A deserter who has been in desertion for a period in excess of three (3) years, who lived during that time within the jurisdiction of the United States, and who was not at any time during that period not amenable to military justice, may not be tried for desertion by court-martial, in time of peace. In a case of this kind, the action to be taken consists of the following:

a. Confine the deserter until proof that the 39th AW applies is received.

b. Notify The Adjutant General of fact of apprehension or surrender as in a (2), above.

c. Have physical examination conducted as in a (3), above.

d. Upon receipt of the deserter's record from The Adjutant General and verification of the fact that AW 39 applies, have deserter accomplish an affidavit substantially as follows (or as required by local regulations), and release him from confinement: --

"I certify that I deserted the service of the United States at (place at which desertion occurred) on or about (date of desertion) and that I surrendered (or was apprehended) and returned to military control at (place of apprehension or surrender) on or about (date of apprehension or surrender) and that during the entire period from (date of desertion) to (date preceeding that of apprehension or surrender) I resided within the continental limits of the United States and was amenable to military justice during the entire period."

e. Report case to authority empowered to order discharge under Section VII, AR 615-360. (See War Department Circular No. 102, dated 1941).

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AIRCRAFT BOMBS

(Continued from page 120)

this type used during the World War I. The advantages of the "oil drum" are five-fold:

1. Cheap and readily obtained.
2. Saturation of the target.
3. Usually a long period of burning.
4. Burn with a great deal of heat.
5. Easily ignited.

EUROPEAN BOMBS

Due to the nature of confidential reports, little can be told of the present day European bombs. It is interesting to note, however, that the Germans have contemplated the use of bombs of approximately 3 tons in weight. Such bombs would be used for the destruction of the public utilities of our modern cities since their terrific blast effect would destroy gas mains, water mains, sewer connections, subway lines, electric and telephone communication lines, and virtually every other public utility known to modern mankind.

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ORDNANCE AMMUNITION PRODUCTION OFFICE

(Based on information furnished by G. W. Boush, Capt., Ord. Dept.)

The feature article of this issue, "The Ordnance District Office," makes reference to fourteen Ordnance District Offices. Actually, at the time the above mentioned

article was prepared, the district set-up consisted of thirteen Districts and one Region, making a total of fourteen offices involved.

To avoid any misunderstanding regarding the use of the terms "District" and "Region", the following definition, furnished by Captain G. W. Boush, Ord. Dept., of the Ordnance Ammunition Production Office in Wilmington, Delaware. "An Ordnance District is a procurement agency performing the functions of contracting, purchasing, inspection, acceptance and delivery for all varieties of Ordnance materiel, within a certain prescribed geographical area. An Ordnance Region operates within the geographical area of a parent district, performing the same functions as the district office, but for only a limited number of items or a specified item of Ordnance materiel."

There were only two Regions designated as such, Los Angeles and Wilmington. An article pertaining to the Los Angeles Ordnance Region appears in this issue.

The Wilmington Ordnance Region was established in 1937 as a sub-office of the Philadelphia Ordnance District. It differed from the above definition of "Region", since it had the specific purpose of procurement planning or war planning for munitions plants to manufacture smokeless powder, high explosives and auxiliary raw materials. It performed no functions of contracting, purchasing, inspection, acceptance or delivery.

In 1940, the Wilmington Ordnance Region was made an independent unit to administer itself apart from the Philadelphia Ordnance District. With the advent of the current Defense Program, the planning work was superseded by the functions of engineering consultant and approving agency for plans, design, specifications and purchase orders for the various munitions manufacturing plants being built for the Government by private contractors. In this connection, notice the article "Powder for the Army in a Hurry", which began in the July issue, and continues in this issue.

Recently the Wilmington Ordnance Region was re-designated as the Ordnance Ammunition Production Office. As such, this office is independent in respect to administration, but is responsible to the Ammunition Division branch of Industrial Service in the Office of the Chief of Ordnance. Most of the contractors with which the office deals have main or sub-offices in Wilmington, Delaware. The office maintains an informal consultant or advisory service for the various contractors and acts in liaison capacity between the office of the Chief of Ordnance and the private contractor.

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IS THIS A CHALLENGE?

First Sergeant Michael A. Savine, 484th Ordnance Company (Aviation) (Bombardment), of Borinquen Field, Puerto Rico, writes to suggest that THE ORDNANCE SERGEANT obtain information regarding the time records of various bombardment companies in the handling of different weights of bombs. THE ORDNANCE SERGEANT will be glad to distribute this information if the different companies will send it in. How about it, bomb handlers? How fast are you? Let us hear from you.

ORDNANCE NEWS ITEMS

Prepared by: W. L. Boland, 1st Lt., Ord. Dept.
Assistant Secretary, The Ordnance School

By order of the Secretary of War, "The Ammunition Storage Depot now being established at Texarkana, Texas, is designated as 'Red River Ordnance Depot', and the address is New Boston, Texas."

By order of the Secretary of War, the Ordnance Ammunition Storage Depot now being established at Ken- daia, Seneca County, New York, is designated as "Seneca Ordnance Depot."

List of Ordnance Organizations at Their Stations As of July 1, 1941 Now Ready for Combat

