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# REPORT OF THE NEW WEAPONS BOARD

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E. S.  
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Office of the Commanding General • Army Service Forces

Washington, D. C.

27 April 1944

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**WAR DEPARTMENT**  
**WAR DEPARTMENT GENERAL STAFF**  
**ORGANIZATION AND TRAINING DIVISION G-3**  
**WASHINGTON**

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2 June 1944.

WALNO 591

MEMORANDUM TO COLONEL SCHMAHL:

1. Attached report identified as ROTNWB should be of interest to all instructors.

Instructors Reading this Document

*W. H. Van Dine*

Sign Below

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Lt Col, QMC

Name -----

Date -----

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*Officer*

*12 June*  
*14 June*

*Mumford*  
*Ensign*

*16 June*

*H. Blinn*

*1 July*  
*14 July*



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**REPORT OF THE  
NEW WEAPONS BOARD**



**AMERICAN  
AMMUNITION  
AND ARTILLERY  
DID THIS**

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# **REPORT OF THE NEW WEAPONS BOARD**

**Office of the Commanding General • Army Service Forces**

**Washington, D. C.**

**27 April 1944**

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**This report has been published  
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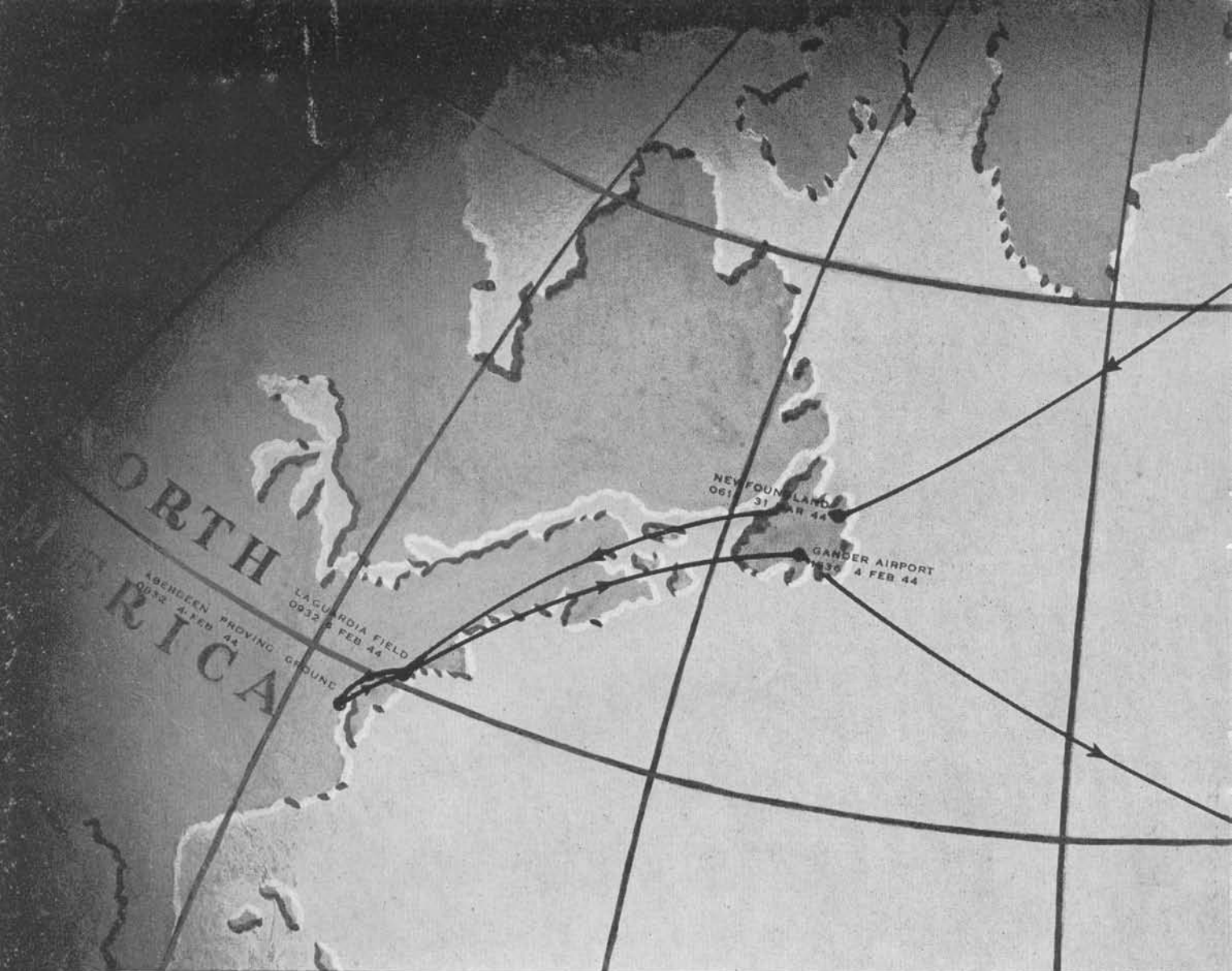
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## INTRODUCTION

