



THE *Capt. W. G. Sylvester*



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HIGHLIGHTS

This month THE ORDNANCE SERGEANT features the office of the Division Ordnance Officer. Captain Hinamon covers the entire subject, except the ammunition viewpoint, in his article on page 280.

Lieutenant Jerome explains the ammunition problem of the Division Ordnance Officer in an article on page 289. If your organization does not keep one or more policy books, as described on page 286, give the idea careful consideration. It's well worth the effort required.

The problem of exterior ballistics is explained on page 302 by Professor Bennett, who carries its development from the earliest ideas to modern knowledge.

"Making Guns Prove Their Worth", on page 296, gives interesting insights on the operation of Aberdeen Proving Ground.

If you read "Lip Service" on the editorial page (279), believe that it is intended especially for YOU.

The first of a series of articles on the Car, Half-track, begins under the Automotive heading on page 316.

Another new series, of special interest to potential or active instructors, is "Ordnance Training Methods", which Major Phillips begins on page 342 of this issue.

One of the trickiest of Ordnance gadgets is the French sight. Lt. Ramnes makes it seem much more simple than might be suspected in his article on page 309.

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The cover for April was designed by Mr. Frank P. Schimenti, Assistant Photographer, Photographic Section, The Ordnance School.



EDITORIAL



Lip Service...

If you can't make your lips work for Uncle Sam, at least don't let them do service for the Axis.

If you read the papers, you have heard a lot about this lately, but you haven't heard too much. Americans are prone to talk, and too often they overlook the fact that seven times one is seven. Seven, as you will agree, is a considerably larger number than one. Still, seven apparently insignificant bits of information, when added together efficiently, can equal a sizable portion of information of military value.

In the halls and rooms of The Ordnance School are to be seen dozens of little posters. The message they carry is simple, but so very vital. "Discreet silence is a full time job."

It may be difficult to keep little bits of information to yourself. You might be offended if someone suggested that your best civilian friend, or your best girl, or your mother, or any other person with whom you come in con-

Large force of mechanized and air units will assemble at New Orleans Tuesday. Units from Fort Knox will pass through Jackson, Miss., Sunday night. Transports probably leave New Orleans Friday bound for Canal Zone.



tact might be a spy. That would be a harsh statement, of course. But if you are guilty of a slip of the lip, if you are careless in your remarks, so might your best friend, or your best girl, or your mother, or any other person also be careless and guilty of a slip of the lip. And the process might continue, even in a few hours, until your innocent remark passed into the ear of a real spy to whom it might not be insignificant.

The British say that "A slip of a lip may sink a ship." Remember that an American doesn't have to be a spy to help the Axis. A remark may be made purposely to give information to the enemy. The same remark may be made innocently in ordinary conversation. Yet the result may be exactly the same in each case. Your remark, added to another equally innocent may add tremendously to the success of Hitler or a Hitler stooge, and may do irreparable damage to our own cause.

If you can't make your lips work for Uncle Sam, at least don't let them do service for the Axis.

NEW ORLEANS, LA.
Beginning Tuesday this will be a jammed place. Men are coming from everywhere. Hope they leave Friday so we can get some rest by Sunday.

MACDILL FIELD, FLA.
I think I can see you Sunday night. We don't have to be in New Orleans until Tuesday. Not a long flight.

FT. GEO. G. MEADE, MD.
Hope we get to New Orleans by Tuesday, like they say. Gulf water'll sure look good again.

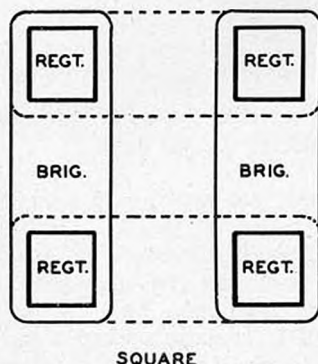
JACKSON, MISS.
No, we'll only be here until we can feed the outfits coming through from Knox on Sunday night.

PINE CAMP, N. Y.
I'm leaving tonight to help guard a train load of tanks. I'll write you from New Orleans Tuesday.

NEW ORLEANS, LA.
We'd better make the most of this week, Babe. I think we leave for the Canal on Friday.

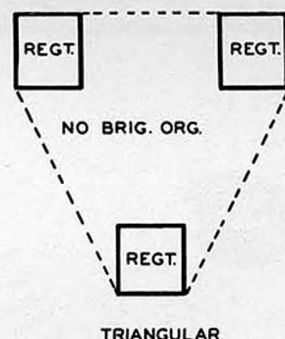
WESTOVER FIELD, MASS.
We're taking off for New Orleans on Sunday. After that, we don't know where, but we're taking tropical clothing.

THE ORGANIZATION AND OPERATION OF THE DIVISION ORDNANCE OFFICE



It is hardly necessary to call attention to the fact that this article refers to Ordnance service within the "Triangular" division, for the old "Square" division is rapidly becoming a thing of the past. "Ordnance service" to combat troops is not a thing of the past. Organizations may change, and administrative and supply methods may change, but the old established policy to "give the using service what it wants before it knows it" changes only in that its meaning is intensified under current conditions. What we tried to do well for the old square division we now strive to do even better for the modern streamlined triangular division.

The division is the smallest of the tactical units which provides a complete Ordnance arrangement. Its position in regard to the flow of unserviceable materiel to rear echelons and in the flow of repaired materiel back to the combat troops is shown in Fig. 1. The methods employed by the division setup are explained in the following article.



By--
Hubert B. Hinamon,
Captain, Ordnance Department

The Ordnance Section of the Infantry Division, Triangular, is a part of Division Headquarters, and has been so designed and organized that it possesses both the personnel and the equipment necessary to handle the immediate Ordnance Service requirements of the Division. The Tables of Organization for the Division include an Ordnance Section of the Headquarters Company consisting of three commissioned officers and twenty-two enlisted men, all this personnel being Ordnance rather than Infantry. Distribution of this personnel is shown in Figure 2.

The motor equipment provided for the Section in order that it may efficiently carry out its mission consists of one (1) five-passenger sedan (QM), three (3) 1/4-ton trucks, 4x4 (QM), one (1) trailer, two-wheel (QM), and three (3) emergency repair trucks (ORD). Other equipment which is authorized for the Section is listed in Table of Basic Allowances No. 9 (ORD) and in pertinent Standard Nomenclature Lists.

After considering the numerous duties and responsibilities of the Division Ordnance Officer, we may safely assume that he is one of the busiest of the staff officers of division. These duties and responsibilities may be summarized as follows:

To command all Ordnance and attached troops and installations in the divisional area.

To meet all Ordnance maintenance and supply requirements of the division in accordance with the tactical plan.

To provide recommendations upon which the division G-4 may base the Ordnance plan.

To execute the G-4 plan as it concerns Ordnance activities.

To establish and operate the necessary distribution points for Ordnance general supplies and ammunition.

To advise the division commander and his staff in all Ordnance matters. This applies particularly to Ordnance technical problems and recommendations of plans for Ordnance activities.

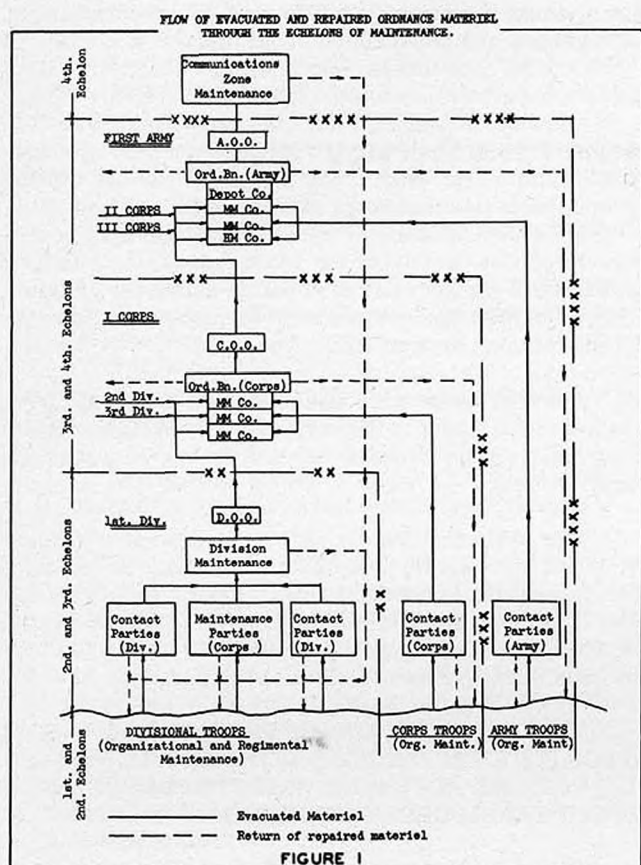
To prepare plans for use by Ordnance troops not assigned to subordinate units.

To collect and evaluate information concerning means and methods of utilization of captured enemy Ordnance materiel and ammunition as well as that of our own troops.

To procure, store and distribute ammunition and other Ordnance supplies and equipment in accordance with apportionment approved by the division commander.

To operate Ordnance storage and maintenance and repair facilities, including the salvaging of Ordnance materiel.

To supervise the Ordnance activities in subordinate units with limits prescribed by the division commander,



especially in combat units where Ordnance personnel is not present.

To make formal and informal inspections of Ordnance equipment.

To select and recommend ammunition distributing points and, after obtaining their approval by G-4, to make the necessary arrangements for transportation required for stocking them.

To arrange through the division G-4 for the submission of ammunition expenditure reports.

To select the site, make recommendations for, and secure the approval of the division G-4 of the location of the Ordnance section or company.

To determine whether the "train" -- the motor transportation organically assigned to the section -- is released to the division Ordnance officer or is still under division control.

To make the necessary arrangements for ammunition supply and maintenance service to attached units.

To make and carry out plans for Ordnance service to troops by means of maintenance and contact parties which go forward to the unit bivouacs or to other convenient locations.

To become thoroughly familiar with the tactical plan of operation, and to keep himself up-to-date regarding that plan by means of frequent visits to the bivouac of the division G-3.

To prepare alternate plans for Ordnance supply and maintenance in readiness for any sudden change in the divisional plan, or for other interruption in the normal chain of supply.

To consult with the artillery commander and the infantry officer, if the division is operating independently, so that they may prepare together plans for the delivery of ammunition and select sites for ammunition refilling points -- subject to the approval of the division G-4.

To supervise Ordnance salvage activities in the field, reclaiming and reconditioning abandoned and discarded Ordnance materiel so that it may be suitable for reissue and use.

To maintain a diary of all important events affecting Ordnance service, including a statistical operations and procedure report. This diary will be of inestimable value to successors as well as to the division G-4.

To plan for the protection, evacuation, or destruction (as a last resort) of Ordnance installations and materiel.

To maintain friendly relations with other arms and services, rendering unstinted service to further the successful execution of the tactical plan.

To determine, by frequent formal and informal inspections of the combat units, whether the Ordnance plan of service is being carried out to the fullest possible extent.

It would seem, then, that the division Ordnance officer has a large and varied task to perform. He has assistants, of course, as indicated by Figure 2, and the responsibilities outlined above are not in excess of those which are necessary to provide adequate Ordnance service to the combat units.

The personnel of the division Ordnance headquarters office consists of one master sergeant, one corporal and four privates, the master sergeant functioning as chief clerk and being responsible to the division Ordnance officer for the performance of his duties. These duties consist of responsibility for all clerical work connected with the operation of the entire section, supervision of all records of maintenance and supply within the section, supervision of the records of the ammunition office of the section, and the maintenance of files and records of the headquarters.

The corporal functions as an assistant to the chief clerk and performs whatever duties may be assigned by him.

One of the privates is the chauffeur of the five-passenger car and is responsible for its care and maintenance. A second private acts as a messenger and a chauffeur-driver of a 1/4-ton truck, the truck being used principally for the transportation of maintenance personnel to locations not otherwise accessible. The two remaining privates assigned to the headquarters office are available for any duties to which the division Ordnance officer or the chief clerk assign them.

The division ammunition office personnel (see Figure 3) consists of a captain, a technical sergeant, a staff sergeant, a sergeant, and four privates. The captain is the

assistant munitions officer, is in charge of the office, and has the following duties and responsibilities:

To train his office staff to carry on at all times, either with or without his presence at the office.

To keep in close touch with the changing situation, so that pertinent information may reach the office for the proper control of the ammunition situation.

To assign and train a responsible noncommissioned officer in the duties of an ammunition officer, so that he may act in that capacity if no commissioned officer is present.

To insure that all clerical assistants have a reasonable working knowledge of all tasks within the office.

To maintain efficient operation of the office itself.

To perform such phases of the ammunition administrative problem as may be delegated to him by the division Ordnance officer.

To understand and be guided by the provisions of Ordnance Field Manual 9-6, Ammunition Supply.

To render technical assistance to the division Ordnance officer in the preparation of an adequate division ammunition plan.

To maintain records and consolidate and submit ammunition reports to the division Ordnance officer for transmission to the next higher command.

To carry out the policies of the division Ordnance officer with regard to coordination and control of the supply of ammunition within the division.*

To keep constantly up-to-date with regard to the constantly changing tactical situation, so that effective plans for each problem may be worked out with the division Ordnance officer.

To maintain active liaison between the various munitions offices and ammunition depots.

The technical sergeant functions as the chief clerk of the division ammunition office, and is responsible for the assignment and supervision of all clerical activities of the office; for the preparation of the necessary time schedules to permit the division ammunition office to function on a 24-hour schedule if need be; for the instruction of personnel in accordance with the policies of the division ammunition officer, for the accomplishment of all routine correspondence in accordance with the policies of the division ammunition officer, so that that officer may have a maximum of time available for other duties; for attaining of knowledge of the ammunition situation within the division; and for the performance of any duties which may be directed by the division ammunition officer.

The staff sergeant is an assistant to the chief clerk, and understudies him to the extent that he will be able to take over his normal duties at any time it may become necessary.

The sergeant may be referred to as an alternate chief clerk, and he, too, acts as an understudy to the chief clerk. In addition he performs such duties as may be assigned by either the division ammunition officer or the chief clerk, and is charged with the traffic control and routing of ammunition trains to the proper supply point.

THE THREE NONCOMMISSIONED OFFICERS LISTED ABOVE ARE CHARGED WITH AND ARE RESPONSIBLE FOR THE ACCURACY AND COMPLETENESS OF FINISHED TRANSPORTATION ORDERS.

Of the four privates assigned to this office, one will normally maintain a Record of Allocations (OFM Form 301) and keep Credit Records (OFM Form 308) up to date. Two other privates will receive Ammunition Reports (OFM Form 303) from troops of the division, and prepare Consolidated Reports (OFM Form 304) for transmission to corps.* The remaining private is assigned as a motorcycle driver, but is capable of performing clerical duties when necessary.

The maintenance and supply office personnel consists of a first lieutenant, a technical sergeant, three sergeants, and five privates. (See Figure 4.)

* For a more detailed description of these procedures see "The Ammunition Supply Problem of the Division Ordnance Officer" on page 289.

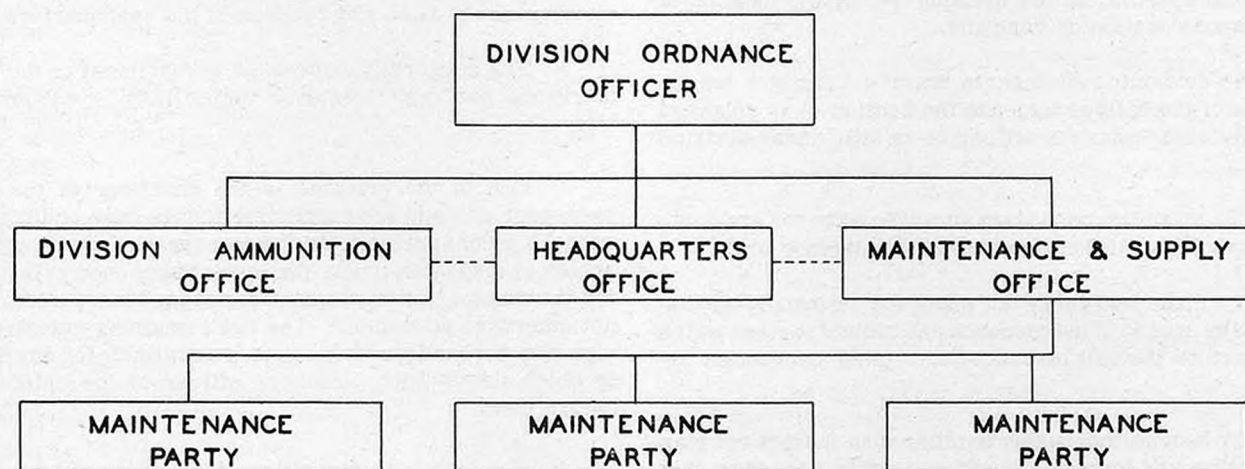


FIGURE 2

* See "Policy Book" on page 286.

The first lieutenant is in charge of this office, and has the following duties and responsibilities:

To take charge of all maintenance operations of the division Ordnance Section.

To dispatch maintenance parties to the proper locations for inspection and repair work.

To supervise the work of maintenance parties.

To call upon corps battalion, under authority of the division Ordnance officer, for additional maintenance parties, if necessary.

To maintain a record of all spare and repair parts, as well as materiel expenditure.

To maintain by serial numbers a record of all major items of Ordnance equipment within the division.

The technical sergeant functions as the chief clerk of the office, and as assistant to the maintenance officer is charged with its efficient operation. In addition he is responsible for the keeping of records of the office and of parties operating therefrom, these records indicating the unit contacted, work performed, spare parts expended, and general condition of Ordnance materiel.

The two privates act as general clerks, performing such duties as the first lieutenant or the technical sergeant may assign to them.

Maintenance parties consist of two enlisted specialists each, one sergeant and one private, one being an artillery mechanic and the other an armorer. No specific duties are assigned except to do everything possible toward keeping the division's Ordnance materiel in the best possible working condition. For this work an emergency repair truck, fully equipped, is used. This vehicle contains all the necessary hand tools, spare parts, repair parts, and a few replacement small arms weapons. Included in the load, is a limited quantity of cleaning and preserving materiel for issue to the combat troops.

Although the duties and responsibilities already outlined indicate the normal functions of the various branches and individuals of the section, it will be found that the administrative details governing the supply of divisional troops by the division Ordnance officer will, of necessity, vary with circumstances and location.

It is understood, of course, that in the combat zone strict adherence to formality and insistence upon special forms in requisitioning supplies is to be avoided.

In the zone of the interior, however, the administrative details of the supply of divisional troops is governed by Army Regulations. Material is obtained through the use of requisitions or purchase orders. Property is accounted for in the normal manner on stock record cards, voucher registers, and voucher files. The supply is disposed of through the use of shipping tickets, certified receiving reports, certificates of expenditure, reports of survey, and inventory and inspection reports, all properly approved by higher authority. Although the division Ordnance officer need not be an accomplished property officer, a working

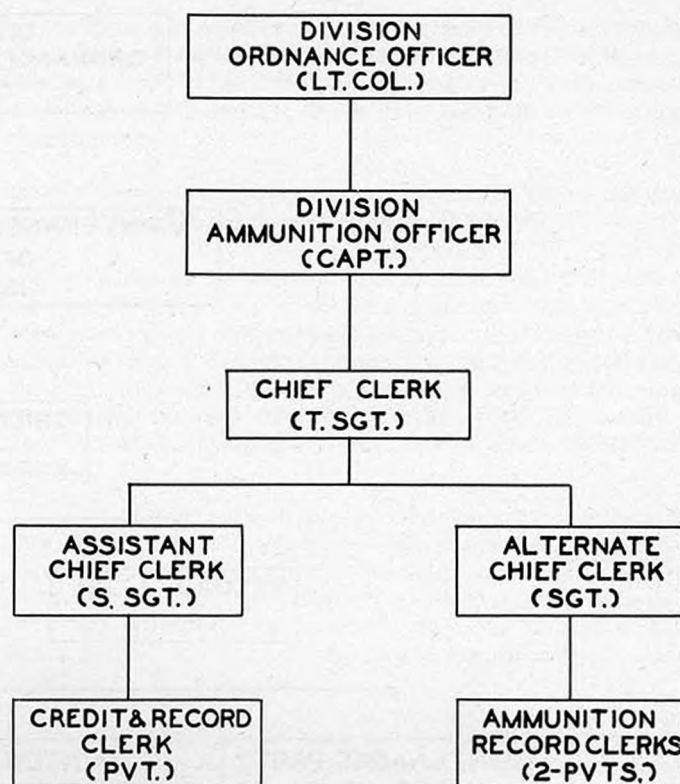


FIGURE 3

knowledge of the following pertinent publications pertaining to property is essential:

- Army Regulations
- Training and Technical Manuals
- Technical Regulations
- Field Manuals
- Ordnance Field Service Bulletins
- Standard Nomenclature Lists
- Tables of Organization
- Tables of Basic Allowances
- Ordnance Provision System Regulations

Army Regulations 1-6, 1-10 and 1-15 should be referred to for indexes pertaining to all Army Regulations; Field Manual 21-6 should be consulted with regard to indexes covering training and technical manuals and training and technical regulations. A complete file of Ordnance Field Service Bulletins is vital, for they constitute Ordnance Department interpretation of existing law in regard to Ordnance materiel. The division Ordnance officer must have a working knowledge of Ordnance supplies and facilities under his control, and the Ordnance Provision System Regulations, of course, is an important aid in acquiring that knowledge.

There are other publications as well which are almost invaluable. Among these is the Ordnance Equipment Chart which really take the place of, and supplements, the Table of Basic Allowances, listing as it does every item of Ordnance equipment which should be on hand in each type of organization in the army. The Ordnance Storage and Shipping Chart is also of fundamental importance, indicating the size, weight and components that may be loaded into various types of transportation vehicles.

It should be noted in considering Ordnance supply in the zone of the interior that the division Ordnance officer

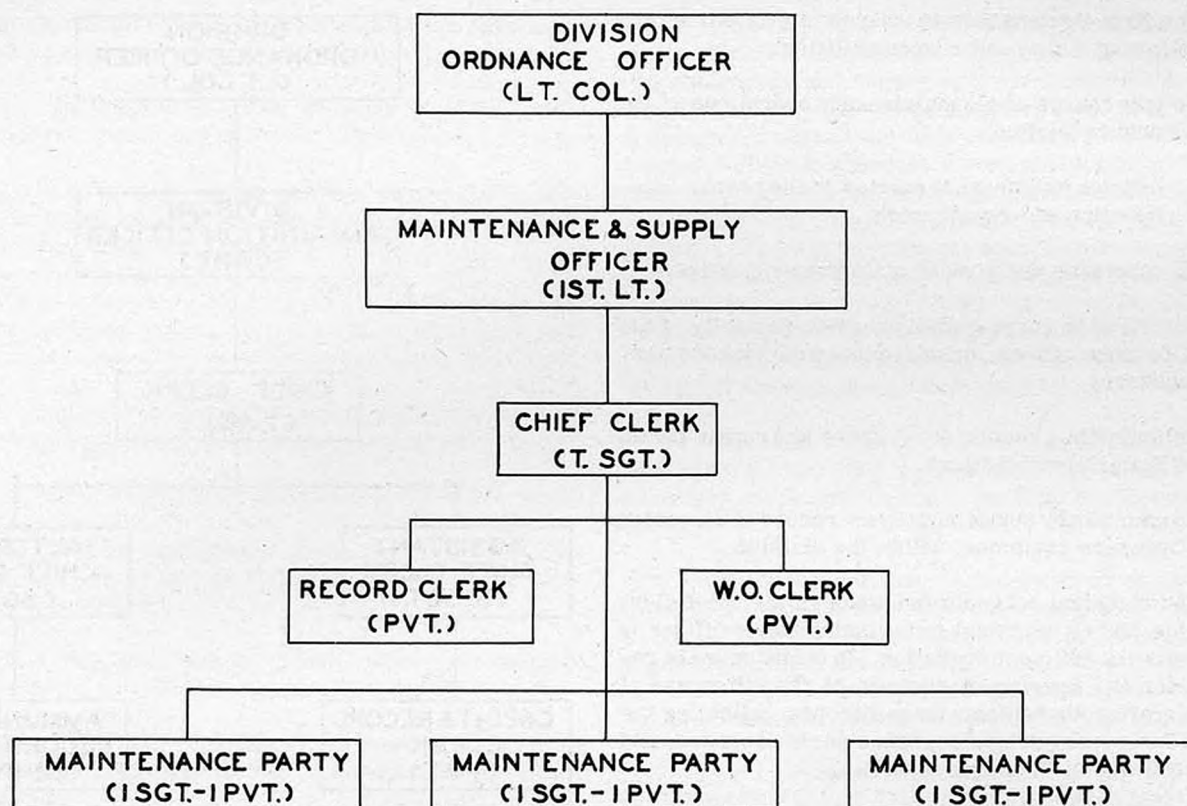


FIGURE 4

acts as a company commander in that the property involved is carried on the stock record account of the headquarters and military police company of the division.

All property is procured through the use of Quartermaster Form No. 400, known as the "Requisition", or by use of any other paper which contains the essential information. Detailed explanations of this form and the procedure to be followed in its preparation and use may be found in Army Regulations 35-6720, 35-6540 and 45-80, and in OFSB 2-1 and 2-2. The following points should not be overlooked.

Before a requisition is prepared, the person engaged in its preparation should consult the Ordnance Standard Nomenclature Lists, Ordnance Equipment Charts, Tables of Organization, and any other publications which may give him essential information concerning type, nomenclature, or amount of property which is authorized.

Separate requisitions must be prepared and submitted in the following instances:

For material authorized in established allowances.

For material authorized but in excess of established allowances.

For material unauthorized.

For material coming from separate supply points within branches.

For separate standard nomenclature list groups.

If it is desired to obtain quartermaster items, Ordnance materiel, and signal property, it is necessary to sub-

mit at least three complete and separate requisitions. If the Ordnance materiel includes items in two or more groups, two or more requisitions are required. Similarly, if the materiel of one group is supplied by different supply points, an additional separate requisition must be prepared for each supply point involved.

Requisitions for materiel which will be supplied by the post Ordnance officer are prepared in triplicate, the original and one copy being forwarded to the post Ordnance officer while the final copy is retained in the office of the division Ordnance officer as a file copy.

On the other hand, materiel to be supplied by an outside agency must be obtained by means of a requisition prepared with an original and six copies. The original and five copies are forwarded to the supplying agency, with the final copy being retained as a file copy.

In the case where the items required can be obtained locally the requisition is addressed to the depot or post Ordnance officer, whereas for items to be furnished by an outside agency the requisition is addressed to the commanding general of the corps area in which the division is located (or to the department commander if the division is in foreign service). Note that the requisition is sent to the commanding general of the corps area in which the division is located rather than to the commanding general of the corps to which the division is attached.

All pertinent information with regard to the addresser, the approving authority, the submitting authority, nomenclature of materiel desired, the amount on hand and the amount consumed and desired, is placed on the face of the requisition. In other words, the properly prepared requisition will show a complete and detailed picture of the need

for supplies which it presents.

The maintenance and supply officer of the Ordnance section of the division must submit timely requests for required materiel to the supply officer of the headquarters, in the proper number of copies in each instance. The division Ordnance officer, through whom these requisitions are submitted, maintains in the maintenance and supply office the Requisition Register, which is a "brief" of all requisitions submitted for the supply of property.

Upon receipt of a requisition by the post Ordnance officer from the division Ordnance officer, even though property units maintain the stock record accounts for the division, the Post Ordnance officer determines whether or not the materiel is available for issue at his station. If it is available he issues it, and uses the requisition, properly certified, as a valid voucher to his account. If the materiel is not available in the warehouse of the post Ordnance officer, he certifies the certificate as to non-availability and forwards it to the commanding general of the corps area for necessary action.

If property is not available by any other means, it may become necessary for the division Ordnance officer to obtain the property by means of "local purchase."

If this procedure is necessary, at least three local concerns dealing in the commodities concerned are contacted, and the lowest price for the required items is ascertained.

Through command channels the division Ordnance Officer then initiates a letter to his supply agency -- the commanding general of the corps area -- requesting that funds be made available for the purchase. This is necessary in order that the commanding officer of the station may intelligently determine the reason for the purchase.

Upon receipt of this request the commanding general of the corps area orders the corps area Ordnance officer to allocate the funds required to the office of the division Ordnance officer or to the post property officer, as circumstances may dictate.

The funds are allocated as ordered, and the office to which they are allocated then arranges to purchase the materiel through the local purchasing agent. This agent contacts at least three local dealers, determines the lowest price which can be obtained, and prepares a purchase order. The dealer supplying the materiel is furnished with two copies of this purchase order, the finance officer designated to make payment is furnished with one copy, one copy is furnished the post Ordnance officer, and one is retained by the agent handling the purchase. This purchase order contains a notice directing that the materiel be delivered to the post Ordnance officer. Upon its receipt a receiving report in quadruplicate is prepared by the post Ordnance officer. The signed original and one copy is sent to the finance officer designated to make payment, one copy is sent to the purchasing agent, and one is retained as a debit voucher.

Upon receipt of his copy of the receiving report the purchasing agent prepares a report to the corps area Ordnance officer, indicating the exact amount which is being spent under the original allocation.

In case the materiel is intended for immediate use

by the division Ordnance officer, the post property officer issues it, and receives a certificate on the face of the receiving report to the effect that the materiel is for immediate use and, therefore, is not to be taken up on the stock record account.

Army Regulations 5-240 should be consulted for general instructions regarding this procedure.

While as a rule the division Ordnance officer does not carry materiel on stock record account, this might be done under some circumstances, and for that reason a description of the proper procedure in accounting follows. General references on this subject may be found in Army Regulations 35-6520, 35-6540, 35-6560, 35-6620, 35-6700, 35-6720, 45-80, 30-950, 30-955, 30-975, and in OFSB 2-1 and 2-2.

A few definitions may prove beneficial as a part of this discussion. An officer is said to have accountability for property which he carries on his stock record account and has in his physical possession, either in his warehouse or in use by him, or for property which he carries on his stock record account and has issued out on memorandum receipt.

An officer is said to have responsibility for property which he has in his physical possession and for which he has given his memorandum receipt. (Someone is responsible for property at all times, regardless of whether or not a signed memorandum receipt has been given.)

Expendable property includes all property which is consumed in the maintenance and upkeep of the public service, as distinguished from property which is worn or worn out. Examples of expendable property are fuel, forage, gasoline, oil, cleaning and preserving materials, and spare and repair parts which lose their identity upon installation.

Non-expendable property includes all property which retains its identity through a relatively prolonged period of use and must be worn or worn out in the maintenance and upkeep of the public service. Examples are clothing, equipment and weapons.

The stock record account is a written record of all materiel for which an officer is accountable. The account consists of a stock record card, voucher file, and a voucher register.

The voucher register is used to list all vouchers, both credit and debit, and to assign a number to each. A new register is begun for each fiscal year with voucher number "1", succeeding vouchers being numbered consecutively, whether credit or debit. The last voucher on June 30th of each year closes a voucher register, and the first voucher of the next day, July 1st, begins a new series of numbers.

When a voucher must be recorded, the number which it will bear is obtained from the voucher register and placed on the voucher. Proper entries are then made on the appropriate stock record cards, and the voucher is filed in the voucher file, pending the next visit of the auditor.

With regard to accountability property is classified as Class I, Class II or Class III.

Class I property is real estate, and includes docks, lands, buildings, etc.

Class II property is commonly known as "permanent property". It includes installed machinery, appliances, pictures, etc.

These two classes of property are not carried on the stock record account of any accountable officer, but are placed on the historical records of the post, camp or station. The Quartermaster General is responsible for the location and general maintenance of all property, permanent and real, and designates a quartermaster at each post, camp or station (not exempted from control of the chief of branch concerned) as the custodian of the historical records for the station.

Class III property consists of supplies. It includes all raw material, manufactured items, equipment, etc., when secured and issued to the army. Care must be taken not to confuse the permanently installed machinery in trucks with permanent machinery installed in buildings. The former are supplies (Class III) while the latter are permanent property (Class II).

Before property accountability is assumed, however, certain formalities must be carried out. First of all the receiving officer, whether he be a post, depot or unit supply officer, must check all shipments assigned to him. This check must determine both the quantity and quality of the property assigned to him on a shipping ticket or a receiving report. Then, in the event of either shortages or overages, necessary adjusting steps must be taken, either by means of a Report of Survey or of an OS&D (over, short and damage) Report. If a Report of Survey is required, the necessary data must be secured. Finally, vouchers must be executed by the officer who is to assume responsibility and accountability for the property in question.

In the issue or replacement of property certain requirements must be observed. All organizational property is issued to the unit supply officer of the unit concerned. Such issues are made by one of the following methods:

Shipping ticket.

Completed vouchers, such as reports of survey, statements of charges, or accomplished inventory and inspection reports.

Direct exchange accompanied by certificates of re-

sponsible officers.

Certified requisitions.

All table of allowance property is issued on memorandum receipt to the company or unit supply officer.

All issues of organizational non-expendable initialed equipment, and all issues of non-expendable equipment are made by shipping tickets addressed to the unit supply officer (accountable officer).

All issues of expendable initialed equipment are made by the post property officer by means of certificates placed on the faces of the post property officer's vouchers. These certificates are signed by the unit supply officer.

All replacements of expendable property are accomplished either by direct exchange or by the submission of a requisition which states the reason for the material not being presented for exchange.

All replacements of non-expendable property are made by direct exchange accompanied by a certificate of fair wear and tear, signed by the responsible officer; or, by a completed voucher such as a report of survey, statement of charges, or inventory and inspection report; or, by a requisition adequately supported by written entries indicating the reason for the needed supply.

Several different procedures are required in the preparation and use of shipping tickets, depending upon circumstances in each case. For issues of property within the post three copies are prepared. The original and one copy are forwarded to the receiving officer, and one copy is retained in the shipping officer's file. The receiving officer files the copy which has been forwarded to him, but receipts the original and returns it to the shipping officer. Upon receiving it the shipping officer places it in his voucher file and sends the copy, which he had originally filed, to the corps area finance officer for the auditor's file.

For issues leaving the post to another location within the same corps area, one circumstance will dictate the use of one of two methods. If the material being issued bears serial or lot numbers, seven copies of the shipping ticket must be prepared, and the following distribution



THE POLICY BOOK



Ordnance Field Manual 9-10 (Tentative) describes an idea which certainly has unlimited usefulness.

The "policy book" is a note book, or folder, in which is recorded for the future reference of interested personnel the policies of the officer in charge of the echelon to which the book pertains, on problems the solutions of which are discretionary with such officers, as well as the procedures for handling matters not otherwise covered by authorized publications.

Such a book is most useful in maintaining a continuity of policy in operation, on changes of command, during the absences of officers, and for the training of personnel in the desires of the officer in charge. Sections of the

book should be properly titled and entries should all contain the reference which is the authority for the entry, for instance, "Co. Order No. _____, date," or "Shop Order No. _____, date," or "VOCO, date," etc. As the book develops it should be properly indexed. If properly kept, the Policy Book will develop into a valuable source of information for the Office of the Chief of Ordnance concerning the operations of type organizations or sections.

(THE ORDNANCE SERGEANT, too, would find Policy Books, or even extracts from Policy Books, quite interesting and useful, for it might be possible to pass worthwhile policies or ideas found therein on to other organizations. Such a system might be especially useful to newly activated organizations.)

made:

Original and one copy -- Send to receiving officer.

One copy -- Retain for file.

Two copies -- Forward to corps area finance officer for the auditor's file.

One copy -- Send to the Office of the Chief of Ordnance.

One copy -- Send to corps area Ordnance officer.

If the material does not bear serial or lot numbers, six copies are prepared. Distribution is the same as that listed above, except that a copy need not be forwarded to the Office of the Chief of Ordnance.

For an issue of property leaving the post to a different corps area the same procedure is followed as in an issue to another post within the corps area, except that one additional copy of the shipping ticket is prepared and forwarded to the Ordnance officer of corps area to which the issue is being made.

One of the most important of property considerations is that of the storage and safekeeping of property. This is especially important to the accountable officer, since Army Regulations 45-80 and 700-10, as well as OFSB 2-2, require all Ordnance and other materiel to be properly safeguarded and stored when not in use.

It is the responsibility of the post commander to see that property is correctly stored and properly safeguarded,

as well as to insure that sufficient materiel is on hand to equip the troops present and that adequate supplies are available for the proper maintenance of that materiel. He is also responsible for the protection of stored property against fire, theft, etc.

It is the responsibility of the post Ordnance officer to maintain sufficient stores for proper service at the station; to properly clean, brush, store and safeguard materiel not in use; to assist in the selection of a site for storage; to aid the commanding officer in the formulation of plans for efficient warehousing, considering the location and type of materiel to be stored, as well as to insure that adequate transportation facilities, including highways, railroads, waterways, and landing fields, are available; to arrange for the storage of Ordnance materiel in accordance with the standard nomenclature lists, by groups and alphabetically within groups; to maintain adequate charts showing the locations of items in storage; to insure the making of adequate fire-fighting arrangements to include proper arrangement of stores and materiel and provisions for fire aisles in warehouses; and to provide suitable and sufficient strong rooms for proper storage of small arms and other small but expensive items, such as fire control materiel.

In addition to being classified for purposes of accountability, property is also classified for purposes of disposition after it becomes unserviceable. Class I property is that which has been worn out through fair wear and tear in the public service. An Inventory and Inspection Report is issued in connection with its disposition (AR 20-35).

Class II property is that which has become unserviceable due to causes other than fair wear and tear. A

ACTION OF RECEIVING OFFICER			Possible action of commanding officer of Report of Survey when required.
CIRCUMSTANCES	OS & D Required	R/S Required	
1. Common carrier accepts full financial responsibility for loss or damage.	NO	YES	Approve Report of Survey finding carrier responsible.
2. Less than \$10.00 in value - carrier denies financial responsibility.	NO	YES	a. Approve Report of Survey finding carrier responsible. b. Approve Report of Survey relieving all concerned. c. Appoint surveying officer.
3. More than \$10.00 in value but less than \$500.00 in value - Common carrier denies financial responsibility.	YES		
a. Shipping officer approves OS&D		NO	
b. Shipping officer disapproves OS&D		YES	a. Approve Report of Survey without action or Surveying Officer finding common carrier responsible and relieving all others concerned. b. Approve Report of Survey without action of Surveying Officer relieving all concerned. c. Appoint Surveying Officer.
4. All cases where property exceeds \$500.00 in value - Common carrier denies financial responsibility.	YES		
a. Shipping officer approves OS&D		NO	
b. Shipping officer disapproves OS&D		YES	<u>MUST</u> appoint a Surveying Officer.
NOTE: The \$500.00 maximum for which a commanding officer can approve a report of survey without the action of a surveying officer is waived at depots and arsenals.			

Report of Survey must always be used to fix responsibility for the condition of such property, as well as to recommend its disposition (AR 35-6640). It follows, therefore, that it is the duty of the surveying officer to recommend disposition of the property as well as to fix responsibility for its condition.

The chart on page 205 may be used as an aid in the preparation of reports of survey.

It sometimes becomes necessary to transfer property, transfers as they are considered here involving a complete change of property accountability from one officer to another. This is accomplished by means of certificates signed by both officers to the effect that the account is true and correct.

The certificate is worded in accordance with the provisions of War Department Circular No. 63, 1941, published pending changes in AR 35-6680. The pertinent explanation and procedure quoted from the circular follows:

"(1) Transfer of public property in stock record accounts.

(a) A transfer of public property involves a change of possession and accountability. In ordinary cases of transfer, the transferring officer will furnish the receiving officer with shipping tickets in duplicate, accurately enumerating the property, and the latter will return one signed copy. In cases in which complete transfer of property occurs, instead of exchanging shipping tickets, the officer being relieved of accountability, and his successor, will sign certificates effecting the transfer as follows:

19__

(Place) (Date)

I certify that the balances shown on the stock record account of the (Designation of the Account) _____, as of the above date, last voucher No. _____, dated _____, 19__, are true and correct to the best of my knowledge and belief, and that the property has, this date, been turned over to (Name of receiving officer) _____, pursuant to (Order directing transfer) _____.

(Officer turning over property)

I certify that I have, this date, received from (Officer being relieved) _____, predecessor, all property pertaining to the above designated stock record account for which my said predecessor is accountable, as shown by the last audit of the account, plus all proper charges against and less all authorized credits to my predecessor's account to the time of transfer, last voucher No. _____, Dated _____, 19__, and that I have, this date, assumed accountability for the property pertaining to this account.

(Officer receiving property)

Approved: _____
Commanding

(b) One copy of the certificate of transfer will be retained by the officer who is relieved of the accountability; one copy will be filed with the property records, and one copy together with a copy of the order directing the transfer will be sent immediately to the corps area finance officer for the auditor's file."