1st Ord. Co. (MM),	First Army	Madison Barracks, N.Y.
2nd Ord. Co. (MM),	Third Army	Ft. Sam Houston, Texas
3rd Ord. Co. (MM),	Fourth Army	Ft. Lewis, Wash.
4th Ord. Co. (MM),	Fourth Army	Ft. Ord, Calif.
5th Ord. Co. (MM),	First Army	Camp Edwards, Mass.
6th Ord. Co. (MM),	II Army Corps	Ft. Monroe, Va.
7th Ord. Co. (MM),	III Army Corps	Camp Haan, Calif.
8th Ord. Co. (MM),	I Army Corps	Ft. Bragg, N. C.
9th Ord. Co. (MM),	VIII Army Corps	Ft. Sill, Okla.
10th Ord. Co. (MM),	Panama Canal Dept.	Corozal, C.Z.
11th Ord. Co. (MM),	Hawaiian Div.	Schofield Barracks, T.H.
12th Ord. Co. (MM), (PS)	Philippine Div.	Ft. Stotsenburg, P.I.
13th Ord. Co. (MM),	Third Army	Camp Hulen, Texas
14th Ord. Co. (MM),	V Army Corps	Camp Livingston, La.
15th Ord. Co. (MM),	First Army	Camp Stewart, Ga.
16th Ord. Co. (MM),	First Army	Ft. Bragg, N.C.
18th Ord. Co. (MM),	III Army Corps	Camp Haan, Calif.
20th Ord. Co. (MM),	Panama Canal Dept.	Post of Corozal, C.Z.
21st Ord. Co. (MM),	First Army	Camp Stewart, Ga.
22nd Ord. Co. (MM),	Second Army	Ft. Knox, Ky.
23rd Ord. Co. (MM),	Second Army	Ft. Sheridan, Ill.
24th Ord. Co. (MM),	2nd Cav. Div.	Ft. Riley, Kansas
25th Ord. Co. (MM),	Third Army	Camp Hulen, Texas
26th Ord. Co. (MM),	Third Army	Ft. Bliss, Texas
27th Ord. Co. (MM),	1st Cav. Div.	Ft. Bliss, Texas
28th Ord. Co. (MM),	Third Army	Ft. Oglethorpe, Ga.
29th Ord. Co. (MM),	VI Army Corps	Ft. Devens, Mass.
30th Ord. Co. (HM),	First Army	Ft. George G. Meade, Md.
31st Ord. Co. (HM),	Third Army	Ft. Benning, Ga.
33rd Ord. Co. (MM),	Puerto Rican Dept.	Ft. Buchanan, P.R.
34th Ord. Co. (MM),	I Army Corps	Ft. Bragg, N.C.
40th Ord. Co. (TNG),	Ordnance School	Aberdeen Proving Ground, Md.
41st Ord. Co. (Depot),	Panama Canal Dept.	Corozal, C.Z.
42nd Ord. Co. (Am),	Puerto Rican Dept.	San Juan, P.R.
44th Ord. Co. (PG),	Aberdeen Proving Gr.	Aberdeen Proving Ground, Md.
50th Ord. Co. (Am),	First Army	Ft. Jackson, S.C.
51st Ord. Co. (Am),	First Army	Delaware Ordnance Depot, Pedricktown, N.J.
52nd Ord. Co. (Am),	Second Army	Savanna Ord. Depot, Proving Ground, Ill.
53rd Ord. Co. (Am),	Second Army	Ft. Knox, Ky.
54th Ord. Co. (Am),	First Army	Ft. Bragg, N.C.
55th Ord. Co. (Am),	Fourth Army	Ft. Lewis, Wash.
56th Ord. Co. (Am),	First Army	Nansemond Ord. Depot, Portsmouth, Va.
57th Ord. Co. (Am),	Third Army	Camp Blanding, Fla.
58th Ord. Co. (Am),	First Army	Raritan Arsenal, Metuchen, N.J.
59th Ord. Co. (Am),	Third Army	Ft. Sill, Okla.
60th Ord. Co. (Am),	Third Army	Camp Livingston, La.
61st Ord. Co. (Am),	Hawaiian Dept.	Honolulu, T.H., Ft. Shafter
62nd Ord. Co. (MM),	Hawaiian Dept.	Ft. Shafter, Honolulu, T.H.
63rd Ord. Co. (MM),	Hawaiian Dept.	Ft. Shafter, Honolulu, T.H.
64th Ord. Co. (Am),	Third Army	Camp Shelby, Miss.
65th Ord. Co. (Am),	Third Army	Ft. Benning, Ga.
72nd Ord. Co. (Depot),	Third Army	Ft. Benning, Ga.
73rd Ord. Co. (Depot),	Third Army	Ft. Knox, Ky.
74th Ord. Co. (Depot),	Hawaiian Dept.	Ft. Shafter, Honolulu, T.H.
75th Ord. Co. (Depot),	Philippine Dept.	Manila, P.I.
76th Ord. Co. (Depot),	Puerto Rican Dept.	Puerto Rico
79th Ord. Co. (Depot),	First Army	Augusta Arsenal, Augusta, Ga.
80th Ord. Co. (Depot),	Fourth Army	Fort Ord, Calif.
81st Ord. Co. (HM),	Second Army	Ft. Bliss, Texas

82nd Ord. Co. (HM),	Third Army	Benicia Arsenal, Benicia, Calif.
84th Ord. Co. (Depot)	Second Army	Lacarne, Ohio
95th Ord. Co. (Mant Ry		
96th Ord. Co. (" " " ")	First Army	Ft. Hancock, N.J.
101st Ord. Co. (MM),	First Army	Aberdeen Proving Ground, Md.
102nd Ord. Co. (MM),	26th Div. N.G.	Camp Edwards, Mass.
103rd Ord. Co. (MM),	27th Div. N.G.	Ft. McClellan, Ala.
104th Ord. Co. (MM),	38th Div. N.G.	Indiantown Gap, Pa.
105th Ord. Co. (MM),	29th Div. N.G.	Ft. George G. Meade, Md.
106th Ord. Co. (MM),	30th Div. N.G.	Ft. Jackson, S.C.
107th Ord. Co. (MM),	31st Div. N.G.	Camp Blanding, Fla.
108th Ord. Co. (MM),	32nd Div. N.G.	Camp Livingston, La.
109th Ord. Co. (MM),	33rd Div. N.G.	Camp Forrest, Tenn.
110th Ord. Co. (MM),	34th Div. N.G.	Camp Claiborne, La.
111th Ord. Co. (MM),	35th Div. N.G.	Camp Joseph T. Robinson, Ark.
112th Ord. Co. (MM),	36th Div. N.G.	Camp Bowie, Texas
113th Ord. Co. (MM),	37th Div. N.G.	Camp Shelby, Miss.
115th Ord. Co. (MM),	38th Div. N.G.	Camp Shelby, Miss.
116th Ord. Co. (MM),	40th Div. N.G.	Camp San Luis Obispo, Calif.
118th Ord. Co. (MM),	41st Div. N.G.	Camp Murray, Wash.
119th Ord. Co. (MM),	43rd Div. N.G.	Camp Blanding, Fla.
120th Ord. Co. (MM),	44th Div. N.G.	Ft. Dix, N.J.
	45th Div. N.G.	Camp Berkeley, Texas
17th Ord. Bn.	2nd Armored Div.	Ft. Benning, Ga.
18th Ord. Bn.	3rd Armored Div.	Camp Polk, La.
19th Ord. Bn.	1st Armored Div.	Ft. Knox, Ky.
20th Ord. Bn.	4th Armored Div.	Pine Camp, N.Y.
1st Ord. Service Co.	First Corps Area	Army Base, Boston 9, Mass.
2nd Ord. Service Co.	Second Corps Area	90 Church St., New York, N.Y.
3rd Ord. Service Co.	Third Corps Area	Baltimore, Md.
4th Ord. Service Co.	Fourth Corps Area	P.O. Bldg., Atlanta, Ga.
5th Ord. Service Co.	Fifth Corps Area	Ft. Hayes, Columbus, Ohio
6th Ord. Service Co.	Sixth Corps Area	P.O. Bldg., Chicago, Ill.
7th Ord. Service Co.	Seventh Corps Area	Federal Bldg., Omaha, Nebr.
8th Ord. Service Co.	Eighth Corps Area	Ft. Sam Houston, Texas.
9th Ord. Service Co.	Ninth Corps Area	Presidio of San Francisco, Calif.
11th Ord. Service Co.	U.S. Military Acad.	West Point, N.Y.

GHQ Air Force - Bombardment

440th Ord. Co. Avn.,	GHQ Air Force	Albuquerque, N. Mex.
441st Ord. Co. Avn.,	" " "	Bangor, Me.
442nd Ord. Co. Avn.,	" " "	Boise, Idaho.
443rd Ord. Co. Avn.,	" " "	Bowman Field, Louisville, Ky.
444th Ord. Co. Avn.,	" " "	Fresno, Calif.
445th Ord. Co. Avn.,	" " "	Jackson, Miss.
446th Ord. Co. Avn.,	" " "	Langley Field, Va.
447th Ord. Co. Avn.,	" " "	MacDill Field, Fla.
448th Ord. Co. Avn.,	" " "	McChord Field, Wash.
449th Ord. Co. Avn.,	" " "	Manchester, N.H.
450th Ord. Co. Avn.,	" " "	New Orleans, La.
451st Ord. Co. Avn.,	" " "	Oklahoma City, Okla.
452nd Ord. Co. Avn.,	" " "	Orlando, Fla.
453rd Ord. Co. Avn.,	" " "	Salt Lake City, Utah.
454th Ord. Co. Avn.,	" " "	Savannah, Ga.
455th Ord. Co. Avn.,	" " "	Sunset Field, Spokane, Wash.
456th Ord. Co. Avn.,	" " "	Tucson, Ariz.
457th Ord. Co. Avn.,	" " "	Westover Field, Mass.
458th Ord. Co. Avn.,	" " "	Pendleton, Oregon
459th Ord. Co. Avn.,	" " "	Barksdale Field, La. (less 1 platoon)
460th Ord. Co. Avn.,	" " "	Ellington Field, Texas
461st Ord. Co. Avn.,	" " "	Lowry Field, Colo.
462nd Ord. Co. Avn.,	" " "	Langley Field, Va.
463rd Ord. Co. Avn.,	" " "	MacDill Field, Fla.
464th Ord. Co. Avn.,	" " "	Savannah, Ga.
481st Ord. Co. Avn.,	" " "	Hickam Field, T.H.
482nd Ord. Co. Avn.,	" " "	Hickam Field, T.H.
483rd Ord. Co. Avn.,	" " "	Howard Field, C.Z.
484th Ord. Co. Avn.,	" " "	Borinquen Field, P.R.
485th Ord. Co. Avn.,	" " "	Borinquen Field, P.R.

GHQ Air Force - Pursuit

673rd Ord. Co. Avn.,	" " "	Ponce Field, P.R.
674th Ord. Co. Avn.,	" " "	Wheeler Field, T.H.
675th Ord. Co. Avn.,	" " "	Tallahassee, Fla.
676th Ord. Co. Avn.,	" " "	Baton Rouge, La.
677th Ord. Co. Avn.,	" " "	Charlotte, N.C.
678th Ord. Co. Avn.,	" " "	Everett, Wash.
679th Ord. Co. Avn.,	" " "	Ft. Wayne, Ind.

680th Ord. Co. Avn.,	"	"	"	Hamilton Field, Calif.
681st Ord. Co. Avn.,	"	"	"	Windsor Locke, Conn.
682nd Ord. Co. Avn.,	"	"	"	March Field, Calif.
683rd Ord. Co. Avn.,	"	"	"	Mitchell Field, N.Y.
684th Ord. Co. Avn.,	"	"	"	Portland, Oregon.
685th Ord. Co. Avn.,	"	"	"	Selfridge Field, Mich.
686th Ord. Co. Avn.,	"	"	"	West Palm Beach, Fla.
687th Ord. Co. Avn.,	"	"	"	Meridian, Miss.
688th Ord. Co. Avn.,	"	"	"	Eglin Field, Valparaiso, Fla. (less 1 platoon)
689th Ord. Co. Avn.,	"	"	"	Ellington Field, Texas.
690th Ord. Co. Avn.,	"	"	"	Las Vegas, Nevada. (less 1 platoon)
691st Ord. Co. Avn.,	"	"	"	Gunnery School No. 10, Panama City, Fla.
692nd Ord. Co. Avn.,	"	"	"	Hamilton Field, Calif.
693rd Ord. Co. Avn.,	"	"	"	March Field, Calif.
694th Ord. Co. Avn.,	"	"	"	Mitchel Field, N.Y.
695th Ord. Co. Avn.,	"	"	"	Selfridge Field, Mich.
696th Ord. Co. Avn.,	"	"	"	Wheeler Field, T.H.
697th Ord. Co. Avn.,	"	"	"	Albrook Field, C.Z. (1 platoon)
697th Ord. Co. Avn.,	"	"	"	France Field, C.Z. (2 platoons)
698th Ord. Co. Avn.,	"	"	"	Nichols Field, P.I. (3 platoons)
699th Ord. Co. Avn.,	"	"	"	Fairbanks, Alaska (1 platoon)
700th Ord. Co. Avn.,	"	"	"	Eglin Field, Valparaiso, Fla. (1 platoon)

GHQ Air Force - Air Base

701st Ord. Co. Avn.,	"	"	"	Albuquerque, N. Mex.
702nd Ord. Co. Avn.,	"	"	"	Tallahassee, Fla.
703rd Ord. Co. Avn.,	"	"	"	Bangor, Me.
704th Ord. Co. Avn.,	"	"	"	Baton Rouge, La.
705th Ord. Co. Avn.,	"	"	"	Boise, Idaho.
706th Ord. Co. Avn.,	"	"	"	Bowman Field, Louisville, Ky.
707th Ord. Co. Avn.,	"	"	"	Charlotte, N.C.
708th Ord. Co. Avn.,	"	"	"	Everett, Wash.
709th Ord. Co. Avn.,	"	"	"	Ft. Wayne, Ind.
710th Ord. Co. Avn.,	"	"	"	Fresno, Calif.
711th Ord. Co. Avn.,	"	"	"	Hamilton Field, Calif.
712th Ord. Co. Avn.,	"	"	"	Hartford, Conn.
713th Ord. Co. Avn.,	"	"	"	Jackson, Miss.
714th Ord. Co. Avn.,	"	"	"	Langley Field, Va.
715th Ord. Co. Avn.,	"	"	"	MacDill Field, Fla.
716th Ord. Co. Avn.,	"	"	"	McChord Field, Wash.
717th Ord. Co. Avn.,	"	"	"	Manchester, N.H.
718th Ord. Co. Avn.,	"	"	"	March Field, Calif.
719th Ord. Co. Avn.,	"	"	"	Mitchel Field, N.Y.
720th Ord. Co. Avn.,	"	"	"	New Orleans, La.
721st Ord. Co. Avn.,	"	"	"	Oklahoma City, Okla.
722nd Ord. Co. Avn.,	"	"	"	Orlando, Fla.
723rd Ord. Co. Avn.,	"	"	"	Portland, Oregon.
724th Ord. Co. Avn.,	"	"	"	Salt Lake City, Utah.
725th Ord. Co. Avn.,	"	"	"	Savannah, Ga.
726th Ord. Co. Avn.,	"	"	"	Selfridge Field, Mich.
727th Ord. Co. Avn.,	"	"	"	Sunset Field, Spokane, Wash.
728th Ord. Co. Avn.,	"	"	"	Tucson, Ariz.
729th Ord. Co. Avn.,	"	"	"	West Palm Beach, Fla.
730th Ord. Co. Avn.,	"	"	"	Westover Field, Mass.
731st Ord. Co. Avn.,	"	"	"	Pendleton, Oregon.
732nd Ord. Co. Avn.,	"	"	"	Meridian, Miss.
740th Ord. Co. Avn.,	"	"	"	Hickam Field, T.H.
741st Ord. Co. Avn.,	"	"	"	Wheeler Field, T.H.
742nd Ord. Co. Avn.,	"	"	"	Albrook Field, C.Z.
743rd Ord. Co. Avn.,	"	"	"	France Field, C.Z.
744th Ord. Co. Avn.,	"	"	"	Howard Field, C.Z.
745th Ord. Co. Avn.,	"	"	"	Nichols Field, P.I.
746th Ord. Co. Avn.,	"	"	"	Borinquen Field, P.R.
747th Ord. Co. Avn.,	"	"	"	Ponce Field, P.R.
748th Ord. Co. Avn.,	"	"	"	Elmendorf Field, Anchorage, Alaska