Army Regulations 35-6520 require that the accounts of accountable officers be inventoried at least once each year. In large accounts these inventories need not be taken all at one time, but may be conducted as a "running inventory" and spread over the entire year. On the other hand, inventories of comparatively small accounts should be taken all at one time, even if it is necessary to stop operations temporarily.

Inventories are taken by men who physically count all items in storage, and give accurate signed records thereof. These individuals need not be commissioned officers, nor even noncommissioned officers, but it is required that the count slips be signed by the person in charge of the count.

These slips are turned over to the stock record clerk, who enters the information contained on them on the stock record cards. These entries include "date", "as per inventory", and "amount". The entries are made in red, and the amount entered is the exact amount found in the count, regardless of whether or not it agrees with the balance shown on the card. The slips are retained pending a check at the next visit of the inspector or auditor. Adjustment of discrepancies is made by means of OS & D reports for overages, and by Reports of Survey for shortages.

Each year an audit is made of the account of each accountable officer. It is ordered by the corps area commander, and is made under the supervision of the corps area finance officer.

An audit is a check of an account in order to determine whether all entries have been made, and whether the account is true and correct. If the account is correct, the auditor issues a Certificate of Audit.

Thus far we have been considering conditions as they exist within the zone of the interior. It must be remembered that division Ordnance officers have no accountability for property in a theater of operations. Responsibility, however, is retained, and accurate records are maintained.

Necessary spare and repair parts, and some small arms weapons, may be drawn from the supply officer of the corps maintenance battalion, and while the division Ordnance officer is responsible for this property he is not accountable for it. Usually the amount of such requirements will be determined by the maintenance section of the division.

Periodic certificates of expenditure are submitted to the accountable officer of the corps maintenance battalion so that that officer may be relieved from accountability of property on his stock record account.

Periodic requisitions are used to replenish the unit supply.

Sufficient copies of certificates of expenditure should be prepared by the division Ordnance officer so that one or more copies may act as requisitions for replacement items.

This discussion of the division Ordnance office would not be complete without some consideration of "contact parties". The mission of the contact party is to

(Continued on page 293)

THE AMMUNITION SUPPLY PROBLEM of the DIVISION ORDNANCE OFFICER

The provision of adequate supplies to combat troops is an indispensable factor in the successful prosecution of any military operation. Both before and during combat, the most essential item to be supplied is ammunition. It constitutes by far the greatest mass of the supplies to be moved to combat troops and the complexities imposed by the numerous kinds and types which must be supplied, and the large tonnages which must be handled, make its supply a difficult problem. Therefore, making this essential commodity available to the using troops in the kinds and quantities needed and at the times required, is one of the major responsibilities of the Ordnance Officer of all echelons who is the special staff member charged with the administrative tasks of ammunition supply. The Division Ordnance Officer may establish the division ammunition office to assist him in this task.

The ammunition supply problem in the division is such that the Division Ordnance Officer must keep in constant touch with the tactical situation of the division, and with the plans of the division commander, particularly as to the effect of these plans upon the ammunition supply problem. He must also keep himself constantly acquainted with the current ammunition supply situation.

In connection with the latter requirement, the following factors must be considered: The amount of ammunition currently in the hands of the combat troops; The amount of ammunition remaining in stock or on credit at depots or other supply points; The size and location of any reserve to be retained under the control of the division commander; and the location of the ASP's in which the ammunition is available with reference to the locations of troops requiring the ammunition for use.

A brief discussion of the factors mentioned in the preceding paragraph is given in the paragraphs which follow.

Ammunition in the Hands of Troops

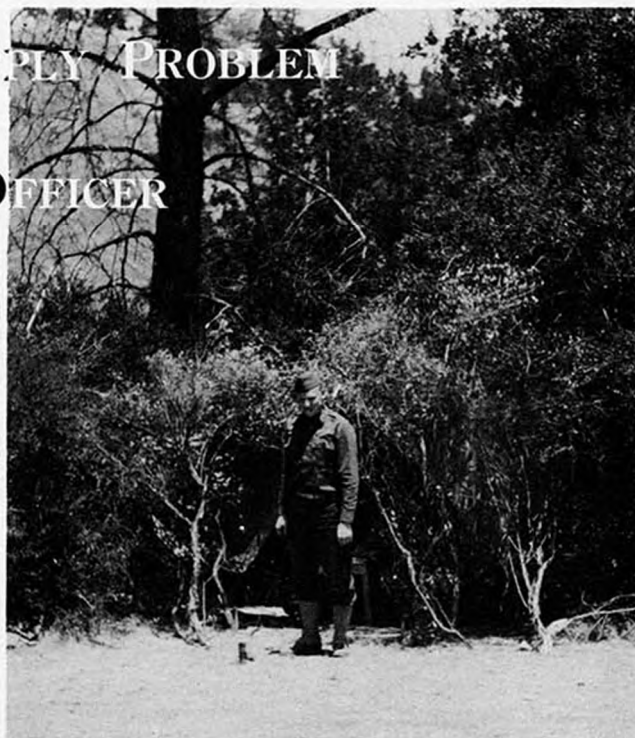
The amount of ammunition in the hands of troops is determined by means of ammunition reports. All reports from divisional units are prepared on OFM Form 303. Artillery units of the division submit their reports to the artillery officer for consolidation and transmission to the Division Ordnance Officer. All other units submit their reports directly to the Division Ordnance Officer.

OFM Form 303 consists of two sheets: OFM Form 303 a for artillery ammunition and OFM Form 303 b for infantry ammunition. The amounts of each type of ammu-

By—

C. W. JEROME,

1st Lieut. Ord. Dept.



Army Ammunition Supply Point, Fourth Army maneuvers, June, 1941.

nition received, expended, and remaining on hand are entered opposite the code symbol for that type of ammunition. The key to the code symbols is given on the reverse side of the sheets. (Only the obverse side of the form is reproduced here.) (See Figures 1 and 2.)

At the division ammunition office, the information contained in the OFM Forms 303 is consolidated and an ammunition report, OFM Form 304, is prepared for transmission to the Corps Ordnance Officer. The OFM Form 304 shows the amount of ammunition received and expended by the troops of the division during the reporting period, the ammunition remaining in the hands of the troops, the ammunition held to the credit of the division in ASP's under the existing allocations, and the sum of these two figures, or the total available to the division under the existing allocations. The entries for each type of ammunition are posted opposite the code symbol for that type of ammunition. Due to the large number of types of ammunition distributed, the form consists of two sheets. On the reverse side of each sheet there is a description of the types of ammunition covered by the code symbols listed on the front of the sheet. (Only one sheet is reproduced, in part, here.) (See Figure 3.)

In all cases, ammunition reports must be sent to the next higher echelon by the most expeditious means possible, and will be substantiated or confirmed by a written copy of the same report. It is essential that all reports reach higher headquarters as soon as possible in order that the "dead time" between the termination of the reporting period and the time that the Army Ordnance Officer has all the facts is kept as short as possible.

The check on the status of credits due to the division is maintained by means of the Credit Record, OFM Form 308. (See Figure 4.) One sheet is kept for each type of

OFM 303A

AMMUNITION REPORT
(Artillery Ammunition)

Unit: _____ Location: _____

From: _____ To: _____
(Hour and Date) (Hour and Date)

Comp. Rds Code	Bal. last report	Rec'd	Exp'd	Bal. on hand	Comp. Rds Code	Bal. last report	Rec'd	Exp'd	Bal. on hand
P1ZAM					R1QCA				
P1ZCM					R1QIA				
P1ZAN					R1QKA				
P1ZAO					R2ZAG				
P1ZAP					R2ZAR				
P1ZBC					R2ZAS				
P1ZCN					R2ZAT				
P1ZBD									
P1ZBE					T1IBD				
P1ZBG					T2AAA				
P5EAA									
P5ETX									
P5MEX									
P5MTX									
R1LOA									
R1MCA									
R1MDA									
R1MXX									
R1NAA									
R1NBA									
R1OAA									
R1OBA									
R1QBA									
R1QCA									

(See Reverse for Code Legend)

(Signature) _____

OFM 303A
Figure 1.

complete round of ammunition credited to the division. A separate set of Credit Record sheets will be kept for each ASP in which credits have been received. A suggested method of keeping the form is as follows:

(1) Date — Calendar date when the transaction is posted to the record.

(2) Voucher number — The number designating the valid voucher covering the transaction.

(3) Unit — the name of the unit issuing or receiving the voucher.

(4) Credited — When an allocation is received it is posted in this column provided that there is no other credit currently in effect. If there is another credit currently in effect, the new allocation will be entered in the space provided at the bottom of the sheet. When the current credit is reduced to zero, is cancelled, or expires, the next credit at the bottom of the sheet is entered to the body of the record and is crossed out of the record at the bottom of the page.

(5) Issues — In this column is entered ammunition actually issued against credits. Cancellations of credits may also be entered here with the notation "Cancellation of credit". The "Running Balance" column under "Issues" is used for the purpose of keeping the balance of issues for the reporting period.

(6) Balance — This is the balance of the credit being used. To determine the total credit available to the division, the credits at the bottom of the sheet must be added to this balance.

Location of ASP's

The suitability of the location of army ASP's supplying the division with ammunition with respect to the

road net between divisional units and the ASP's must also be considered by the division ordnance officer. He must be prepared to make timely recommendations to division G-4 concerning this matter for transmission of the recommendation to the Army Ordnance Officer. The Army Ordnance Officer is responsible for the assignment of general areas for the establishment of ASP's while the commander of the ASP is responsible for choosing the exact location within the designated area.

While it is true that the success attained by the ASP commander in locating his supply point will have a large influence upon the ease or difficulty with which the division

OFM 303B

AMMUNITION REPORT
(Infantry Ammunition)

Unit: _____ Location: _____

From: _____ To: _____
(Hour and Date) (Hour and Date)

Comp. Rds Code	Bal. last report	Rec'd	Exp'd	Bal. on hand	Comp. Rds Code	Bal. last report	Rec'd	Exp'd	Bal. on hand
R1GBA					T1EPB				
R1GEA					T1EPC				
R1GHA					T1IBD				
R1LCA					T2AAA				
R1LDA					T2APA				
R1LEA									
R1LFA									
R1LGA									
R1LHA									
R1LIX									
R1LLE									
R1LXX									
R1LOA									
R1NAA									
R1NBA									
R1OAA									
R1OBA									
R1CAA									
R1FCX									
T1EGA									
T1EGD									
T1EGE									

(See Reverse for Code Legend)

(Signature) _____

OFM 303B
Figure 2.

ordnance officer may obtain his required ammunition, it is the responsibility of the latter to make the best of any situation and in every case to keep himself constantly aware of the situation which he must meet and devise adequate means of meeting it.

Division Reserves

Another factor which must be kept constantly in mind by the division ordnance officer in the desirability of moving division reserves of ammunition forward from army ammunition supply points. The ideal solution of any supply problem would be the delivery of all types of material from the communications zone directly to front line units at the times and in the quantities needed. Such a solution is impracticable in the case of ammunition supply, however, since the demand for the various items fluctuate widely from day to day. Also, lines of communication may be interrupted and shipping schedules delayed not only by hostile interference but also by unforeseen incidents within the transportation system. All these conditions require that a reserve of ammunition be accumulated closer to the front than the advanced depot of the communications zone. The army establishes reserves of ammunition in ASP's in order to meet promptly the needs of the combatant troops. Such reservoirs of ammunition are designed to take up the

OFM 302A AMMUNITION TRANSPORTATION ORDER (Artillery Ammunition) No. _____

Division _____ Corps _____ Army Ammunition (Service Train).

Hour _____ Day _____ Month _____ Year _____

Charge to Allocation No. _____ Office _____

To be executed (date) _____ Expiration date _____

1. Tonnage: _____ 2. Number of trucks: _____

3. Material to be transported:

Code	Quantity	Code	Quantity	Code	Quantity
P12AM		R1LGA		R22CA	
P12CM		R1LHA			
P12AN					
R1LEA		R22EM			
R1LEA		R22BY			
R1LEA		R22BE			

(See Reverse for Code Legend)

4. Place of loading: _____

5. Time to reach loading point: _____

6. Destination of ammunition: _____

7. Place where guide will be found: _____

8. Ammunition is for: _____

(Munitions Officer)

(Train Commander)

Div. _____ Corps _____ Army

OFM 302A
Figure 5.

6.) The form is filled out by entering the amounts of each type of ammunition to be transported opposite the code symbol for that type of ammunition. The key to the code symbols is located on the reverse side of the form.

The form is prepared in duplicate. One copy is retained by the division ammunition office for the records and information of that office, and the other is presented at the ASP as the authority for drawing the ammunition.

Ammunition Dumps.

As the term implies, an ammunition dump is a temporary stockage of limited quantities of ammunition on the ground. Such a stockage is normally established because the transportation carrying the ammunition is needed for other hauling duty, or because it is believed necessary to provide reserves of ammunition in forward areas for contemplated tactical operations. An ammuni-



Sign with Ordnance colors pointing to the Division Ammunition Office during Fourth Army maneuvers, June 1941.

tion dump, as such, does not constitute an ammunition supply facility, for the reason that it is not organized for issues.

When it is the desire of the division commander that issues be made from dumps, they become distributing points and the Division Ordnance Officer will be responsible for all details necessary to accomplish issues to the units at the times designated by the division commander. In those cases where the Ordnance personnel available to the DDO is not adequate, he will call upon the Army Ordnance Officer through the Corps Ordnance Officer for troops from the army ammunition battalion to operate the division distributing points.

OFM 302 B AMMUNITION TRANSPORTATION ORDER (Infantry Ammunition) No. _____

Division _____ Corps _____ Army Ammunition (Service Train).

Hour _____ Day _____ Month _____ Year _____

Charge to Allocation No. _____ Office _____

To be executed (date) _____ Expiration date _____

1. Tonnage: _____ 2. Number of trucks: _____

3. Material to be transported:

Code	Quantity	Code	Quantity	Code	Quantity
R1GBA		S1RCA			
R1GBA		S1RCA			
R1GBA					
S1ABA					
S1ABA					

(See Reverse for Code Legend)

4. Place of loading: _____

5. Time to reach loading point: _____

6. Destination of ammunition: _____

7. Place where guide will be found: _____

8. Ammunition is for: _____

(Munitions Officer)

(Train Commander)

Div. _____ Corps _____ Army.

OFM 302 B
Figure 6

When an ammunition dump becomes a distributing point its organization and operation must be similar to that of other facilities in the ammunition supply system. Certain factors affecting the ammunition distributing point and its operation must be given careful consideration; they should be well camouflaged, and should be located in defiladed areas; they should avoid main roads, cross roads, or points that will invite hostile fire or air attack; receipts and issues must be coordinated; and distributing points should normally be established according to the class of ammunition, i.e., infantry or artillery ammunition.

Summary

The duties and responsibilities of the Division Ordnance Officer with respect to the ammunition supply problem can be summarized as follows:

1. He must constantly consider the adequacy of stocks available to the division and the suitability of the location of ASP's supplying the division.

2. He must consider the advisability of moving division reserves forward from ASP's and the desirability of maintaining rolling reserves or of establishing ammunition dumps.

3. He must be prepared to make timely recommendations to division G-4 concerning the above cited subjects.

4. He is responsible for the supervision of the operation of divisional rolling reserves and distributing points.

5. He keeps the records of all allocations and of drafts made therefrom. He receives and acts on requests for ammunition and carries out such other administrative details with respect to ammunition supply as may be required.

6. He may establish the division ammunition office to assist him in the above duties.



THE DIVISION ORDNANCE OFFICER

(Continued from page 288)

carry Ordnance service to the combat troops of the division. Each party working from the division Ordnance office is assigned to the support of certain combat troops of the division. Any other disposition or assignment which might become necessary for the solution of particular problems is made by the division Ordnance officer.

Maintenance operations of the contact party usually extend only to (1) the inspection of weapons, (2) the accomplishment of repairs to Ordnance materiel, and (3) the issue of Ordnance general supplies to troops. The party makes regularly scheduled and emergency visits to the troops as often as may be necessary for the purpose of providing such Ordnance maintenance service as may be required.

The following sources of information should be consulted in regard to initial basic loads for contact parties:

Standard Nomenclature Lists.
Ordnance Equipment Charts.



VALVE HOLDER CONSTRUCTION

If you tried to manufacture one of the valve holders shown and described in the February issue, maybe you noticed a slight error in dimensions — or maybe you juggled dimensions shown.

For the information of all who are interested, the working drawing is reproduced here — with correct dimensions shown.

The original drawing reproduced in the February issue specified that annealed copper should be used in the manufacture of this gadget. Since then it has been learned that it is practically impossible to obtain this material, and it is recommended that either mild or soft steel be substituted.

Tables of Organization.

Ordnance Shipment and Storage Charts.

A contact party must be equipped with adequate tools, including gages, for the repair of:

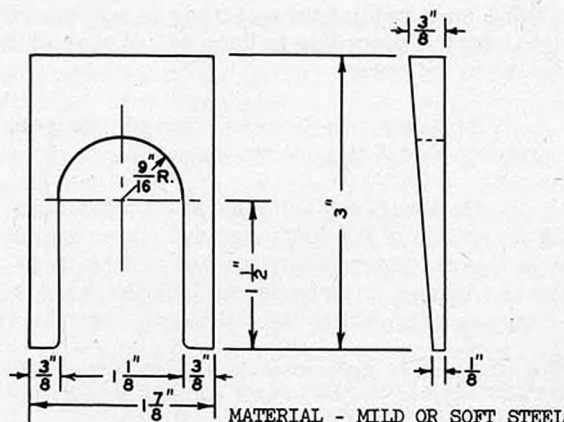
Rifles, all types.
Pistols and revolvers.
Machine guns.
Automatic rifles.
Semi-automatic rifles.
37 mm guns, all types.
75 mm guns.
155 mm guns and howitzers.

Small arms spare and repair parts are also very important, and should include full assemblies in as large quantities as possible. These are more desirable than the individual parts because of the time element involved. It is much more simple to install a bolt assembly in a machine gun than to remove the back plate, remove the bolt, strip the bolt, remove the unserviceable sear spring -- for example -- reassemble the bolt, replace it in the gun, and replace the back plate. By means of the unit replacement system four of these steps or operations are eliminated.

Each contact party also carries with it a limited number of extra small arms such as pistols, revolvers, rifles, machine guns, and automatic rifles. In this manner complete weapons may be replaced if necessary. This should not be made a practice, however, because such a policy would result in excessive overloading, and it must be remembered that unserviceable materiel may easily be evacuated to the corps or any maintenance battalion.

In considering Ordnance service by contact parties to artillery units, some of the most important items to be carried include complete breech blocks, firing mechanisms, spare wheels, recoil oils, sights, shields, and recoil mechanism filling valves and filling valve gaskets.

It should be realized that the task of the division Ordnance officer and the personnel included in the division Ordnance section is a large one. This personnel must be alert at all times, must exercise a goodly portion of foresight, and must bear constantly in mind that its chief purpose must be to "give the using service what it wants before it knows it wants it".





Insignia of His Majesty's Royal Army Ordnance Corps

By: Captain F. G. Noel-Hudson, O.M.E. R.A.O.C.

It is strange how these things occur quite accidentally and without preamble. My host started to examine the badge. He was interested and we talked long into the night. Finally he suggested that we record the substance of the discussion as many people have been curious about the history and the legend surrounding the insignia of his Majesty's Royal Army Ordnance Corps.

Before describing the arms according to the phraseology of the College of Herald's, it might be well to set out the method of analysing a coat of arms and also to explain the old Norman French terms used. An arms consists of a "field" or a background on which is carried some emblem which is known as the "charge". The field is synonymous with the shield, the top part of which is known as the "Chief" and may be of a different colour from the lower field. If we imagine a knight bearing his shield in battle, with the coat of arms displayed to the enemy, we see that the terms "right" and "left" are given from the point of view of the man bearing the shield.

The "right" half of the shield or "dexter pale" is that part nearest his right hand. This must be borne in mind when reading arms, as one is accustomed to name right and left according to the point of view of the person looking at the object.

Heraldry uses a combination of colours and metals to present a coat of arms or "device".

*In describing the arms one always starts by naming the colour of the field, and then describing the charge from thereon giving its colour and arrangement. For instance "Azure a chevron argent between three estoiles or" — means — "on a blue field a silver chevron with three

gold stars, two above the point of the chevron and one below".

The colors are:	The metals are:
Gules - red	Or - gold
Vert - green	argent - silver
Sable - black	
Azure - blue	
Pourpure - purple	

The system in composing a "device" is that one color should not be superimposed on another color, or one metal on another metal. The combination is always "metal on color" or "color on metal".

For instance, although several branches of a family may bear similar arms, the cadet or junior branches may be identified by a slight distinguishing mark in the field which is then said to be "differenced" and the crest gives further information as to the rank or degrees of nobility of the various branches. This is usually done by employing a crown or a coronet in the crest. These indicate whether the bearer is a reigning monarch, a Duke, a Baron, or a Baronet. The arms shown above on the left are those borne by the Master of the Queen's Ordnance in the time of Elizabeth.

The Heraldic Description is as follows:

Arms: Azure three guns argent. On a Chief argent three roundels sable.

Crest: Out of the Royal Crown an arm proper holding a thunderbolt.

Supporters: Dexter, a man holding in the dexter hand a hammer. Sinister, a man holding in the sinister hand, tongs.

*The arms may be surmounted by a crest which adds another little chapter to the story already partly told by the device on the shield.

Motto: "Sua Tela Tonanti"

Translation: (We give) to the Thunderer (Jupiter) his weapons.

Cap Badge of the Royal Army Ordnance Corps: The Arms within the Royal Garter.

The arms have never changed throughout the centuries and today we wear them in our cap badge and collar badges, the same insignia that our forefathers wore amid the smoke and heat of their clumsy belching bombards at Crecy in 1346.

The precise date of their origin is lost in the mists of antiquity, but it is known that they were in use not long after the adoption of cannon in the 14th Century. They were originally borne by the Companies of Master Craftsmen who made the necessary guns in obedience to the decrees or "Ordinances" of the King and not only made, but also maintained and were the owners of the early cannon.

One can imagine that most of the repair problems were solved very effectively with a sledge hammer by the armourer who accompanied the ordnance, but his greatest responsibility, as the owner's representative, was to keep a watchful eye on the gun crews to see that they meted out fair treatment to the cannon.

Among the early gunners there was a tendency, inspired by laudable motives, to load their cannon with charges grossly beyond the capacity and strength of the weapons, in order to make things more unpleasant for the enemy. Only too often, they succeeded in blowing themselves up, and the guns were apt to cause a higher mortality among the men in the home team than among their opponents. To be "hoist with their own petard" had a very real meaning for them!

This procedure was frowned upon by the armourers naturally, and it also made the gun an even more ghastly horror in the eyes of the ordinary soldiers who attributed its power to Satanic Agencies, and were convinced that the Armourers who served the "great Ordnance" had sold themselves to the Devil. The mounted knights took rather a poor view of having large lumps of granite hurled at them, and said that this "wasn't cricket" and that the Ordnance men were not gentlemen! This superstitious fear of guns was terribly strong in every class with the result that only the extremely rough and undesirable part of the community could be persuaded to work them and as the Armourer was the only person who understood the work he automatically became at the same time the Master Gunner.

One is reminded of the Shakesperian character who complained, "and but for these vile guns, I, myself had been a soldier". That seemed to be the general feeling which has persisted until very recently in other directions. Any new arm of the service has had a struggle against the same kind of prejudice. The submarine branch of the Royal Navy, and the Royal Tank Corps, are two modern examples of Arms that have been very much looked down on in their infancy.

In the 16th Century there was a gradual separation of the functions of the Armourer and the Gunner. The reasons are twofold:

First — With the increased range of guns, the mathematical problems of gunnery grew and became a study quite separate from the mechanical side of ordnance. The second reason was that as guns multiplied in number the Armourer became so much in demand at home in the arsenals that he relinquished the actual serving of the gun, which passed to the gunners themselves, who were later formed into the Royal Regiment of Artillery. A number of armourers continued to be employed with the Army and were formed into the Ordnance Train, which consisted of workshops and blacksmith's forges carried in carts, ready to provide repair facilities for weapons of all kinds, and including farriers for shoeing horses.

Such was the ancestor of the modern mobile workshop. In later years the Master of the King's Ordnance had a growing civilian body under his command, the army of tradesmen and storekeepers in the arsenals of Woolwich, Chatham and Deptford, where guns and equipment were made and kept ready for issue to both Army and Navy. This army was ruled by the Clerks to the Ordnance, whose semi-military status persisted for three centuries until the mechanics of gunnery became so complicated that it was realized that a body was needed, apart from the using service, to handle the issue and inspection of stores connected with artillery.

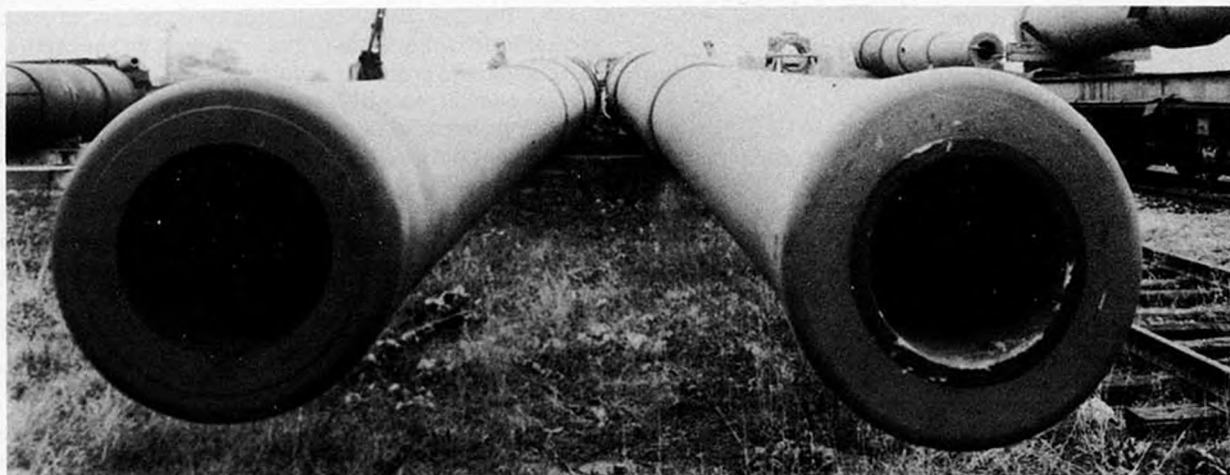
In 1874 the Ordnance Store Corps was formed combining the civilian storekeepers with the Ordnance Train and the Clerks to the Ordnance blossomed forth in blue and scarlet and became Ordnance officers. The scarlet and gold piping on their jackets very soon got them the title of the "Sugar Stick Brigade". They were still storekeepers and handled not only gun stores but also general stores and clothing, and it became evident that more advanced technical knowledge was needed for the inspection of guns. For this reason three qualified mechanical engineers were granted commissions in the Royal Artillery. They were needed particularly in connection with some new steam-operated heavy coastal guns mounted at Dover and Deal, and they held the title of Inspector of Ordnance Machinery, or simply I.O.M.

These officers were later transferred to form a new branch of the Ordnance Store Corps. After the Boer War, its title was changed to Army Ordnance Corps and with the coming of the motor car, and later the tank, the Corps' activities increased a hundredfold.

In 1920, in recognition of Great War Services, the King granted the title the Royal Army Ordnance Corps and honoured it further by becoming the Colonel Commandant of the Corps.

The old nickname of "Sugar Stick Brigade" is dying out now, but various wits have invented others. There are two distinct branches of the Corps, the storekeeping and the Engineering. The storekeepers retain their original title of Ordnance Officer, or O.O., the Engineer Officers have since 1924 been distinguished by the letters, O.M.E., which means that they hold the appointment of Ordnance Mechanical Engineer. Naturally, there is a certain amount of rivalry between the O.M.E.'s and the O.O.'s, and this finds expression in the names we call each other. They issue the drums of paint, the tents, the blankets and the socks, so they are known to us as the "Blanket Wallahs". "Wallah" is Hindustani for "a fellow of no account" — but nobody takes that literally and it is a term of familiarity

(Continued on page 357)



MAKING GUNS PROVE THEIR WORTH!

The following article is reprinted, with permission, from the Sunday Sun, Baltimore, Maryland.

By: William B. Crane

Twenty miles from Baltimore as the air-line radio beam between Washington and New York flies, big guns are roaring night and day, hurling projectiles in an unreturned barrage which whips up the waters of the Chesapeake Bay, or, striking on land, tosses Maryland soil in all directions, leaving huge craters where it was ejected.

Hundreds of bombs, ranging from huge demolition missiles to small incendiaries, are dropped from planes to blast the countryside. The United States has the best bombsight in the world, experts believe; but the efficiency of any bombsight is predicated upon the accurate flight of the bombs themselves. Consequently the behavior of every type of bomb must be known in advance. Proving Ground officers tell of Capt. S. C. Smink, one of the finest bombardiers in the world, who went aloft with ten bombs whose qualities were unknown. Working almost by guesswork, Captain Smink aimed his charges at a parachute spread out as a target. Nine of them were bull's eyes. One missed, and sorely disappointed the captain. It wasn't the one out of ten, he explained; he had been trying for one hundred straight bullseyes and he only made fifty-one. Incidentally, bombs are equipped with small propeller-like gadgets. Lying in the plane racks, the bombs are safe. When released the propeller spins and cocks the firing apparatus which fires on contact.

Probably few Baltimoreans know that not so long ago civilian employees at the Aberdeen Proving Ground loaded the tremendous 16-inch coast defense guns being tested at the army post with "live" shells and fired them, the missiles landing in the water near the Eastern Shore below the mouth of the Patapsco river. At such range serious miscalculation might have put one of the 16-inchers on the Baltimore City Hall, presenting Mayor Jackson with something hotter to handle than any political campaign ever gave him. And when the shell had finished its work about

Photos by A. Aubrey Bodine, The Sun Papers

all citizens of Baltimore would have to remember the City Hall by would be the municipal debt.

Don't Make Errors

But Mayor Jackson needn't worry; miscalculations such as that don't occur at Aberdeen. When those in charge decided to send the big shells down the bay, past the ordinary range limit, they sent word to Baltimore port authorities, asking them to warn shipping. Then they sent their own range boats down to insure against harming stray civilians. The watchword of Aberdeen personnel is safety — safety for the outsiders who may wander, unwittingly, into danger zones; safety for the civilians who test the guns, and, what is far more important to the nation as a whole, safety for the soldiers who may, some day, be called on to fire those guns in a more serious barrage, against an enemy far more deadly than Chesapeake Bay whitecaps. One of the main objects of the Aberdeen Proving Ground, commanded by Brig. Gen. Rolland W. Case, is to see that American troops, whether they be using pistols, rifles, machine guns, cannon or aerial bombs, are not endangered by their own weapons.

To accomplish this, Proving Ground workers put everything connected with modern warfare on the spot. They test shell cases, powder, fuzes and other parts of ammunition separately; then they combine them and test the combination. Simply finding one which seems satisfactory and passing it for issue is not enough. Every gun and most of the pistols and rifles issued to American troops are tried out and every new model is "range-tested" with real shells. When a gun is issued to an artillery battery a chart accompanies it. This shows just how the weapon will fire and how to adjust it to meet varying conditions. To get this data the Proving Ground tests must match exactly the

stresses which will be placed upon the gun in combat. Hence the use of "live" ammunition, one of the more hazardous tasks at the post, is necessary.

Heat and cold, air density and other weather conditions are factors in the efficiency of ammunition, and powder is tested under temperatures varying from 150 degrees above zero, Fahrenheit, to fifty degrees below. Army men feel that range takes care of any conditions troops are likely to find in combat.

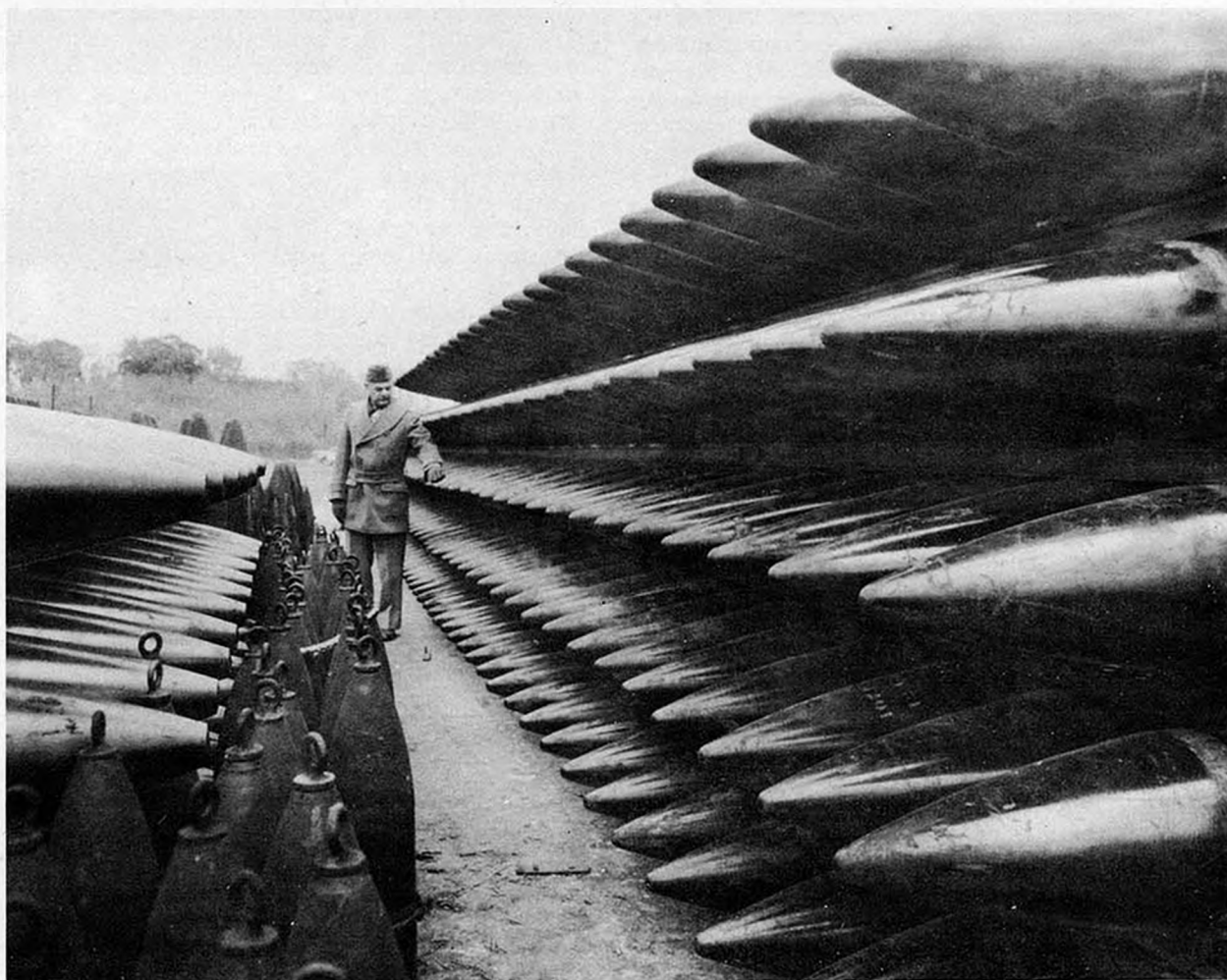
The post itself spreads over some 75,000 acres of land and water, the latter the upper reaches of the Chesapeake. Inland are the executive offices, buildings housing strange and delicate instruments used in the testing work, and structures for the social life of the post, such as officers' homes and their club. Near the water front are the "fronts" from which the guns are fired. There are a number of these, some with water, some with land ranges.

Some distance back from the firing fronts are two tall towers, capped with small houses. These have two-way radio equipment, and warning sirens which will lift the hat right off a man's head. On points along the eastern and western shores for some distance down the bay are other towers, also with radio installations, while the Proving Ground "navy", a fleet of six small but speedy craft, is similarly equipped.

Day's Firing Mapped

Each day before 4:30 P. M. senior officers make up a "program" for the next day's firing. This tells which ranges will be used; the time of firing, the elevation of the gun and the number of rounds to be fired, together with other data for the men in charge of the work. Copies of it are distributed to the officers concerned, to the men in the various towers, those aboard the patrol boats and others in key positions. Towermen mark off the ranges designated for use, so that they can tell by a glance at a map which range is dangerous, which clear. Incidentally, officers at the post can do a little testing on their own account during the ducking season. They are permitted to test their ability to bring down canvasbacks and other ducks, shooting from blinds in the clear ranges.

With the programs before them the guardians of the ranges are ready to warn off trespassers. Those in the shore towers and the boats are in constant radio communication with the main towermen, telling of traffic ashore and afloat, giving weather conditions and other pertinent facts. An airplane is kept ready to take off to warn commercial or civilian planes from flying over the ranges. The official numbers of such planes are taken and forwarded to the proper authorities in the Department of Commerce. In connection with this, officers at the Proving Ground, accustomed to rather startling facts, report one



A shipment of heavy projectiles recently received at Aberdeen Proving Ground is inspected by Lt. Col. George G. Eddy, Chief Proof Officer.

more with ease.

Dodged by Air Liners

The radio beam from Washington to New York pierces the ether directly above the range. Passenger liners flying it between the two cities, would be forced to rise to 80,000 feet above the earth in order to be perfectly safe from the shells hurtling up from the ground. Since 40,000 feet is about tops, even for stratosphere flyers, pilots flying the route simply swing around the army post. A beacon light at each extremity tells them when they are approaching the danger point and they veer to one side.

Most of the warnings issued to civilians go to people from other sections and States who are taking their boats to and from the Chesapeake and Delaware Canal. The eastern limit of the firing area is close to the western side of the channel leading to the canal and persons unfamiliar with the territory occasionally stray into prohibited waters. They don't stay long. A towerman may spot them and summon a boat, or the boat's crew itself may go into action. Generally speaking, when the yachtsman hears where he is and the possibilities of the situation, he doesn't linger.

No Precautions Overlooked

That is the safety side from the civilian point of view. From the point of view of the worker at the Proving Ground, every precaution is taken and the fact that these are effective is shown by the accident record. Cuts and bruises abound, as around any plant where metals are handled in quantities, but there has not been a death from explosives in years. Officers in charge are loath to discuss the record — not that they are not proud of it, but from the point of view of pride going before a fall. They admit that anything may happen around explosives and few people will argue with them. In any event, the "program" precautions apply to Proving Ground personnel as well as outside civilians; everything must be "cleared" and in order before firing starts. In a great many cases the men do not stand in the open near the guns when they are fired. They load them and retire, taking a lanyard into a splinter-proof shelter before pulling the trigger. If anything goes wrong, they are safe. Powder is loaded in small, strongly built rooms and only a certain number of men — usually three or five — are permitted in these at one time. The powder, incidentally, is kept in refrigerators at a constant temperature of 70 degrees.

But the main work of the Proving Ground (and until recently it was the only one in the United States; since the national emergency arose three others have been built, in Indiana, Ohio and Arkansas, experts going from Aberdeen to operate them) is the protection of the United States soldier, whether on the training ground in time of peace or in combat. Almost every action of every employee is dedicated to this task and it is a very necessary one, for as Col. George G. Eddy, chief proof officer of arms and ammunition division, pointed out, there is nothing as dangerous to the morale of artillerymen as distrust of their own weapons. Here men and machines work together; and the Proving Ground has one machine, the only one of its kind in existence, which works instantaneously and accomplishes an incredible task. It measures, with hitherto unknown accuracy, the speed of a projectile as it leaves the muzzle of a gun and writes it down in black and white for the testers

to see.

New Speed Measure

Chronographs (instruments to record speeds of projectiles) have been known for years and have been accurate. The Proving Ground had two forms of these, but felt that a better one could be made. One was not as accurate as they wished, the other was better, but slow, for its results were recorded on film, which had to be developed. Ordnance officers, civilian experts and business scientists put their heads together and, after about a year and a half of experimentation and work the "cycle-counter chronograph" resulted.

In a solid brick building some miles from the firing range it stands, a green metal machine with a central instrument panel about five feet high and two wings, all studded with buttons, knobs and lights. Above the central section is a small cylinder, its glass face crisscrossed with screening. Across the screen a thin line of green light appears. Men at the instrument are connected with men at the gun by telephone. These discuss the test to be fired; the gunner reports when he is ready. Off in the distance there is a deep "boom".

When a Gun Speaks

The green light is broken, its center portion flashing upward. Other lights appear on the panels. There is a clicking noise and then, only seconds after the gun has been fired, keys click on a typewriter-like machine attached to the main instrument, tapping out the speed of the shell. A visitor watched it work. He heard the gun, saw the lights and watched the keys clicking. "2,189" they registered. "That means the shell was traveling 2,189 feet a second," the young lieutenant in command explained. "Ninety feet a second is sixty miles an hour, so you can see how fast that thing was going." The visitor marveled and decided that speed laws didn't count at the Proving Ground.