List of Ordnance Organizations at Their Stations
(As of September 1, 1941)

32nd Ord. Co. (MM),	Second Army	Ft. Bragg, N.C.
35th Ord. Co. (MM),	First Army	Ft. Jackson, S.C.
36th Ord. Co. (MM),	First Army	Camp Forrest, Tenn.
37th Ord. Co. (MM),	First Army	Camp Shelby, Miss.
38th Ord. Co. (MM),	First Army	Camp Davis, N.C.
39th Ord. Co. (MM),	First Army	Camp Davis, N.C.
45th Ord. Co. (MM),	First Army	Camp Davis, N.C.

46th Ord. Co. (MM),	First Army	Ft. Custer, Mich.
47th Ord. Co. (MM),	First Army	Ft. Ethan Allen, Vt.
48th Ord. Co. (MM),	First Army	Ft. F. E. Warren, Wyo.
66th Ord. Co. (Am),	First Army	Camp Forrest, Tenn.
67th Ord. Co. (Am),	First Army	Camp Stewart, Ga.
68th Ord. Co. (Am),	First Army	Ft. Bliss, Texas.
69th Ord. Co. (Am),	Second Army	Camp Edwards, Mass.
83rd Ord. Co. (HM),	First Army	Ft. Lewis, Wash.
85th Ord. Co. (HM),	First Army	Camp Bowie, Texas.
621st Ord. Co. (Am),	Second Army	Ft. George G. Meade, Md.
630th Ord. Co. (Am),	Second Army	Ft. Riley, Kansas.
632nd Ord. Co. (Am),	Second Army	Fort Ord, Calif.
636th Ord. Co. (Am),	Second Army	Ft. Leonard Wood, Mo.



LIBRARY

Conducted by: J. M. Kelleher, Staff Sergeant, Ord. Dept.

An Ordnance Technical Manual which has been eagerly awaited, is that on the 75 - mm Gun Materiel, M1897 and Modifications, (TM 9-305). This supersedes TR 320-95, March 25, 1925 (including C 1, dated January 3, 1927), and in part TR 1305-A, February 1, 1933.

You will find that it is right up-to-date and replete with illustrations, including those of ammunition and fire control apparatus.

It is for sale by the Superintendent of Documents, Washington, D. C.,Price 25 cents.

Another technical manual of interest to Artillery Sections is the 37 - mm Aircraft Gun Materiel, M4 (TM 9-240). The foregoing and an Air Corps technical manual, "Bomb Racks, Tow Target Equipment, and Flare Racks" (TM 1-500), will no doubt be of interest to Aviation Ordnance personnel.

"Sound Locators, M1A1 to M1A8, Inclusive," (TM 9-1661) and "Instruction Guide, Fuze Setter, T15 (For 90 - mm AA Gun, M1)," (TM 9-2841) are valuable aids in maintenance and repair of fire control apparatus.

"Chassis, Body, and Trailer Units," (TM 10-560) is

the title and numerical designation of a technical manual prepared under the direction of the Quartermaster General. Automotive maintenance personnel will be especially interested in its contents. This manual is also for sale by the Superintendent of Documents, Washington, D.C.....Price 15 cents.

Advance Information on Care and Preservation of Seacoast Artillery published by the War Department, June 19, 1941, contains useful data on recoil fluids, lubrication and painting of those weapons pending the publication of Technical Manual 9-850.

Advance Information on the 90-mm Antiaircraft Materiel, M1, published by the War Department, June 6, 1941, contains pertinent data on this gun pending the publication of Technical Manuals 9-370 and 9-1370.

Have you read the July-August issue of Army Ordnance? If you haven't this brief resume will give you an idea of what you are missing.

First, a chart which shows the tactical organization of the Army. Second, the article by Major General Johnson Hagood is certain to arouse much comment. Third, the ar-

(Continued on page 134)

"LETTERS FROM THE FIELD"

116th Ordnance Company
June 9, 1941

Editorial Staff THE ORDNANCE SERGEANT
The Ordnance School
Aberdeen Proving Ground,
Aberdeen, Maryland

Gentlemen:

Your publication serves a double purpose as far as I am concerned. I not only find valuable information as to the work of the Small Arms Section, but am also becoming better acquainted with the work of the other sections as well. Too often the difficulty of finding understandable information on the work of the various sections discourages any attempt toward education out of the section one is in.

As soon as our company returns to Fort Lewis, I intend to use the series of articles on the M1 rifle as a basis for instruction of the selectees in the Small Arms Section.

I haven't seen the following information in any number of THE ORDNANCE SERGEANT, so will pass it on.

In the manufacture of the M1 rifle, the accelerator is sometimes assembled upside down in the operating rod catch. This causes the operating rod catch to release the operating rod as soon as the follower starts down, thus making it impossible to insert the loaded clip. This is corrected by replacing the defective operating rod catch with a correctly assembled unit.

This information was passed on to me by the sergeant in charge of the armory section of the 4th Ordnance Company. I appreciated it, and am passing it on to you. I hope someone finds it useful.

Sincerely,

MYRON F. OLIVER
Technical Sergeant
Chief of Armory Section
116th Ordnance Company

Comment by Small Arms Section: The condition mentioned in the above letter is true, of course, but in only a very small percentage of cases. Although Sergeant Oliver's solution is satisfactory, it might be mentioned that the pin may be removed and the accelerator turned over. Thus, no additional unit will be required.

742ND ORDNANCE COMPANY AVIATION (AB)
Albrook Field
Canal Zone

June 13, 1941

Editor,
"THE ORDNANCE SERGEANT"
The Ordnance School,
Aberdeen Proving Ground, Md.

Dear Sir:

Will wonders never cease? It is now an actual fact that the 742nd Ord. Co. Avn. (AB), has rendered a negative report on the marital status of this organization. The report included the company commander and all 1st three graders.

Without the often present "apron strings" the majority of bachelors are in an askance mood, whether or not the War Department might cast quizzical eyes on this organization for the role of performing in some distant base, (not inferring that we are close to the blessed shores of our homes). But we don't believe that much farther would make an awful lot of difference to us. So let come what may, at least we are prepared in the above mentioned manner!

C. Z. KIROHN
Technical Sergeant
742nd Ord. Co. AVN. (AB)

AIR BASE HEADQUARTERS
OFFICE OF THE BASE ORDNANCE OFFICER

Albrook Field, Canal Zone
June 6, 1941

Editor,
"THE ORDNANCE SERGEANT"
The Ordnance School,
Aberdeen Proving Ground, Md.

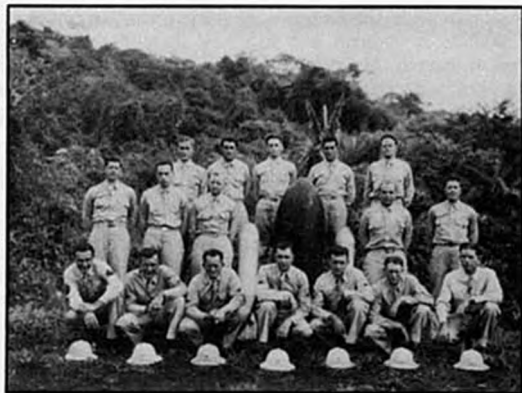
Dear Sir:

Not having the gift of originality I will open this letter in the customary manner, at the same time, however, hoping you will overlook my deficiency in that respect.

In an earlier edition of THE ORDNANCE SERGEANT you requested letters from Ordnance Sergeants in the field. Well, here comes Albrook Field gliding in on a bomb trailer.

On April 1 of this year, we had four newly organized Ordnance Companies, made up almost entirely of personnel transferred here from line organizations. It was found necessary to start up schools immediately (if not sooner).

Captain J. G. Zierdt, Ord. Dept., who was Base Ordnance Officer, Ordnance Property Officer, 12th Wing Ordnance Officer, acting 19th Wing Ordnance Officer, and com-



Front row, left to right: S. Sgt. Hester, S. Sgt. Davis, S. Sgt. Long, T. Sgt. Kirohn (Instr.), T. Sgt. McArthur, 1st Sgt. Caulfield, S. Sgt. Harmon; center row, left to right: Corp. Yingling, Corp. Williamson, Pvt. 1 Cl. Patterson, Corp. Silvestro, Pvt. Scott; top row, left to right: Sgt. Carathers, Corp. Lethridge, Pvt. Stevenson, Pvt. Costakos, Pvt. Stronigan.

manding the 483rd Ord. Co. Avn. (Bomb), 697th Ord. Co. Avn. (Pur), 742nd Ord. Co. Avn. (AB), and 744th Ord. Co. Avn. (AB), was also, in addition to his other duties, President of the Albrook Field Officers' Club, Chairman of the Entertainment Committee, and Mess Officer at the Officers' Club. As a side line, he also performed the duties of Base Chemical Warfare Officer and Disbursing Agent Officer for the Ordnance Companies and Chemical Warfare Service Troops at this station. He did get a break, though, by getting relieved of his duties as Adjutant.

Well anyway, under his able supervision we soon had a course running full blast in Depot and Supply, Automotive, and Small Arms. Yours truly being Chief Clerk for the above mentioned organizations, was naturally elected to conduct the Depot and Supply course. Now I know where the saying originated, "Oh, for the life of a sailor." Depot and Supply was condensed to 25 school days.

In order to keep from boring you to death I will cut this short at this time. Enclosed are a couple of pictures of the future Ordnance Sergeants who graduated from the Depot and Supply course. I wish them LUCK. The tent was our little red school house.

In closing, the men of this organization voted unanimously for you to continue the march on the rejuvenated Ordnance Sergeant. Everyone thinks it's the TOPS, but no matter what kind of paper keep it up and at 'em.

Long live THE ORDNANCE SERGEANT, so he may add the flame.

Sincerely yours,

CHARLES Z. KIROHN,
Technical Sergeant
742nd Ord. Co. Avn. (AB)
Albrook Field, C. Z.

Don't you have a photo which has some Ordnance interest? Send it in; it may interest others.



101st ORDNANCE COMPANY
26th Division
CAMP EDWARDS, MASS.

THE ORDNANCE SERGEANT,
Aberdeen Proving Ground, Md.

It is a pleasure to contribute in any way to THE ORDNANCE SERGEANT, a publication which we at Camp Edwards have read with great interest. This publication should be helpful to all members of the citizens' Army connected with the Ordnance Department.

In taking our place with the Ordnance Units of the Regular Army, we have found a most excellent spirit of mutual understanding and cooperation. While Camp Edwards has only a small detachment of the 1st Ordnance Service Company and are entirely lacking of the necessary equipment to represent Ordnance at this post, nevertheless, the 101st Ordnance Company has been cooperating to the fullest extent in the use of their shop equipment, so that the greatest percentage of major repairs are handled completely at this post. It is natural that our company as a whole has a feeling that we are taking an important part in the plan for National Defense, and that we are daily proving to ourselves as well as to the entire command that we are fully qualified to function as an active Ordnance unit.

It is the definite feeling that one year of active duty will prove beneficial to the company in striving to approach the point of perfection expected of them. However, a longer period of active duty of from two to three years would bring them as near as possible to that ultimate perfection desired as an all 'round Medium Maintenance Company.

Training of Selectees, for instance, as instrument repairmen, is one which takes a long period of time to develop, and a long period of time is necessary due to the varied types and kinds of instruments used by an Infantry Division. Inasmuch as most of the Regular Army Ordnance units are filled with Selectees, as ourselves, it is felt that the Regular Army is no different from ourselves, and that we can learn much from each other.

Inquiries have been made as to what thoughts are presented when the men will return to their home stations, and it has been found that a great many would like to continue their present assignment, due to the interesting type of work in which they are engaged. Some, however, have given thought to the amount of wages that they will receive

upon returning to civil life, due to the training that they will have received in this company.

I hope that the information disclosed is somewhere near the thoughts that you desired, and trust that the 101st Ordnance Company (MM) will receive its share of the good publicity in THE ORDNANCE SERGEANT.

Very truly yours,

EDWIN A. SMITH
1st Lt. (FA), Ord. Dept.,
Commanding

Key West Barracks, Fla.
June 17, 1941

THE ORDNANCE SERGEANT,
The Ordnance School,
Aberdeen Proving Ground, Md.

Not that it matters to the undersigned, but it is believed that Technical Sergeant G. W. Akers' Depot and Supply article in the May issue of THE ORDNANCE SERGEANT made an error. In the first place, burlap, jute, 8-oz., 72-inch, is not listed in Group L-1. And in the second place, burlap is not issued by the Ordnance Department for the purpose of covering either 6 x 6 or 6 x 10 ft. target frames. He will find, however, in Group L-1, Cloth, target, 72-inch, for the purpose of covering target frames. He may, in order to check my experience, consult Technical Regulation 1395-A, in regards to burlap and why burlap is used and a product of issue.

Burlap, jute, 8-oz. is listed in K-1. Its usage is explained as to clean bores of cannon. It is wrapped around and sewed to sponge heads, brushes, bore, bristle, etc., in Field and Coast Artillery, for washing and oiling the bores after firing. This is the only reason burlap is issued in the Ordnance Department.