Further investigation indicates how marvelously complicated the chronograph is. Electricity is its guiding force. The gun, in place several miles away from the instrument, is aimed at a tubelike wooden frame thirty feet long, with circular openings at both ends. These are thirty inches in diameter. The shell flashes from the muzzle and through the nearest opening, some seventy feet away and covered with a thin screen. It tears the screen and electrically registers upon the chronograph the time it entered. A split second later it rips a second screen at the farther opening and registers the time it departed. Comparing these two times gives the speed at which it was traveling when it passed through the framework.

This, however, is not good enough for Proving Ground testers, who know that the shell's speed was cut the instant it entered the air. So the chronograph, in much less time than it takes to write about it, calculates the speed during transit between the two screens, estimates the lag changes and making up the charts which accompany the guns into active service.

Many more tests are made at Aberdeen. Confronted with particularly knotty problems the testers will insert gauges in the shells themselves, fire them and recover them to read the news. Nor are all the men at the post behind the guns when they go off. Out on the land ranges, where

(Continued on page 305)

THE NEW SEMIAUTOMATIC CARBINE*

The War Department recently has announced the adoption of a new infantry weapon. Its official name is "U. S. Carbine, Caliber .30, M1." This announcement marks the completion of exactly one year's intensive work on the part of the Army Ordnance Department, the Office of the Chief of Infantry, and several major arms manufacturers, as well as independent inventors.

In October 1940, a circular was first issued, listing the requirements for a new weapon and outlining the tests to which it would be subjected. Efforts were made to place this circular in the hands of all small-arms manufacturers and leading gun designers of the United States. There was a generous response to the circular, and there evolved nine designs which merited consideration.

The need for a new weapon for the individual soldier — one that would weigh little but hit hard — resulted from a change in tactics and was made apparent when it was seen that rear elements often became suddenly confronted by the enemy at close range. Previously, it had been found that a pistol was sufficient for personnel serving machine guns and other team-operated weapons. When the Nazi spearheads began to penetrate the Allied lines and parachutists appeared in the rear areas, the defenders had no weapons which could adequately reply to their fire.



What is needed, it developed, is a light but powerful weapon. It must be light because it must be carried by the soldier in addition to the equipment which he carries for his team weapon. Secondly, it must compare favorably with the fire power of the enemy infantry. This requirement indicated a rifle, as the low velocity of a pistol or revolver makes either unreliable at ranges beyond a few hundred yards. Thus the carbine and its cartridges were conceived. The carbine is light and short for portability; the cartridge has a light bullet and high muzzle velocity for increased striking power at distances beyond practical pistol range.

Production of the carbine involved an investigation into the most intimate and basic details of gun and ammunition design. It first was necessary to design a cartridge to meet the ballistic requirements. This was completed in December 1940. There was no military weapon of the desired type in existence, and no commercial weapon of such light weight handling so powerful a cartridge was available. In spite of these handicaps, eight rifles were sub-

By: Rene R. Studler,
Lt. Colonel, Ord. Dept.**

mitted to the Ordnance Department on May 1, 1941. The board of officers who examined these entries declared that six were worthy of test, and this was immediately undertaken by the Aberdeen Proving Ground. By working under pressure, thorough tests of these guns were completed by the middle of June.

These six rifles represented, in the judgment of their individual designers, the nearest possible approach to the gun described by the original circular. None of the models met the requirements exactly, but all were so close it was believed that any one of them, with some additional development, could be redesigned within the limits prescribed.

These rifles have been described in the September-October 1941 issue of Army Ordnance (Vol. XXII, No. 128, p. 225), so the following brief tabulation shows only the over-all length, weight, and type of mechanism of these models:

Weapon	Length (inches)	Weight (pounds)	System
Auto-Ordnance	35	5.5	Recoil
Harrington & Richardson	38	5.8	Inertia
Hyde	34	5.3	Gas
Savage	33	5.2	Recoil
Springfield	35	4.9	Gas
Woodhull	30	5.5	Inertia

It should be noted that these rifles represent three different types of operation: gas, recoil, and inertia. Further, they were individually developed by men who are designers for leading manufacturers of small arms or are well known as private gunsmiths.

As the sultry summer weather grew more oppressive at the proving ground, the relentless tests began to develop weaknesses and faults in the guns. In one, a spring would break, in another an extractor — or a gun would develop that mysterious trouble known as "failed to function". The proof officers carefully compiled voluminous statistics listing with equal favor fine accuracy groups and discouraging malfunctions.

During these tests, which were closely observed by Army personnel from all combat branches eager to learn the habits and possibilities of the new weapons, evidence was gathered which led to loosening some of the restrictions originally placed on the design. For example, the gun was no longer required to incorporate both automatic and

* Reprinted from ARMY ORDNANCE, January-February, 1942

** Executive Officer, Small Arms Division, Industrial Service, Office of the Chief of Ordnance, Lieutenant Colonel, Ordnance Department, U. S. Army.

semiautomatic actions, nor was it required to function satisfactorily with a magazine containing as many as fifty rounds.

At the conclusion of the preliminary tests, it was decided that the rifle submitted by George Hyde and that submitted by Springfield Armory were worthy of further Ordnance and service tests, provided the rifles were modified in certain respects. Thereupon additional models of each type were ordered for further tests. In June 1941, the Ordnance Department announced that a service test of the light rifles would start on September 15, 1941, and would be completed by September 30, 1941.

During the summer months, consideration was given to rifles that had failed in their preliminary tests but had been modified in an attempt to overcome the original faults. Consideration also was given to "late starters" in the competition. Prior to September 15th, R. J. Turner submitted his rifle to the Ordnance Department. This rifle was gas-operated, weighed 4.2 pounds without magazine or sling, and was 34 inches in over-all length. As originally submitted, it was an all-metal weapon, but preliminary tests soon indicated the desirability of a wooden forearm and stock.

About this time the Winchester Repeating Arms Company also submitted a gas-operated rifle. This weapon was 35 inches long, including an 18-inch barrel and weighed 4.6 pounds without magazine or sling. It was remarkably simple in construction and very pleasing to the eye. This favorable reaction was continued and strengthened as the gun progressed successively from one test to the next. That this gun could perform so well under the grueling trials could hardly be believed by those who knew that scarcely six weeks had elapsed since the first lathe tool had started its fabrication.

In the meantime, it had become increasingly apparent that if the branches of the Army interested in this weapon conducted their tests individually, much time would be consumed. As the Infantry, Armored Force, Field Artillery, Cavalry, and Engineers all were concerned, the number of weeks that could be lost by having each arm conduct its own test, together with time lost in repairing the guns between tests, would be greater than the emergency permitted.

To expedite this work, the Ordnance Department proposed that the Infantry conduct the service test at Aberdeen Proving Ground about September 15, 1941. In line with this proposal, the Infantry was to prepare the test program which was to be submitted to and concurred in by the other interested branches. The tests conducted under this program were to be executed by Infantry personnel. Further, in the event that additional tests might be required by arms other than the Infantry, the proving ground was available for these tests. This arrangement was not limited to the Army. Representatives of the Navy and Marine Corps, too, visited the tests and engaged in the firings. (Their agreement with the findings of the board has recently been signalized by the placing of a substantial order for the new carbine by the Navy Department.)

With the Infantry furnishing the organization and personnel for these tests, the Ordnance Department contributed by making available a large area at the Aberdeen Proving Ground. During the period September 15th to September 30th, required for the tests, this region was in

effect a portion of the Infantry Board's facilities at Fort Benning, Ga. The technical personnel necessary to service and mark targets, to compile and reproduce the test records, were furnished from the employees of the proving ground. Due to these teamwork arrangements, within two weeks it was possible to conduct an exhaustive test, under simulated combat conditions, of the five types of rifles available.

On September 15th, the following rifles were presented for the service test: Springfield, Hyde, Winchester, Turner, and Reising. The detachment of officers and enlisted men from Fort Benning put each rifle through its paces. Testing started early each morning and lasted until dark. Each model was tested by each soldier in turn. The rifles were fired "dry", with dust in the mechanism, after a mud bath, rapid fire, slow fire, from all positions, during skirmish runs — in fact, under all known conditions of severe service. The tests were conducted on schedule, and the last few days of September found the test personnel, assisted by the Aberdeen technicians, reducing data, assembling records, drawing conclusions, and skillfully working the report into its final form.

September 30, 1941, exactly one year after the initial announcement, the subcommittee charged with the selection of a light rifle convened. The report of the test board was presented, discussion of its findings ensued, and doubtful or unfamiliar points were cleared up. Finally, agreement was reached as to last-minute, perfecting modifications, and with unanimous agreement the Winchester entry was recommended for adoption.

Later in the same day, a special meeting of the Ordnance Technical Committee was held, and the findings of the subcommittee were presented. The findings were received and approved, and a new Army team — carbine and cartridge — was recommended to higher authority for approval. This necessary clearance was soon obtained, and the development and experimental phases were completed. With the adoption of the carbine and its inclusion in the Ordnance Department's Book of Standards, the work is not finished. Facilities for its manufacture must be provided, production schedules must be worked out, and the necessary raw materials assembled.

This work is continuing at the rapid but careful pace which marked the development. Already tooling is under way and contracts for manufacture are being negotiated. Within six weeks of the date of standardization, five production models of the carbine were delivered to the Chief of Ordnance. These guns will be checked against production drawings and thereafter will be subjected to extensive endurance tests. The tests will provide the basis upon which maintenance procedure, training manuals, and other necessary data will be based. Thus, the announcement of standardization is not the end of the story. The main activity has but shifted from the Army to American industry; it now has the task of producing America's latest and handiest weapon for the individual soldier.

KEEP

THEM

ARMED!

MAGNIFICATION!



By magnification (or power, as it is sometimes designated) we mean the number of times the image seen through a glass or telescope is larger than the object appears to the naked eye. Magnification is a comparatively easy characteristic to obtain. By placing lenses of the proper curvature the proper distance apart, any desired magnification within reason can be obtained.

The square illustration below shows an aerial view of an area surrounding the Administration Building of The Ordnance School. Others show magnifications of the entrance to this building which would be obtained with optical systems of the powers indicated.



2 POWER



8 POWER



3 POWER



4 1/2 POWER



6 POWER

THE PROBLEM OF EXTERIOR BALLISTICS*

The art of applied exterior ballistics has flourished from earliest times. The boulders which rolled down the mountainsides to crush strangers or hostile marauders as they traversed narrow passes are the historical prototype of the modern airplane drop bomb. (See Fig. 6.)

The smooth pebble, hurled at the approaching figure of an opponent, was chosen for its high density; and its point of impact was selected with all the skill available. The keen-pointed javelin was designed in partly "stream line" form, and given an acute "ogival" angle to secure the maximum penetration. (See Fig. 1.) The initial velocity in



Figure 1 -- Javelin head; brass.

every case was made as high as the warrior's good right arm could deliver it.

Exterior ballistics deals with the path of the projectile in air, and is not primarily concerned with the original source of energy, or the manner in which this energy is imparted to the projectile. Ballistically, except in the magnitude of the quantities involved, there are few distinctions to be drawn among the following: The stone flung by hand, the pebble thrown by sling, the boulder fired by cannon, or the pea of the pea shooter and the ball of the old-fashioned musket.

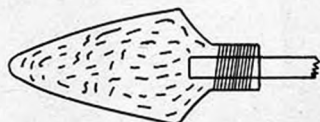


Figure 2 -- Arrow head; stone.

The javelin, arrow, cross-bow bolt, blow dart, modern elongated shell all have much in common. (See Figs. 1 - 10.) The principal new element in exterior ballistics is the spin of the projectile, resulting in increased stability and thus preserving head-on motion. (See Figs. 12 and 13.)

From shadowy antiquity warriors have distinguished for practical purposes between the flat trajectory of "direct fire", where the projectile traces approximately a straight line, and the cases of higher angles of departure. For ranges too great to be attained at the given velocity and with the given projectile by methods of flat fire, one



Figure 3 -- Cross-bow bolt; iron.

had only to aim upward and count on the projectile finally falling downward again. The old ballisticians distinguished three parts of the path as suggested by Fig. 14. The first part AB, they regarded as straight. Later, at B, the projectile was supposed to start curving down on an arc of a circle, BC, and finally at C the path, they thought, straightened out until it reached D, the point of impact. This theory was entirely adequate for securing hits and

By: Albert A. Bennett,
Professor of Mathematics

Brown University, Providence, R. I.

measuring clearances, such as when firing over a heavy battlemented stone wall into the courtyard within.

Such was the state of things when theorists first began reducing laws of motion to mathematical form. The case in which one disregards the retardation of the projectile occasioned by air resistance was completely solved by Galileo on the basis of laws verified by dropping balls from the leaning baptistery tower at Pisa. Balls of different sizes were dropped together. While, according to Aristotle, the time of fall should be inversely proportional to the weight, Galileo demonstrated that the time was nearly the same for great differences in size and weight.

The case in which air resistance is disregarded was much more important formerly than now, since in the

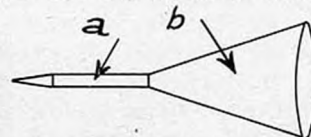


Figure 4 -- Malay blow-dart; a, wood; b, paper.

first place, our present muzzle velocities are so great as to result in quite violent resistance by the air to the forward motion of the projectile; and in the second place, the increased mechanical accuracy of our equipment renders a moderate percentage error due to computational methods no longer tolerable. (See Figs. 15 - 17.)

Treating the trajectory as a problem in the mechanics of a particle moving through a resisting medium, one is led to write down certain relations involving such quantities as the velocities, accelerations, forces, masses, etc., which are involved. These may be said to be the



Figure 5 -- Modern small arm projectile; cupro-nickel jacket, lead core.

differential equations of motion for the projectile. Certain simplifying assumptions are always made. The more factors that are ignored the simpler becomes the theory, but the greater becomes the divergence between computations and observations. Simplifications in the equations become unjustifiable in proportion as materiel is improved and increased accuracy of fire becomes possible. The extreme simplification of ignoring air resistance was long ago admitted to be unsatisfactory for artillery fire, and is now made only for illustrative purposes or in elementary texts on mathematics and mechanics.

*This article, although it appeared in ARMY ORDNANCE for July-August, 1922, outlines principles which have been true for centuries, and will remain true throughout all time. It is reprinted without change except for footnotes which have been added by Captain O. R. Schurig, Ordnance Department, of the Ballistics Research Laboratory, Aberdeen Proving Ground, Maryland. These footnotes are "gratefully accepted" by the author.

The comparative Figure 16 suggests some of the relations between what a certain 3-inch projectile actually does and what it would do if there were no air resistance. For the trajectory in air:

- (a) The range is considerably shorter than that of the trajectory in value.
- (b) The maximum ordinate is less.
- (c) The trajectory is not symmetrical.
- (d) The angle of fall is greater than the angle of departure.

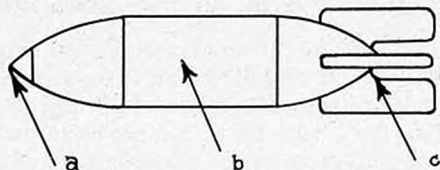


Figure 6 -- Air-plane drop bomb. These appear much like torpedoes, but have no propulsive or steering device; a, fuze, to explode on impact; b, cigar-shaped body, containing explosives; c, fins, to direct and steady the flight.

- (e) The maximum ordinate is beyond the mid-point of the range.

- (f) The velocity at any point in the descending branch is less than the velocity at the point of equal height in the ascending branch. In particular, the terminal velocity is less than the muzzle velocity.

- (g) The trajectory is not a plane curve.

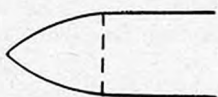


Figure 7 -- Projectile head, for penetrating armor. Obsolete for large calibers.

Previous to the World War (I) the theory of ballistics was of approximately the same form in all countries. Which simplifications were to be regarded as satisfactory and which were not was a matter on which a practical agreement existed among most ballisticians. The mathematical methods used were those developed with great ingenuity by an Italian ballistician, Siacci, and further extended by Colonel Ingalls of our service, and were based chiefly on experiments conducted by the Krupps at Meppen in Germany, reduced by a Russian General, Mayevski, to equational form. Minor improvements and differences occurred in the various nations in their local methods, as was to be expected. In this country such improvements were due in large measure to Colonel Hamilton of the U. S. Coast Artillery.

Now, Siacci's whole point of view was to make use, to as great an extent as would be convenient, of the fact

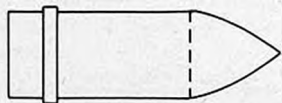


Figure 8 -- Type of projectile fired in earlier experiments.

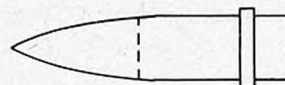


Figure 9 -- Type of projectile fired in earlier experiments.

that the computations were intended for direct fire. He succeeded in what had been considered a hopeless task — that of constructing tables of small size well adapted to solving the whole ballistic problem for fire with guns which only in extreme cases were aimed as high as fifteen degrees above the horizontal. It was a considerable shock to such artillerymen as had been taught to accept Siacci's method without question when the newer models of powerful guns began to be used at higher elevations, and marked discrepancies began to appear between theory and observation. A spherical shell, such as was used in our Civil War, had a resistance nearly three times as great as the older ogival types (see Figs. 7, 8 and 9) and about five times that of the modern boat-tailed, sharp-pointed type for the same caliber (see Fig. 10.) It must be clear, then, that approximate methods which might be satisfactory with the earlier projectiles, would be disastrous with modern gun-fire.

By 1916, new methods were in use in France and in England to cover with accuracy these new types of tra-

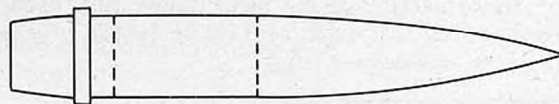


Figure 10 -- Modern type of projectile.

jectories. More or less complete ignorance of these methods persisted here until we were fairly into the war and until confidential pamphlets and reports treating of French and British methods began to be available in Washington. Although we were thus handicapped by a late start, it was but a short time before direct numerical interpretation of equations without two of Siacci's simplifying assumptions was part of the ballistic routine. One of these simplifications which was avoided made use of the fact that the curvature of the path was slight and a second that the density of the air could be regarded as having a mean constant value for the whole trajectory.

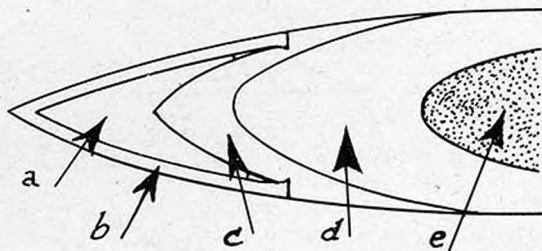
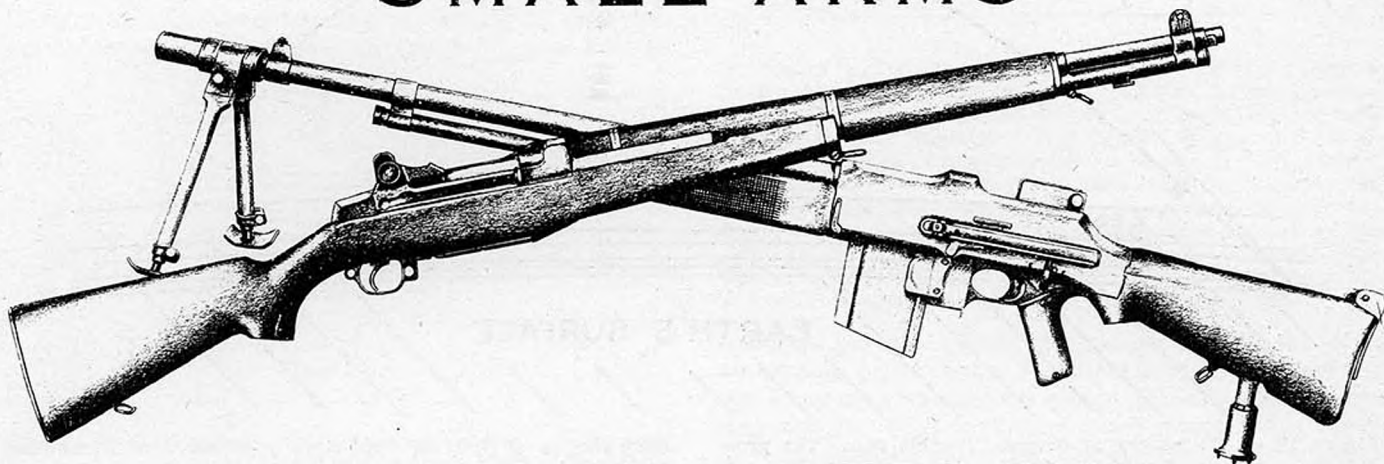


Figure 11 -- Section of modern armor-piercing projectile; a, air space; b, wind-shield, to give better air penetration; c, armor-piercing cap; d, projectile proper; e, explosive.

Despite the great serviceability of Siacci's method for the problem for which it was designed, it was obviously inexact for long ranges. For example, to cite but one feature, Siacci's form of the equations, as usually employed, yielded maximum ranges at 45 degrees elevation in all cases, just as is the fact for firing in a vacuum. The maximum range for the German long range gun was for about 55 degrees elevation (see Fig. 17), while that for a

SMALL ARMS



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

SHOTGUN, REMINGTON, 12-GAUGE, M1910, RIOT TYPE

By: Edward Dyer, T. Sgt. Ord. Dept.

MECHANICAL OPERATION

UNLOCKING. - The first five-eighths of an inch movement of the action bar to the rear causes the rear end of the breechblock to pivot downward, away from the locking shoulder in the upper part of the receiver. This action is accomplished by means of the cam stud on the action bar acting on the rear surface of the cam groove in the breechblock. The breechblock supporting pins on the right and left side of the receiver mating with the recesses on the front end of the breechblock form the center of rotation, as the rear end of the breechblock is cammed out from in front of its locking shoulder.

The unlocking actually begins when the trigger is pulled, since the cocking head moving forward releases the spring tension in the action bar lock shoe, and the action bar lock button spring then forces the action bar lock out of its groove in the side of the receiver.

In the guns equipped with the breechblock latch, unlocking is accomplished as follows: The cocking head moving to the rear forces the rear end of the latch to move outward, causing the front end of the latch to move inward and out of engagement with the top surface of the action bar cam groove in the left side of the receiver. This is accomplished within 1/16 of an inch movement of the cocking head.

Continuing rearward movement of the action bar causes the ejection of the spent cartridge in the chamber and complete cocking as well as retraction of the firing pin. Total travel of the action bar to the rear is about 3-7/8 inches.

COCKING. - The left wall of the cocking head projects into the cam groove on the breechblock, the front

end of the cocking head wall being rounded much the same as the cam groove. When the action bar cam makes contact with the rear camming wall of the cam groove it also has established contact with the front end of the cocking head. As the bar is moved to the rear, the action bar cam moving in the curved part of the cam groove forces the cocking head back within the breechblock. Since the firing pin is pinned securely to the cocking head, it must move back with it. As the firing pin moves to the rear the shoulder on the front end of the firing pin rides off the projection on the bottom of the extractor, permitting the extractor to function. The firing pin bushing is pinned to the breechblock and therefore cannot move back with the firing pin. Since the rear end of the mainspring rests against the bushing which is not movable, and the front end of the mainspring rests against the shoulder of the firing pin which is movable, the movement of the firing pin to the rear will compress the mainspring. The total movement of the cocking head to the rear is approximately 1/2 inch.

EXTRACTION. - The extraction of the empty cartridge from the chamber is accomplished by the extractor pinned in its groove on the top of the breechblock. While the cartridge is in the chamber the extractor claw is engaged over the rim of the cartridge until the gun is fired. Then the shoulder of the firing pin, moving forward, rides under the projection on the bottom of the extractor and cams the extractor away from the cartridge. The extractor is held cammed away from the rim of the cartridge until the firing pin is retracted. This is a safety precaution which we will discuss later. When the breechblock is rotated downward out of the locking recess and is moved to the rear through the manipulation of the action bar, the claw of the extractor engages behind the rim of the cartridge and pulls it out of the chamber.

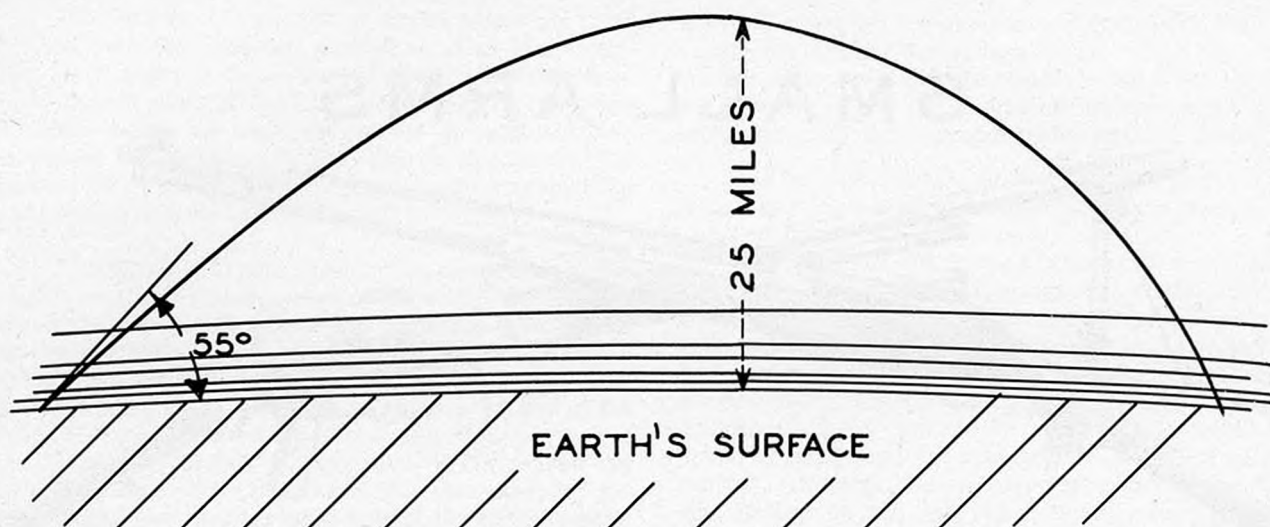


Figure 17 -- Trajectory of German "75-mile gun." The projectile, getting through the dense lower air at the most advantageous angle, traverses the rarer air under conditions more like those in a vacuum. The air density at the summit is only 1/150 of that at the surface. The projectile thus secures a greater range than it would if fired at 45 degrees, as it would then have to spend more time in a denser level.

Ordnance Department is the construction of tables for exterior ballistics using these astronomical methods†. The work is not simple and the tables will be necessarily

†The tables as originally planned were completed in 1935. Certain expansions are being worked on at the present time.

very large. It is to be expected, however, that something like astronomical accuracy may be secured by their use provided that corresponding improvement in materiel is sustained. Such accuracy as that with which eclipses may be predicted is perhaps permanently beyond all possible attainments of artillery, but the comets need scarcely be regarded as more definite in their path than a well-behaved projectile. If a more or less permanent peace becomes probable, and target practice with major caliber artillery continues to increase in cost, the trajectory of a large projectile may become as rare but as dependable a phenomenon as a reappearance of Halley's Comet.

MAKING GUNS PROVE THEIR WORTH!

(Continued from page 216)

the shells fall and churn the terrain, are stout bomb-proof shelters, where men may go to observe the missiles falling around them. Each range has a mark in the exact center and it is not hard to calculate to within a few inches the distance a shell has traveled.

Other things come under Proving Ground scrutiny. Bombs are tested, anti-aircraft guns and shells, and material for the navy. Tanks are run down to the ranges on flat cars and fired as they stand. The huge railway car guns come in and are fired with a blast which rocks the post community. Despite all these things and the fact that the post is working at full speed, sometimes twenty-four hours a day, there are no bottlenecks. Everything which comes in must be reported on in forty-eight hours, even if it keeps a crew at work all night. Frequently materials offered to the War Department are sent in for emergency testing. Red tape is cut and under examination they go. The Proving Ground personnel is not bothered by cranks who have invented something which will automatically wipe all the nation's enemies off the map. These are referred to a special War Department division, which deals with them. Everything which comes to Aberdeen has been approved for testing in Washington.

Tempted by Ducks

A visitor to Aberdeen, who had been conducted through the plant by Colonel Eddy and Capt. Harvey

Rivkin, post intelligence and public relations officer, left with his head spinning. He had discussed cycles and coils and kilowatts and chronographs with Colonel Eddy and Col. William B. Hardigg, officer in charge of the proof department. He had been jolted by guns going off and had heard weather reports coming in from patrol boats and gingerly walked through a room marked "no more than three men allowed in here at once." He had watched the machine which translated a big bang and a flash to feet per second. He had sympathized with the Proving Ground employee who had a beautiful big gun in his charge and couldn't fire it at the thousand or more ducks congregated off shore. The gun was a 155-mm howitzer and fired a shell six inches in diameter. Still, the employee admitted that his mouth was watering for a duck dinner. The visitor left the post with one very definite impression: every item which comes into the Aberdeen Proving Ground is behind the eight-ball when it arrives, and only gets out on its own merits. The United States Army wants perfection.

BACK ISSUES

Back issues of THE ORDNANCE SERGEANT do not exist, except in the possession of owners who do not care to part with them.

(2) Place the master level on the gun with the indicator to the rear.

(3) Center the bubble by raising the breech with the angle of site handwheel. (This establishes level of the bore.)

(4) Set the indicator at zero and center the bubble by means of the adjusting screw on the master level. (Before rotating the adjusting screw release the locking screw. Better results will be obtained by having the locking screw in such position that a slight drag can be felt on the adjusting screw, in order to avoid destroying the level of the bubble when the locking screw is tightened.)

(5) Check the adjustment by turning the master level end for end.

3. Test of the Leveling Plates

(1) Place the muzzle rest in the muzzle.

(2) Place the master level on the muzzle rest with the indicator to the rear and set at zero, the key in place.

(3) Center the bubble of the master level by raising the muzzle with the angle of site handwheel. (Note that here we raise the muzzle, whereas, in the test of the master level, we raised the breech. This is due to the fact that by placing the muzzle rest in the muzzle we gave the tube a muzzle preponderance rather than a breech preponderance, which was the case in the first instance. It must be remembered that we are trying to keep to a minimum the error due to lost motion in the elevating gears.)

(4) Place the master level on the gun with the indicator to the rear.

(5) If the leveling plates of the gun are parallel to the axis of the bore, the bubble will remain centered. If the bubble is not centered, center it by means of the indicator. The reading of the indicator will represent the error in the leveling plates of the gun and must not exceed 1/4 minute. (It is assumed that the leveling plates on the muzzle rest are parallel to the axis of the bore, since the center of gravity is located at such point as to cause the muzzle rest to lay on the bottom of the bore, thus insuring that its position will not be affected by wear of the tube.)

4. Adjustment of the Leveling Plates

(1) Leveling plates can be brought into parallel by scraping the higher plate with a suitable scraping tool. This operation requires both skill and patience, as well as a proper tool. An excellent scraping tool can be improvised from a flat file by grinding the end until the cut has been removed and the end is at right angles to the face, and rounded in the manner of a bearing scraper. The tool must not be knife edged or it will have a tendency to "dig in". However, the probability of having to adjust the leveling plates is slight, unless the gun has been turned over, or damaged by shell fire, etc.

5. To Determine the Trunnion Friction

(1) Place the angle of site level on the level support.

(2) With the range scale at 1000, the angle of site

scale at zero, elevate the breech until the angle level is centered.

(3) Place the master level on the gun with the indicator to the rear and set at zero, and center the bubble by means of the thumb nut.

(4) Elevate the breech two or three turns of the angle of site handwheel and then depress the breech until the angle of site level is again centered.

(5) Center the bubble of the master level by means of the indicator, and record the reading with its sign. This reading represents trunnion friction and must not exceed 3 minutes.

(A minus trunnion friction indicates binding in the right trunnion. If friction of both trunnions is equal, a plus trunnion friction can be expected. Trunnion friction can be reduced in many cases by simply cleaning and lubricating the trunnions and bearings, or by stoning rough burrs, rusty spots, etc., revealed by close examination of the bearings and trunnions.)

6. To Test the Angle of Site Level

(1) Place the level testing seat on the leveling plates of the gun.

(2) Place the angle of site level on the level testing seat with cover open to the left.

(3) Center the bubble of the angle of site level by raising the breech with the angle of site handwheel.

(4) Remove the angle of site level and the level testing seat, and place the master level on the gun, indicator to the rear, key in place, and center the bubble with the indicator.

(5) Record the reading on the indicator with its sign. (This reading represents the error of the angle of site level and must not exceed two minutes. If it does exceed two minutes the level cannot be used until it has been adjusted by a competent instrument repair man.)

7. To Test the Auxiliary Angle of Site Level

(1) The auxiliary angle of site level is tested in the same manner as the angle of site level. Care should be taken to insure that the proper auxiliary level testing seat is used. For levels of French manufacture use the one marked 11°27'32", and for levels of American manufacture use the one marked 11°15'.

8. Test of the Sight Bracket for Lost Motion of the Deflection Drum.

(1) Place the gun in the center of the cradle using the following method: Place a screwdriver between the side of the recoil mechanism and the sweeper plate and pry the gun as far to one side as it will go, then back as far as it will go to the other side, then to the center of the two positions.

(2) Place the vertical line of the bore sight on the lower righthand butterfly of the testing target by traversing the carriage.

The tension of the extractor spring keeps the front end of the extractor pressed against the rim of the cartridge. The length of the extractor enables the extractor claw to keep a straight back pull on the empty cartridge case, even though the rear end of the breechblock has been moved out of line with the axis of the bore. The downward force of the ejector spring exerted against the extractor also assists in the extraction.

EJECTION. - In this weapon the empty cases are ejected through the bottom of the receiver and the ejection is accomplished as follows: As the cartridge is extracted from the chamber by the extractor, the rear end of the cartridge can not move below the line of the axis of the bore due to the fact that the flange at the rear end of the cartridge is larger than the upper surfaces of the projecting walls of the breechblock rib grooves. This causes the cartridge to move back in a straight line, keeping the ejector spring compressed until a point is reached where the flange of the cartridge clears the walls mentioned. At this point the cartridge is ejected by the expansion of the ejector spring.

FEEDING. - When the magazine is loaded, the base of the last cartridge inserted into the magazine rests against the projection on the carrier spring which forms an obstruction preventing the cartridge from moving into the receiver.

As the breechblock enters the last 3/8 of an inch of its rearward travel, the carrier cam mating with its cam groove on the breechblock causes the carrier to rotate downward to block the ejection opening in the bottom of the receiver. This rotation also causes the carrier spring to move out of the path of the cartridge in the magazine.

When the carrier has been rotated approximately 105 degrees, the cartridge under the tension of the magazine spring moves into the receiver and is prevented from slamming against the face of the breechblock by the cartridge stop. The succeeding cartridge in the magazine is prevented from moving into the receiver by a small collar formed integrally on the front end of the carrier just ahead of the projecting part of the carrier spring.

This collar is at right angles to the end of the carrier spring. At the start of the feeding action the flange of the cartridge is past the collar and resting against the carrier spring. As the carrier rotates, the spring clears the flange and allows the cartridge to move into the receiver; at the same time, however, the collar is rotated into position to block the cartridge from emerging from the magazine.

As the action bar is moved forward, a very rapid rotation of the carrier takes place which brings the flap against the cartridge. As the action bar is pulled forward, the rotation of the carrier continues, causing the cartridge to move upward toward the top of the receiver and to compress the ejector spring. When the carrier has rotated upward to its vertical position, the nose of the cartridge is opposite the chamber and the flange of the cartridge has slipped over the projecting walls of the breechblock rib grooves and can no longer fall out.

After the cartridge has started into the chamber, the breechblock moving forward bears against the rear

end of the flap on the carrier and completes the rotation of the carrier until it rests against the side of the receiver. At this time the collar is rotated away from the base of the cartridge, and the magazine spring forces the cartridge out until it is engaged by the carrier spring.

The breechblock moving forward forces the cartridge into the chamber completing the loading.

LOCKING. - When the action bar is moved forward, the first 3-3/8" of travel brings the breechblock to the start of its locked position, and the next 3/8" completely locks it into position. The locking action is brought about by the cam stud on the action bar, acting on the front cam surface of the cam groove, the action being opposite to the unlocking. If the cam groove walls are observed closely it will be seen that both cam walls have the same general contour. However, it must be remembered that the cam stud pushes on one and pulls on the other, causing the locking and unlocking.

During the locking action, the upward motion of the front part of the breechblock is made positive by the breechblock cam riveted to the side of the carrier flap. The two recesses on the front end of the breechblock engage over the breechblock supporting pins, then acting as a pivot for the front end of the breechblock, while the rear end is cammed upward into the locking recess. When the breechblock has moved into the locked position, the rear end of the action bar lock springs out and engages into its groove in the receiver wall, at the same time contacting the action bar lock button and compressing the button spring. The action bar lock thus engaged in its groove will prevent any downward rotation of the breechblock until the piece is fired, unless the action bar lock button is depressed manually. Consequently, the only way the rear end of the breechblock may be rotated downward to unlock it is to pull the trigger, thus allowing the cocking head to move forward, which removes the tension from the action bar lock spring and permits the button spring to force the action bar lock out of the groove, or to press the button. This is also a safety factor, as the weapon can not fire, due to a ledge on the action bar lock blocking the downward movement of the sear until the action bar lock moves into its groove on the receiver wall. The trigger guard also keeps the breechblock in alignment as the breechblock is moved forward.

FIRING. - Pulling the bow of the trigger to the rear causes the bent arm of the trigger to rotate downward, and to exert pressure on the sear arm, moving it downward against the tension of the sear spring. This causes disengagement between the sear shoulder on the sear and the sear notch on the cocking head, allowing the cocking head to move forward. Since the firing pin is pinned to the cocking head, the releasing of the cocking head also releases the firing pin, which then moves forward under the tension of the mainspring and explodes the primer.

SEAR ACTION. - The sear is acted upon by the leaf-type spring which is constantly trying to move it upward. As long as there is any obstruction to this upward movement the sear remains down, but as soon as the obstruction is removed the sear is forced up by the sear spring and the sear itself becomes an obstruction by engaging in the sear notch of the cocking head and holding it to the rear. When the sear is pulled down by the trigger, the cocking head moves forward under the tension of the mainspring. During its forward movement, the inclined

indicator and record the reading, with its sign, in the "Readings" column.

(5) Elevate the breech and then depress until the tube is bore sighted on the testing target.

(6) Center the bubble of the master level with the thumb nut, indicator at zero.

(7) Realign the battery sight on the testing target by lowering the breech.

(8) Center the bubble of the master level with the indicator and record the reading, with its sign, in the "Readings" column.

14. Determine Level Readings for entry in "Readings" column

(1) With range at zero, angle of site at zero, center the bubble of the angle of site level by raising the breech.

(2) Place the master level on the gun, with key in place and indicator to the rear, and center the bubble by means of the indicator. Record the reading, with its sign, in the "Readings" column.

16. To Scribe New Index Line on the Deflection Drum.

(1) Rotate the deflection drum until the 100 division falls midway between the two pencil lines, then opposite the 100 division draw a third line.

(2) To the third line add algebraically the deflection error of the master service sight, and at that point draw a fourth line.

(3) This fourth line represents the position of the new index line, and should now be scribed permanently with the scribe and the deflection drum scribing guide.

Recapitulation

1. Test of the master level.
2. Test of the leveling plates.
3. Test for trunnion friction.
4. Test of the angle of site level.
5. Test of the auxiliary angle of site level.
6. Test for lost motion of the deflection drum.
7. Test of the battery sight for deflection.
8. Test of the sight extension.
9. Test of the battery sight for elevation.
10. Taking the readings on the sight.
11. Taking the readings on the level.
12. Scribing the new index line on the deflection drum.

Although ten example problems are included in these notes, only the first will be explained in detail, as follows:

Relative Errors	Known Errors	Readings	Mean Readings	After Correction of Known Errors	Adjustment of the Level Support	Remaining Errors	Adjustment of the Tailstock	Remaining Errors	Maximum Adjustment possible to Level Support
KEMTS -0.8	Sight +2.2	-3.2 -2.6	-2.9	-5.1	None	-5.1	+4.5	-0.6	+1.5
REMSS +2.4									
REBS +0.6	Level +1.6	-2.4 -2.2	-2.3	-3.9		-3.9 B 1.2		+0.6 B 1.2	
				B 1.2					

(3) Elevate the breech two or three turns of the angle of site handwheel, then lower the breech until the bubble of the angle of site level is centered.

(4) Center the bubble of the master level with the indicator and record the reading, with its sign, in the "Readings" column.