I have just received 70 yards of burlap, jute, 40-inch, from the Commanding Officer, Augusta Ordnance Depot. Requisition was submitted for same under K-1, routed through the Ordnance Officer, 4th Corps Area for supply.

Hope this causes no "stink", and I invite your attention that I consult all articles in THE ORDNANCE SERGEANT.

OSCAR DAVIS,

Technical Sergeant
Det., 4th Ord. Service Co.

Editorial Note: Technical Sergeant Akers is now temporarily absent from The Ordnance School, but in his absence the following comment is furnished by Staff Sergeant William L. Wise, Instructor, Depot and Supply Section:

"With reference to the attached 'correction' from the field, we do not stand to be corrected. It is suggested, for the information of the writer (and all readers-Editor) the following be published:

"There is in Technical Regulation 1395-A specific

instruction as to the use of burlap for covering for breech and muzzle of cannon and to cover sponges for cleaning bores of cannon, of which we are aware and duly respect. This particular burlap is listed in Standard Nomenclature List K-1 as an item of issue by the Ordnance Department, and is for the use as above specified.

"However, if the writer will turn to page 26, SNL L-1, dated March 28, 1939, and look under the heading on that page of "Miscellaneous Equipment and Supplies", he will find listed there -- "BURLAP, jute, 8-oz., 72", yd., (required in musketry practice)", with an asterisk (*) opposite the item in the "Note Symbol" column. Explanatory note of the asterisk (*) states, "Items indicated by an asterisk are purchased locally, other items are stored and reviewed in their respective group." This item was used as an example for the article in question and is relevant in every respect to the article."

Omaha, Nebraska
June 21, 1941

THE ORDNANCE SERGEANT,
The Ordnance School,
Aberdeen Proving Ground,
Maryland

Dear Sir:

Please allow me to offer my heartiest congratulations on the rebuilding of THE ORDNANCE SERGEANT for I think you are indeed doing an excellent job.

As I read the magazine I found two articles which especially interested me - History of the Development of Field Artillery Materiel - and the Editorial about Washington, D. C., and the Arlington Cemetery. Since visiting these two places I have read some things about Arlington Cemetery and the tomb of the unknown soldier that were of particular interest to me and I'll pass it on to you for any use you may have for it.

The following information was obtained from the 1941 copy of the World Almanac and from an article which appeared in the Recruiting News some time back.

There is held at the Arlington Cemetery an average of more than four funerals per day (no burials on Sundays or holidays). The first burial of a soldier in this cemetery was that of a Union soldier from Pennsylvania, on May 13, 1864. Up to June 17, 1931, 48,014 persons had been buried there. There are over 408 acres of ground, more than 10 miles of surfaced roads, and 3 miles of sidewalks in the cemetery. More than two million people visit the cemetery each year and more than a million and a half of these visit the tomb of the Unknown Soldier. This tomb is constructed of Yule Colorado marble, weighs 72 tons, is 8 ft. wide, 13 ft. 11 in. long, and over 8 ft. high. On the east end of the tomb, in low relief, are three figures - two women representing victory and peace, and one male figure -- valour. On the west end are the words "HERE RESTS IN HONORED GLORY AN AMERICAN SOLDIER KNOWN BUT TO GOD."

Truly is "he" known but to God, for every possible precaution has been taken to insure the Unknown Soldier's perpetual anonymity. No one will ever know who he is,

from where he came, the organization with which he served "over there" when struck down, or anything about his background, history or racial strain.

All America knows of and honors its Unknown Soldier who represents the many hundreds of unidentified and unidentifiable dead among the more than 50,000 American soldiers who made the supreme sacrifice in battle action during the World War.

In France are six military cemeteries of the A.E.F., another in Belgium and another in England.

Most of the little white crosses in our overseas military cemeteries bear an identifying legend showing the name, rank and organization of him who sleeps beneath the sod of that country which he died to help defend. But on many of those tiny white crosses there is nothing but a pitiful little number, and the same legend, "Here Rests in Honored Glory an American Soldier known but to God," which appears on the tomb of the Unknown Soldier in Arlington Cemetery, Virginia.

Late in October, 1921, one body of such an unknown soldier was disinterred from each of four of these overseas cemeteries - Aisne-Marne, Meuse-Argonne, Somme, and St. Mihiel. These four bodies were conveyed by a special guard of honor to the town of Chalons-sur-Marne where, at the City Hall four catafalques had been made ready and the four caskets containing the bodies, received.

As these bodies were placed in the City Hall all of the forms pertaining to their burial, containing all the bare fragments of information about the dead men; where, when, and how he was found dead on the field of battle, what efforts had been made to identify him, etc., were solemnly destroyed. At the same time, the duplicate records pertaining to each

of these unknown soldiers, known only by assigned numbers, were destroyed in Paris and in Washington.

On the morning of October 24, 1921, the Quartermaster officer, with a specially selected detail of French and American soldiers, rearranged the caskets, placing them about the room in such a fashion as they saw fit and thus further insuring that none could be identified by its previous location.

Each of the four caskets rested on a like catafalque draped with an American flag.

The military guard of honor outside came to "Present Arms." One American Soldier (Edward F. Younger, Hq. Co., 2nd Bn., 50th Inf.) entered the chamber, alone. In his hand, as he entered the chamber to make his selection of the One Unknown, he carried a spray of French roses.

While the French military band outside played a hymn, he paced slowly about the four caskets in the chamber. Several times he walked about the chamber before, finally, he halted before one of the caskets, gently placing the spray upon this casket he had chosen. So was our Unknown Soldier selected, for time and all eternity to be "Known but to God."

Keep up the good work for I shall be looking forward to seeing each copy.

Sincerely,

I. L. BRASHEAR
Technical Sergeant
Ord. Office, Hq. 7th C.A.
Omaha, Nebraska

★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★

R. O. T. C. CAMP

(Continued from page 105)

tennis, golf, badminton, volleyball, horseshoes, and even table tennis. Boats are available for those who enjoy rowing, and the opportunity has not been neglected.

Camp authorities and students alike believe that the camp schedule has been a most beneficial one. There is no doubt that the students will leave the camp, either to return to their homes or to accept active duty assignments, greatly benefited, both mentally physically.

★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★

"MACHINE SHOP NOTES"

(Continued from page 115)

chined and scraped to have a true plane top surface with square sides. This plate provides a flat surface on which, and from which to work. A hammer, usually light in weight, a prick punch and center punch, a scriber, a pair of dividers, a combination set with twelve inch blade, square head and protractor head, and a surface gage. If available, a height

gage will add considerably to the accuracy of the work. With these tools any plain layout job, and many of the more complex ones, can be accomplished.

Layout work can be a simple procedure, depending entirely upon the intelligent reasoning of the man doing the job. The whole routine is merely the drawing of a series of lines, either curved or straight, on a piece of stock for the machinist to follow in machining operations.