15. Compute and enter the data for the remaining columns, referring to the example problems for procedure. — low, thus:

"Relative Error" Column

-0.8 minutes represents the known error of the master test sight in elevation. In this particular case it means that if we were to take this master test sight and place it in a perfect sight bracket, we would have an angular divergence of 0.8 minutes between the line of sight and the axis of the bore. Although the line of sight is actually above the C/L of the bore, it is referred to as a minus error because it would cause the gun to be pointed too low, thus:

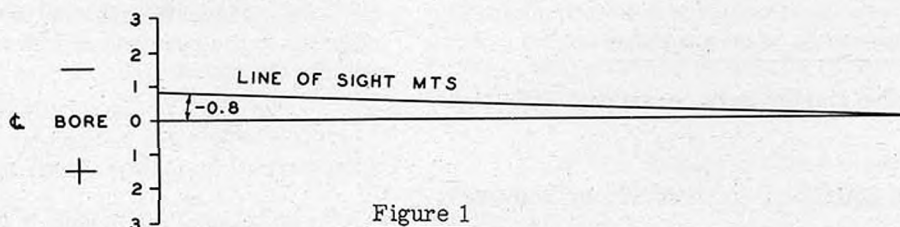
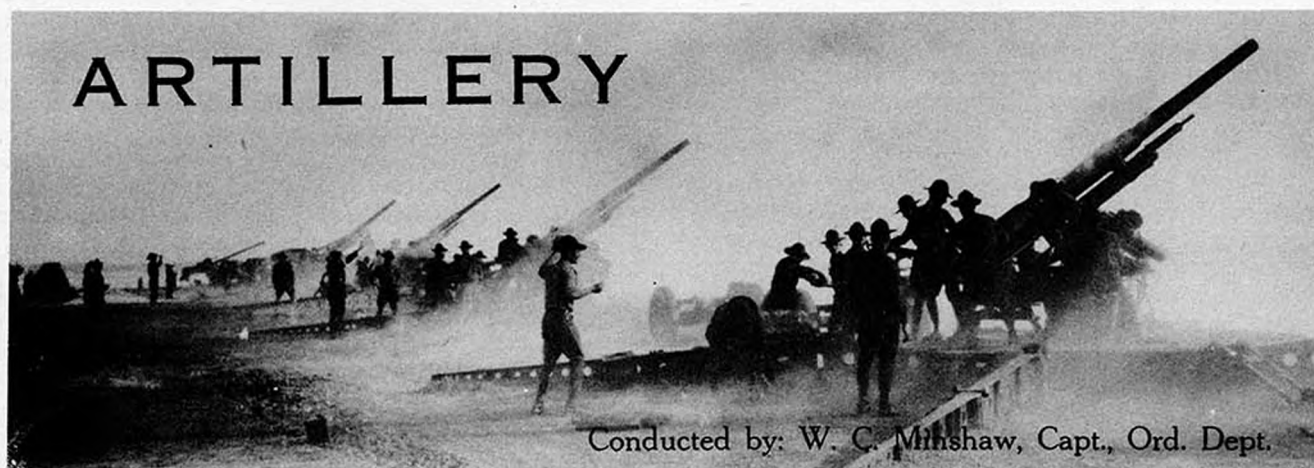


Figure 1



NOTES ON THE TEST AND ADJUSTMENT OF THE FRENCH SIGHT

By: O. A. Ramnes, 1st Lt., Ord. Dept.

The test and adjustment of the French sight is relatively a difficult operation, and should not be undertaken by the artillery mechanic until he has a thorough knowledge of the basic principles involved and a thorough understanding as to exactly what is to be accomplished by the test and adjustment.

These notes are primarily for the use of artillery mechanics who have had some experience with "on carriage" fire control equipment, and who have had some instruction, however slight, on the test and adjustment of the French sight. However, it is believed that the test and adjustment can be successfully accomplished simply by following, to the letter, the detailed instructions contained herein, provided the student has an understanding of the principles involved.

The most difficult portion of the operation is that which pertains to the test and adjustment of the sight bracket in elevation. A detailed study of the example problems included herein should assist the student materially in that respect.

The purpose of the test and adjustment of the French sight is twofold: (1) To determine serviceability of the battery sight, the angle of site level, the auxiliary angle of site level, the sight extension, and the sight bracket, and (2) To adjust the sight bracket to the axis of the bore so as to permit the use of any serviceable battery sight, or any serviceable angle of site level, with a minimized error. It should be remembered that each battery carries a spare battery sight, and that the test and adjustment insures that all guns in the battery are adjusted so that any gun could use the spare sight without an appreciable error.

Before beginning the test and adjustment the testing target should be placed about fifty-four yards to the front, with the lower right-hand butterfly about three feet above the trunnions of the gun, and the vertical line of the testing target verified with a plumb-bob. (Having the testing target above the gun eliminates the possibility of the target

being in such position that the tube might be perfectly balanced when bore sighted, thereby causing an erroneous reading due to the lost motion between the cradle and the elevating mechanism.) The carriage should be cross-leveled by means of a gunner's quadrant on the exposed part of the axle.

The complete procedure is listed step by step, in the sequence believed to be most practicable.

1. Test of the Master Level.

(Since the master level is to be used frequently throughout the test to measure other errors, we must make certain that its own error is negligible.

(1) Clean the leveling plates of the gun and the feet of the master level.

(2) Place the master level on the gun, with key in place, indicator to the rear and set at zero.

(3) Center the bubble by raising the breech with the angle of site handwheel.

(4) Turn the master level end for end and, if necessary, center the bubble with the indicator.

(5) The reading on the indicator will be equal to twice the error in the level and it must not exceed 1/4 minute (actual error must not exceed 1/8 minute.)

(The reading on the indicator will be equal to twice the error in the level since half the error shown is due to the tube being out of level.)

2. Adjustment of the Master Level

(1) Set the actual error of the master level on the indicator.

that the error of the battery sight be used as the subtractend in order to compute the actual error of "S", thus:

not be moved away from the reference point in any case, due to eccentric mounting of the level support on the angle

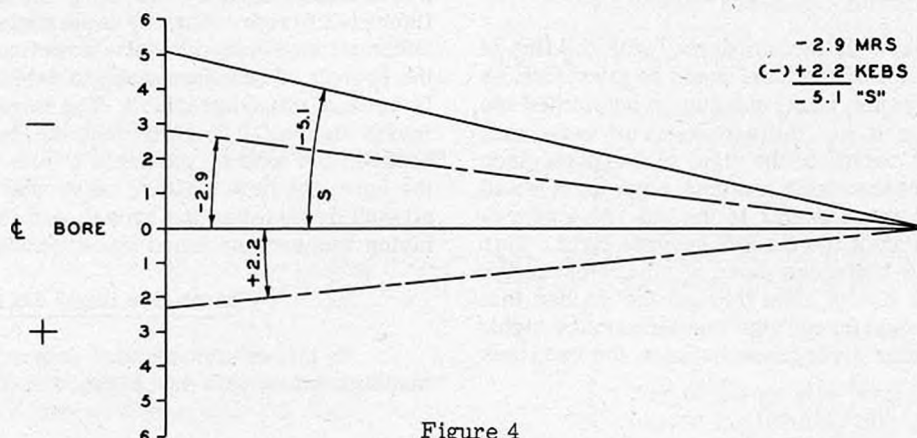


Figure 4

The second figure in column 6 (-3.9) represents the angular divergence between the axis of the level support and the axis of the bore. Hence, if we were using a perfect angle of site level, we would have an angle between the axis of the bore and the axis of the level of 3.9 minutes, due to misalignment between the level support and the axis of the bore. This error, which is hereafter referred to as "L", is obtained by subtracting algebraically the known error of the angle of site level from the mean reading of the level, in the same manner as was used to determine "S", thus:

of site worm wheel. The reference point is 0.6mm in width, thus, if the index line were moved from one edge to the other it would be equal to a movement of three minutes in the level support. Or if the index line is in the exact center of the reference mark, a maximum adjustment of the level support of plus or minus 1.5 minutes is possible.

In this particular problem the value of "B" is less than three minutes, hence no adjustment is necessary. However, in any case, if, after the adjustment of "L", the

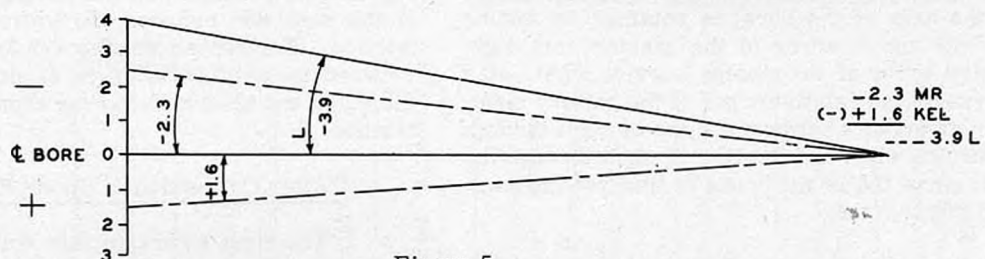


Figure 5

The third figure in "After Correction for Known Errors" column represents the angle between "S" and "L", and is referred to as the error "B". As error "B" is the algebraic difference between errors "S" and "L", it is computed by subtracting algebraically the smaller of "S" and "L" from the larger, thus:

value of "B" is more than three minutes, the sight bracket is unserviceable.

"Remaining Errors" Column

Since no adjustment was made to "L", the data in

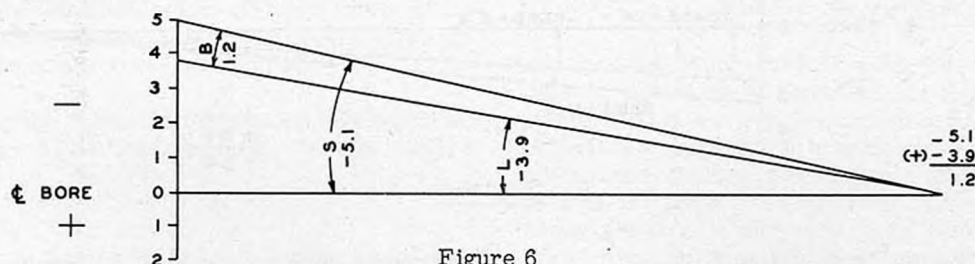


Figure 6

It is evident that the error "B" is due to the relative position of the sight socket and the level support on the sight bracket. Obviously, this error cannot be altered by adjusting "S", since an adjustment to "S" will move "L" an equal amount. Hence, the only means of reducing "B" is by an adjustment to "L", which may or may not be possible, depending upon the relative position of the angle of site index line to the reference mark, since the index line can-

column "Remaining Errors" is the same as that entered in "After Correction of Known Errors".

"Adjustment of the Tailstock" Column

If the angles "S" and "L" are algebraically equal, the best possible adjustment to the tailstock would be one which would zero both. However, when "S" and "L" differ,

(3) Bring the vertical line of the master service sight on its part of the testing target by revolving the deflection drum from zero.

(4) With a sharp pencil and the deflection drum index scribing guide, draw a line on the sight support opposite the 100 division of the deflection drum.

(5) Revolve the deflection drum until the 200 division is reached, then in the opposite direction until the vertical line of the sight again rests on its part of the testing target.

(6) As before, scribe a line with a pencil opposite the 100 division. The distance between these two lines represents lost motion of the drum and must not exceed 4 mils. If it exceeds 4 mils the sight bracket is unserviceable.

9. Test of the Battery Sight for Deflection

(1) Place the master test sight in the sight socket and set the deflection drum at 100 by rotating it from zero.

(2) Place the vertical line of the master test sight on its part of the testing target by traversing the carriage.

(3) Replace the master test sight with the master service sight.

(4) Place the master service sight on the testing target by rotating the deflection drum from zero.

(5) Take a reading on the deflection drum and record.

(6) Repeat this procedure nine times and determine the mean of the nine readings. Record the difference between the mean reading and 100, using the minus sign if the mean reading is below 100, and the plus sign if the reading is more than 100. The result is the relative deflection error of the master service sight. The absolute error (known error) is determined by adding algebraically the known error of the master test sight to the relative error of the master service sight. To add algebraically: If the numbers have like signs, add and give the sum the common sign. If the numbers have unlike signs, subtract the smaller from the larger and give remainder the sign of the larger.

(7) Determine the relative deflection error of the battery sight by comparing it to the master service sight in exactly the same manner that the master service sight was compared to the master test sight. However, in this case the mean of five readings may be used instead of the mean of nine readings. The known deflection error of the battery sight must not exceed 2 mils. If it does the battery sight is unserviceable and must be returned to an arsenal.

10. Test of the Sight Extension

(1) Place the master service sight in the sight socket.

(2) Set the deflection drum at 100 by rotating it from zero.

(3) Place the vertical line of the service sight on its part of the testing target by traversing the carriage.

(4) Remove the master service sight and place the sight extension in the sight socket, then place the master service sight on the sight extension.

(5) Place the vertical line of the sight on its part of the testing target by rotating the deflection drum. The difference between the reading of the drum and 100 will be equal to the error of the sight extension, and if it exceeds 2 mils the sight extension is unserviceable and must be replaced.

11. Test of the Battery Sight for Elevation

(1) Place the master test sight in the sight socket and align its horizontal line on the testing target, by raising the breech.

(2) Place the master level on the gun, indicator to the rear, and set at zero, and center the bubble by means of the thumb nut.

(3) Replace the master test sight with the master service sight.

(4) Depress the breech two or three turns of the handwheel and align the horizontal line of the master service sight on its part of the testing target.

(5) Center the bubble of the master level with the indicator and record the reading with its sign.

(6) Repeat the procedure nine times and determine the mean reading by adding the nine readings algebraically. The result will be the relative elevation error of the master service sight. To determine the known error (absolute) add algebraically the known elevation error of the master test sight and the relative error of the master service sight.

(7) Determine the known error of the battery sight by comparing it to the master service sight in the same manner as the master service sight was compared to the master test sight. The known elevation error of the battery sight must not exceed 3 minutes. If it does exceed three minutes the sight is unserviceable and must be returned to an arsenal.

12. Record the known error of the battery sight and the angle of site level in "Relative Error" column of the chart.

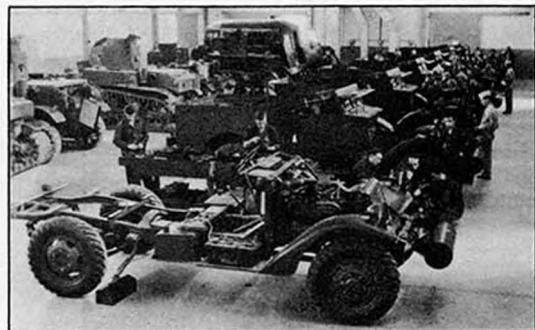
13. Determine Sight Readings for entry in "Readings" column.

(1) With range at zero, angle of site at zero, bore sight the tube on the testing target by raising the breech.

(2) Place the master level on the gun with the indicator to the rear and set at zero, and level the bubble with the thumb nut.

(3) Place the horizontal line of the battery sight on its part of the testing target by raising the breech.

(4) Center the bubble of the master level with the



Automotive

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

REMOVAL OF TRACK ON CAR, HALF TRACK

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

The following procedure is recommended for removing the track from the Car, Half Track.



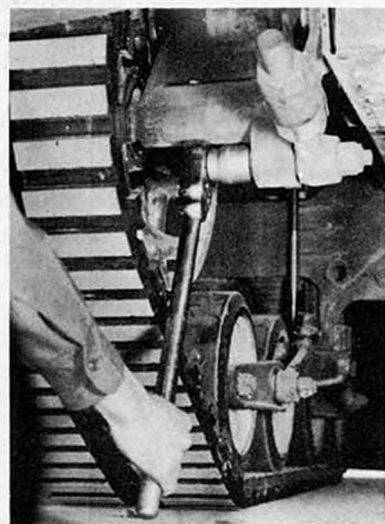
①
Remove the four (4) cap screws from the top roller brackets.



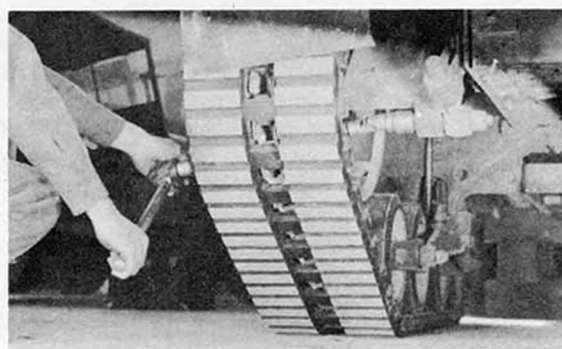
②
Remove the top roller by sliding it forward toward the driving sprocket.



③
Remove the nuts from the studs that retain the outer flange of the track-adjusting idler.



④
Loosen the anchor pin nut about three (3) turns. This can be done either directly or by using an extension.



⑤
Place a large drift against the end of the anchor pin, and use a heavy hammer to break the anchor pin loose from the tapered hole in the bracket. This is done in order to insure free rotation of the anchor pin.



Conversely, if the line of sight points below the axis of the bore, it is expressed with a plus sign, as it causes the gun to be pointed too high.

A sight having a deflection error, with the line of sight pointing to the left of the tube, would be expressed as a plus error, as it would cause the gun to be pointed too far to the right. Or if the deflection error were such that the line of sight points to the right of the bore, such error would be expressed with a minus sign, as it would cause the gun to be pointed too far to the left. +2.4 represents the relative error of the master service sight. This figure was obtained by taking the mean of nine comparative readings between the line of sight through the master test sight and the line of sight through the master service sight. Hence, it is the angular divergence between the two lines of sight, thus:

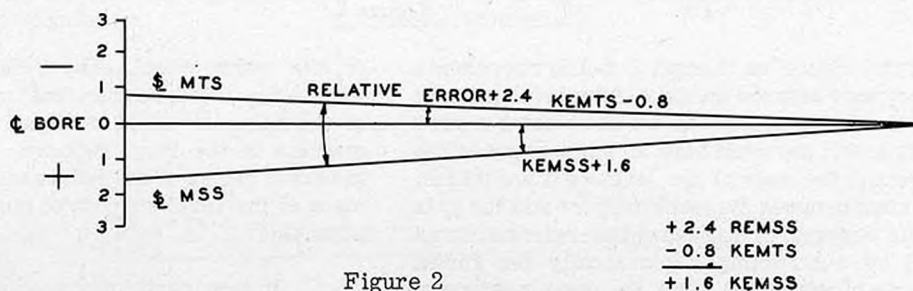


Figure 2

It can be seen from the diagram (Figure 2) that the known error of the master service sight (angular divergence from the axis of the bore) is obtained by adding algebraically the known error of the master test sight and the relative error of the master service sight. +0.6 minutes represents the relative error of the battery sight, or the angular divergence between the line of sight through the master service sight and the line of sight through the battery sight, since 0.6 is the mean of five readings between the two sights, thus:

readings taken with the level. The first reading (-2.9) represents the angle between the line of sight and the axis of the bore and includes the average effect of trunnion friction. The second reading (-2.3) represents the angle between the axis of the angle of site level and the axis of the bore, and also includes the average effect of trunnion friction.

"After Correction of Known Errors" Column

The first figure in this column (-5.1) represents the angular divergence between the axis of the bore and a line at right angles to the axis of the sight socket. In other words, if we were using a perfect sight in the sight bracket,

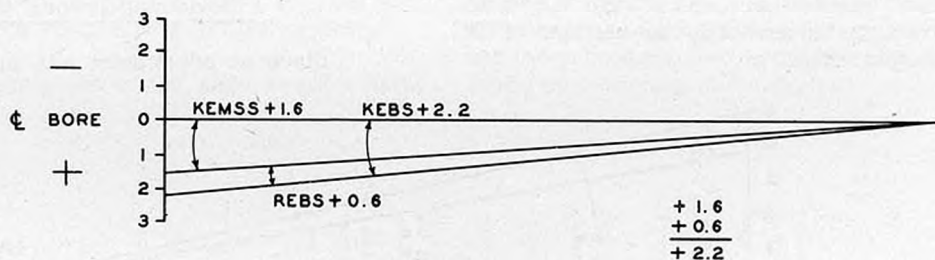


Figure 3

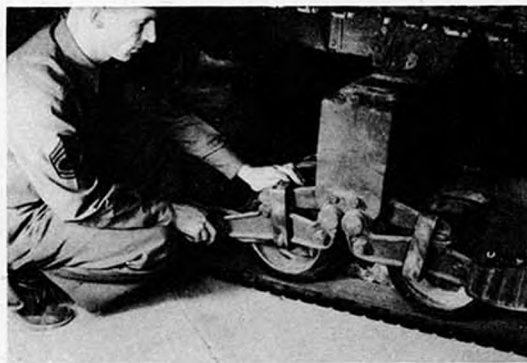
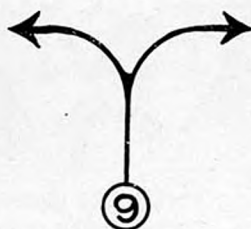
"Known Error Column"

In this column we have recorded the known error of the angle of site level (+1.6) as determined per paragraph 6, and the known elevation error of the battery sight, computed as outlined in Figure 3.

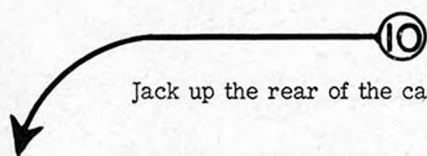
"Readings" Column

The first reading in column 4 (-3.2) represents

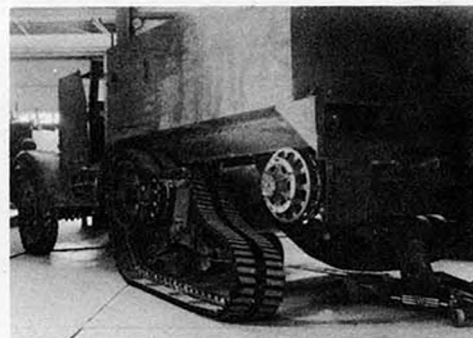
we would have an angle of 5.1 minutes between the line of sight and the axis of the bore, due to misalignment of the sight bracket on the sight mount. This error of the sight socket, which is hereafter referred to as the error (S), is obtained by subtracting algebraically the known error of the battery sight from the mean reading listed in the "Mean Reading" column. To subtract algebraically: Change the sign of the subtrahend and proceed as though adding algebraically. Since the mean readings of the sight were obtained by using the battery sight, it is evident



The special hooks (see drawings on preceding page) are put in place on the bogie arm and the crab arm.



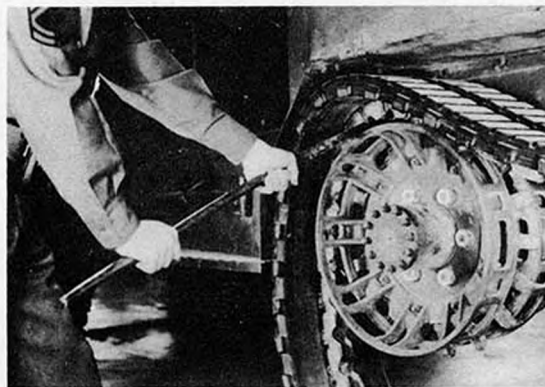
Jack up the rear of the car until the bogie rollers clear the track guides as shown.



Pull the track off of the idler as shown.

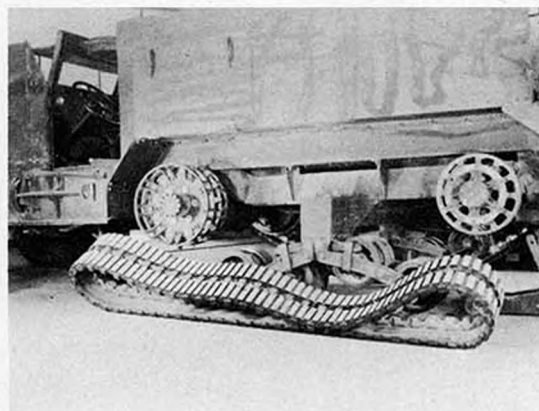
⑫

Use a pry bar to raise the track clear of the driving sprocket and then slide it off of the sprocket. Track guides must be free of the sprocket teeth or difficulty in prying the track off the driving sprocket will be experienced.



The track as removed is shown here. Replacement of the track is accomplished by reversing this procedure.

⑬



The author of this article wishes to express his appreciation to Technical Sergeant Veech of the Automotive Section of the Ordnance School for his aid in planning this procedure and arranging the sequence of the illustrations shown.

which is normal, the best possible adjustment is one which will place one above the bore and one below about the same amount. It is obvious that an adjustment to the tailstock will change the value of "S" and "L", since the entire sight bracket will be moved, but will not change the value of "B", whereas, an adjustment of "L" will change the value of "L" and "B", but will not change the value of "S". From Figure 6 it can be seen that although the value of "B" is less than three minutes, both "S" and "L" are above the bore an appreciable amount, necessitating an adjustment to the tailstock. Since the adjustment to the tailstock will move "B" "down", causing the gun to be pointed higher, the adjustment is in a plus direction.

Figure 7 will show what condition we desire to have after the tailstock adjustment has been made. The amount of adjustment can be more readily determined, as well as the direction of adjustment, by drawing a diagram (see Figure 7) from the data now available.

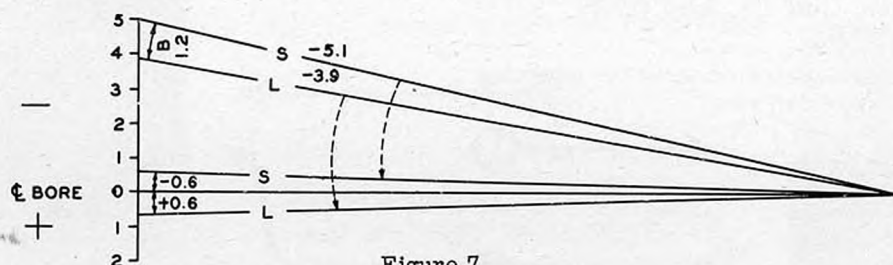


Figure 7

From Figure 7 it can be seen that we have moved "S" and "L" in a plus direction until "B" has been equally divided by the C/L of the bore, making "S" equal to minus 0.6 and "L" equal to plus 0.6, with the value of "B" remaining unchanged. Hence, if the tailstock were adjusted in a plus direction until the line "L" were moved from a point 3.9 minutes above the bore to a point 0.6 minutes below the bore, the tailstock must have been moved through an arc of 4.5 minutes, in a plus direction.

"Remaining Errors" Column

Since the adjustment to the tailstock changed the value of both "S" and "L", the data relative to their new position is entered in the "Remaining Errors" column.

The actual adjustment of the sight bracket (tail-

stock) can best be accomplished in the following manner:

(1) With the angle of site scale at zero, place the level testing seat in the level support.

(2) Place the master level on the level testing seat, with the indicator to the rear and set at zero, and center the bubble with the thumb nut.

(3) If the tailstock is to be adjusted in a plus direction, set off the desired amount of adjustment as a minus angle on the indicator.

(4) Change the thickness of the tailstock shims until bubble of master level is again centered, with the tailstock locked in position. After the adjustment has actually been applied, the data for all columns beginning with "Readings" should again be computed as a check against the adjustment.

Although the average student tends to think of the test and adjustment with respect to one gun, all guns of the battery should be adjusted, as nearly as possible, to each other. For example, if, after the completion of the test and adjustment of the sight on No. 1 gun, it is found that "L" has a slight minus error, the other guns should be adjusted, as far as practicable, so that their error of the level support, if any, will be in the same direction. Likewise, if, after the test and adjustment, it is found that the remaining error of "S" is in a plus direction, the same condition should be strived for in the other guns of the battery. Thus it can be seen why it is desirable to have known errors throughout the battery in the same direction.

The attached problems are not explained in detail, as was Problem No. 1. However, they should be of assistance since they show a number of probable situations, and the procedure used in determining data can be ascertained by referring to the explanation of Problem No. 1.

	Relative Errors	Known Errors	Readings	Mean Readings	After Correction of Known Errors	Adjustment of the Level Support	Remaining Errors	Adjustment of the Tailstock	Remaining Errors	Maximum Adjustment Possible to Level Support
Problem #2	KEMTS	Sight	-2.4	-2.1	-3.7					+3.0 (Unserviceable - a movement of +3.0 to level support would increase B to 9.0)
	+0.2	+1.6	-1.8							
	REMSS									
	+0.6	Level	+0.6	+0.7	+2.3					
	REBS	-1.6	+0.8		B 6.0					
	+0.8									

(Continued on page 358)

d. Check all scales for legibility.

- (1) The diopter scale.
- (2) The correction scale.
- (3) The range scale.

e. Check the whole range finder for broken, fogged, chipped, scratched and unserviceable optical elements by looking through the instrument from the objective end. All defects can be readily distinguished if this procedure is followed.

f. Check for definition of the halving line. (See paragraph 28, THE ORDNANCE SERGEANT for March.)

g. Check for definition in lower and upper fields of view. (See paragraph 29, THE ORDNANCE SERGEANT for March.)

h. Check for tilted images in both fields of view. (See paragraph 31, THE ORDNANCE SERGEANT for March.)

i. Check for speed of travel across the halving line. (See paragraph 32, THE ORDNANCE SERGEANT for March.)

j. Check the measuring wedge. (See paragraph 33, THE ORDNANCE SERGEANT for March.)

k. Check general appearance of the mount. Note condition of paint, serviceability, etc.

49. INSPECTION OF THE MOUNT. - a. Check all scales for legibility and serviceability.

- (1) The azimuth scale.
- (2) The azimuth micrometer.
- (3) The angle of site scale.
- (4) The angle of site micrometer.

b. Check the mount for backlash and lost motion as follows:

(1) Orient the instrument as described in paragraph 16. (See THE ORDNANCE SERGEANT for February.)

(2) Observe a reference point at least 200 yards distant.

(3) Bring the vertical line in the field of view to bear on this reference point.

(4) Rotate the azimuth knob moving the instrument at least 500 to 700 mils in azimuth.

(5) While observing the reference point through the instrument bring the vertical line in the field of view back to the reference point by rotating the azimuth knob. Do not overpass.

- (6) Note the reading of the azimuth micrometer.
- (7) Repeat the same operation in the opposite

direction.

- (8) Read the micrometer.

(9) The algebraic difference of these two readings should not exceed 1-1/2 mils.

c. Check the angle of site mechanism for smoothness of operation and for lost motion. To check for lost motion proceed as follows:

- (1) Set the scale at three, the micrometer at zero.

(2) Level the bubble by elevating or depressing the instrument.

(3) Rotate the micrometer to the limit of its movement.

(4) Rotate the micrometer back until the bubble is level again. Do not overpass. Take the reading of the micrometer.

(5) Repeat the above operation in the opposite direction.

(6) The algebraic difference of the two readings obtained should not exceed 1 mil.

d. Check the elevating mechanism for plus or minus 18 degrees elevation, and in addition check for smoothness of operation.

e. Check the support clamp lever for ten degrees free movement.

f. Check the hinge movement. The hinge clamp should clamp tight enough to support the instrument in any position.

g. Check the range finder support. The plunger should have a free action yet hold the instrument securely to the mount.

h. Inspect the orienting mechanism for smoothness of operation and for excessive lost motion and backlash. This movement can be somewhat stiffer than the azimuth movement but must not require excessive force to orient the instrument. (See paragraph 45d, THE ORDNANCE SERGEANT for March.)

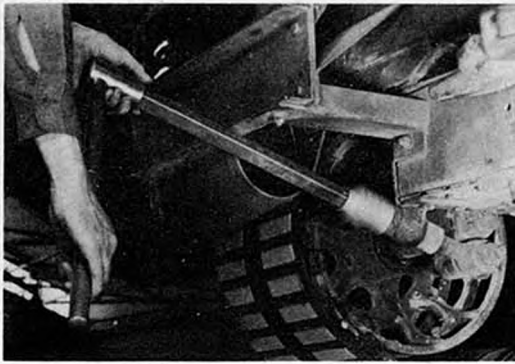
50. INSPECTION OF THE TRIPOD. - Inspect the tripod to see that it is serviceable, presentable, and that all parts work properly.

51. INSPECTION OF THE ADJUSTING LATH. - a. Check the adjusting lath. See that the lath and the instrument bear the same serial number. Inspect the screws to see that they have not been tampered with. Inspect the lath to see that it is not bent. Fit the sight tube in the adjusting lath.

52. INSPECTION OF THE CARRYING CASES. - Inspect the carrying cases for serviceability. Note all the straps and seams. Note the condition of the leather.

53. INSPECTION OF ACCESSORIES. - Inspect accessories for serviceability.

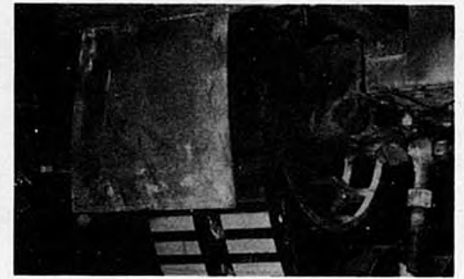
(Continued on page 354)



← ⑥

Remove the nut from the adjusting idler post.

⑦ →

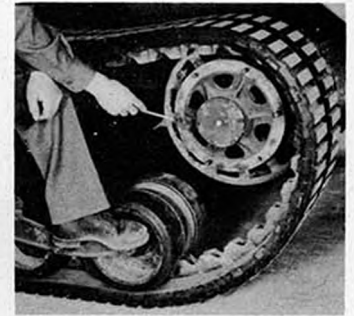


Push the idler assembly forward to the position shown. If the weight of the track fails to drop the idler forward sufficiently to allow the anchor post to fall out as shown, it will be necessary to push the anchor pin forward. Care must be taken to prevent damage to the threaded portion of the adjusting idler post. The anchor pin must be free to rotate as the adjusting idler post is pushed forward or damage to the threads will result.

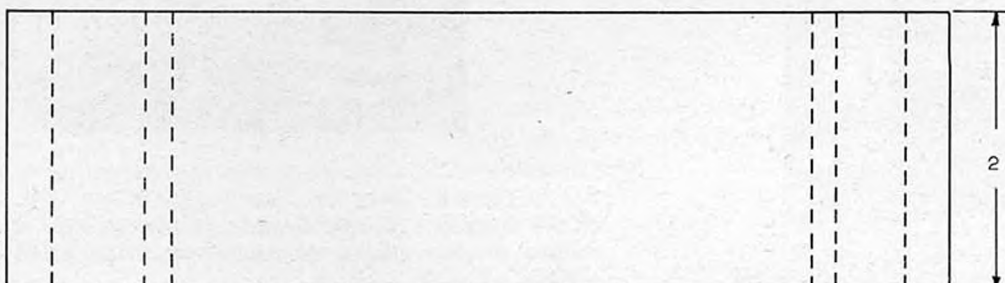
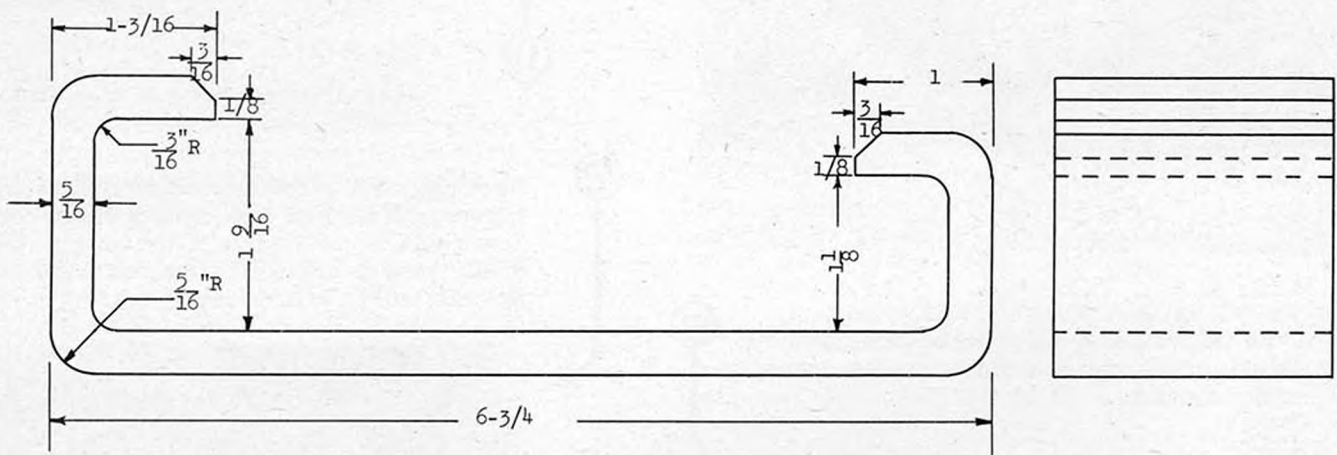


← ⑧

Remove the outer flange of the track adjusting idler. It may be noted that often the stud comes out completely when the nut is removed.



Specifications for the manufacture of special hooks to be used are shown by the drawing below, and their use is shown by illustrations on the next page. The hooks are made from M.S. $5/16"$ x $2"$ material, and four (4) are required per car.



No.	RANK.	NAME.	NATURE OF DUTY AND WHEN LAST PERFORMED.					
			Charge of Quarters and Room Orderly.	Fatigue.	Kitchen Police.			
1	1st Sgt	Roberts						
1	Sgt	Mills						
2	"	Newman	Feb 7, 4, 6, 7	Feb 1, 4, 30				
3	"	Ross	Feb 7, 3, 5, 6	Feb 20				
1	Corp	Caldwell	Feb 7, 24	Jan 1, 16				
2	"	Dewey						
1	Priv 1st Cl	Adams						
2	"	Dunn		Feb 7, 25	Feb 5, 27			
1	Priv	Evans		Feb 7, 29	Feb 1, 27			
2	Priv	Foster		Feb 18, 31	Feb 21			

8-1636

Figure 2

and fatigue duties, but the duties of noncommissioned officers and privates first class, or privates differ while on guard or fatigue duty, and of course noncommissioned officers are not detailed for kitchen police. Hence, it is necessary to segregate enlisted men into at least three separate lists.

Whenever a person detailed for a duty is not present or available at the time he is due to report for that duty, the duty falls to the next available person on the roster. The person absent is the first for duty when he becomes available.

If a person becomes first for guard, outpost, or other armed duty at the same time he becomes first for other duties, he is detailed for the guard or similar duty first and is available for other duties upon being relieved.

No duty, except in emergencies, is required of members of the old guard until four hours after they have been relieved.

All persons must serve when detailed whether or not they are due for the particular duty for which detailed or whether or not a roster is kept for such duties.

Rosters are not kept for special duty details.

The names of newly joined officers and men are placed at the foot of the respective rosters on the day after joining. This is done by entering in the column for each duty to which they are subject to detail, the numeral for the day of joining, the roster for other duties, and by entering the number 1 in the square for the day after joining, on the guard roster.

Company and similar unit commanders are responsible for the supervision of the keeping of their organization duty rosters. In commands higher than the company or similar unit, duty rosters are supervised by the executive officer through the adjutant.

Used blank forms are held for one year and then disposed of.

ROSTER FOR OTHER DUTIES

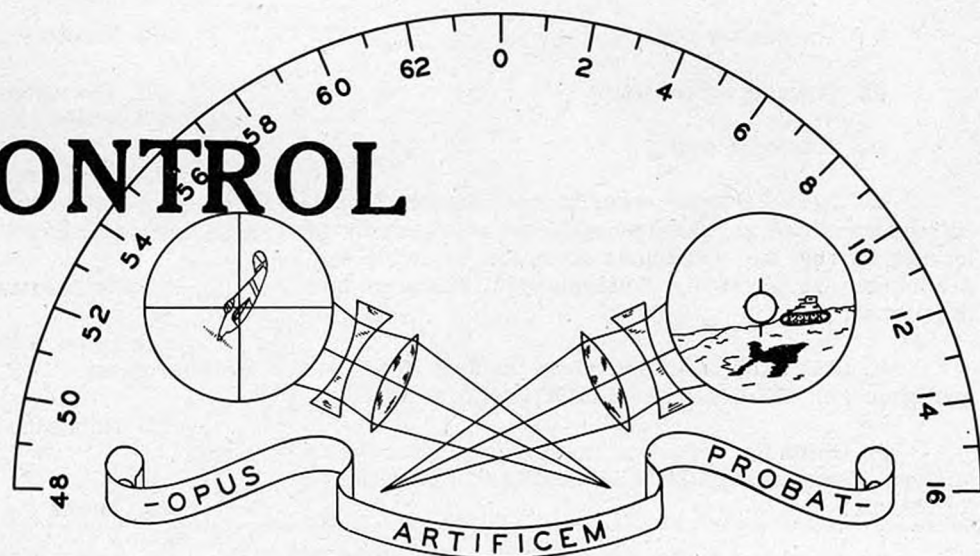
The form for the roster for other duties (see Figure 1) is made up of nine columns, three of which have blank headings. The columns with blank headings are used for duties other than those normally performed in an organization or unit. The first column on the left is for the purpose of numbering the persons serially within each separate list. Note that the First Sergeant's number is 1, and also that the first sergeant, corporal, private first class and private all have the number 1. These numbers coincide with like numbers in the right hand column on the guard roster (see Figure 2) which simplifies the task of associating names of persons with the status recorded on the guard roster.

A new duty roster is prepared at the beginning of each month by listing all persons alphabetically within each separate list. In the spaces provided opposite each person's name, in the columns for the different duties, the date last performed each duty is entered by using the abbreviation of the month and the numeral indicating the day of the month. When a person is detailed for any duty, the date last performed is lined out and the numeral indicating the day on which the duty is performed is entered. It is not necessary to use the abbreviation for the name of the month at any time except when preparing the new roster at the beginning of each month. All numerals, except the one preceded by the abbreviation of the month indicate that the duty was performed on that day of the month covered by the roster, the current month.

Absence from duty in any status has no effect on the date last performed any duty other than guard, outpost, or similar armed duty, with one exception, which is detached service. When a person departs on detached service, the numeral indicating the day of departure is entered and a hyphen is placed after the numeral to indicate that it is the date of departure. When the person returns to duty from detached service, the date of departure is lined out and the numeral of the day of return to duty is entered after the hyphen. This action has the effect of placing him at the foot of the roster.

FIRE CONTROL

Conducted by:
R. L. JOHNSON,
1st Lt. Ord. Dept.



FINDER, RANGE, 1-METER BASE, M1916

Part III

SEALING

46. PROCEDURE. - a. The sealing of the range finder cannot be accomplished as one complete operation after assembly. Some parts must be sealed as assembly progresses and some parts must not be sealed until adjustment is complete.

b. The general requirement is that all holding screws and plugs will be set in a drop of shellac to stake them in place.

c. All adapter plates on the outer tube will be set in plastiline to seal them except the tripod adapter plate and the gimbal joint adapter which will be set in white lead that has the consistency of paste.

d. After assembly of the inner optical bar and before it is placed in the outer tube all screws will have a drop of shellac placed on their heads except those that may require movement during adjustment, or except those screws that serve as bearings or trunnions, such as the two screws which hold the gimbal joint fork to the optical bar.

e. After assembly and adjustment is complete, all screws on the optical bar which have not previously been staked, except those screws that serve as bearings or trunnions, will have a drop of shellac placed on their heads.

f. All plates on the outer tube will be sealed in place as described in paragraph c above. All screws and plugs on the outer tube will be set in a drop of shellac and the screw slots or holes will be filled with plastiline and spot painted.

g. It will require good judgment on the part of the instrument repairman to determine which screw will be set in shellac and when it should be done, as many screws

may require movement after assembly and during adjustment. Also do not seal or stake screws that serve as trunnions or where sealing will interfere with the operation of the range finder.

FIELD INSPECTION

47. MATERIALS REQUIRED. - a. The field inspection can be made without tools although it will be facilitated if the following are available:

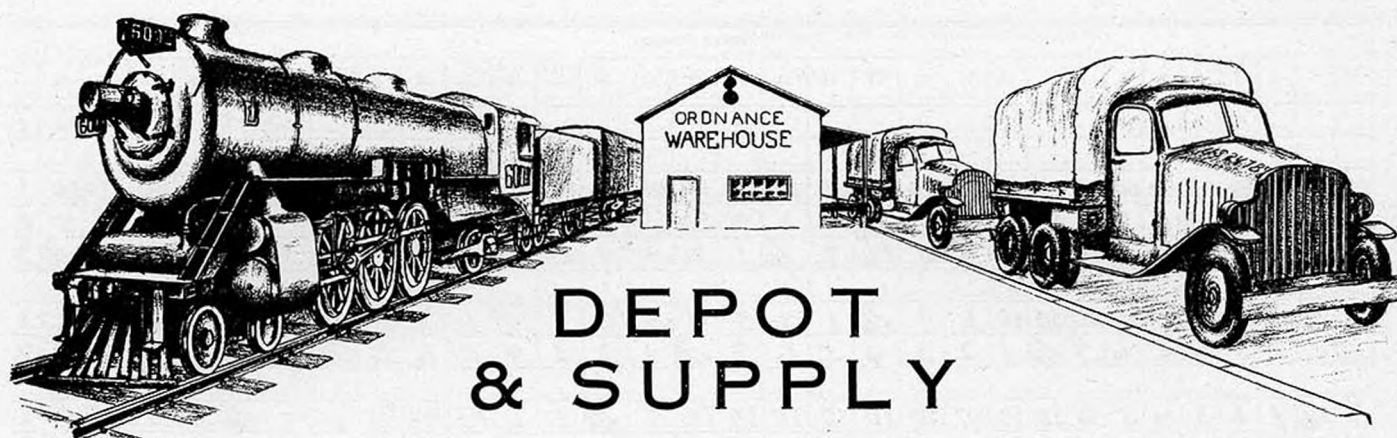
- (1) Adjustable leveling plate.
- (2) Collimating telescope.
- (3) Adjustable "V" block.
- (4) Inspection Form.

48. INSPECTION OF THE RANGE FINDER. - a. Check for completeness, record serial number of instrument being inspected. Instrument should have all the accessories, etc., listed in SNL F-1 necessary to make the instrument complete.

b. Note general appearance: check for missing, broken parts, etc.

c. Check the moving parts of the instrument:

- (1) Correction scale for full movement and smoothness.
- (2) Focusing nut for smoothness of operation and proper diopter movement, plus or minus four.
- (3) Range roller for smoothness and full movement.
- (4) Check the halving adjuster.



Conducted by: J. E. Dempsey, 1st Lt., Ord. Dept.

MAINTAINING ACCOUNTABILITY OF SMALL ARMS AMMUNITION

By: R. J. McCoy,
Staff Sergeant, Ord. Dept.

National Defense! Keep 'em flying! Remember Pearl Harbor! Thus read our numerous and timely placards of the day. Each in itself has a meaning which, when fulfilled, will help our government and Uncle Sam in the present World War which is No. II.

In our public transits we, soldiers, meet the near and dear relatives of other soldiers who are in the Infantry, the Cavalry, the Coast Artillery, and the other Arms and Services. Likewise, we contact members of the Navy and the Marine Corps. As a result of such communication, we, as Ordnance men, are questioned about our duties and mission. In answer to such inquiries, may we quote from the Ordnance Text, OS 9-32, December 1941, which is a temporary publication pending an approved War Department Manual: "The Ordnance Department is responsible for design, development, procurement, storage, supply, and maintenance of Ordnance materiel."

In order to deviate from technical lines to explain this mission, let us refer to the musical lyrics of Irving Berlin and his popular song "Arms for the Love of America," which, incidentally, was written especially for the Ordnance Department. Therein is contained the secret of Ordnance work -- "the man behind the gun." We are the first mentioned "man". Therefore the Ordnance Department must supply the man behind the gun with supplies, namely, weapons, repairs, and ammunition. All of which leads us to a unit of the Depot and Supply Course which is entitled: "The Supply and Use of Small Arms Ammunition."

Before going any further, it is desirable that a few situations be made clear before complications arise. First, let us bear in mind that in the Depot and Supply classes, students are trained for clerical positions or the proverbial "red tape." It is with the paper end of the Supply and Use of Small Arms Ammunition that we are concerned. Secondly, we don't wish to trespass on the Ammunition Section. However, in reviewing the articles which have appeared in THE ORDNANCE SERGEANT, it is evident that Ammunition

articles have been technical in nature. Further, the clerical handling of Air Corps Ammunition is not being considered at this time.

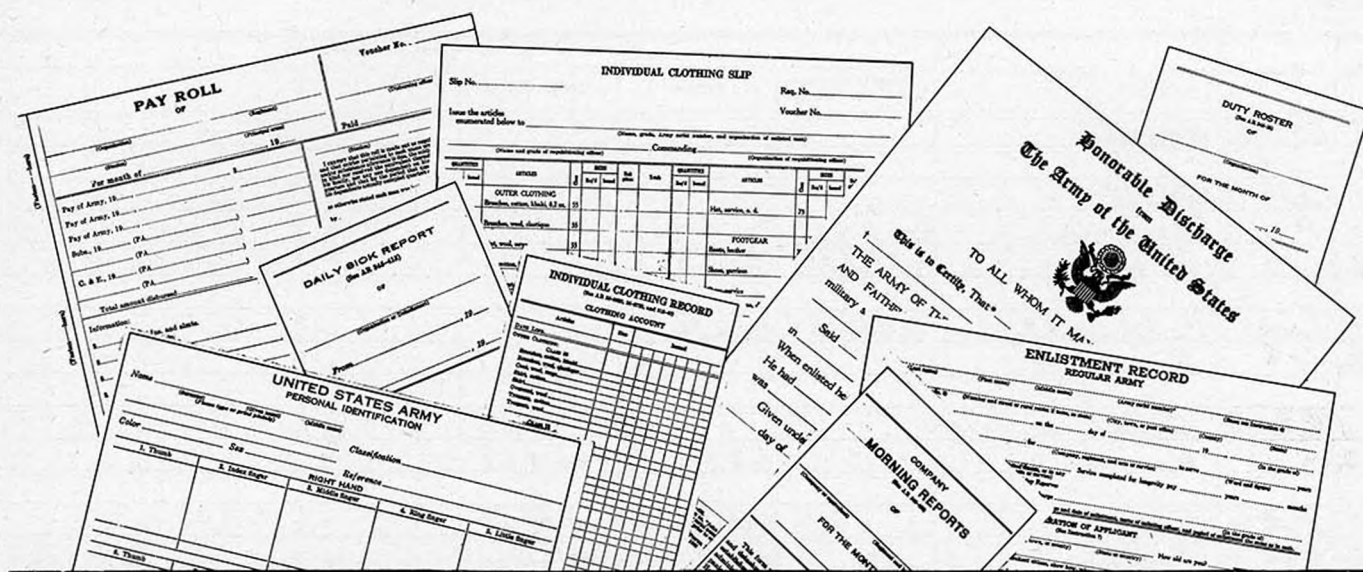
The first publication to be considered is Army Regulation 775-10, Qualification in Arms and Ammunition -- Training Allowances, which is published annually and effective as of January 1st. Therein are prescribed the annual training allowances which are for the calendar year. Tables of Organization are used to learn the number of men who will be entitled to these training allowances. In addition, the Service Records of the men are consulted in order to determine their individual eligibility.

Since there are various organizations and persons who are entitled to receive small arms ammunition, Army Regulation 775-10 is considered as the governing publica-

WAR DEPARTMENT Q. M. C. Form No. 400 Revised Apr. 1, 1941		REQUISITION				
COMMANDING GENERAL, Third Corps Area, Baltimore, Maryland		No. of Sheets	Sheet No.			
Requisition No. 727-66-42		Date JANUARY 18, 1942	Period Special			
SHIP TO ORDNANCE PROPERTY OFFICER, Fort Blank, Maryland.						
Requested By (show Signature, Rank, Organization, Destination. If different from "amr to" include address):		Approved By:				
 SAMUEL GUNNER, Captain, Ord. Dept., Ordnance Property Officer.		 JOHN SMITH, Colonel, Infantry Commanding.				
STOCK No.	ARTICLES	UNIT	ON HAND AND DUE	CONSUMED	REQUIRED	APPROVED
GROUP T-1						
	CARTRIDGE, ball, cal..30, M2 Grade R, packed in cartons.	rd	22,750	107,250	186,000	
	CARTRIDGE, ball, cal..30, M2 Grade R, packed in clips and bandoleers.	rd	8,500	71,500	96,000	
	CARTRIDGE, ball, cal..30, M2 Grade MG, packed in cartons.	rd	10,800	339,200	372,500	
	CARTRIDGE, ball, cal..50, M1, Grade MG, packed in cartons.	rd	1,200	6,000	18,000	
	CARTRIDGE, tracer, cal..30, M1, Grade MG, packed in cartons.	rd	7,500	52,500	72,000	
	LINK, metallic belt, cal..50, M1.	ea	2,000	0	7,000	
GROUP T-2						
	CARTRIDGE, ball, cal..45, M1911, Grade 1 or 2, packed in boxes.	rd	2,000	56,000	64,000	
BASIS: To meet the requirements of the troops who are stationed at this post for the coming target season.						
DISTRIBUTION: Six (6) copies 1 File 5 Corps Area 1 File, 2 Supply Point, 1 Follow-up, 1 Return.						

FIGURE 1

#66-42



ADMINISTRATION

Conducted by: J. E. Dempsey, 1st Lt., Ord. Dept.

DUTY ROSTERS

By: I. J. Dreher,
T. Sgt., Ord. Dept.

An important phase in the administration of military personnel is the keeping of duty rosters. Army Regulations provide rules for the keeping of these rosters and in order to perform this function properly, a full understanding of the rules is essential.

A duty roster is a list of officers or enlisted men by name that is kept for the purpose of recording the duty performed by each person, from which record the status of the different persons regarding availability for duty may be obtained. The duties so recorded are those duties which are necessary outside the normally assigned daily duties. They might be classed under the general heading of "The Necessary Guard and Fatigue" for the proper functioning of any organization or unit.

The use of the duty roster makes it possible at all times to know the date on which each person last performed any of the duties for which the roster is kept and to pick out which persons have been longest off each duty. When details are made, the persons longest off duty are usually detailed first.

The form used for duty rosters is W.D. A.G.O. Form No. 6. It is a small booklet the same size as that of the Morning Report. All the pages of the booklet are identical, having the form used for duties other than guard on one side of the page and the form used for guard on the other side. The pages of the booklet are so bound so that when it is opened the roster for duties other than guard appears on the left page (see Figure 1) and the roster for guard duties appears on the right page (see Figure 2). Several lists of names may be kept in a booklet, each list in itself being a separate roster.

Separate rosters are kept according to rank or grade as follows:

OFFICERS

Lieutenant colonels and majors, who are detailed when the importance of the duty make it necessary, especially in large commands where a field officer of the day is essential.

Captains, who are generally detailed as officers of the day, and who are excused from ordinary fatigue details.

Lieutenants, who are generally detailed as officers of the guard, but who may, if the commanding officer deems it advisable, be included on the captains' roster.

ENLISTED MEN

Noncommissioned officers of the first three grades normally are not included on rosters of enlisted men, but when the lack of personnel, in the opinion of the commanding officer, makes it necessary, they may be included, either by keeping them on the same list with sergeants or on a separate list, as desired.

Sergeants, corporals, and privates first class and privates are also kept on separate lists for each grade. It is not necessary to segregate privates first class from privates on a roster because they are subject to detail for the same type of duties.

When persons of more than one rank or grade are kept on a roster, and are subject to detail for the same type of duties, it is not necessary to segregate them according to rank or grade. For example, in the case of lieutenant colonels and majors, each becomes available for detail as field officer of the day as often as the other, and it is not necessary to segregate them on the roster. At the same time, in the case of enlisted men, sergeants, corporals, privates first class, and privates are all detailed for guard

ITEM CARTRIDGE, ball, cal..30, M2 LOT NO. FA 3004 GRADE R (X - MG)*
(Packed in cartons)

DATE	REF. NO.	RECEIVED RR. OR ISSUED TO	RECEIPTS	ISSUES	EXPEND-ITURES	BAL. ON HAND
1942 2/5	133	FR: Raritan Arsenal, N. J.	99,000			99,000
2/18	144	TO: R.S.O., 99th Infantry		53,376		45,624
2/28	C/E #1	FR: Co. "A", 99th Infantry			20,656	45,624

NCO - 100

* Data within parenthesis --- note article

FIGURE 5

Part II of both SNL T-1 and SNL T-2 in which are listed the different packings and the number of rounds composing a complete box, e.g., if 2,300 rounds of CARTRIDGE, ball, cal..30, M2, packed in cartons were required, 3,000 rounds would be ordered because there are 1,500 rounds of that particular packing in a complete box. Consider Figure 1.

There are a few features about Figure 1 which may be well to note. There are, as already mentioned, the various packings and grades. Ammunition, unlike other Ordnance Materiel, may be requisitioned with more than one Standard Nomenclature List groups on the same requisition. It is the duty of unit or organization commanders to properly control the expenditure of ammunition within their jurisdiction. Thus, it should be used wisely and economically and, at the same time, with the idea of retaining a sufficient amount for reserve which may be used for competitions, special projects, salutes, emergencies, and the like, this being a reason for the amounts enumerated in the column ON HAND AND DUE. These allowances are not accumulative from year to year. That ammunition which remains at the end of one year may not be added to the total allowances for the following year. Finally, the distribution of the requisition -- this varies according to the ground rules. Nevertheless, the number of copies as shown establish a complete circuit to inform all concerned.

Requisitions for ammunition may be submitted under

REF RA PD-PC- 477-1941

War Department, Ordnance Office,
Washington, Dec. 20, 1941

Ordnance Officers receiving this notification are responsible that the information contained herein is furnished to all organizations, stations, etc., within their jurisdiction, which are affected thereby

CARTRIDGE, ball, cal..30, M1
Lot F.A. 1444 - Grade 3

DETACH AND RETURN REPLY CARD

By order of the Chief of Ordnance:

FIGURE 6

J. K. Crain,
Brig. General, U.S. Army,
Chief of Field Service.

two situations. First, they are initiated as the need arises within an organization, and secondly, one requisition may cover a complete target season and an allowance will be established; then the organizations will draw on that established allowance. Tracer ammunition is also listed and it will be explained later in this article.

As may be known, requisitions originating at posts, camps, and stations within Corps Areas will pass through Corps Area Headquarters for action; thence to the supply point, which may be either a depot or an arsenal. For the sake of clearer explanation, only two particular grades and packings of the requested ammunition will be shipped by the supply point. Consider Figure 2.

After the shipment arrives, it is checked and then the items are entered on stock record account; at which time accountability is established. Consider Figures 3 and 4.

Notice that voucher number 133 is listed on both Figures 3 and 4, which is the same as the consignee's debit voucher number on the Shipping Ticket, Figure 2. The next step is setting up a file of Lot Data Cards for the Ordnance Property Office. Consider Figure 5. This system of office Lot Data Cards is not required by Army Regulations but it is established at most post, camp, and station ordnance offices. As may be seen, only one lot number is recorded on each form. In addition to the lot number, information as to the grade, the manner of packing, receipts, issues, expenditures, and balance on hand may also be found. An explanation of the issues, expenditures, and balance on hand will follow.

From time to time surveillance tests are made of each lot of small arms ammunition. Often these tests are conducted as a result of reports that are submitted to the Chief of Ordnance by the using arms and services. The purpose of such tests is to determine the accuracy, durability, and effectiveness of the ammunition. If for some reason, certain lots fail to meet the required standards, those particular lots will be regraded to a lower grade. The sequence of the regrade follows the order of the grades as enumerated earlier. All grades and lots of small arms

GUARD ROSTER.																																No.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			
																																1	
ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	ED	1	
3	4	5	6	7	1	2	3	A4	A5	6	7	8	1	2	3	Sk	Sk	4	5	6	7	8	1	F	F	F	F	2	3	4	5	2	
5	6	DS	DS	DS	DS	7	1	2	3	4	5	P6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	3		
4	5	SD	SD	SD	SD	SD	SD	SD	SD	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	1	
7	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	2	
7	8	1	2	3	4	5	6	SD	SD	SD	SD	SD	SD	SD	SD	SD	7	8	1	2	P3	P4	P5	6	7	8	1	2	3	4	1		
DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	DS	3	4	5	6	7	8	2		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			
Rct	Rct	Rct	Rct	7	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	9	10	11	12	

Figure 1

8-1636

GUARD ROSTER

The form used for the guard roster (see Figure 2) is made up of 31 columns of squares, with the numerals indicating the days of the month at the head of each column. On the right hand edge of the roster is the number column in which numbers are entered to coincide with those entered in the left hand column on the roster for other duties. (See Figure 1.)

The following abbreviations are used to indicate the status of persons absent or not available, in guard rosters:

- A -- Absent without leave.
- Ar -- Arrest in quarters.
- C -- In confinement.
- DS -- On detached service.
- F -- On furlough.
- P -- On pass.
- Rct -- Recruit.
- SD -- On special duty.
- Sk -- Sick.

The abbreviation ED -- Excused from duty, although not authorized by regulations, is often used to indicate persons, who, although present and available, are excused

from such duty by the commanding officer of the organization or unit.

The fact that a person performs guard duty is indicated by shading half of the square opposite the person's name in the column for the day of the month on which the duty is performed. In the case of interior guard duty, which is usually for a period of 24 hours, the day on which the duty is begun is considered as the day of performance of the duty and the following day as the first day off that duty, regardless of the hour relieved.

Special guard duty, such as stable guard, is indicated by entering the initial letter in the open half space.

Persons who are not available because of absence without leave, in arrest, in confinement or on pass, or being sick not in line of duty are charged the same as if they were on duty and available. Their numbers of days off guard continue to accumulate. The number of days off guard of persons on authorized absence, except on pass, do not accumulate but merely continue, upon return to duty, where they left off at the beginning of the absence.

The detail for supernumerary should as a rule fall to the man next for detail. This, however, may be varied so as to "even up" the detail.

YOUR CHANGE OF ADDRESS

A great many changes are taking place within the Ordnance Department, and THE ORDNANCE SERGEANT wants to know about these changes as early as possible. Even though you can't receive this magazine as an individual, you should feel obligated to report any change in the address of your organization. If your outfit moves, or if you are assigned to a newly activated organization, spend a penny for a card to tell us about it. If your outfit goes to foreign service you may not be able to tell us where you are going, but there will be a mailing address you can furnish us. Help us to keep THE ORDNANCE SERGEANT going direct to each and every Ordnance organization.

MASTER MAGAZINE RECORD CARD

ITEM CARTRIDGE, ball, cal..30, M2.			CLASS 1	GRADE MG	UNIT rd	GROUP T-1
DATE	REFERENCE NUMBER	RECEIVED FROM OR ISSUED TO--	QUANTITY RECEIVED	QUANTITY ISSUED	BALANCE ON HAND	
3/28/41	S/T 133	FR: Raritan Arsenal, Metuchen, N. J.	130,000		130,000	
5/ 3/41	S/T 142	TO: Regimental Supply Officer, 99th Infantry, Post.		24,765	105,235	
8/ 7/41	S/T 16	TO: Battalion Supply Officer, 82nd Fld Arty, Post.		58,440	46,795	
9/30/41	S/T 48	TO: Regimental Supply Officer, 99th Infantry, Post.		24,045	22,750	
2/ 5/42	S/T 133	FR: Raritan Arsenal, Metuchen, N. J.	186,000		208,750	
2/11/42	OS&D 141	TO: Ordnance Property Officer, Post.		99,000	109,750	

OO Form 7232

FIGURE 9

U. S. GOVERNMENT PRINTING OFFICE 3-10907

sider Figure 11. Attention is directed to the consignor's Credit Voucher number 144, and that it is used on Figures 4, 5, and 8. For your information, the total number of rounds required to fulfill the basis is 66,720. However, when considering the substitution of tracer ammunition, the amounts as shown on Figure 10 result.

It will not be amiss, at this point, to make note of the visual physical inspection that is given to small arms ammunition immediately prior to issue. It is required that a careful physical examination will be made of one to five boxes of each lot of ammunition; depending, of course, upon the amount being issued. Paragraph 13, Technical Regulation 1350-A, May 18, 1934, lists fifteen defects which may be detected. A characteristic explanation of each defect is also given. Herewith is a list of the defects only: season crack, corrosion, mouth pull down, shoulder bulge, oil dent, draw scratch, split mouth, folded neck, scale, indent and burr, crease, thin head, round head, thick head, and split bullets (found in tracer ammunition). In making this inspection, there should be good light. Further, the examiner should turn the cartridge in his fingers and use a magnifying glass whenever necessary. Lots which have more than five percent (5%) defective cartridges will be given a one hundred percent (100%) inspection. The defective rounds will be culled and regraded into Grade 3; which, as stated will not be used by military personnel and will be disposed of in conformity with standing or current instructions and methods. A report of such findings will be sent to the Chief of Ordnance. This report will take into consideration local storage and climatic conditions. If, as a result of the visual physical inspection, the percentage is less than five, a complete or one hundred percent (100%) inspection is unnecessary. On the other hand, it is the duty of the unit or organization commanders to have a one hundred percent (100%) inspection made of the ammunition as it is being issued to the troops.

After a subordinate organization has expended or used or fired the ammunition which was issued to them, they will complete a Certificate of Expenditure to that effect. Paragraph 2, Army Regulation 35-6620, August 14, 1941, lists seven conditions or circumstances by which an organization may expend ammunition, namely: authorized training, military exercises, and hunting -- all within prescribed allowances; in action, in defense of life or public

property, in carrying out the prescribed duties of sentinels, and for authorized tests and salutes. These certificates may cover a complete target season or they may be for a partial period according to the situations at hand.

Once more, another assumption -- this time it shall be considered that a Certificate of Expenditure is received from a subordinate organization. Consider Figure 12. This certificate is a modified form as authorized and serves a twofold purpose. First, as a means of checking expenditures against authorized allowances, and secondly, furnishes accurate data for basic reports, such as, the Principle Items of Ordnance Supplies --- Ammunition, OO Form 87. It is well to number the Certificates of Expenditures

WAR DEPARTMENT Q. M. C. Form No. 400 Revised Jan. 1, 1941						
REQUISITION						
ORDNANCE PROPERTY OFFICER, To: Fort Blank, Maryland.			No. of Sheets 1 Sheet No. 1			
Requisition No. 99-74-42			Date FEBRUARY 16, 1942		Period Special	
SHIP TO: REGIMENTAL SUPPLY OFFICER, 99th Infantry, Fort Blank, Maryland.						
Requisitioned By (show Signature, Rank, Organization, Destination. If different from "SHIP TO" include address):			APPROVED BY:			
 ANDREW JACKSON, Captain, 99th Infantry Regimental Supply Officer.			 JOHN SMITH, Colonel, Infantry, Commanding.			
STOCK NO.	ARTICLES	UNIT	ON HAND AND DUE	CONSUMED	REQUIRED	APPROVED
GROUP T-1						
Item I	CARTRIDGE, ball, cal..30, M2 Grade M2, packed in cartons.	rd	0	0	53,376	Approved as called for.
Item II	CARTRIDGE, tracer, cal..30, M1, Grade M2, packed in cartons.	rd	0	0	10,137	
BASIS:						
Item I -- 73 men to fire Marksmanship course with Machine gun, cal..30, (flex.) EB., M1919A4, with ground tripod. 36 men to fire Qualification "C" course with Machine gun, cal..30, (flex.) EB., M1919A4, (vehicular mounted). 28 men to fire Qualification 1,000 inch course with Machine gun, cal..30, water-cooled, M1917. 19 men to fire Requalification 1,000 inch course with Machine gun, cal..30, water-cooled, M1917. Item II -- Maximum amount of tracer ammunition for the above allowances.						
DISTRIBUTION: Three (3) copies 1 File 2 Supply Point (Ordnance Property Office)						

FIGURE 10

#14/42

QUANTITY		STOCK NO.	ARTICLE	UNIT	UNIT COST	TOTAL COST	
ORDERED	SHIPPED						
186,000			<u>GROUP T-1</u> CARTRIDGE, ball, cal. .30, M2, Grade R, packed in cartons, Lot No. FA 3004 - 99,000 rd Lot No. FA 3010 - 87,000 rd	M	33.64	\$6,297.04	
72,000			CARTRIDGE, tracer, cal. .30, M1, Grade M3, packed in cartons, Lot No. FA 292.	M	44.29	3,188.88	
						Total cost	\$9,445.92
<u>PARTIAL SHIPMENT</u> Shipped via _____ Freight LCL No. of boxes -- 172 Numbered 1 to 172 incl. Total weight -- 12,000 lbs. Gov't B/L No. 234639							
DISTRIBUTION: Eight (8) copies. 1 File 2 Consignee 2 Corps Area Finance Office (Consignee) 1 Corps Area Finance Office (Consignor) 1 Corps Area Ordnance Office (Consignee) 1 Chief of Ordnance							
<i>Posted</i> <i>2/5/42</i> <i>M. M. M.</i>							

CAPTAIN, Ordnance Department, Ordnance Property Officer.
 (NAME) (ORGANIZATION)

tion unless otherwise specified by the War Department. However, the allowances which are authorized may be restricted by Ordnance Field Service Bulletin 3-6, Training Ammunition Credits. After the amount of small arms ammunition which is necessary for a company or organization has been determined, the essential step now is to acquire the desired needs; this is accomplished by means of a requisition. The using organization of each arm and service will determine the manner that the ammunition is to be packed. This manner will be determined by the weapon to be used and by the course over which the candidates fire the ammunition. The following list shows both the grades and uses of small arms ammunition.

TYPE --- CARTRIDGE, BALL, CALIBER .30, M1
or M2.

GRADE SYMBOL	USE
AC	Aircraft machine guns.
R	Rifles and Automatic rifles.
MG	Ground machine guns only.
3	Unserviceable; not to be used for any purpose.

CARTRIDGE, BALL, CALIBER .45, M1911.

1		Reserve.
2		Issue.
RT		Roll Test.
3		Unserviceable; not to be used for any purpose.

CARTRIDGE, BALL, CALIBER .50, M1.

AC	Machine guns mounted on aircraft.
MG	All other machine guns.
3	Unserviceable; not to be used for any purpose.

STOCK RECORD

[illegible]

Article CARTRIDGE, ball, cal..30, M2,

Description Grade R.Unit rd Unit cost \$33.64

Maximum ----- Minimum

WAR DEPARTMENT Stock No.
O. M. C. Form No. 104

WAR DEPARTMENT
Q. M. C. Form No. 424
Revised April 6, 1931

FIGURE 3 T-1

Sheet No.1

3-9932

Another important factor remains to be considered before making the final requisition step. That is determining complete and full boxes of ammunition that is being requisitioned. Whenever a post, camp, or station property officer orders from an arsenal or another supply point, he will requisition for the number of rounds which will be contained in full boxes. For this information, one may consult

STOCK RECORD

DATE	VOU. No.	RECEIVED	ISSUED	BALANCE
3/28/41	113	37,500		37,500
6/ 6/41	167		11,550	25,950
7/14/41	9		18,400	7,500
2/ 5/42	133	72,000		79,500
2/18/42	144		10,137	68,363

Article CARTRIDGE, tracer, cal..30. M1

[illegible]Unit rd Unit cost \$44.29

Maximum ----- Minimum

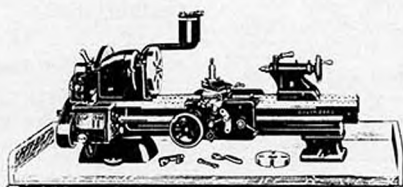
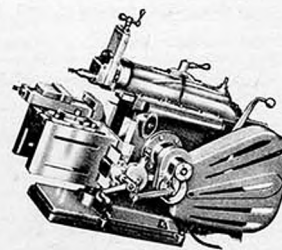
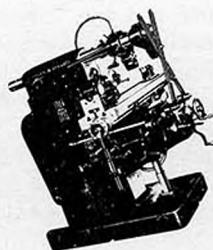
WAR DEPARTMENT Stock No.

WAR DEPARTMENT
Q. M. C. Form No. 124
Revised April 6, 1931

FIGURE 4 T-1

3-9932

THE MACHINE SHOP



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

TRAINING THE ORDNANCE MACHINIST

By:
F. P. Bingert and G. E. Tibbetts,
Staff Sergeants, Ord. Dept.

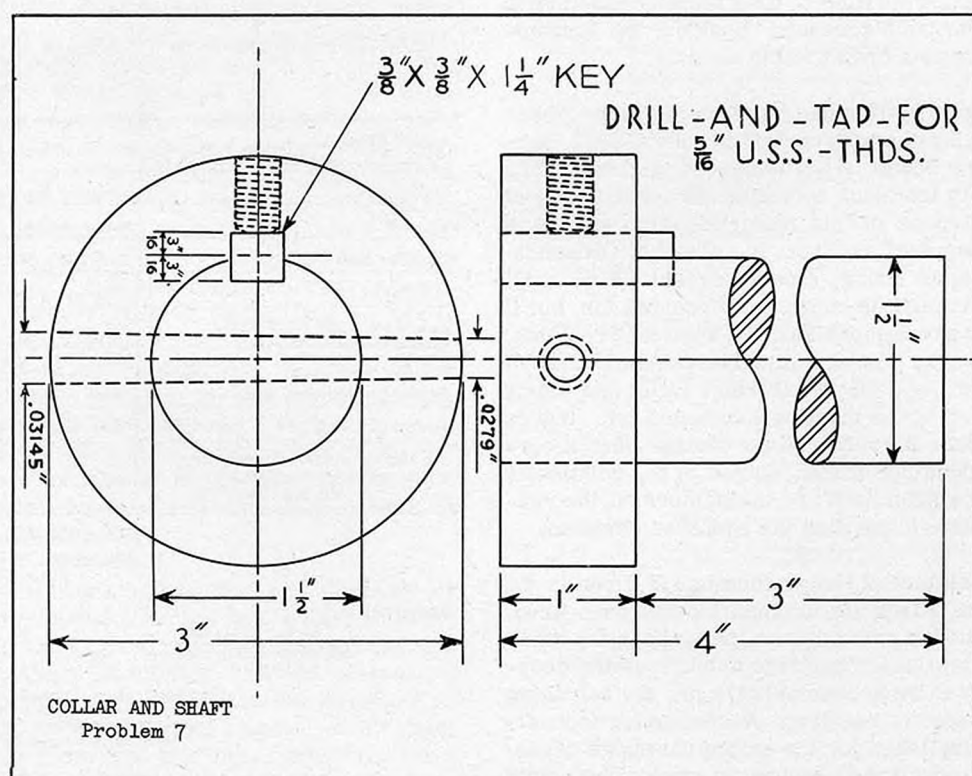
In the preceding article, our student completed the first problem, which was the Cast Iron Block. This consisted of chipping, filing, and elementary layout.

The next problem, which is the collar and shaft, will cover advanced chipping and layout, due to closer tolerances; as well as keying the collar to the shaft, which requires close fitting.

Up to the present time our students were not re-

quired to work to given dimensions, but in this problem they will have to work within specified dimensions, due to the fact that the collar must be fitted and keyed to the shaft. Problems of this nature verify the necessity and importance of the use of hand tools. Many jobs of this sort will present themselves when machine tools are not available. Even when machine tools are available a certain amount of hand work is usually necessary to accomplish final fitting of mating parts. This final fitting depends entirely upon the ability of the student.

The following is the drawing of the collar and shaft problem.





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

OXYACETYLENE AND ELECTRIC ARC CUTTING

Oxyacetylene Cutting: The principle of cutting with the oxyacetylene cutting torch is based on the fact that steel will burn very rapidly in an atmosphere of pure oxygen when it is brought up to its kindling temperature. For steels, the kindling or ignition temperature range is between 1400 and 1600° F. Oxyacetylene or flame cutting is a process of preheating the material to be cut to its kindling temperature and then rapidly oxidizing it by means of a closely regulated jet or stream of oxygen issuing from a specially designed cutting torch tip. The reaction of oxygen with steel to form iron oxide is a chemical reaction which gives up considerable heat. Only the metal in the direct path of the oxygen jet is acted upon thus resulting in a narrow kerf or slot being cut in the steel plate. When properly performed the flame cutting process will produce accurate cuts with walls that are parallel throughout the entire thickness of the plate. The oxides formed in the cutting reaction are blown through the slot to the bottom by the kinetic energy of the oxygen stream. The melting point of the oxide formed is somewhat below the melting point of steel. This enables the heat generated by the burning iron to melt the iron oxide thus exposing more iron to the oxygen jet. The molten slag which is blown through the slot cut in the steel plates consists principally of the magnetic iron oxide, the chemical formula for which is Fe_3O_4 . This oxide of iron is a black brittle substance, which is identical with the magnetic ore or hammer scale.

In actual flame cutting, the iron or steel removed from the kerf is not entirely oxidized by the oxygen, but due to the eroding effect of the cutting oxygen jet about 30% to 40% of the metal is washed out of the cut as metallic iron. The theoretical requirement for cutting is 4.6 cu. ft. of oxygen per lb. of iron removed from the slot. This reaction generates 1865 B.T.U. per lb. of iron removed. Actually, since some of the metal removed is unoxidized, as little as 3.5 cu. ft. of oxygen is consumed per lb. of iron removed.

A typical cutting process is shown in Figure 1, using a cutting torch designed with a 90° head. Most cutting tips used are designed with four or more orifices located around a central orifice. The central orifice sup-

plies the oxygen used for cutting while the surrounding orifices supply the preheating gases to bring the steel to be cut up to its kindling temperature. Theoretically, the heat formed by the cutting reaction would be sufficient to heat the adjacent iron to a red heat, so that once started the cut could be continued indefinitely with oxygen only. Practically however, the smoothness of this operation is interrupted by heat losses due to radiation at the surface, conduction by the plate being cut and the presence of paint, scale, dirt and other foreign matter on the surface of the plate. This makes it necessary to keep the preheating flames of the cutting torch burning throughout the cutting operation.

Although it resembles the welding torch in some respects the cutting torch is used to cut or sever pieces

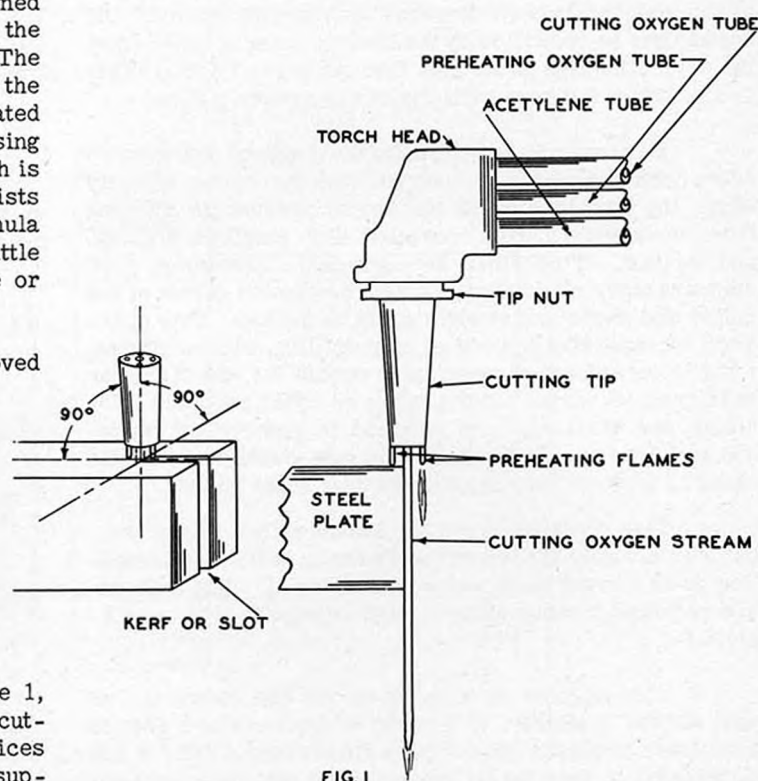


FIG. 1

QUANTITY		STOCK NO.	ARTICLE	UNIT	UNIT COST	TOTAL COST
53,376			CARTRIDGE, ball, cal..30, M2, Grade M2, packed in cartons, Lot No. FA 3004.	M	33.64	\$1,795.57
10,137			CARTRIDGE, tracer, cal..30, M1, Grade M2, packed in cartons, Lot No. FA 252.	M	44.29	448.97
					Total cost	\$2,244.54

COMPLETE SHIPMENT
Shipped via government truck.
43 Boxes.

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1 File
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ARTICLES LISTED IN COLUMN "ORDERED" HAVE BEEN RECEIVED UNLESS OTHERWISE NOTED IN COLUMN "SHIPPED." 2/19/42

Andrew Jackson
ANDREW JACKSON
Captain, 99th Infantry,
FIGURE 11
Regimental Supply Officer,
CY-144

(C/E No. 1) as they are filed; then that number may be used as a reference number as shown on the office Lot Data Card, Figure 5. The difference between the "issue column" and the "expenditure column" will give the amount of unexpended ammunition that is still in the hands of the troops. Incidentally, this information is chiefly for the benefit of the local ordnance officers or the corps area chemical warfare officers, depending upon whomsoever issues the ammunition, and who from time to time submit consolidated reports which cover such accounts. Besides, the accountable officer uses it as a credit to his account.

After an organization has fired on the range, there is naturally a residue of empty cartridge cases, clips, bandoleers, and packing boxes. A percentage of all these items must be returned to the local ordnance officer who will at specified times dispose of this material which will be in accordance with instructions from the Chief of Ordnance. Under ordinary range firing, ninety percent (90%) of all the above named materials must be accounted for, but if the circumstances are demonstrations, tactical problems, or some similar work, then seventy-five percent (75%) of the clips, bandoleers, and empty cartridge cases and ninety (90%) of the packing boxes must be accounted for. If it is impossible to produce the required percentage, then a certificate by the responsible officer, signed by the commanding officer, must be submitted and state, thereon, the reason for not being able to salvage the required amounts.