The process for gaining the ultimate result of a machine operation may vary, even though the underlying principle remains the same. This principle is to work from a constant point, or a point which doesn't change, even though the work is shifted in layout procedure. The surface or bench plate usually serves as the constant, and measurements started from any spot on the plate can be retraced in case of error.

After setting the work on the surface plate, a "base line" should be drawn. To this base line other lines may be referred. It is indispensable for leveling or resquaring work which has been shifted. To scribe lines on the job, the dimensions may be transferred from the print to the work by adjusting the point of the surface gage to the scale of the combination square. Intersection lines may be laid off by measuring from finished surfaces, previously located

squares, or by a divider from a given point. Angular lines are layed off with a bevel protractor.

Centers of circles are indicated by a rightangle intersection of two straight lines. A prick punch mark is made at the intersection and is used as a center for one leg of the dividers when scribing the circle. The dividers are set to a scale to the required radius. After the circle has been scribed a deeper center punch mark acts as an excellent drill guide.

Lines scribed on layout work must be clear and distinct. Double or blurred lines are not only bad form but cause inaccuracies in the machining operations. When there is a chance of the lines being obliterated, as on a rough casting, prick punch marks one quarter of an inch apart along the lines will make the pattern more permanent.

Checking a layout as a final step before machine operations will save many a scrapped job, wasted material, and lost time.

LIBRARY

(Continued from page 129)

article by Lieut. Col. J. K. Christmas on the new medium tank, and the article, "Industry at Arms" is well illustrated and makes good reading. Lastly, Mr. Charles Hiller, Jr. presents a brief history of the development of the modern Scout Car.

"Testing the Medium Tank, M3" is the title of a silent 16-mm training film produced here at the Proving Ground.

ART OF LOADING SHELLS AND BOMBS

by Mark S. Watson

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When the Radford Powder Works, in southwestern Virginia, started production late in March, it marked, in effect, the first step in a process which is carried out at the Ravenna Ordnance Works.

In the same way, when the government's big TNT plants at Sandusky, or at Wilmington, Ill. finally turned out their first lots of that high explosive, it was not an end in itself at all. The TNT is sent to Ravenna for further processing.

Likewise, a black powder factory is making its quick-flaming product for use at Ravenna. So is a plant which produces tetryl, and another which produces lead azide, and another which produces fulminate of mercury or

a variant of it. So are a host of other plants which make steel products, and brass and copper, and aluminum, and even such everyday things as paper and wood and fiber containers and paint. Even adhesive tape (yellow, not red, one hastens to add), to the extent of 1,000,000 yards a month.

All of these items are moved to Ravenna, just as were many items of machinery and machine tools, and 8,000 operatives -- 4,000 of them women -- to assemble all these parts into the finished product. That product's sole purpose is to blow itself up, and, in its own destruction, to demolish the enemy's ships or fortifications or factories.

For Ravenna is one of the government's largest plants for the loading of artillery shells and bombs -- ranging from a few pounds to a full ton. It is larger than the largest we had during the first World War, and is expected to be much more efficient, thanks to progress in the art of making high explosives.

It is an art which is little known to most of us. In peace time, our commercial industries make very little high explosive, almost none save the various dynamites -- and it happens that dynamite is very little used in war, owing to its tricky qualities. That is why the army and navy, almost alone, must maintain even in peace time their constant arsenal activities, small as they have been, to furnish the seed which in war can be forced into sudden growth such as we are now witnessing.

How great is that growth is suggested by the fact that when Ravenna's first unit opened operations early in July (two months ahead of schedule) it had a capacity ten times as great as the army's existing capacity. There later will be two other such units at Ravenna. And there will be four other government-built plants within the year.

What is the art of making and loading artillery shells and bombs?

Obviously it is complex, for it would take ten months to get the first unit started, but a cursory and much simplified description of it is worth the giving.

The cannon uses two sorts of ammunition. One is "fixed," very much like that which is used in a rifle or shotgun. That is, within a single metallic cartridge case are both the bullet or shot (the projectile) and the powder whose explosion drives the projectile from the gun. This powder is the propellant charge.

In the second type of cannon, the projectile and the propellant are separate. That is, the propellant force is provided by powder packed in carefully measured bags, sewed together but capable of being snatched apart so that the gun will use just enough to send its huge projectile to the required distance, and no more. Powder is expensive, and too much of it will ruin the gun barrel.

The projectile in this second instance is a separate item. It is flung from the gun by the powder charge, as stated. But when it hits the target, or at some determined time after impact, the projectile itself explodes with a crash of its own, far mightier than that which the propellant powder had given. It is a crash so mighty that the projectile's steel walls are shattered, and the whole area about it (the target) whether it be earth or stone or steel, is torn,

bringing death and destruction and ruin -- perhaps to a whole ship.

What is inside the projectile to produce this result? And how does it get there?

To both questions Ravenna provides the answer, for at Ravenna are finally mixed the various elements which combine to make up the army's great artillery shells or the air corps' mighty bombs, whose ultimate use will be exerted no one knows where or when. Besides the two varieties of shells referred to, Ravenna will make aerial bombs of many sizes, ranging from the small 50-pounders for fragmentation to the huge 2,000-pounders for demolition.

A typical shell for the 75-millimeter cannon looks very much like a very large rifle cartridge, approximately three inches thick and two feet long, and weighing 20-odd pounds. The smokeless powder propellant is all contained at the butt end, of course, taking up nearly half the shell's total length. This powder is ignited by the explosion of the "primer", a mixture of fulminate of mercury and potassium chlorate, which itself is ignited by the initial blow from the gun's firing pin. Instantly upon that impact, the powder bursts into flame and the projectile half of the cartridge (as with the rifle) is torn loose and violently propelled from the gun's muzzle toward the target.

What does this projectile section look like? It is a long cylinder with a narrowing front end, at the tip of which is another firing pin. This latter is not disturbed by the gun's own discharge; its function is, rather, to explode the projectile itself, automatically, only when the firing pin itself is driven violently against the target.

Nothing happens to the steel-cased projectile while it is in mid-air. That is the special virtue of TNT, as opposed to dynamite. It can be handled without injury to the gun crew, even when within a foot of it there is an explosion of powder sufficient to drive the projectile itself as much as twenty miles.

How is the projectile constructed, inside its steel shell? The largest part of the interior chamber is filled with TNT. Within it is a recess, in which is the "booster," composed of tetryl, a chemical far more explosive than TNT. Ahead of the booster is a "detonator" filled with a mixture of tetryl and some still more explosive substances such as lead azide or fulminate of mercury, and ahead of the "detonator" is the projectile's "primer," which is filled with fulminate or some other very high explosive which serves the same purpose, i.e., to set off the larger quantity in the detonator -- and thus the booster, and thus the main charge.

Why not use just one charge of TNT? It wouldn't go off. Why not, then, one single charge of fulminate? That would go off all right, but at what a cost. For fulminate costs about \$3.25 a pound and TNT now costs 17 cents a pound -- which, incidentally, is less than a third of what it cost us in 1918.