The nomenclature of live ammunition is given in the appropriate SNL's. After the ammunition has been fired, the remaining cartridge cases can no longer bear the same title. The Certificate of Expenditure authorizes the dropping of ammunition from accountability; yet, the salvaging of certain percentages is required. Accordingly, accountability must be established for the empty cartridge cases. To complete this, an OS & D Report is used. The empty

cases may be classified as BRASS, scrap, (Cartridge cases, cal..30, empty) to distinguish between the live and the expended cartridges. The unit for BRASS, scrap, (Cartridge cases, cal..30, empty) is "pound" and one thousand (1,000) of such cartridges weigh approximately twenty-seven (27) pounds. Further, if one were to use a nomenclature such as, CARTRIDGE, empty cases, cal..30, or some other name, the unit would necessarily be "each" as used in all other cases. Following the completion of the OS & D Report, the information, thereon, will be posted on the appropriate Stock Record and the accountability for the residue is then established.

The manner of packing and shipping empty ammunition boxes, clips, and the like to prescribed destinies, likewise, has standards. The mental linings, except the tearing-off strip, will remain in the boxes. The empty cartridge cases and clips will be packed separately in the ammunition boxes. Special caution must be observed to see that no live rounds are mixed with the packings of the shipment. On the inside of each packing lid will be marked or labeled the name of the responsible officer, his organization, and his certification to the effect that there are no live rounds of ball ammunition. The outside will bear the name of the specific organization.

Army Regulation 45-80, August 14, 1938 and OFSB 1-6, October 25, 1941, states that annually reports concerning "Principle Items of Ordnance Supplies --- Ammunition" will be submitted to the Chief of Ordnance as of December 31st. These reports must be in the office of the

(Continued on page 355)

CERTIFICATE OF EXPENDITURE --- AMMUNITION No. 1

Fort Blank, Maryland, February 28, 1942
(Place) (Date)

I certify that the following ammunition was expended by Company "A",
99th Infantry.
(Organization)

ITEMS AND QUANTITY EXPENDED	
CARTRIDGE, ball, cal..30, M2, Grade M2, Lot No. FA 3004, 20,656 rounds.	
PERIOD FROM <u>February 1,</u> 19 <u>42</u> TO <u>February 28,</u> 19 <u>42</u>	
PURPOSE	Authorized training.
WEAPON	Machine gun, cal..30, water-cooled, M1917.
COURSE FIRED	1,000 inch - Qualification & Requalification
AUTHORITY	Paragraph 36, AR 775-10.
ALLOWANCE PER INDIVIDUAL ORGANIZATION OR WEAPON	610 rd - Qualification & 460 rd - Requalification
NUMBER OF INDIVIDUALS, ORGANIZATION OR WEAPON FIRING	28 men Qualification & 19 men Requalification.
TOTAL ALLOWANCE	20,656 rounds (tracer deducted)
AMOUNT OF ALLOWANCE EXPENDED ON PREVIOUS CERTIFICATES (if any) DURING THIS TRAINING YEAR	None

Alex Ackerman
ALEX ACKERMAN, Captain, 99th Infantry,
(Name & Grade) Company Commander.

APPROVED: *John Smith*
JOHN SMITH, Colonel, Infantry,
Commanding.

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1 Local Ordnance Officer (Ord. Prop. Officer)
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Plate beveling with a manually operated cutting torch



Pipe beveling with a manually controlled cutting torch

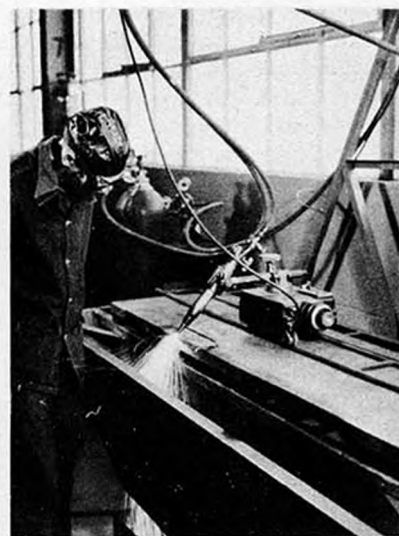


Plate beveling with a machine guided cutting torch

on the top side of the stack to prevent distortion in the upper sheets. Since the cut is directed through the waster plate, it thereby serves to maintain ignition in the cut by its own combustion.

ELECTRIC ARC CUTTING

The process of electric arc cutting is a melting process using the heat of the electric arc to melt the metal along the desired line of cut. It differs from oxygen cutting in that it separates pieces by melting rather than by rapid oxidation. The quality of the cuts produced by arc cutting does not equal that of cuts produced with the oxyacetylene torch; however, it is satisfactory for many applications where smooth cuts are not essential. Arc cutting can be used to sever or cut all ordinary ferrous metals including alloy steels and cast iron. It has a definite advantage over flame cutting in that all types of non-ferrous metals can also be cut with the arc whereas flame cutting is restricted to cutting of ferrous metals only.

Arc cutting can be performed using either a carbon or graphite electrode or a shielded arc type of electrode. These processes are illustrated in Figure 3. The cut is made wide in order to melt and work away the metal in the kerf or slot. Although cuts can be made with the

plate in the horizontal or vertical positions, best results are obtained with the plate in the horizontal position. The angle to which the electrode must be adjusted is dependent upon the position of the plate. In cutting heavier plates the electrode should be worked from the top to the bottom of the plate with the bottom of the cut slightly ahead of the top as shown in Figure 4.

When arc cutting with either carbon or shielded arc type electrodes, straight polarity (electrode negative) and a long arc should be used. The current and voltage settings at the arc are much higher than those required for arc welding. These conditions may require special electrode holders to resist the high heat developed.

Rivet cutting and hole piercing are further applications of the arc cutting process. For these operations as well as for cutting through heavier sections, the shielded arc electrode is used to better advantage than the carbon electrode. This is primarily due to the electrode coating which acts as an insulator, thus preventing the arc from shorting against the side walls of the hole being cut. In addition the electrode coating extends beyond the metal core, thus making it possible to push the electrode against the plate or rivet without shorting the circuit.

In general, where an oxyacetylene cutting torch is available, the principal use of the arc cutting process is for cutting non-ferrous metals, since these cannot be cut with an oxygen jet.

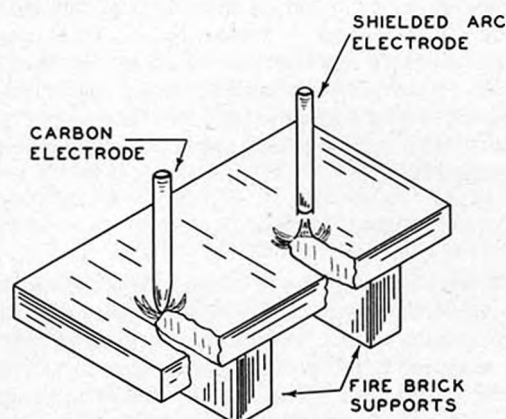


FIG. 3

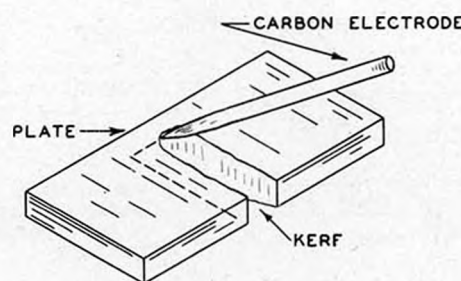
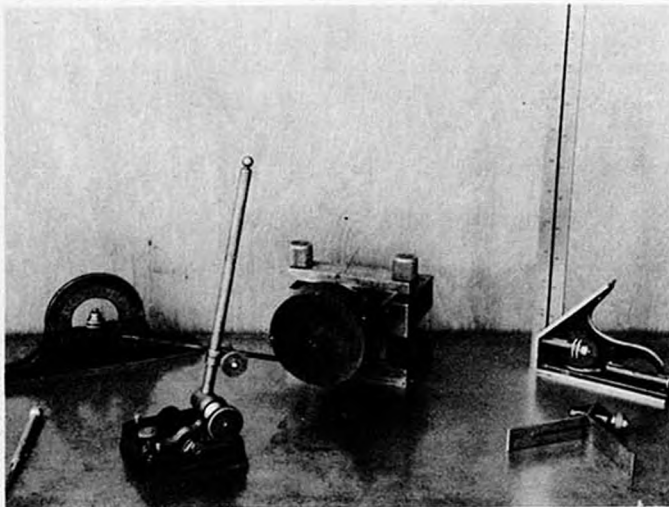


FIG. 4



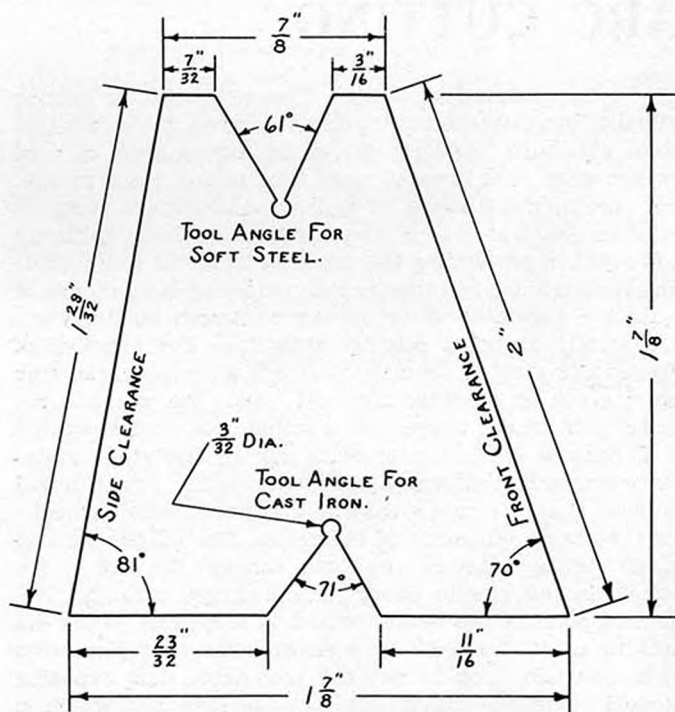
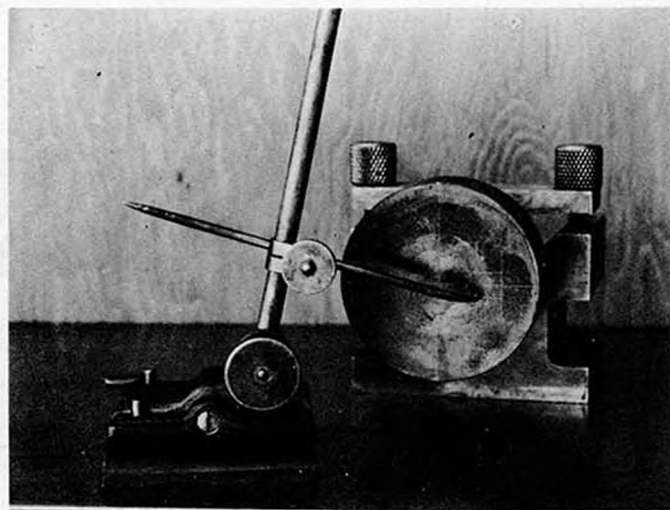
The first step in advanced layout brings into use layout fluid, surface height gauge, surface plate, square head, center head, blade, and precision ground "V" blocks. The result produced will be a very accurate full scale layout of the key on the collar and shaft. This layout will then be marked by the use of a prick punch, which will identify the layout and prevent the lines from being obliterated by handling. Following this the collar is disassembled from the shaft to enable the student to further lay out the keyway within the collar and on the shaft, which was covered by the collar when the two were assembled.

The problem is checked by the instructor to insure the student's accuracy in his layout. The keyway in the collar is then sawed, chipped, and filed to size, and the keyway in the shaft drilled with a bottoming drill, with a sufficient amount of material being left for filing and chipping to size. The key is then fitted to the assembly of the collar and shaft. If there is any binding, or too much pressure is required to seat the key into its proper place, prussian blue is coated over the key itself. The key is again inserted into the keyway, and the low spots in the keyway can be identified by the blueing being scraped from the key. The high spots can then be worked down. This procedure is followed until the key is properly fitted.

To complete the work on the key and keyway, an Allen head set screw is inserted into the collar directly above the key, binding on the key to prevent its slipping from the keyway. This operation also employs drilling, and tapping. To further strengthen the assembly, a #6 standard taper pin is then inserted through the center of the collar and shaft, and at right angle to the key. This operation incorporates the use of step drilling, which removes a sufficient amount of material to enable the use of a taper hand reamer, so the taper pin can be fitted properly. The collar and shaft are then polished to remove all burrs, and tool marks. The problem is now complete, and the class is advanced to the next, the tool angle gauge.

This problem is not an advanced one in any way, but it is actually thrown at the students, with no information given except the drawing and material. The students are required to move along on their own initiative to complete it.

This is given as a check-up for the instructor as well as the students. If a group of students are able to complete a problem, consisting of simple layout and the use of hand tools, then the instructors feel that they have put



their information across, and the students have actually learned a few fundamentals of bench work.

As the actual work and instruction is completed on the bench course, a written quiz is given to determine the amount of theory which our students have absorbed.

The following questions are examples of those used for a written quiz.

1. What is the difference between a cape chisel and a cold chisel?
2. What is the difference between a countersunk hole and counterbored hole?
3. What is step drilling?
4. Is it necessary to use lubricant when drilling; (a) cast iron (b) brass?

(Continued on page 355)

3. Blower. The blower consists of a fan which is either hand cranked or motor driven. In either case, the fan rotating in a cast iron housing furnishes the blast for the fire.

4. Hood. The hood is provided on the forge to carry away smoke and fumes from the fire. A portion of the hood is adjustable as shown in Figure 1. The adjustable hood may be tilted out over the fire, thereby using both the natural updraft and the downdraft systems. The hood may be tilted half-way back so that it cuts off the updraft system, using only the down draft system. By tilting the hood all the way back, the downdraft system is cut off, leaving only the updraft flue open. In the updraft forge the smoke and fumes from the fire pass through the hood and chimney by natural draft. However, if the natural draft is not sufficient to carry away the smoke and fumes from the fire, an exhaust fan may be installed in the flue to create a forced draft.

On a purely downdraft forge the smoke and fumes from the fire are drawn under an adjustable hood, and then through a duct by an exhaust fan. This fan and ducts are entirely separate from the blower system. However, on the portable forge there is a circulating action of the gases when the downdraft system is used. Thereby unconsumed gases are forced back through the fire for full combustion. The blower is used for this forced or downdraft action, pulling the gases from the back of the hood as shown in Figure 1.

5. Quench tank. The quench tank is a small water tank made of light gauge sheet metal and attached to the forge. It is used as a quenching bath for the heat treatment of iron and steel. It also serves as a supply of water for keeping the coal banked around the fire wet down, and for cooling the ends of tongs and other hand tools which may have become hot in the handling of hot metal.

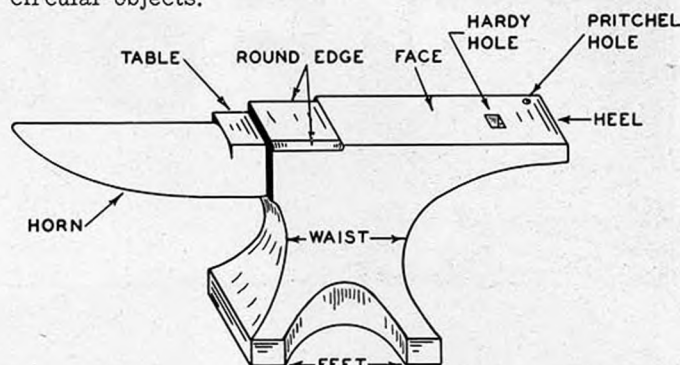
6. Rest. The rest is an adjustable bracket made of round mild steel stock and attached to the front of the forge. It is used to support long bars which extend over the side of the forge while being heated. By a hinging action the material rest may be let down out of the way while not in use.

The piece of equipment next in importance is the anvil. This is the tool on which the smith forms his metals. The blacksmith is very particular in regard to the care and condition of his anvil. He is intimately acquainted with it, knowing its dimensions and every small variation in the shape of its construction. The anvil and its nomenclature are shown in Figure 2. Anvils are usually made of two forgings welded together at the waist. They are designated by weight, a #150 weighing 150 pounds, ranging from #150 to #300.

The table of the anvil is used as a cutting block. It is relatively soft so that the cutters coming in contact with it, after piercing a piece of steel, will not be dulled.

The face of the anvil is the part on which the smith performs most of his work. It is made of tool steel, hardened and tempered, and welded to the top of the anvil. The edges of the face are rounded off for about four inches from the table. This provides a place for bending stock over the edge of the anvil without cutting it. All other edges of the face are sharp and will cut stock if it is hammered against them.

The horn is the round horn-shaped projection extending from one end of the anvil. It is used for bending eyes or hooks, in drawing stock and in forge welding circular objects.



ANVIL

FIG. 2

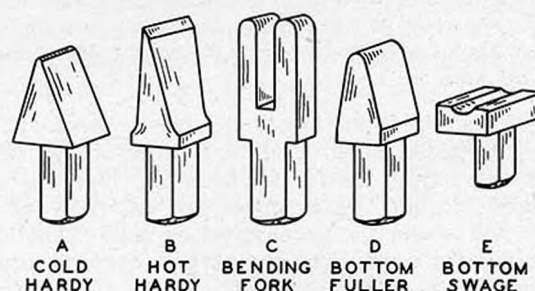
The square hole in the heel of the anvil is known as the hardy hole. It is designed to hold the basic tanged anvil tools and other special tools which the blacksmith may design. It is also used in bending small stock.

The pritchel hole is the small round hole in the heel of the anvil. This hole is used mainly in punching small holes in heated stock. It permits the slug removed from the stock to fall through.

The anvil is usually placed on a block of wood the size of its base, being secured firmly in position by passing strips fastened to the block over the feet.

The horn of the anvil is always to the left of the blacksmith as he faces it in a working position. The anvil should be at such a height that its face will touch the knuckles of the blacksmith's fist when standing erect.

There are two types of anvil tools, the handled tools and the tanged tools. The tanged tools have a shank extending from them which fits in the hardy hole of the anvil. Some of the more commonly used tanged tools are shown in Figure 3.



ANVIL TOOLS
(TANGED)

FIG. 3

Hardys are generally used when the blacksmith does not have a helper. The stock to be cut is held in position over the cutting edge of the hardy and struck with the hand hammer. The cold hardy has a thick blade and is used to nick cold stock to be broken. The hot hardy has a thin blade and is used in cutting hot stock.

rather than to join them. In design the cutting torch has two separately controlled valves for adjusting the preheating oxygen and acetylene gases used for the preheating flames. Each gas passes through a separate tube in the cutting torch handle to the cutting torch head. The gases are mixed in the cutting tip and burn at the preheating orifices surrounding the cutting orifice. The oxygen used for cutting is controlled by means of a quick acting trigger valve and is conducted through a separate tube to the central orifice in the cutting tip. This design enables the cutting oxygen to be turned on when the plate to be cut has reached its kindling temperature and to be turned off after cutting is completed.

There is a wide variety of cutting tips available in different styles and sizes designed to suit every conceivable type of work. Cutting tip sizes are calibrated in terms of the cutting orifice diameter and the thickness of the material to be cut generally governs the selection of the tip size used. However, best results are obtained when the cutting oxygen pressure, cutting speed, tip size and preheating intensity are controlled to give narrow, parallel sided kerfs. Cuts that are improperly made will produce ragged and irregular edges with adhering slag at the bottom of the plates.

Flame Cutting Steel, Wrought Iron and Cast Steel.

Plain carbon steels whose carbon content does not exceed 0.35% can be cut without special precautions other than those required for good quality cuts. However, for higher carbon and alloy steels care should be taken to prevent the formation of a hard layer at the edges of the plates. This is especially true when so-called air hardening steels are cut since a thin layer of metal at the cut edge is heated to its critical temperature and rapidly quenched by the adjacent plate and surrounding atmosphere. The hard edges thus formed are difficult to machine

where further machining is required and the lower ductility of this hard layer may cause cracking under load. In order to avoid this, the plate edges are preheated in advance of the cut to prevent formation of the hard layer, by lowering the temperature gradient and therefore the rate of quench. Preheating temperatures of from 500° to 600° F. should be used when cutting steels in this class.

When cutting heavy sections the cut should be started by preheating a sharp corner at the edge of the plate or by using a steel rod at the start of the cut. In some cases the same result is obtained by raising a small burr on the edge of the steel plate using a cold chisel. This is particularly helpful for cutting large round shafts, to bring a localized area up to its kindling temperature. By following the above procedure the reaction between oxygen and the sharp edge or rod used generates sufficient heat to preheat and enable the cutting reaction to start in the heavier section. Special torches have been developed using a "starting rod attachment" for cutting heavy sections on a production scale.

Stainless steels are designed to resist oxidation and therefore have considerable resistance to oxyacetylene cutting. These steels can be cut by laying a steel welding rod or steel plate along the line of cut. The heat developed by the reaction of oxygen with the steel rod or plate is sufficient to melt a slot in the stainless steel. Stainless steel cutting is a melting process rather than an oxidation process.

Flame Cutting Cast Iron

Cast iron melts at a lower temperature than its oxide, and when cast iron melts the oxide mixes with it. It is therefore much more difficult to cut cast iron than steel. Cast iron must be preheated to a much higher temperature and requires an oxygen pressure from 25 to 100 percent greater than steel of the same thickness. The preheating flames should be adjusted to carburizing so that the length of the feather of acetylene is equal to the thickness of the cast iron being cut. It can be cut by using a rather complicated technique illustrated in Figure 2.

Machine Flame Cutting

In order to make uniformly clean cuts or bevels on steel plate, motor driven cutting machines have been designed to support the cutting torch and guide it along the line of cut. Straight line cutting or beveling is accomplished by guiding the machine along a straight line on steel tracks. Arcs and circles may be cut by guiding the machine with a radius rod pivoted about a center point. Machines are available which guide the torch along irregular cam surfaces to produce the desired surface contour in the finished piece. These operations are performed using one or more torches operating simultaneously to produce a like number of identical shapes.

Stack Flame Cutting

This process consists of making cuts through several thicknesses of sheet or plate material simultaneously with a single cutting torch. The plates are cleaned, stacked, and firmly clamped together with their edges in alignment when the cut is started. The cut is caused to progress through the several plate thicknesses without buckling or warping the individual plates. When cutting very thin sheets by this method, a "waster plate" should be clamped

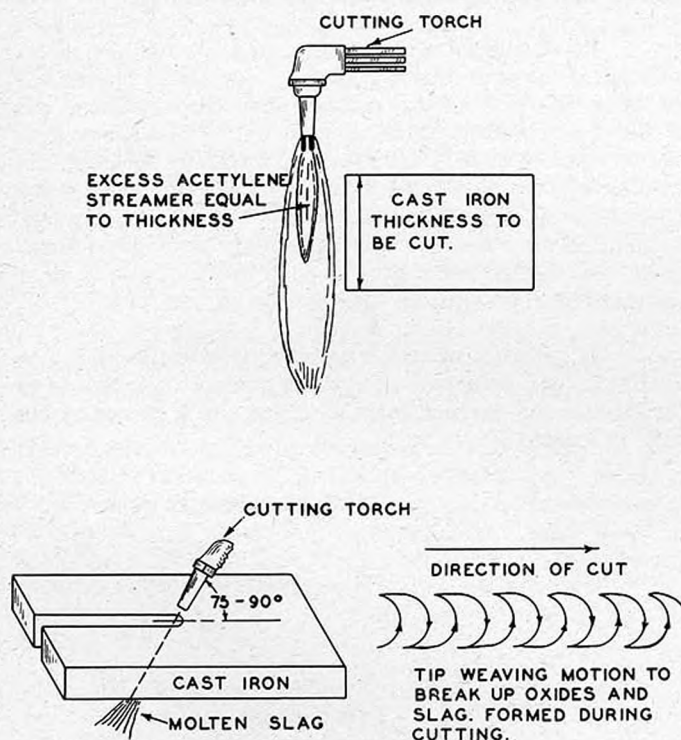


FIG. 2



FORGING

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

FORGE SHOP EQUIPMENT

The purpose of this article is to develop the types and uses of blacksmith equipment and tools as applied to forging operations.

Tools, and good tools, are essential to the mechanic's success. The mechanic must know his tools and how to apply them to every job that he is required to perform. His tools must be suited to the type of work performed. The dentist will not carry a blacksmith's hammer or a machinist's chisel in his instrument kit. Neither will the blacksmith be expected to use the fine and intricate tools of the watchmaker.

Having the correct tools, they should be kept in good condition and in their proper place. The aphorism, "a place for everything, and everything in its place", is very appropriate in regard to tools. Neither should we forget that "a man is known by the company he keeps, and a mechanic by the tools he uses."

Most of the tools used by the blacksmith may be bought ready made at a heavy hardware store, and this is the procedure used by most blacksmiths today. However, a great proportion of these tools can and should be made by the blacksmith himself. The ancient smith, of necessity, made all the tools he used. Also, the first class blacksmith of today knows how, and prefers to make most of the tools which he uses.

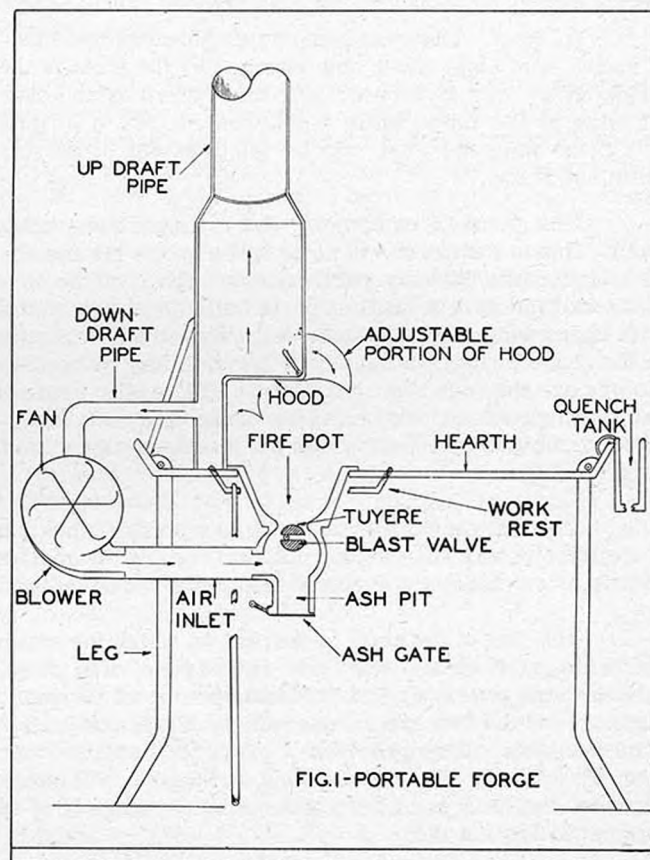
The forge is the most important piece of equipment in the blacksmith shop. They are either of the portable or stationary type, the former being the type used in The Ordnance School. While forges are of different types, shapes and sizes, their construction and operation are essentially the same. The ordinary blacksmith forge is a fireplace, in the bottom of which is a unit called the tuyere, through which a blast of air enters the fire. This blast is furnished in large volume by a suitable blower at pressures ranging from two to six ounces per square inch. The portable forge which is used in The Ordnance School is similar to the one shown in Figure 1.

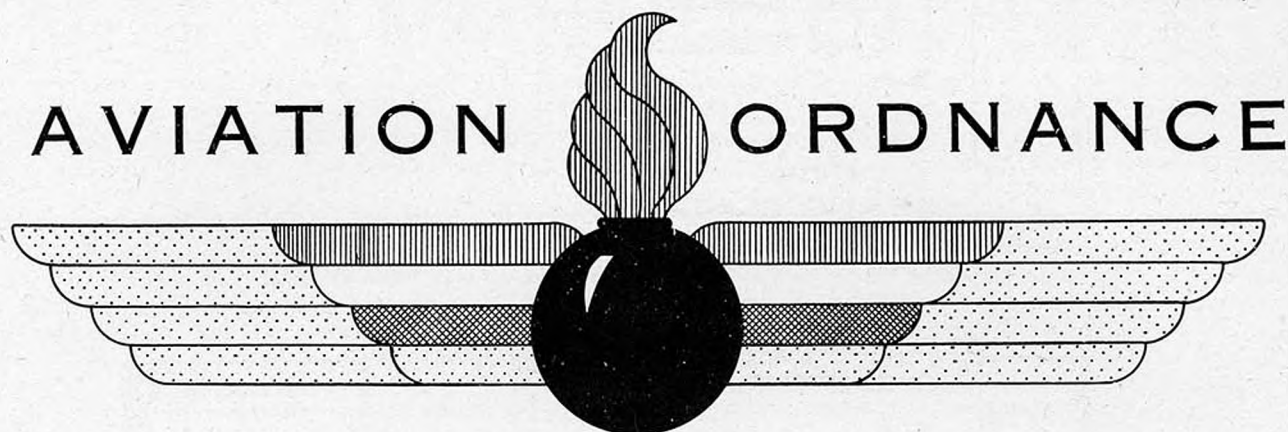
The principal parts of the forge are:

1. Hearth. The hearth is the flat top of the forge, usually made of rolled steel, on which metal to be heated is placed, and also upon which coal is banked around the fire.

AND TOOLS

2. Tuyere. The tuyere is that part of the forge over which the fire is built, and through which the air blast is furnished to the fire. The tuyere is made of cast iron and consists of a base, blast valve, fire pot, and ash gate. The air blast is controlled by the blast valve, and is admitted to the fire pot through the base. Ashes and clinkers are cleared from the tuyere through the ash gate. A diagram of the tuyere construction is also shown in Figure 1.





Conducted by: Glenn H. Staley, 2nd Lieut., Ord. Dept.

CARE AND PRESERVATION of the GUN, AUTOMATIC, 37-mm, M4

By: L. Askren,
2nd Lieut., Ord. Dept.

In view of the fact that some questions have arisen in the field concerning proper methods of caring for and preserving the Gun, automatic, 37 mm, M4, it is deemed worthwhile to publish an article on the subject representing the research efforts of several instructors at The Ordnance School.

When the weapons are received from an arsenal, they will be covered with a rust preventive compound better known as cosmoline. The rust preventive compound must be entirely removed before the gun is placed in service. Particular care must be used to remove all of the rust preventive compound from the lock frame group parts, the tube extension group parts, and the feed box group parts. A small amount of this compound left in the gun will cause a stoppage, especially at low temperatures. For example, a small amount of cosmoline may be adhering to the hammer slot in the lock frame which will retard the hammer as it goes forward resulting in a light blow on the firing pin. Or, if the rust preventive compound is not cleaned out of the firing pin hole in the breechblock, the compound will cushion the blow, thus preventing the primer from igniting. It may be easily seen, then, that the weapon must be completely disassembled before the rust preventive compound can be removed.

It is also important that the receiver and moving parts to be kept clean and properly lubricated for efficient functioning. The heavy recoiling parts move at a cyclic rate of 150 rounds per minute and these parts produce considerable sliding friction. Therefore, the moving parts must be kept well oiled in order to decrease this friction and to prevent galling. The life of the gun depends, to a great extent, upon proper lubrication.

Grit must be kept out of the lubricant and off the sliding surfaces. No lint should be permitted to remain on any moving part. The lint will collect grit and will scratch

the bearing surfaces, increasing the friction between them.

Oil is best applied by using a soft bristle brush. In this manner, no lint will be deposited upon the sliding surfaces. It is important that the correct lubricating oil be used. If the oil is too heavy, it will become gummy or solidify at the lower temperatures, causing the gun to stop. This condition is dangerous for the pilot. It may not only cause the loss of the plane, but quite likely the life of the pilot himself will be forfeited. The latest issue for lubricating oil is oil, lubricating, for aircraft instruments and machine guns, U. S. Army Specification 2-27F. This oil (2-27F) affords little or no protection against rust or corrosion. When so used, it should be renewed at least every forty-eight (48) hours. If the weapon is to be out of service for any length of time, all parts should be protected with engine oil, SAE 30. When the gun is to be placed in service again, the engine oil should be removed entirely and the parts properly lubricated with aircraft instrument and machine gun lubricating oil.

To lubricate the 37 mm, M4, in a plane is a difficult task. However, one may achieve a high degree of success by utilizing a fly sprayer to spray the parts with oil. Do not overlook the tube when lubricating the weapon. When the gun is removed from the plane in cold weather, the weapon should be thoroughly cleaned and oiled immediately upon bringing it indoors because moisture condensing on the cold metal in a warm room will cause rust. After the weapon reaches room temperature, it should be wiped free of condensed water vapor and oiled again.

By far the greatest amount of trouble experienced with the 37 mm automatic gun, M4, has been with regard to the Recuperator oil. Servicing personnel have not had available the information concerning the methods and proper time of checking the oil level in the Recuperator, the manner of filling the Recuperator, the proper adjustment of the Recuperator piston, and the precautions to be taken to insure the proper amount of oil in the Recuperator at all times.

Ordnance personnel should place the gun in a horizontal position (as indicated by a bubble gauge) when checking the Recuperator oil. The Recuperator filler screw should then be removed and the threads of both the screw and its hole should be wiped clean of any oil. After

The bending fork is used in bending and twisting flat stock. It is usually used in conjunction with the handled bending fork. The bottom fuller is used for drawing, spreading, fullering, or offsetting stock. The bottom fuller may be used with the top fuller or it may be used alone by placing the stock in the proper position on the fuller and striking with a hammer.

The bottom swage is a tool used to shape smooth round, square or octagonal stock. It is usually used in conjunction with the top swage. The groove in each swage conforms to the size and shape of the stock desired. The hot forging being placed in the bottom swage, the top swage is held on the stock by the smith, while the helper strikes the top swage with a sledge.

The handled anvil tools have an eye punched in them, in which a wooden handle is inserted. They are held on the work by the smith while the helper strikes the tool with a sledge. Continuous pounding on these tools makes it necessary to redress and reform the heads frequently to prevent them from splitting and chipping. These tools are shown in Figure 4.

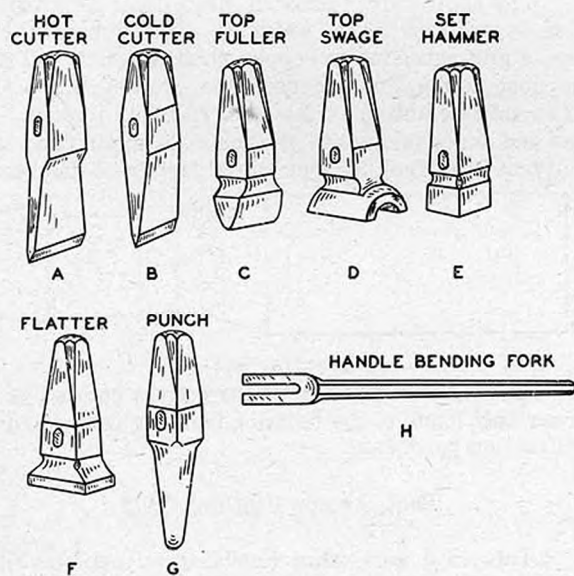


FIG. 4
ANVIL TOOLS (HANDLED)

The hot cutter is a thin-bladed chisel used to cut hot metals.

The cold cutter is a thick-bladed chisel used to cut cold metals.

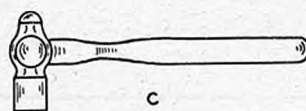
The top fuller is used for spreading, drawing, and offsetting stock. It may be used with the bottom fuller.

The top swage is used in conjunction with the bottom swage in shaping and smoothing round, square and octagonal stock. The set hammer is used in close places and in shaping sharp inside corners where the flatter or hand hammer would be impracticable.

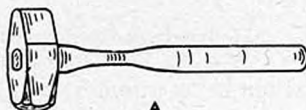
The flatter is used in shaping and smoothing flat surfaces.

Punches are used for the purpose of piercing holes in stock. The punch is tapered from the eye to a blunt point at the end and is made in the shape of the hole desired,

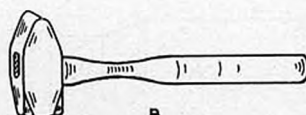
that is, round, square or octagonal. The punch is held on the heated stock in the place where the hole is desired, the helper striking the punch with a sledge to drive it through the stock.



C
BALL PEEN



A
STRAIGHT PEEN



B
CROSS PEEN

HAND HAMMERS

FIG. 5

The handle bending fork, used for bending and twisting flat stock, is generally used in conjunction with the tanged fork. Flat stock is heated and placed in the tanged fork. The handled fork is then placed in the proper position on the heated flat stock. By applying pressure on the handle of the handled fork the flat stock is twisted to any desired angle.

It is noted that the use of the handled tools requires the use of a helper to deliver blows to the tools in accomplishing a job. Therefore, a blacksmith working alone depends on his tanged tools and his hand hammer to do the job. The three principal types of hand hammers are shown in Figure 5.

The ball peen hammer is generally used on light and finishing work. They vary in weight from 1/2 to 2-1/2 pounds. The 1-1/2 or 2-pound ball peen hammer is a good weight for general shop use.

The straight peen and cross peen hammers are used when the smith is required to complete a heavy job of forging without the assistance of a helper. These hammers weigh from 1-1/2 to 5 pounds, the 3-pound hammer being most generally used. The straight peen hammer is sometimes used in drawing stock at right angle to the hammer handle. The crosspeen is used to draw stock in line with the hammer handle.

The sledge hammer is used by the blacksmith's helper in various ways, some of which have already been discussed. The sledge is made in sizes from five to twenty pounds. The 8-pound sledge hammer is sufficient for general shop use. The sledges may be either straight peen or cross peen, and resemble the hand hammers of these types.

ORDNANCE TRAINING ACTIVITIES

Conducted by: G. D. Meixel, 2nd Lieut., Ord. Dept.

Assistant Secretary, The Ordnance School

ORDNANCE TRAINING METHODS

By: P. J. Phillips, Major, Ord. Dept.

Director of Training Methods, The Ordnance School

Part II

The Student and the Teacher

The purpose of this material is to give to the personnel responsible for training in the Ordnance Department the information and guidance which will assist them in imparting knowledge to others in their training program. While a complete knowledge of the subject being taught is highly desirable, knowledge alone is not a sufficient basis for adequate instruction on the subject. The successful instructor, in addition to his technical knowledge, must possess an understanding of certain methods and procedures in order for him to impart adequate instruction in a minimum of time.

It follows, then, that there are two requirements which the successful instructor must meet: (1) complete knowledge of the subject being taught, and (2) the ability to impart that knowledge to others.

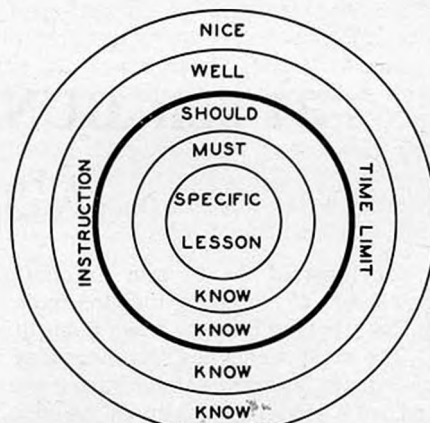
Teaching is the process of controlling, directing, or managing the thinking of the student so that he will be able to do and to understand the thing which the instructor strives to teach him. The instructor, therefore, must not attempt to force the student to understand processes and methods from the viewpoint of the already trained mind of the instructor; but rather to develop the mental processes in the mind of the student until they approximate as nearly as possible the mental processes in the mind of the instructor. This means that whereas the instructor himself may accomplish the most difficult step of a task first, and leave operations of a less complex nature until later, the student must be taught the simple ideas first of all,

THE ORDNANCE SERGEANT has received a considerable number of letters from both officers and enlisted men who are conducting classes or schools in various subjects at their own stations in order to increase the efficiency of their organizations. In numerous instances these individuals have asked for information regarding teaching methods, suggested schedules or outlines for various courses, and other information regarding the conduct of classes or schools.

This is the first of a series of articles which will be published monthly in an effort to meet this apparent need. The entire series is condensed from portions of Ordnance School Text 9-11, "Manual for Ordnance Instructors", prepared by Major P. J. Phillips, Director of Training Methods of the Ordnance School.

progressing gradually to the more complex operations, so that he will eventually be able to duplicate the accomplishment of his instructor.

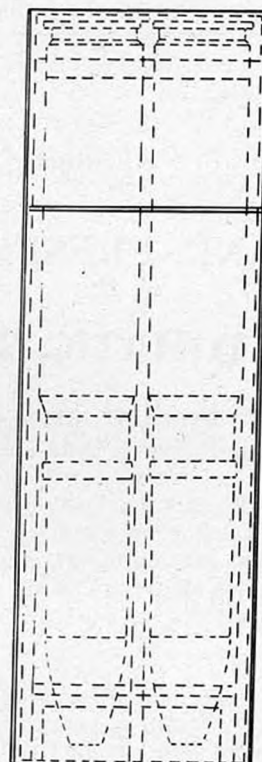
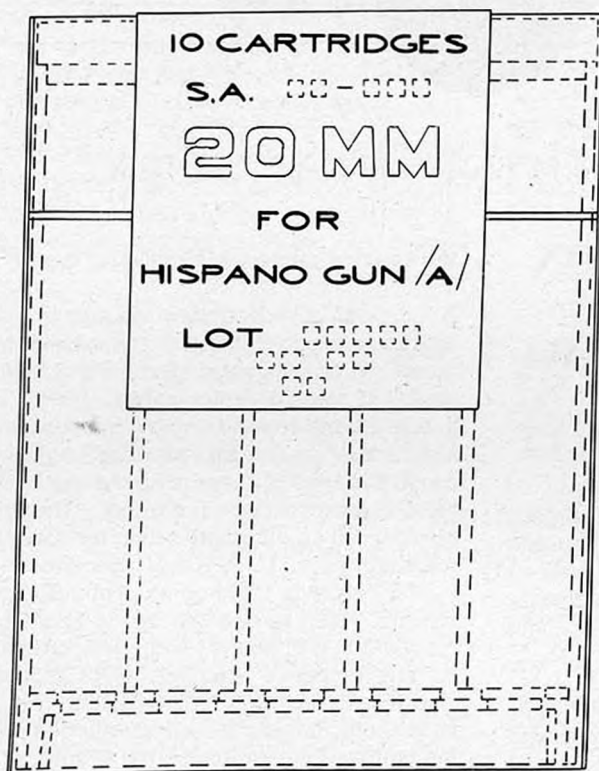
The new instructor often asks, "How much shall be taught on this subject?" Time is almost always the limiting factor, and all other considerations must be limited to some extent thereby. If, for example, the lesson or specific operation to be taught is Levels and Level Vials in the Instrument Repair Section, the instrument repairman must know the level vial adjustments and how to make them. He should know the types of levels in use and the precautions in use and handling. It would be well for him to know the different manufacturer's names. It would be nice for him to know the history and background of the



development and use of levels. Time, generally, does not permit instruction to go beyond the must and should know rings. The instructor with complete knowledge of his subject will know the information in all rings.

One of the first motives of the instructor should be to understand and appreciate the difficulties encountered by his students in the process of learning. These difficulties do exist, and by acknowledging their existence and making a sincere effort to analyze them, the instructor can best determine the most advantageous method to overcome them.

One of the most serious of student problems in a streamlined training program is inability to grasp and understand or assimilate more than a limited number of ideas at once. Another serious difficulty at this time is the inability to understand the technical language of the army and especially that of the Ordnance Department. Another obstacle to be overcome is selfconsciousness of the student, or a hesitancy to ask questions and thereby expose his ignorance. These are difficulties which must be overcome by the instructor alone if either he or his students are to achieve success, for the student himself does not possess the means of overcoming them. His mind is filled with many new and perplexing ideas, and he has no mental time to analyze or combat his own difficulties. This is definitely the task of the instructor.



muzzle of the weapon. The body is painted black for identification.

Projectile, ball.

This projectile body is made from steel bar stock, with a blunt nose tip and gilding metal or copper rotating band. The body has an empty cavity, extending from the base up to about the origin of the ogive. This cavity is

closed at the end with a steel closing plug. The projectile is painted black for identification. It weighs approximately 1935 grains and has a velocity of 2800 feet per second at 90 feet from the muzzle.

The packing of the 20mm ammunition is: 10-rounds per cardboard carton, 12-cartons per metal lined box. Some may be found packed: 1-round per container, 90 containers per box.

Do those of you who are associated with the Armored Force realize that changes are taking place in the organization of the Maintenance Battalion assigned to the Armored Division? Do you understand the proper functioning, and the organization, of each section of the Ammunition Company? Do you know the relationships existing between the Ordnance Department and the various arms which we serve, the Infantry, the Cavalry, the Field Artillery and the Coast Artillery? Do you have a clear conception of the functions of the Office of The Chief of Ordnance, and the manner in which it supervises all Ordnance activities? Do you understand the importance of the Corps Area Ordnance Office?

If you know all these things, the feature articles in future issue of THE ORDNANCE SERGEANT may not mean much to you; but if your information on these subjects is not complete, then you will find interesting articles in issues which are being planned for the future.



ELEMENTARY SHOP AND THE ORDNANCE MECHANIC

By: J. P. Hackett, M. Sgt., Ord. Dept.

"For want of a nail the shoe was lost,
For want of a shoe the horse was lost,
For want of a horse the rider was lost,
For want of a rider the battle was lost,
For want of a battle the kingdom was lost,
And all for the want of a horseshoe nail.

(Poor Richard's Almanac)

Paraphrased, this old, familiar quotation could very well sound like this today: "For lack of a link, the track was lost; for lack of a track the tank was lost; and for lack of a tank the battle was lost." Today, however, at the point where most breakdowns in mechanized or armored equipment may occur, the ever vigilant Ordnance mechanic is standing by, ready to make the necessary repairs. In most likelihood, there is in addition a Tool and Bench Truck also at hand with metal, hand tools, electric drills, bench grinder, etc.

Let's use the track link again in this following example which demonstrates the ability of the Ordnance me-

chanic to "keep 'em rolling". We find an M-3 tank stalled because a single link has broken. Assuming that another link can not be obtained, our Ordnance mechanic goes to work in typical fashion to fabricate by hand a new link from the metal which is at hand. A simple drawing is made, the best metal available is selected and the layout made. The metal is then shaped by chiseling, hacksawing and filing. The final operation is to check the link for proper

size and fit by using calipers and scale. Thus, in a few hours, the link is in place and the tank again ready to carry on its deadly work against the foe. The responsibility of maintaining the mobility of these behemoths of destruction is but one of many similar tasks which face the Ordnance mechanic in his daily chores.

In seeking one of the clues to the quiet efficiency of the Ordnance Replacement Training Center mechanic,



Corporal Labenz keeping a watchful eye on a student using the electric portable drill



Sergeant Thompson helping a student with the soldering project

we must go back to his early training, when he first embarked upon his technical career. The initial step was taken in the Elementary Shop. In the time allotted, he was given a thorough grounding in the use of simple hand tools, thus qualifying him for more specialized training in one of three important mechanical subjects: Armory, Automotive or Artillery repair. In most cases our Ordnance mechanic came from a non-mechanical field, since the demand for mechanics far exceeds the number of skilled men entering the Replacement Training Center. This problem is met by the very nature of the instruction program which makes it possible to start a former shipping clerk on his way toward becoming an Ordnance mechanic.

The objectives of the training given at the Elementary Shop may be listed as follows:

1. To acquaint the embryo mechanic with the tools which will normally be found in a maintenance organization.

wiping all excess oil from the points indicated, the Recuperator filler screw is fully screwed into place. The screw is again removed and examined for evidence of oil about the lowermost thread of the Recuperator filler screw. If oil is present about this thread, the Recuperator is properly filled. If not, oil must be added. Every opportunity should be taken to check the Recuperator oil. Air Corps personnel should examine the oil level after each flight. This is necessary since it is definitely known that after a flight during which the gun has been used there may be several ounces of oil needed to bring the oil to the proper level. This loss of oil may be caused by oil leakage, absorption of some oil by the packings, and air bubbles which existed at the time of filling. The above condition may seem trivial until it is known that the Recuperator holds but 42-3/4 ounces of oil and that the loss of less than 10 ounces can cause shearing of the gun's mountings.

The ports of the Recuperator bushing are so fixed as to determine the characteristics of the oil to be used. Therefore, the greatest care must be taken so that no oil is used in the Recuperator except the grade and kind specified.

In filling the Recuperator, only oils of government specifications should be used. These are either RIXS-189 or 2-36D. It is preferable to use only clean oil. If old oil is used, it should be strained through a fine mesh cloth before using. The gun should be raised to a position of five degrees above the horizontal (determined by the bubble gauge). The Recuperator is then filled until the oil overflows. As the oil is poured in, the Recuperator housing should be struck sharply with the hand to prevent air bubbles from forming on the inside of the Recuperator walls. After waiting a few minutes, and before the Recuperator filler screw is replaced, the oil level should again be checked. It is very essential that this procedure be followed exactly. Too much oil will cause the gun's action to be sluggish and too little oil may cause jams due to failure to extract, a bent carrier pin, etc. With too little oil, the gun will recoil too fast, bending the rim of the empty case leaving the case in the gun. It will also hit the carrier dog too hard, bending the carrier pin. Also, as was explained previously, if there is too much oil missing, the gun's mountings may be sheared off.

(Continued on page 355)

37-mm GUN, M4, TUBE WRENCH

By: Frank W. Brey, Shop Officer,
708th Ordnance Company, Paine Field, Wash.

The servicing of the 37 mm Automatic Gun, M4, presented a problem of removing the tube from the gun not only when in the airplane but also when being disassembled in the shop. The strap wrenches recommended were found to be very inadequate, inasmuch as the straps were frequently broken and had a tendency to slip on the tube, even when crocus cloth was wrapped around the tube before applying the strap wrench.

As a solution to this problem the following wrench was developed:

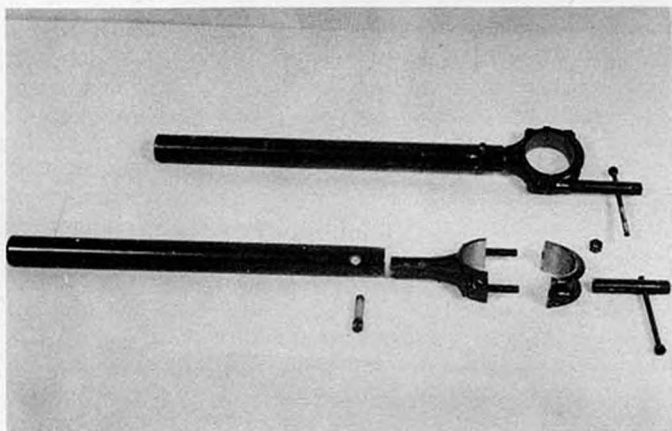
The head of the wrench was made of a connecting rod taken from a Chevrolet truck. The connecting rod was cut off to enable it to be swung in the lathe provided in the machine shop truck, and to allow the end of the connecting rod to be inserted into a piece of pipe to provide a handle of adequate leverage, as shown in the pictures. The nut

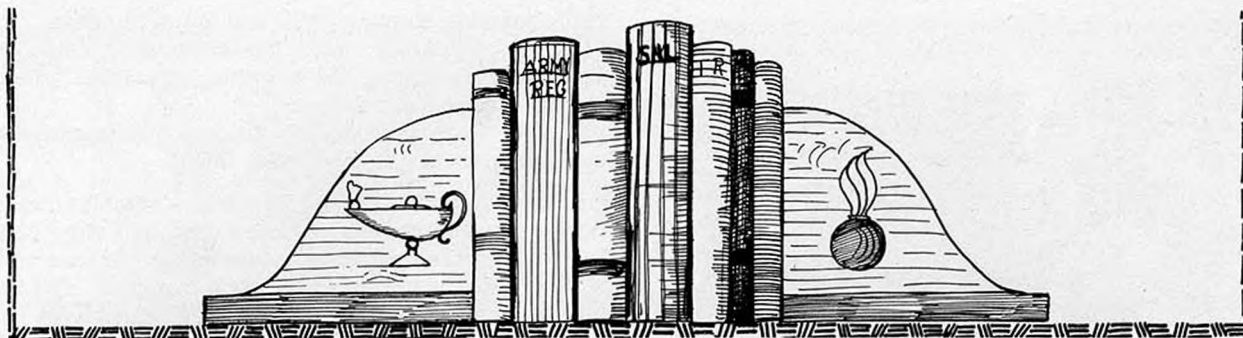
furnished with the connecting rod was replaced with an extended nut having a tightening handle. The connecting rod bearing was bored out to size to enable the wrench to slip approximately six (6) inches over the tube of the gun.

It was found that there was sufficient bearing metal left in the rod bearing so that the wrench presented a soft metal contact to the gun tube, and therefore did not scratch the tube. In turning the bearing, shims about .020 inch in thickness were used to make a gap between the halves of the bearing when installed on the tube so that there is a clamping action.

One illustration shows the wrench assembled and broken down into parts, while the other shows it installed on the gun tube.

-- Photos by U. S. Army Air Force
34th Air Base Group





LIBRARY

Frequent inquiries are received regarding the purchase of various publications of interest to Ordnance personnel. The following listings are taken from a price list issued by the Government Printing Office.

These publications should be ordered from the Superintendent of Documents, United States Government Printing Office, Washington, D. C., giving title, issuing office and classification number.

All publications are in paper covers unless otherwise specified.

Remittance must be made with order by check or Money Order payable to the Superintendent of Documents. Cash is sent at the sender's risk. For small orders a check or Money Order for one dollar (\$1.00) may be remitted, and the balance due the purchaser will be returned in the form of coupons with a value of five cents (5 cents) each, which are good until used.

TRAINING MANUALS (ARMY): (ADJUTANT GENERAL'S DEPT.)

- W 3.39/1:34 Basic Electrician, students' manual for all arms: Part 2, Electricity and magnetism, 1928. 65 cents.
- W 3.39/1:55 Automobile mechanics, students' manual for military specialists, 1923. Cloth, 55 cents.
- W 3.39/1:58 Motorcycle repairer for military specialists, 1924. Cloth, 40 cents.

ARMY EXTENSION COURSES, SPECIAL TEXTS; (ADJUTANT GENERAL'S DEPT)

- W 3.52:18 Military Discipline, courtesies, and customs of the service, 1932 edition, 5 cents.
- W 3.52:19 Military sanitation and first aid. 1940 edition, 10 cents.
- W 3.52:21 Military law, law of military offenses. 1940 edition, 5 cents.
- W 3.52:42 Ordnance district organization and administration. 1928 edition, 15 cents.
- W 3.52:227 Organization of the Army. 1940 edition, 5 cents.
- W 3.52:252 Heavy machine guns, 1937 edition, 20 cents.
- W 3.52:303 Transportation, rail, 1939 edition, 10 cents.

FIELD MANUALS (WAR DEPARTMENT)

- W 1.33:9-5 Ordnance Field Manual. 1939 edition, 124 pages, 25 cents.

Basic Field Manuals

- W 1.33:21-100 Soldier's handbook, 1941, 253 pages, 35 cents.
- W 1.33:23-5 U. S. rifle, caliber .30, M1, 1940, 243 pages, 30 cents.
- W 1.33:23-10 U. S. Rifle, caliber .30, M1903, 1940, 221 pages, 25 cents.
- W 1.33:23-15 Browning automatic rifle, caliber .30, M1918A2, with bipod, 1940. 208 pages, 25 cents.
- W 1.33:23-20 Browning Automatic Rifle, caliber .30, M1918, without bipod, 1940, 227 pages, 30 cents.
- W 1.33:23-35 Automatic pistol, caliber .45, M1911 and M1911A1. 1940, 96 pages, 15 cents.
- W 1.33:23-40 Thompson submachine gun, caliber .45, M1928A1, 1940, 80 pages, 15 cents.
- W 1.33:23-45 Browning machine gun, caliber .30, HB, M1919A4, ground, 1940, 217 pages, 30 cents.
- W 1.33:23-50 Browning machine gun, caliber .30, HB, M1919A4 (mounted in combat vehicles), 1940. 156 pages, 25 cents.
- W 1/33:25-55 Browning machine gun, caliber .30, M1917, 1940, 327 pages, 40 cents.
- W 1.33:23-60 Browning machine gun, caliber .50, HB, M2 ground, 1940, 187 pages, 25 cents.
- W 1.33:23-65 Browning machine gun, caliber .50, HB, M2 (mounted in combat vehicles), 1940, 141 pages, 25 cents.
- W 1.33:23-70 37-mm gun, antitank, M3, 1940, 186 pages, 25 cents.
- W 1.33:23-75 37-mm gun, M1916, 1940, 160 pages, 25 cents.
- W 1.33:23-80 37-mm gun, antitank, M5 (Mounted in tanks), 1941, 153 pages, 20 cents.
- W 1.33:23-85 60-mm mortar, M2, 1940, 87 pages, 15 cents.
- W 1.33:23-90 81-mm mortar, M1, 1940, 138 pages, 25 cents.
- W 1.33:2605 Interior Guard Duty, 1940, 50 pages, 10 cents.

Technical Manuals

- W 1.35:1-430 Welding, 1941, 170 pages, 40 cents.
- W 1.35:3-250 Storage and shipment of dangerous chemicals, 1940, 127 pages, 20 cents.
- W 1.35:4-205 Coast Artillery Ammunition, 1940, 102 pages, 15 cents.
- W 1.35:4-245 Preservation and care of seacoast defense materiel, 1941, 26 pages, ten cents.
- W 1.35:5-230 Topographic drafting, 1940, 302 pages, \$1.00.
- W 1.35:6-220 Field artillery fire control instruments, 1941, 62 pages, 15 cents.

What troubles students in the afternoon is not fatigue, but boredom.

Neither the instructor nor the student is justified in placing the responsibility for unsatisfactory class progress upon most of the disadvantages which are often considered detrimental. It is the duty of the instructor to so

impart his instruction that he holds the interest of his students. It is the duty of each student to devote his undivided attention to the instruction which is being imparted to him. If both these requirements are met to the fullest possible extent, such handicaps as poor ventilation, mental fatigue, long class periods, etc., will be found not to have

(Continued on page 356)

ANOTHER PHASE OF THE "LEASE-LEND" . . .

For the last two and a half months the students and staff of the Ordnance School have been asking many questions about six individuals whom they noticed about the School area. "Who are they?" "What uniform is that?" "What rank is he; never saw insignia like that before?" "To what unit do they belong?" Others who knew would answer, "Why, they are British officers who are taking some course at the School." More specifically the officers are members of the Royal Army Ordnance Corps and are attending classes at an American school in order to gain information concerning the operation and maintenance of American Ordnance equipment. The British have acquired much American materiel under the provisions of the Lease-Lend Act, and it is only logical that

they want to keep it running.

The senior officer of the group is Major Harold A. H. Shepherd. He and Captains Noel-Hudson and Lewis took the Artillery course. Captains Kimberley, Sage and Smith were enrolled in the Automotive Section.

Some little difficulty was at first experienced by the visitors in learning the American equivalent for British Ordnance terms. They would say that when a gun returns to battery, it "Runs out". Adding to the confusion would be the terms "spanner" for open-end wrench, "petrol" for gasoline, "paraffin" for kerosene, and "dynamo" for generator.

(Don't overlook Capt. Noel-Hudson's article on page 294)



Back Row, left to right: Captains F. G. Noel-Hudson, P. C. Lewis, and R. D. Kimberley.
Front Row, left to right: Capt. K. H. Smith, Major H. A. Sheppard, and Capt. T. E. Sage.

- W 34.5:1766 Guns, 3-inch (15-pounder), and Barbette Carriage, Model of 1902: Instructions for Mounting, Using and Caring For, 10 cents.
- W 34.5:1958 Sights, 2-inch Telescopic, Model of 1909: Description, 5 cents.
- W 34.5:1960 Sights, 3-inch Telescopic, Model of 1910: Description, 5 cents.

Army Regulations are obtainable from the Government Printing Office, and with the exceptions listed below are priced at five cents each. In ordering, use the classification number W 1.6/1: followed by the regulation number and title. For example: "W 1.6/1:1-6 Alphabetical Arrangement of Titles of Army Regulations". Those Army Regulations for which the price is in excess of five cents are as follows:

- 1-10 List of Current Pamphlets and Changes, Distribution, 10 cents.
- 30-960 Transportation of Authorized Baggage, 10 cents.
- 30-3000 Price List of Clothing and Equipage, 10 cents.
- 35-6660 Sales of Property, 10 cents.
- 40-105 Standards of Physical Examination for Entrance into the Regular Army, National Guard, and Organized Reserves, 10 cents.
- 40-1025 Records of Morbidity and Mortality, 10 cents.
- 130-10 (National Guard) Induction into the Service of the United States, 10 cents.
- 140-5 (Officers' Reserve Corps) Reserve Officers not General Officers, 10 cents.
- 145-10 (Reserve Officers' Training Corps) Administration and Training, 10 cents.
- 145-20 (Reserve Officers' Training Corps) Supply and Equipment, 10 cents.
- 145-30 (Reserve Officers' Training Corps) Training Camps, 10 cents.
- 210-65 (Posts, Camps and Stations) Exchanges, 10 cents.
- 210-390 (Posts, Camps and Stations) Motion Picture Service, 10 cents.
- 260-10 Flags, Colors, Standards, and Guidons: Description and Use, 10 cents.
- 300-15 Maps and Mapping, 10 cents.
- 340-15 Correspondence: How Conducted, 10 cents.
- 350-2200 Citizens' Military Training Camps, 10 cents.
- 380-5 Safeguarding Military Information, 10 cents.
- 600-40 Wearing of the Uniform, 10 cents.
- 600-750 Recruiting for the Regular Army and the Regular Army Reserve, 10 cents.
- 615-25 Enlisted Men: Classification, 10 cents.
- 615-26 Index and Specifications for Occupational Specialists and Index to Military Occupational Specialists, 15 cents.
- 750-10 Range Regulations for Firing Ammunition in Time of Peace, 10 cents.
- 775-10 Qualification in Arms and Ammunition Training Allowances, 10 cents.

Among the more recent publications of the Government Printing Office are the following which may interest Ordnance personnel:

Army Regulations 345-10, Military Records: Preservation and Disposition, December 5, 1941, 5 pages, 5 cents, W 1.6/1:345-10.

Army Regulations 600-15, Personnel: Rank and Precedence, December 10, 1941, 6 pages, 5 cents, W 1.6/1:600-15

Army Regulations 600-35, Personnel: Prescribed Service Uniform, November 10, 1941, 31 pages and 31 pages of plates, 15 cents, W 1.6/1:600-35.

Army Regulations 615-150, Enlisted Men: Aviation Student Training, August 1, 1941, 6 pages, 5 cents, W 1.6/1:615-150.

Basic Field Manual 23-5, U. S. Rifle, Caliber .30, M1, November 15, 1941, change 1, 3 pages, 5 cents, W 1.33:23-5/ch. 1.

Basic Field Manual 23-15, Browning Automatic Rifle, Caliber .30, M1918A2, with bipod, change 2, November 15, 1941, 5 cents, W 1.33:23-15/ch. 2.

Basic Field Manual 23-60, Browning Machine Gun, Caliber .50, HB, M2 Ground, change 1, December 8, 1941, 5 cents, W 1.33:23-60/ch. 1.

Technical Manual 3-205, The Gas Mask, October 9, 1941, 144 pages, illustrated, 25 cents, W 1.35:3-205.

Technical Manual 9-1695, Ordnance Maintenance, Depression Position Finder, M1, November 21, 1941, 30 pages, illustrated, 10 cents, W 1.35:9-1695.

Ordnance Safety Manual, Regulations Governing the Manufacture, Storage, Loading, and Handling of Military Explosives and Ammunition at Establishments of the Ordnance Department, U. S. Army, December 1, 1941, 221 pages, illustrated, 30 cents, W 34.12/2:Sa 1/2/941.

Report of Bomb Tests on Materials and Structures, 55 pages, illustrated 15 cents, Pr. 32.4402:B 63.

Armored Force Field Manual 17-5, Armored Force Drill, January 12, 1942, 198 pages, illustrated, 25 cents, W 1.33:17-5.

Army Regulations 35-320, Finance Department: Agent Officers, December 19, 1941, 10 pages, 5 cents, W 1.6/1:35-320.

Army Regulations 610-5, Warrant Officers: General Provisions, September 13, 1941, 5 pages, 5 cents, W 1.6/1:610-5.

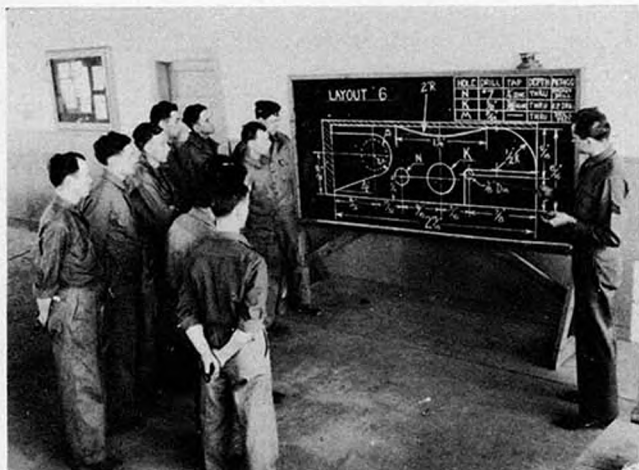
Army Regulations 615-290, Enlisted Men; Absence without Leave, December 27, 1941, four pages, 5 cents, W 1.6/1:615-290.

Basic Field Manual 29-5, Military Police, December 8, 1941, 160 pages, illustrated, 20 cents, W 1.33:29-5.

Basic Field Manual 30-58, Military Intelligence, Identification of Japanese Naval Vessels, December 29, 1941, 182 pages, illustrated, 15 cents, W 1.33:30-58.

Basic Field Manual 31-20, Jungle Warfare, December 15, 1941, 87 pages, 15 cents, W 1.33:31-20.

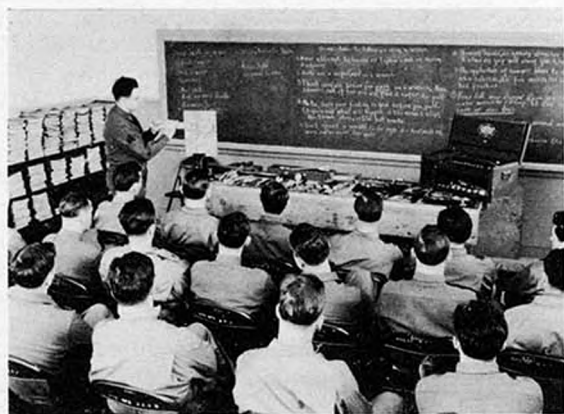
Field Artillery Field Manual 6-75, Service of the Piece, 105-mm Howitzer, M-2, Truck-drawn, 1941, 53 pages, illustrated, 15 cents, W 1.33:6-75.



Sergeant Sarawark explaining the layout of the steel project

2. To teach him how to select and care for the tools he uses, and the technique of using them.
3. To give him an opportunity to develop skill in the use of his hands.
4. To impress upon him the necessity for the conservation of tools and supplies, and the need for doing every job correctly.
5. To teach him how to work safely, and the importance of always doing his work in such a manner.

However short the training period in Elementary Shop may be, the student nevertheless obtains a foundation upon which to build. The following is a summary of the varied and comprehensive subject matter:



Sergeant Burston demonstrating the use of the twelve point wrench.

1. Mathematics - enough fractions and decimals to enable the student to use and understand the foot rule and micrometer.
2. Blue Print Reading - enough to enable the student to read simple sketches.
3. The common layout tools, including the combination square, scribes, dividers, prick punch, and center punch.
4. The common measuring tools, including calipers and micrometers.
5. All the common types of hammers, chisels, files, punches, drifts, bars, clamps, vises, hacksaws, pliers, taps and dies, abrasives, and fastening devices.
6. Drills and reamers and the use of the breast

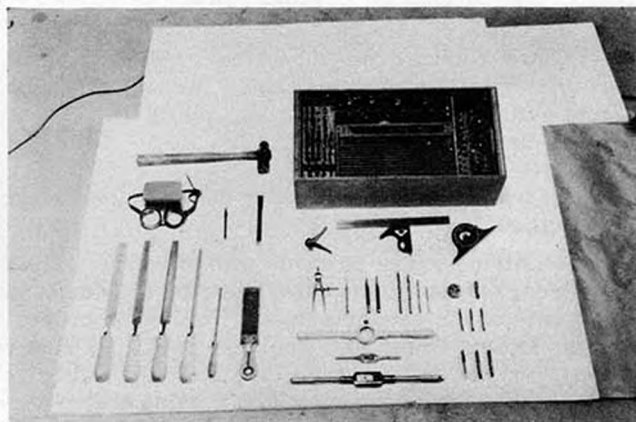
drill, portable electric drill, and the drill press.

7. Soldering, including the care of the blowtorch and soldering copper, the cleaning of surfaces, the use of fluxes, tinning and sweating.

8. Physical characteristics of the common metals, and simple means of identifying them.

The method of instruction is a combination of lectures, demonstrations, discussions, and shop projects. Instructors are trained to present the various subjects without introducing any extraneous material. Thoughtfully planned graphic and visual aids are extensively used in the classroom. Whenever possible, students handle the tools under discussion.

In order to utilize every possible moment for training, the details of administration have been carefully worked out. Every bench is numbered. The tools, texts, and tool checks are laid out on the bench before the student arrives. A small group can be assigned to benches,



The instructors kits and the tools in it are shown on the right. The tools issued to the students are on the left.

have their tools checked and be ready to work in ten minutes. The same procedure would take a group of 300 or more students only about twenty minutes.

Depending on the load, each instructor has a group of from ten to twenty-five students. Since there are additional tools which the students will need for only a short time, these tools are issued by the instructors from their kits. This instructor's kit contains scribes, dividers, prick and center punches, combination squares, drills, taps and dies. The instructor also draws breast drills, hacksaws and other tools in quantity from the tool crib as the group needs them. Thus the student seldom goes to the tool room and as a result a great deal of instruction time is saved.

Each instructor records the progress of his group twice daily on a progress chart. This enables the shop officer to tell at a glance the latest progress of any particular group. Shop schedules are based on the progress of the various groups from day to day.

It is not assumed that the student completing this course is by any means a qualified bench mechanic. However, it has been satisfactorily proven that the student has learned enough about hand tools and their use so he may take with confidence the next step in his training as an Ordnance mechanic.

NEWFOUNDLAND BASE COMMAND, U. S. ARMY
OFFICE OF THE BASE ORDNANCE OFFICER
St. John's, Newfoundland

March 2, 1942.

File-201 O'Connor, David P.

SUBJECT: Commendation.

TO : Ordnance Officer, Fort Pepperrell
: A.P.O. 801, Newfoundland.

1. There is quoted below a commendation dated March 2, 1942, from the Commanding Officer, Quartermaster Detachment, Fort Pepperrell, Newfoundland, which has been noted with pleasure by the undersigned.

"1. Request this unsolicited commendation be recognized and included in the efficiency record of Corporal DAVID P. O'CONNOR, 7071485, Ordnance Department.

2. On the occasion of this organization's initial course in the care and use of the automatic pistol, Corporal O'CONNOR, did, voluntarily and without recompense, devote an evening of his off-duty time in giving careful and efficient demonstrations and lectures to the officers and enlisted men, of this organization, concerning the course of instruction at hand. The undersigned is impressed and most pleased with this noncommissioned officer's competent and capable performance and appreciates his whole hearted efforts, enthusiasm, and spirit of co-operation in rendering this invaluable assistance."

2. The personal interest in the general efficiency of the U. S. Army as a whole, as demonstrated by Corporal O'CONNOR, is considered one of the highest attributes attained by a soldier. It is desired that this letter be brought to the personal attention of Corporal O'CONNOR, and posted on the Bulletin Board of the Ordnance Shop. The spirit of co-operation demonstrated by Corporal O'CONNOR, and in many other cases by other Ordnance men at this Base, serves to place our Ordnance Mission on a very high plane, and will when necessary give us that advantage that will insure eventual victory over our enemies.

Copies furnished: A. A. WHITESELL,
O.O., 2nd Corps Area. Capt., Ord. Dept.,
Editor ORDNANCE SERGEANT, Ordnance Officer.
Aberdeen Proving Ground, Maryland.
Chief of Ordnance, Washington, D. C.

HEADQUARTERS AND HEADQUARTERS SQUADRON
I AIR FORCE BASE COMMAND
Mitchel Field, New York.

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

March 6, 1942

1. Read with enjoyment the February issue of THE

ORDNANCE SERGEANT. However, reference statements on "inclosures" in the article, by S/Sgt. C. B. Hudson, entitled "Military Correspondence", would like to invite your attention to Section VII, AR 340-15, May 15, 1928.

a. In all references, the word is spelled "inclosure".

b. Reference paragraph 85 c, the following is the given example given:

"4 Incls-

Incl 1-W.D., A.G.O. Form No. 55.
Incl 2-Letter A.G. 300.33 (2-1-23) (in dup.)
Incl 3-Report Board of Officers (in trip.)
Incl 4-Letter 220.4, Hq. 2nd C.A., Jan 4/24, w/7
inds. and 6 incls."

2. This letter is not intended as a criticism of an excellent article, but rather an aid for all readers of THE ORDNANCE SERGEANT.

Very truly yours,

JOHN A. DOLAN,
M/Sgt. Ord. Dept.,
Chief Clerk.

108th ORDNANCE CO. (MM)
Camp Forrest, Tennessee
KEEP 'EM FIRING

March 9, 1942

THE ORDNANCE SERGEANT
The Ordnance School,
Ordnance Training Center,
Aberdeen Proving Ground, Maryland.

Dear Sir:

This organization has adopted a slogan that is stamped on all correspondence. The slogan, "KEEP 'EM FIRING", has been taken up by all units at this post, and has resulted in an increased maintenance effort on the part of the troops.

We submit this slogan for adoption by the Ordnance Sergeant to aid all troops in getting the right spirit about maintenance.

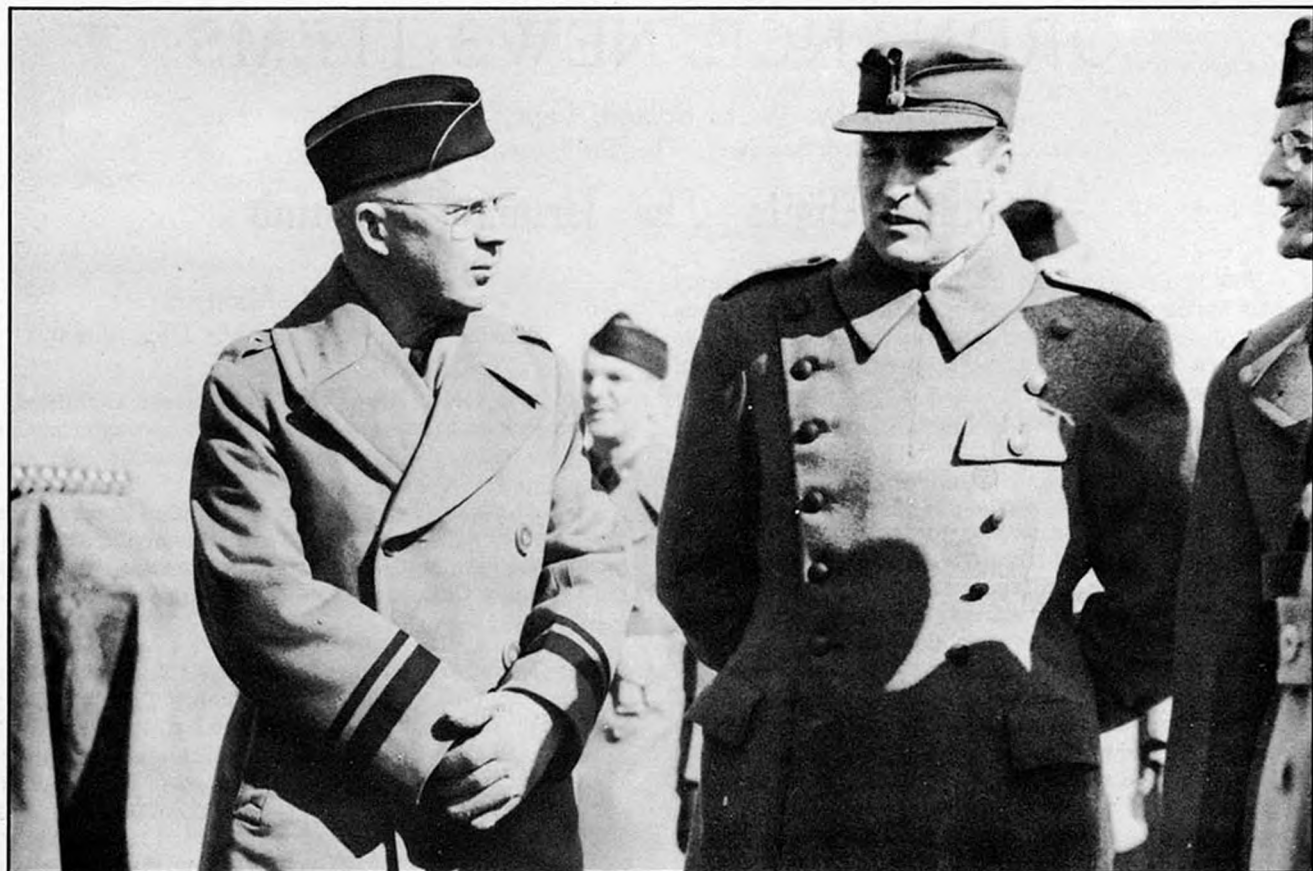
Arnold W. Jensen
1st Sergeant
108th Ord. Co. (MM)

Let us hear from your organization. We can use news items if they do not consist of forbidden military information, photographs, shop hints. And don't forget to report all changes of address for your organization.