The mighty rupturing force is that of the TNT, a truly marvelous explosive, whose own making is a story in itself. It comes from sulphuric acid, plus nitric acid, plus toluol. This last substance used to come from coke ovens, so that the available quantity was determined by the steel business itself. Now it is extracted from petroleum -- it is the same stuff which produces anti-knock qualities

for gasoline -- and in almost infinite quantities.

How are these destructive agents assembled in one small shell? It seems like magic, but the ordnance people regard it as an everyday business, which can be carried on by semi-skilled labor, except, of course, for the technicians and the supervisors. Half of the 8,000 employed at Ravenna are women, whose hand skill is needed in handling the tiny metallic parts which make up the projectile's fuze (the device, which will delay the explosion of the bursting charge a desired length of time.)

The secret is in the breaking down of the whole elaborate process into a series of simple steps, much of which is a check on the one previously performed. The fact is that, despite the tamed fury of these explosives which are handled, there are few accidents in loading plants, and those chiefly -- solely, says one expert -- from lightning. Hence lightning arresters abound at Ravenna, in and on top of all the 456 big igloos, earth-covered, which house the finished shells.

All the components of the shells, save for some metallic parts which are punched out locally, come to Ravenna in finished form. This is not a manufacturing but an assembling plant. Yet in the assembling of all the parts of a 105-mm. shell there are no fewer than thirty-five separate steps -- which suggests how far we have gone in the art of mass production, which is fundamentally a matter of splitting up a large job into a great many parts.

Also it is interesting to note that in a 105-mm. shell there are fifteen major separate parts (a much larger number of minor parts). And, of those fifteen, six parts are related solely to safety. That is why shell-making is relatively safe, in American factories, but not in all other countries. That also is why it is expensive. If there were included only the parts necessary to explode, the job would not take over a twentieth the time per shell -- but we would kill a good many of our own workers and our own gun crews.

The materials for assembly are brought into one end of the great assembling plant and methodically placed so that they will flow smoothly and steadily and perfectly timed to the proper points of assembly. The metal cases here, the powder, in its Radford packed kegs, here; the TNT in crystal form, in rectangular cartons here; the higher explosives, each carefully in its own place, here; the many parts of the "fuze," in exact sequence, here and here and here.

The largest single force is that which assembles the fuze, so that the whole thing, with all its fearfully explosive elements safely confined, is ready to be attached as a unit to the larger chamber which holds the propellant powder. Another large force is that in the several melting and pouring plants, where the crystal TNT is brought to the exact temperature where, fully melted and purified, it pours smoothly.

Another, of course, is that which places the exact amount of smokeless powder in the larger chamber, nearest the butt-end of the shell, occupied solely by the propellant and its primer. All of the several working groups operate smoothly and almost automatically each person limited to one stated task. It is the management which links these tasks smoothly.

The empty projectile cases are up-ended on a platform, perhaps 100 in a lot. In each empty mouth is placed a funnel, and over the whole pattern is stretched a "bib" to keep the liquid TNT from slopping on the outside. Then, from a large bucket carried by hand, a workman pours the yellow, viscous fluid (at 81 degrees Centigrade) into the funnels and so into the shell cases. Then it cools and, with no ceremony whatever, a man with a wooden mallet knocks off the funnels and the extruding TNT. It sounds suicidal, but it isn't.

At the next stop a cavity is bored in the now brick-hard TNT. In the cavity is set the metal container of the "booster." Then the whole fuze -- which meantime has been methodically assembled, bit by bit by the women workers -- is screwed to the shell case, and the whole device is ready to be painted, dried, marked, wrapped in paper, bound in tape, put in the fiber container along with another shell, making a total weight of about sixty pounds, and sent off to the igloo for storage, until such time as the

army calls for a shipment.

There have been inspections all along the way, many of them automatic in themselves, in that if a part does not fit, obviously something is wrong, and the doubtful part and the doubtful shell are put aside. There can be no uncertainty in this business.

The bombs are much easier to make. Moreover, they are far fewer. An army which would use a million shells on a given mission would be unlikely to use more than a few hundred large bombs. But each bomb could do mighty damage. So can each of the great railway gun's shells, which cost something like \$3,000 each.

Which is the most perilous single part of the process? None is especially tough, an old ordnance man assures you. "A kettle, a bucket and a funnel are all you need -- and maybe a thermometer to make sure you're just at 81 degrees Centigrade," he remarked almost with a yawn.

"MATERIALS AND METHODS"

PART 1

In the preparation of a magazine of this type, the Editor usually finds that he has a space of from a fraction of a page to almost four pages at the end of each issue which must be filled with something. One purpose of this column is to fill this space. Some months it will be long; some months it will be short; other months it will not be necessary at all.

But it will serve another purpose as a "filler". More important than the space it fills in the back of the magazine will be the space it fills in the back of your head. Refer to it now and then, for it will contain little facts which you can place in your mental storehouse for future use. It will broaden your general knowledge, we hope, and thus will serve a useful purpose.

NOTE: Items underscored will be discussed in later paragraphs.

1. COPPER, in its alloy with tin, which makes it bronze, was probably the earliest metal known to and used by man. So extensive and characteristic was its use in prehistoric times that one of the early epochs is known as the Bronze Age. Most of the Roman supply came from the island of Cyprus, and the metal was called aes cyprium by the Romans. Gradually this name was shortened to cuprum, and later corrupted into cuprum, from which the English word copper is derived.

2. COPPER is a brilliant metal of a peculiar red color. It takes a high polish, is malleable to a high degree, and is ductile. It is next below iron in tenacity, exceeding both gold and silver in that quality.

3. The MELTING POINT of copper is stated by

various authorities as from 1000° to 1200°. Its freezing point is about 1085°. Its boiling point is variously given as between 1980° and 2310°. The molten metal is sea-green in color, and at higher temperatures it vaporizes and burns with a green flame.

4. POROUS CASTINGS result in copper unless special precautions are taken. The molten metal absorbs carbon monoxide, hydrogen and sulphuric dioxide. In the cooling of the metal these occluded gasses are liberated, causing porous castings.

5. VERDIGRIS forms a coating over copper in moist air containing carbonic acid, although copper is not affected by exposure in dry air. When heated or rubbed copper emits a peculiar disagreeable odor.

6. BLOOD of man and of other animals shows traces of copper. It is widely distributed in nature, being found in most soils, in ferruginous mineral waters and ores. It has been found in seaweed, straw, hay, eggs, meat, cheese and other foodstuffs. Traces of it are often found in the liver and kidneys.

7. ALLOYS of copper are common and are important in the arts. It unites with almost all other metals. The principal alloys in which it forms a leading ingredient are brass, bronze and German or nickel silver.

8. MALLEABLE substance is that which is capable of being hammered or rolled out without breaking.

9. DUCTILE substance is that which is capable of being drawn out, as into wire, for which copper is used extensively.

10. TENACITY is the ability to hold together, as in a substance, such as copper, having great cohesiveness. It will be noted that while these three words, malleable, ductile, and tenacity, are more or less synonymous, each relates to a slightly different quality possessed by copper.