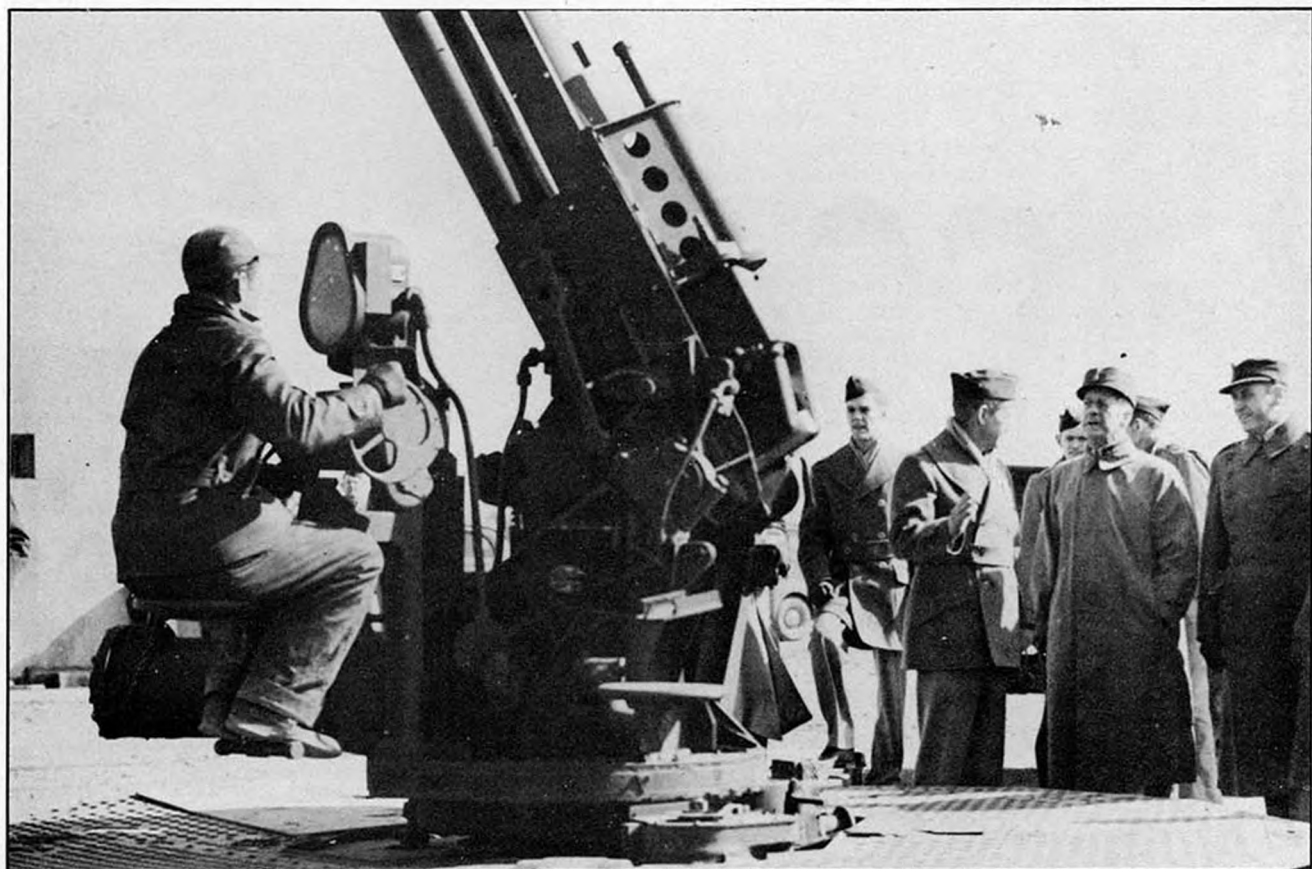
- W 1.35:9-225 Browning Machine Gun, caliber .50, M2 aircraft, fixed and flexible, 1940, 51 pages, 10 cents.
- W 1.35:9-226 Browning Machine Gun, caliber .50, M2, water-cooled, and mounts, 1940, 88 pages, 15 cents.
- W 1.35:9-235 37-mm gun Materiel, M1A2, 1941, 86 pages, 15 cents.
- W 1.35:9-280 U. S. Rifle, caliber .22, M1922, M1922M1 and M2, 1940, 53 pages, 10 cents.
- W 1.35:9-305 75-mm Gun Material, M1897, and modifications, 1941, 202 pages, 25 cents.
- W 1.35:9-315 75-mm Gun and Carriage, M1917, and modifications, 1940, 100 pages, fifteen cents.
- W 1.35:9-320 75-mm Howitzer Materiel, 1941, 160 pages, 30 cents.
- W 1.35:9-705 Scout Cars, M3, M3A1, and 4.2 Mortar Motor Carriage, M2, 1941, 223 pages, 35 cents.
- W 1.35:9-855 Targets, target materials, and Rifle Range Construction, 1941, 134 pages, 20 cents.
- W 1.35:9-1245 37-mm Gun, M3, and Carriage, M4, 1941, 50 pages, 10 cents.
- W 1.35:9-1320 Ordnance Maintenance, 75-mm Howitzer, Material, 1941, 47 pages, 10 cents.
- W 1.35:9-1360 Ordnance Maintenance, 3-inch Antiaircraft Gun Materiel, M2A2, M2A1, M1A1, T1A2, and T1A1, 1940, 39 pages, 10 cents.
- W 1.35:9-1525 Ordnance Maintenance, Angle of Site Instrument, M1917, 1941, 8 pages, 5 cents.
- W 1.35:9-1550 Ordnance Maintenance, Sight, M1901 (French), 1941, 36 pages, 10 cents.
- W 1.35:9-1580 Ordnance Maintenance, Battery Commander's Telescope, M1915A1, 1941, 21 pages, 10 cents.
- W 1.35:9-1585 Ordnance Maintenance, Range Finders, 1-meter base and 80-CM base, all types, 1941, 107 pages, 15 cents.
- W 1.35:9-1590 Ordnance Maintenance, Setters, Fuze, Bracket, M1916 series: Setters, Fuze, Hand, M1912, and M1913 series, 1941, 22 pages, 10 cents.
- W 1.35:9-1595 Ordnance Maintenance, Prismatic Compass, M1918, 1941, 12 pages, 5 cents.
- W 1.35:9-1610 Ordnance Maintenance, Instrument, Flank Spotting, M1, Rule, Flank Spotting, M1, 1941, 15 pages, 10 cents.
- W 1.35:9-1635 Ordnance Maintenance, Fuze Setter, M8, 1941, 22 pages, 10 cents.
- W 1.35:9-1662 Ordnance Maintenance, Binaural Training Instruments, M1 and M2, 1941, 25 pages, 10 cents.
- W 1.35:9-1680 Ordnance Maintenance, Azimuth Instrument, M1918, 1941, 27 pages, 10 cents.
- W 1.35:9-2900 Military Explosives, 1940, 135 pages, 20 cents.
- W 1.35:10-205 Mess Management, 1940, 30 pages, 10 cents.
- W 1.35:10-440 The Blacksmith and the Welder, 1941, 97 pages, 25 cents.
- W 1.35:10-510 The Motor Vehicle, 1940, 89 pages, 15 cents.
- W 1.35:10-515 The Motorcycle, 1940, 43 pages, 10 cents.
- W 1.35:10-540 Automotive Lubrication, 1941, 57 pages, 10 cents.
- W 1.35:10-545 Motor Transport Inspections, 1940, 50 pages, 10 cents.
- W 1.35:10-550 Fuels and Carburetion, 1941, 80 pages, 15 cents.
- W 1.35:10-560 Chassis, Body, and Trailer Units, 1941, 100 pages, 15 cents.
- W 1.35:10-565 Automotive Brakes, 1941, 81 pages, 15 cents.
- W 1.35:10-570 Internal Combustion Engine, 1941, 103 pages, 15 cents.
- W 1.35:10-580 Automotive Electricity, 1941, 177 pages, 20 cents.
- W 1.35:10-585 Automotive Power Transmission Units, 1941, 120 pages, 15 cents.
- W 1.35:10-590 Hand, Measuring and Power Tools, 1941, 121 pages, 20 cents.
- W 1.35:30-250 Military Dictionary, English-Spanish, Spanish-English, 1941, 199 pages, 50 cents.
- W 1.35:30-256 Icelandic Phrase Book, 1941, 30 pages, 10 cents.
- W 1.35:30-257 Military Dictionary, part 1, English-Portuguese; part 2, Portuguese-English, 1940, 190 pages, 45 cents.
- W 26.3/1:24/6 French-English Military Technical Dictionary, with supplement containing recent military and technical terms, 1917, 582 pages, 85 cents.
- W 3.2:G95 Guns. Notes on French 75-mm gun, 1917, 12 pages, 5 cents.

Ordnance Department Pamphlets

- W 34.5:1672 Board, Plotting, 360° Mortar, Model of 1911; Description and Instructions for use, 5 cents.
- W 34.5:1686 6-inch Disappearing Gun Carriage, L. F., Model of 1898, for Gun, Model of 1897 M1, 10 cents.
- W 34.5:1687 6-inch Disappearing Gun Carriage, L. F., Model of 1903, for Guns Models of 1900, 1903, and 1905, 10 cents.
- W 34.5:1691 10-inch Disappearing Gun Carriage, L. F., Model of 1894 MI, for Guns, Models of 1888, 1888 MI, and 1888 MII, 10 cents.
- W 34.5:1694 10-inch Disappearing Gun Carriage, L. F., Model of 1895 and 1900, 15 cents.
- W 34.5:1695 12-inch Disappearing Gun Carriage, L. F., Model of 1896, for Guns, Models of 1888 and 1895, 15 cents.
- W 34.5:1697 12-inch Disappearing Gun Carriage, L. F., Model of 1901, for Guns, Models of 1895 and 1900, 10 cents.
- W 34.5:1700 10-inch Barbette Gun Carriage, Model of 1893, for Guns, Models of 1888, 10 cents.
- W 34.5:1701 3-inch (15-pounder) Barbette Gun Carriage, Model of 1903, 5 cents.
- W 34.5:1703 6-inch Disappearing Gun Carriage, L. F., Model of 1905, and 6-inch Guns, Model of 1905, 10 cents.
- W 34.5:1704 6-inch Disappearing Gun Carriage, L. F., Model of 1905 MI, and 6-inch guns, Models of 1903, 1905, and 1908, 10 cents.
- W 34.5:1705 12-inch Mortar carriages, Models of 1896 MI and 1896 MII, for Mortars, Models of 1890 MI, 10 cents.
- W 34.5:1711 6-inch Disappearing Gun Carriages, L. F., Model of 1905 MII, and 6-inch Guns, Models of 1905 and 1908, 10 cents.
- W 34.5:1712 14-inch Disappearing Gun Carriages, L. F., Models of 1907 and 1907 MI, for Guns, Models of 1907, 1907 MI, and 1910, 10 cents. (Supplement to above, 5 cents.)
- W34.5:1716 Carriage, Disappearing, 16-inch, L. F., Model of 1912, for 16-inch Guns, Models of 1895 and 1912, 10 cents.



Brigadier General Roland W. Case, Aberdeen Proving Ground, Maryland, and Crown Prince Olaf of Norway.



View of AA Gun in operation at Aberdeen Proving Ground. Col. Hardigg explains operation to Col. Klingenberg and the Crown Prince.

Technical Manual 5-240, Aerial Photography, November 21, 1941, 104 pages, illustrated, 15 cents, W 1.35:5-240.

Technical Manual 6-215, Abbreviated Firing Tables, December 15, 1941, 60 pages, illustrated, 20 cents, W 1.35:6-215.

Technical Manual 9-345, 155-mm Gun Material, M1917, M1918 and Modifications, November 1, 1941, 220 pages, illustrated, 30 cents, W 1.35:9-345.

Technical Manual 9-1557, Ordnance Maintenance, Elevation Quadrant, M1, October 20, 1941, 15 pages, illustrated, 15 cents, W 1.35:9-1557.

Technical Manual 9-1675, Ordnance Maintenance, Azimuth Instruments, M1910 and M1910A1 (degrees), September 15, 1941, 30 pages, illustrated, 10 cents, W 1.35:9-1675.

Technical Manual 9-2662, Instruction Guide, Binaural Training Instrument M2, November 21, 1941, 21 pages, illustrated, 10 cents, W 1.35:9-2662.

"LETTERS FROM THE FIELD"

1ST PLATOON
687TH ORDNANCE CO. AVN. (P)
FORT RICHARDSON
ALASKA

February 18, 1942

The Editor,
THE ORDNANCE SERGEANT,
Aberdeen Proving Ground, Maryland.

Dear Editor:

There is a five man crew in this Platoon who believe that they have set a record in belting .30 Cal. Ammunition by hand in one day.

This crew, with a hand operated belt loading machine, belted 17,500 rounds of .30 Cal. Ammunition in one day.

Timed for fifteen minutes the crew belted a hundred round belt every fifty-five seconds. That's pretty fast belting by hand and takes a lot of cooperation.

This Platoon would like to hear from any crew of Ordnance men who have equaled or bettered this record. We don't believe that it can be equaled.

Sincerely,

T/Sgt. E. A. DeWitt
Act'g 1st Sgt.
1st Plat. 687th Ord. Co.
ASN 7009306
Ft. Richardson, Alaska

WE ADD THE PUNCH!



**AVIATION ORDNANCE
ELEVENTH AIR FORCE**

AIR BASE HEADQUARTERS
OFFICE OF THE BASE ORDNANCE OFFICER
Fort Richardson, Alaska.

March 7, 1942.

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

Dear Editor:

The inclosed poster is forwarded for use as you may see fit. I believe it typifies well the spirit of Aviation Ordnance personnel here in Alaska.

The drawing itself was executed by Corporal Kenneth K. Kigans, 748th Ord. Co. Avn. (AB), and Private First Class David Dworkin, 4th Ord. Co. (MM), this station.

PAUL W. SCHIDECKER,
Capt., Ord. Dept.,
Base Ordnance Officer.

1 Incl: "Poster - Aviation Ordnance."

REMINGTON SHOTGUN

(Continued from page 308)

front end in and rendering the latch inoperative. The breechblock is now free to move down.

SAFETY FEATURES. - There are four safety features on this weapon, three automatic and one manual. The first of these is on the extractor, which is so arranged that if for any reason the firing pin is not retracted from the face of the breechblock, the extractor will not function, causing a stoppage and consequently an investigation by the user of the weapon as to the cause of the stoppage. It operates in the following manner: As the firing pin moves forward the shoulder on the firing pin, riding under the projection on the bottom of the extractor, cams the extractor away from the cartridge and holds it cammed away until the firing pin is retracted. During the time that the rear end of the breechblock is moving downward out of the locking recess, the firing pin is retracted sufficiently to allow the shoulder on the firing pin to move out from under the projection on the extractor, permitting the extractor to engage the cartridge. The second safety feature is on the action bar lock. The ledge on the action bar lock engages under the short arm of the sear, locking it, so that the gun cannot be fired until the action is fully locked, and the cylindrical leg on the other end locks the action bar against accidental or intentional movement.

The third safety feature is the breechblock latch,

which functions after the gun has fired, thus keeping the action locked at all times until the action bar is moved.

The manual safety is located in the front part of the trigger guard bow, and when set on safe it interposes an obstruction under the straight arm of the trigger, thus locking the trigger.

LOADING AND UNLOADING. - With the action fully locked, insert a cartridge, base to the rear, through the ejection opening at the bottom of the receiver into the magazine. Push firmly on the base of the cartridge until it passes the carrier spring, then let go. Insert another cartridge in the same manner until five cartridges (capacity) have been loaded. If it is desired to load the gun to maximum capacity (6 rounds), set the safety, press in on the action bar lock button, and move the action bar to the rear and then forward again. This will place a round in the chamber, and by inserting another round in the magazine the gun will be loaded to maximum capacity.

To unload, set the safety, extend the trigger finger on the right side of the receiver and with it press in on the action bar lock button. While holding the button depressed move the action bar foreend back and forth until all the cartridges are ejected.

If the gun has been fired, it is not necessary to depress the action bar lock button to operate the action bar for reloading.

RANGE FINDER

(Continued from page 320)

54. FIELD SERVICE MODIFICATION WORK ORDERS. - The following Field Service Modification Work Orders have been issued:

a. FSMWO F-26-W1. - Involves replacement of measuring wedge scale drum. (Functional - Arsenal)

b. FSMWO F-26-W2. - Improvement of range finder adapter and plate and elimination of eyepiece cap assembly. (Economical - Ord. Mach.)

c. FSMWO F-26-W3. - Modification to improve the method of adjusting the penta prisms. (Functional - Arsenal)

55. ACTION TO BE TAKEN. - Upon completion of inspection recommend the necessary action to be taken and record on the inspection form, such as:

- a. No defects. Continue in service.
- b. Using service make necessary correction.
- c. Repaired and adjusted at time of inspection.
- d. Exchange at local ordnance depot.
- e. Send to local ordnance shop or other designated point for repair.

f. Ship as instructed to depot or arsenal.

g. Dispose of inspection forms in accordance with existing regulations.

SPECIAL TOOLS AND SUPPLIES REQUIRED

56. TOOLS. - Special tools needed for repair and adjustment of the range finder, 1 meter basel M1916:

Surface Plate CI 12"X18".
Adjustable "V" block 13A and 13D.
Bench Level 4G.
Screwdriver jeweler's, asst'd. sizes.
Eye loupe 14F.
Scriber, machinist's.
Hammer, jeweler's 14U.
Screwdriver, 3" blade.
Screwdriver, 4" blade.
Screwdriver, span 2L.
Screwdriver, span 2M.
Wrench, spanner, 3AK.
Wrench, spanner, 3AN.
Wrench, spanner, 3AQ.
Wrench, spanner, 3AX.
Wrench, spanner, 3BA.
Wrench, spanner, 3BF.
Wrench, spanner, 3BG.
Wrench, spanner, 3BH.
Wrench, spanner, 3BK.
Wrench, spanner, 3BM.

ORDNANCE NEWS ITEMS

Prepared by: W. L. Boland, Capt., Ord. Dept.
Record Secretary, The Ordnance School

Royalty Visits The Proving Ground

Had you stood on the platform of the Pennsylvania Railroad station at Aberdeen, Maryland, recently, you might have sensed that something unusual was about to occur. Here at one end of the station stood a group of Army officers, while not far away were several photographers from The Ordnance School and Aberdeen Proving Ground.

Finally a train rounded a curve and slid hurriedly into town, coming to an impatient stop at the station. Several passengers alighted from one of the cars, they were joined by the group of officers while the photographers went into action, the formalities of introductions were quickly disposed of, and the combined parties moved toward a line of official cars near the station. Headed by Brigadier General Roland W. Case, Commanding General of Aberdeen Proving Ground, the official party of Crown Prince Olaf of Norway was soon on its way to view the latest wonders of the Ordnance Department at the Proving Ground.

At the Proving Ground, the party entered a huge building to begin its inspection of various items of Ord-

By: E. R. Manfrin,
Master Sergeant, Ordnance Department

nance materiel. Here, and in several buildings, the Crown Prince displayed keen interest in numerous items which he had probably already seen in action.

At the testing ranges of the Proving Ground numerous types of guns were exhibited and demonstrated for the party, after which the entire party attended a luncheon at the Officer's Club.

The afternoon phase of the visit of royalty included a rather hurried visit to the Ordnance Training Center, including stops at the Artillery Section, the Fire Control Section, and the Machine Shop and Maintenance Section of The Ordnance School. All too quickly, both for the visitors and for their hosts, the party of Crown Prince Olaf of Norway dashed back to Aberdeen to board their train. The pictures on this and the following page tell more adequately than words of some of the interesting moments of the visit.



Inspection of the Artillery Section at The Ordnance School. Left to right, Minister of War Colonel Ljungberg (Norway); Col. J. Bellinger, Office of the Chief of Ordnance; Norwegian Military Attache, Col. Klingenberg; Brigadier General Case, Aberdeen Proving Ground; Brigadier General Hatcher, Ordnance Training Center; Lt. Col. Harold J. Conway, Ordnance Training Center (in background); Crown Prince Olaf of Norway; Col. Hardigg, Aberdeen Proving Ground; Captain Minshaw, Artillery Section, The Ordnance School.

collar; (2) periodic replacement of stuffing box packing; (3) special care should be exercised to prevent scratches occurring on the rearmost ten (10) inches of the Recuperator piston rod; (4) in replacement of the recuperator end caps, white lead should be used to prevent possible leakage of oil; (5) special care should be taken in screwing and unscrewing the Recuperator filler screw. Past experience shows that it is possible for the internal threads of the hole for this Recuperator filler screw to be stripped by careless insertion of the Recuperator filler screw.

TRAINING METHODS

(Continued from page 343)

a disastrous effect.

Measurements of fatigue are complicated by the confusion of fatigue, which is the fact of decreasing competency to do work, with boredom, which is a lack of desire to do work and aversion to it. A positive distastefulness for a task may go hand in hand with a high degree of efficiency in its performance. Boredom appears earlier than fatigue and increases at a more rapid rate, but is quite different from it.

The human body is a wonderfully adaptive mechanism which, given a fair chance, will respond to demands made upon it in most surprising ways. Mental fatigue, in the sense of a loss of real efficiency, is difficult to achieve. There is little loss in efficiency after several hours of hard mental work. Although it is true that such things as alcohol and tobacco reduce efficiency, unfavorable hygienic and other environmental conditions, at least for short periods of time, do not seriously reduce efficiency.

Instructors have long known that improvement in learning is extremely irregular, varying not only from individual to individual, but also in the same individual from time to time. Sometimes the improvement is fast; sometimes slow. Never by any chance is the rate so steady or uniform that we can say the amount learned in 100 hours of practice will be 100 times the amount learned in one hour. Interest, attention, the quality of instruction, the amount of learning previously acquired, the spacing of the practice periods, fatigue, and a host of other factors enter into the situation and make the rate of improvement variable.

Numerous experiments by educators have seemed to indicate that the 45-50 minute classroom period, observed in the average service school, is an acceptable, conservative time allotment, considering that we are dealing with postgraduate, adult students.

The proper distribution of practice periods presents greater difficulties than the determination of their length. It is the consensus of opinion that practice periods should be so arranged that the newly formed "bonds" are exercised again before they have time to fade materially. The "bonds" of some subjects are so numerous that none, except a very few, get sufficient exercise to make them permanent. Consequently they fade away in a most distressing manner. What the instructor must strive to do is to distribute the practice so as to keep all useful "bonds" at a reasonably high level.

The old saying that instructors are "born and not made" has been thoroughly disproved. It is extremely rare that anyone with the proper basic requirements cannot be made into a successful instructor.

When the instructor goes before his class, the students first note his appearance, next his voice and, lastly, his manners and his conduct. There is an indefinable quality that affects his audience, sometimes called his "presence" or his "personality". What is this personality?

Voice. - The voice should be strong, well modulated, of pleasing tone and quality and capable of the rise and fall of inflection that makes music of mere words. It should not be rasping, grating, weak, stammering or monotonous. It should be a voice that grips the hearer and compels attention and interest.

Physique. - Physical and mental fitness at all times are fundamental necessities; therefore, physical and mental training must be continuous, interspersed, of course, with a proper amount of relaxation and recreation. The physique of the instructor should be at least average, and he should seek to develop it to the point where it becomes attractive and not repugnant.

Neatness. - The appearance should be so neat that the audience will not notice the hooked nose, the protruding teeth, the flapping ears, or the wart between the eyes by which the instructor is handicapped but over which he has no control. The frescoe from breakfast upon the front of the coat is deadly to able instruction: carelessness in appearance detracts from instruction more than the instructor can estimate.

Thoroughness. - The instructor should be so thorough in the knowledge of his subject that unconsciously the student is filled with a feeling of confidence and respect for him.

Humor. - Imagination is the heart of humor, and those benighted souls who have no saving sense of humor simply have no imagination; they have no eyes to see. They cannot see themselves; if they could, they would laugh. Other people certainly laugh at them, for the funniest people in the world, to other people, are those who have no sense of humor. A sense of humor depends, in part at least, on those who have the ability to visualize quickly and vividly surprising and incongruous life situations. There are other elements that enter into humor, but the one essential condition of all laughter is imagination.

When humor is utilized in instruction, the speaker must make that humor of practical value; if he tells a story, that story must illustrate a point in his instruction; to tell a joke for the joke's sake is usually fatal. A good test of humor is this principle: That which is not instructive is destructive.

Dramatic Ability. - Dramatic ability is the power to hold the student by a magnetic touch, by eye and by manner, by so conducting one's self that the subject is made to live before the student. This does not necessarily mean the ability to "act".

Resourcefulness. - Resourcefulness is the ability to present the subject from diversified viewpoints; to use varied illustrations; to meet different students in



Crown Prince Olaf of Norway clambering out of a Medium Tank, M3, after a trial run at Aberdeen Proving Ground.



The Crown Prince and his party, accompanied by a Secret Service man, bid farewell to their hosts as they leave the Ordnance Training Center.

we are being supplied with. We are a number of old Soldiers of 1914-1918 War, now serving in the British Home Guard.

Thank ye, yankie,

Your Faithfully

A. Brown, Cpl.

My dear Corporal Brown:

Your considerate letter in which you express thanks for our Thompson submachine guns has just reached me. I am confident that you and your comrades will use these weapons with good effect, if and when the moment comes. In reply to your expression of thanks, I can only say:

You're welcome, soldier!

Sincerely yours

C. M. WESSON
Major General, Chief of Ordnance

The Chief of Ordnance of the United States Army has sent the following reply to the letter:



FRENCH SIGHT PROBLEMS

(Continued from page 315)

	Relative Errors	Known Errors	Readings	Mean Readings	After Correction of Known Errors	Adjustment of the Level Support	Remaining Errors	Adjustment of the Tailstock	Remaining Errors	Maximum Adjustment Possible to Level Support
Problem #3	KEMTS +0.8 REMSS -2.6 REBS -0.6	Sight -2.4 Level -0.8	+2.4 +1.8 +0.8 +1.2	+2.1 <u>+1.0</u>	+4.5 +1.8 B 2.7	None	+4.5 +1.8 B 2.7	-3.1	+1.4 -1.3 B 2.7	+2.8 or -0.2 "L" is favored because it is used in indirect fire - "S" is not
Problem #4	KEMTS -1.6 REMSS -1.2 REBS +4.2	Sight +1.4 Level +1.4	+3.6 +4.2 -0.8 -0.6	+3.9 -0.7	+2.5 <u>-2.1</u> B 4.6	+2.0	+2.5 <u>-0.1</u> B 2.6	None	-2.5 <u>-0.1</u> B 2.6	+2.0 or -1.0 No Adjustment necessary to tailstock since "B" is less than 3' and is divided, with "L" closest to Bore
Problem #5	KEMTS +2.2 REMSS +1.0 REBS -1.4	Sight +1.8 Level -0.6	-2.8 -3.6 -1.2 -0.6	-3.2 -0.9	-5.0 <u>-0.3</u> B 4.7	-1.8	-5.0 <u>-2.1</u> B 2.9	+3.5	-1.5 <u>+1.4</u> B 2.9	
Problem #6	KEMTS -0.5 REMSS +2.5 REBS -3.5	Sight -1.5 Level +1.2	+3.6 +3.2 +2.6 +2.2	+3.4 +2.4	+4.9 <u>+1.2</u> B 3.7	+1.5	+4.9 <u>+2.7</u> B 2.2	-3.8	+1.1 <u>-1.1</u> B 2.2	+ or -1.5
Problem #7	KEMTS -1.6 REMSS -1.0 REBS +4.0	Sight +1.4 Level -1.4	+0.4 -0.2 +0.6 -0.2	+0.1 +0.2	-1.3 +1.6 B 2.9	None	-1.3 +1.6 B 2.9	None	-1.3 +1.6 B 2.9	+ or -1.5

Wrench, spanner, adjustable, 12S.
Wrench, spanner, adjustable, 12T.
Syringe, bulb.

Special tools listed above, with identifying numbers, are listed in SNL F-21.

57. SUPPLIES. - The following supplies will be required for the proper sealing and cleaning of the range finger:

Grease, special, low temperature
Aircraft machine gun oil
Plastilina
White lead
Shellac
Plaster of paris
LePage's glue
Alcohol
Lens soap
Lens tissue
Authorized metal cleaning solution.
Lustreless olive drab paint.
Assorted paint brushes, small.

LIST OF REFERENCES

1. Ordnance Field Service Bulletins
Maintenance of Materiel in Hands of Troops OFSB 4-1
Special Instructions Group F OFSB 4-8
Field Service Modification Work Orders OFSB 5-2
Lubrication of Fire Control Instruments OFSB 6-F-1
2. Standard Nomenclature Lists
Major Items of Small Arms, Automatic Guns,
Trench Mortars, and Field Artillery Sight-
ing Equipment and Fire Control Instruments. SNL F-1
Finder, Range, 1 Meter Base, M1916 SNL F-26
Tripods, All Active Types SNL F-101
Kit, Repair, Optical, for Field Artillery SNL F-21
3. Technical Manuals
Field Artillery Fire Control Instruments TM 6-220
General Information, The Instrument
Repairman TM 9-2602
Shop Manual, Instrument Repairman TM 9-2603
(Ord. Maint.) Range Finders, all types TM 9-1585

ACCOUNTABILITY OF AMMUNITION

(Continued from page 329)

Chief of Ordnance by February 28th. Each local ordnance officer will submit a report to his corps area commander, who will, in turn, consolidate the reports of those within his jurisdiction and forward them onward to the Chief of Ordnance. Some posts, camps, and stations, however, submit their reports directly to the Chief of Ordnance. The local ordnance officer is able to determine his statistics from his office Lot Data Cards, Stock Record Cards, and Master Magazine Record Cards.

In conclusion, a brief summary may well be considered. Step by step the establishing of authorized allowances was followed. This was supplemented by the procurement, the shipment, the receipt and establishing of

accountability. Then the procedure to be followed for regarding and recording of lot numbers was shown. Finally, the issuing and the maintenance of the residues were considered.

Now it can readily be seen that the man behind the man behind the gun, the Ordnance Man, has more to do than just storing or sending ammunition to the front; he must also maintain that accountability which is vital to any unit or organization. As an anticlimax, let it be remembered that there are other methods of handling some of the situations that were narrated and demonstrated. Nevertheless, it is believed that a complete routine method of accurate accountability has been exemplified and, after all, that is the paramount duty of any office --- KEEP THE RECORDS STRAIGHT.

Helpful suggestions and critical reviews are both welcomed and appreciated.

THE ORDNANCE MACHINIST

(Continued from page 331)

5. Name the files most commonly used, and particulars of each.

The grades received from a quiz of this type are averaged with the practical grade of each student, attitude also being considered.

(Continued in the May issue)

37-mm GUN, M4

(Continued from page 341)

It is important that no water be introduced into the Recuperator cylinder since that greatly increases the rate of corrosion and may result in pitting the finished surfaces of the Recuperator bushing, interfering with the functions of the Recuperator, and reducing its normal serviceable life.

The position of the Recuperator piston must also be carefully checked. Even with the proper amount of oil, the gun will not function as is desired unless the position of the Recuperator piston is correct. If the Recuperator piston rod is attached to the tube extension during adjustment, the front face of the Recuperator piston should be .625" + .015" from the end of the Recuperator. If the tube extension is not connected to the Recuperator piston rod, this distance will be only .450" + .015". If adjustment is such that the piston is too far forward, cushioning comes too soon and action of the gun becomes sluggish. If the piston is too far back, the gun comes back very hard in both recoil and counter-recoil. If continued, this last mentioned effect will definitely cause malfunctioning.

Certain precautions should be taken to insure that the proper level of oil be maintained. These include: (1) frequent inspection for oil leakage which will show up between stuffing box packing and recuperator piston rod

tion. It may be due to the phenomenon of "staleness", familiar to every trainer of athletes, but the physiological principles of which are not understood.

SUBSTITUTES FOR MANILA ROPE

Several months ago THE ORDNANCE SERGEANT printed a series of articles regarding the use of rope. Although stocks of Manila rope on hand promise a sufficient supply for the army, suitable substitutes are being sought, just in case they are needed before General McArthur can chase the Japs out of the Philippines again.

The best Manila rope is made from the fiber of the Abaca plant, which grows in the provinces of Davao and South Mindanao. Other sources of supply are sisal fiber from Mexico, Central America, Haiti and the Bahamas; Henequen from Mexico, the Yucatan Peninsula, Cuba and El Salvador; Istle, grown in Mexico and Central America; American hemp, grown in Kentucky and now being tested; and Bowstring hems, grown from Florida down through tropical South America.

None of these substitutes seems to be entirely satisfactory, but improved methods of preparation and manufacture may eventually overcome their deficiencies.



Do you remember this article in the February issue of THE ORDNANCE SERGEANT? It has caused considerable comment. A number of letters have been received, calling attention to errors in our calculation of the number of vehicles assigned to different type organizations, and therefore in the number of tires which would be on the road at one time. Every one of these letters intended to help us correct our errors is deeply appreciated.

"The Army Moves on Its Tires" was not actually intended to state a positive number of tires involved, because that would be impossible. It is admitted that some errors did creep into the article, simply because it was known that the total determined would be incorrect before the article could be printed. For taking this attitude THE ORDNANCE SERGEANT apologizes.

Judging from correspondence, there seems to be some misunderstanding as to how many vehicles are authorized for the different companies. One misunderstanding pertains to the correct source of information. As an example; T/O 9-7, dated November 1, 1940, shows 31 vehicles for the Medium Maintenance Company, while T/BA 9, dated October 1, 1941, shows 33 vehicles. The Table of Organization does show the number of vehicles authorized at the time of its publication, but is not a basis for issue. The Table of Basic Allowances is a basis of issue, and is more apt to be up-to-date in regard to vehicles than is the Table of Organization. Changes made in the T/BA are

published as changes, but corresponding changes are not always published for the T/O.

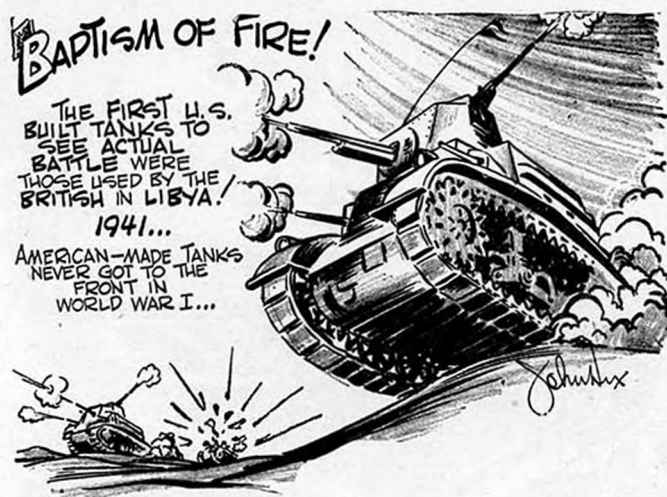
There are certain variations in the equipment assigned to a type of organization for various reasons, such as the Medium Maintenance Company assigned to a cavalry division. In this case six additional vehicles are authorized.

To figure the actual number of authorized tires on the road when all vehicles are in motion would be impossible. New organizations are being activated rapidly, and each of course is authorized its share of vehicles. To cite another difficulty: when "The Army Moves on Its Tires" was written it was understood that the vehicles of the Ammunition Company included three motorcycles, each of which would have two tires. Now it appears that 1/4-ton trucks ("Jeeps") are being substituted for the motorcycles, so that although the number of vehicles remains the same, the number of tires increases.

The Army, including the Ordnance Department, is changing rapidly in many ways. THE ORDNANCE SERGEANT finds it extremely difficult to keep strictly "modern" in regard to all information. But your letters and your corrections are a big help. Keep them coming. They not only set us on the right track, but they encourage us to keep trying to improve.

THEY'RE IN THE SERVICE NOW

The drawing and information below are borrowed from "Strange as It Seems" by John Hix.



M4 MEDIUM TANK

The War Production Board has announced that mass production of the M4 Medium Tank has begun at a new Mid-Western plant, the name and location of which are not disclosed.

The M4, which will supersede the familiar M3, is cast and welded instead of riveted construction, for greater strength and safety. It has a lower silhouette, and carries its major weapon, a 75-mm cannon, mounted in the revolving turret instead of the hull.

KEEP 'EM FIRING!

different ways in question and answer.

Alertness. - Mental alertness usually expresses itself in a vibrance of the voice, a snap in the eyes, and in quickness and decision of movement; it is the developed ability to grasp a situation or a thought speedily and to meet it promptly. It does not include noise, bluster, or egotism, but does include controlled, directed vitality.

Cordiality. - Cordiality is a quality of the heart. It is a result of a sincere liking for a fellow man. Real cordiality cannot be simulated. An instructor who radiates this cordiality in the classroom can never be guilty of irony, invective, or sarcasm; his students are never antagonized, but are drawn to him and to the subject he is presenting.

Patience. - Closely akin to cordiality is patience: that infinite patience that prevents a sharp retort to a foolish question, that causes careful and painstaking effort to explain difficult points to slow-thinking students, and that makes it impossible for the instructor to lose, ever, his temper with a student or the class.

Sympathy. - Patience, in turn, borders on sympathy, not the sympathy that means pity, but the sympathy that seeks out the interests and handicaps of the student, conquers the handicaps by displacing or overcoming them, and converts the student's interest into interest in the subject under discussion. There must be no condescension.

Sincerity. - We must believe implicitly in our subject; in its value and its effectiveness, yet we must never bluff, but be willing at all times to acknowledge our ignorance; such sincerity is contagious to the student.

Enthusiasm. - Enthusiasm is the most infectious quality of an instructor; it is also the most engaging quality of salesmanship, that vocation so closely allied to instruction. Enthusiasm will enable us to overcome our own self-consciousness in our attempt to get our thoughts quickly and easily into the minds of the students.

Perhaps you may say, "Oh, a man is a born speaker or he is not. He is born with a personality." That is true, as far as it goes, for a man may be a natural speaker, or he may not, and each man is born with a personality. But of all the qualities of the capable instructor, only two, voice and physique, are largely dependent upon heritage and are therefore capable of only limited development. All the others — neatness, thoroughness, alertness, resourcefulness, cordiality, patience, sincerity, sympathy, enthusiasm, and even humor and dramatic ability, can be highly developed by hard work.

In seeking to attain the qualities of a good personality, the instructor must not forfeit his individuality. One well known instructor has peculiarly developed his dramatic ability, and is thereby enabled to hold the interest and attention of his classes in the hollow of his hand with no apparent effort. Another has singularly developed his sincerity and enthusiasm, and his students are thoroughly inspired with confidence in him and always make high standings in his subject. These two men are quite different in their personality; yet each is an excellent man to emulate. Each possesses all the qualities we have enumerated, yet neither has forfeited his individuality.

The second article of this series, in the May issue, will discuss "Methods of Instruction" as employed in conferences, lectures, demonstrations and other types of instruction.

ROYAL ARMY ORDNANCE CORPS

(Continued from page 295)

rather than scorn. They retaliate by calling us "grease monkeys" — and sometimes other names that are quite unprintable! Still, we work with perfect harmony, with an occasional laugh because of their misunderstanding of engineering terms. We anticipate a spot of fun when our O.O.'s get hold of the American Ordnance catalogues, because the unfamiliar terms therein are pretty certain to cause them to tear their hair and swear horrible deep-sea oaths. Possibly they may ask us to translate!

In the engineering branch we feel that we are a resurrection of those days when, like us, the old armourers plied their trade in the midst of the battle and "earned a bubble reputation even in the cannon's mouth." An O.M.E. commanding a workshop on active service, hears the noise and clang of it competing with the howl of the dive

bomber, with the sickening tremor of the earth under the impact of bombs and with the incessant bark of artillery. He may well be reminded of Charles Gounod's vision in "Baucis and Philemon" — of Vulcan's sforge hard at work on the armour of the Gods: —

"Where loud my heavy hammers sound
And bright my furnace fires are glowing
Within my kingdom underground, I
Reign supreme, no rival knowing,
No greater Monarch can be found.

Below, in realms of endless night
A valiant Army I assemble
My swarthy slaves of giant might,
Who at my faintest nod would tremble,
I reign, a God here in my right."

"THANK YE, YANKIE"

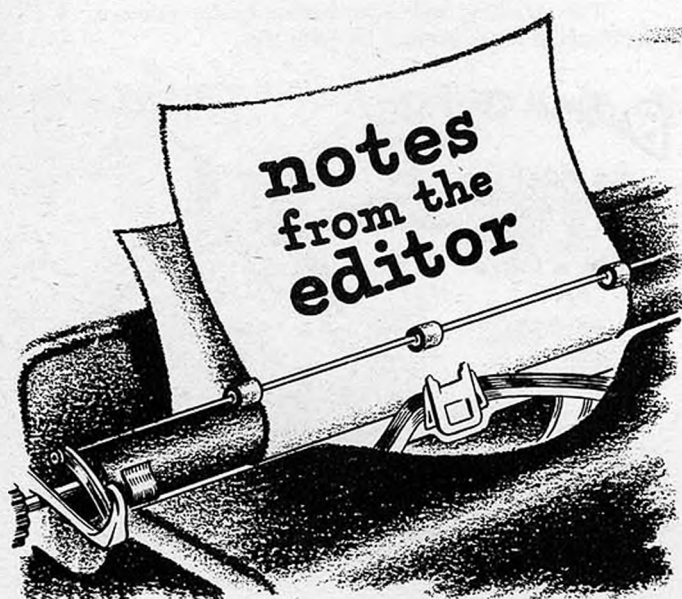
A facility manufacturing the Thompson submachine gun has just received and forwarded to the Office of the Chief of Ordnance a letter from a corporal in the British Home Guard expressing his thanks and the thanks of his comrades for "the good old Tommy guns" supplied through

Lend-Lease. The letter, written from a community in Essex, is as follows:

Dear Sirs:

Please accept the sincere thanks of my comrades in arms and myself, for the good old Tommy guns

	Relative Errors	Known Errors	Readings	Mean Readings	After Correction of Known Errors	Adjustment of the Level Support	Remaining Errors	Adjustment of the Tailstock	Remaining Errors	Maximum Adjustment Possible to Level Support
Problem #8	KEMTS +1.6	Sight -1.2	+4.2	+4.0	+5.2		+5.2		+1.4	+1.2 or -1.8
	REMSS +1.6		+3.8			+1.2		-3.8		
	REBS -4.4	Level -0.8	+1.2		+1.3		+2.5		-1.3	
			-0.2	+0.5	B 3.9		B 2.7		B 2.7	
Problem #9	KEMTS +0.6	Sight +1.8	-3.4	-3.6	-5.4		-5.4		-0.9	-2.0 or +1.0
	REMSS +0.6		-3.8			None		+4.5		
	REBS +0.6	Level -0.2	-4.2	-3.9	-3.7		-3.7		+0.8	
			-3.6		B 1.7		B 1.7		B 1.7	
Problem #10	KEMTS -0.6	Sight +1.6	+1.6							+ or -1.5
	REMSS -1.2		+1.2							
	REBS +3.4	Level +2.2	+2.0							Unserviceable - level error exceeds 2"
			+1.4							



92 PER CENT OXYGEN

The February issue contained an article which explained the making of lenses from glass, but no mention was made of the fact that the type of glass ordinarily used in eye glasses, and no doubt for many other purposes, is almost like the little man who wasn't there. According to Alexis Pincus, of the American Optical Company, the glass we see through is largely composed of the same oxygen we breathe to keep alive. Recent discoveries show that ninety-two per cent of the volume of glass is occupied by the oxygen ions, five per cent by the sodium ions, two per cent by calcium ions and only one per cent by silicon ions. The small bulk of silicon prevents the oxygen from escaping into the atmosphere.

Even a War Cloud has a Silver Lining

LONG HOURS VS. EFFICIENCY

Under "Ordnance Training Activities" in this issue Major Phillips discusses, among other things, the effects of fatigue upon students. In this connection, Dr. A. C. Ivy, of the University of Chicago, reported several interesting facts to the American Medical Association recently.

According to Dr. Ivy, "work can be measured in terms of the rate at which the body burns up fuel to provide energy — the metabolic rate."

Dr. Ivy then explains that "the normal basal rate is between 1,600 and 1,800 calories. This is the energy of keeping alive, used up when the body is completely at rest. Any exertion results in some increase. It is now generally agreed that the maximum exertion which a man can endure steadily for eight hours is that which increases the energy production about eightfold. If continued over a long period the result is collapse."

Referring to the mental aspect, Dr. Ivy reports that "meager data indicate that the recovery from the fatigue effects of mental work resembled that of muscular work. One investigator found that in repetitive mental tasks the optimum rest period was two minutes for each hour of work, or five minutes for each two hours."

Add the energy expenditure for mental work to that for muscular work and we have something else, of course. In both the British and German war efforts, to date, long hours have been reduced as much as possible because of the findings that they actually result in decreased produc-