The Secretary of War directed the formation of the New Weapons Board on 17 January 1944, by letter order AGO 210.31 (29 Jan 44) PO-A. Colonel George G. Eddy, Ordnance Department, Director of the Ordnance Research Center, Aberdeen Proving Ground, was named chairman of the Board, and seven other officers were selected to represent Army Air Forces, Army Ground Forces, Chemical Warfare Service, Corps of Engineers, and Ordnance Department. The Board was directed to gather such technical information and new equipment as it deemed necessary and to proceed as soon as possible to the North African and European theaters of operations. The mission of the Board was fourfold:

1. Disseminate among the theaters information concerning successful solutions to problems encountered in the theaters.
2. Obtain advice concerning the performance and suitability of standard weapons and equipment now in use in the theaters and assist in on-the-spot corrections of defects.
3. Introduce and demonstrate in the theaters new standard weapons and equipment which





are available but are not in the theaters and new items which may be available within the next 8 months; and further, to assist in the determination of requirements for the various items if a need exists.

4. Assist in increasing the effective use of weapons and equipment now in the theaters.

A great deal of help from the personnel and facilities of Aberdeen Proving Ground and the full cooperation of War Department personnel in expediting the preparation and shipment of more than two hundred different items of new equipment made it possible for the eight Board members to leave Aberdeen for North Africa on 4 February 1944 in a C-54A airplane with 6,000 lb. of equipment. Two captains and four sergeants, all from Aberdeen, left shortly thereafter by ship with 250 tons of equipment for the ETO demonstration only.

The personal interest of the theater commanders and their staffs in both NATO and ETO made it possible for the Board to put on its demonstrations with a minimum of time for preparation and to contact military personnel of all ranks in accomplishing the other phases of the mission. This was particularly helpful in Italy. The week spent with the Fifth Army was most

productive of information on the tactical employment, virtues, and weaknesses of our existing weapons. Officers from front-line units attended the demonstration at the Fifth Army Advance Command Post. They were very helpful in giving freely and frankly their opinions on the value of the weapons demonstrated.

As this report indicates, American troops are, in general, highly satisfied with their weapons and equipment. At the same time, they are wide awake to tactical advantages inherent in new types of weapons and improved models of standard equipment. They are also very willing to accept technical advice on methods of increasing the effectiveness of existing weapons.

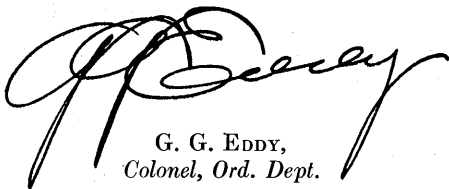
Sources of information made available to the Board were as broad as possible. The personnel consulted ranged in rank from the troops assigned to work on the preparation and execution of the demonstrations (many of whom had extensive combat service) to the top commanders, including General Eisenhower, General Devers, and General Clark, and their immediate staffs. General Eisenhower gave the Board his time on four different occasions.

The large number of new weapons and equipment requisitioned constitutes significant evidence of the attitude in the theaters towards newly developed weapons. A study of this list (see chapter 3 and appendix I) reveals the trend which further new developments should take if we are to be in step with the thinking in NATO and ETO.

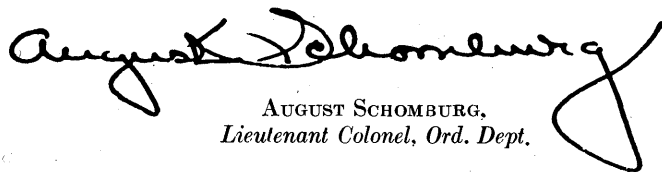
Members of the Board are most grateful to the Air Transport Command, which provided a C-54A airplane and crew for the entire trip from the United States to North Africa, Italy, and back through North Africa to England. Major Donald Hurst and his crew were very efficient and helpful. A full measure of thanks is also due to many military and civilian personnel at Aberdeen Proving Ground who assisted in the preparation of this report.

It is hoped that the work and experience of the Board will be implemented in three ways:

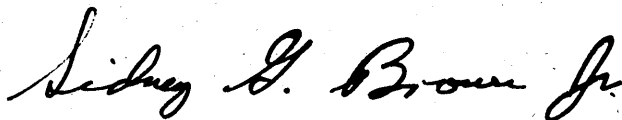
1. The requirements submitted by the two theaters will be filled promptly.
2. The recommendations expressed in this report will be implemented.
3. The rather detailed observations in this report will serve as a guide to the technical services and others concerned with future developments.



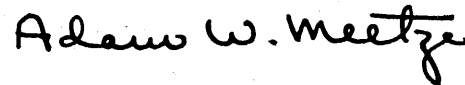
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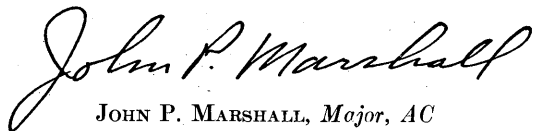
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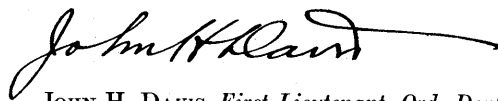
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## **Chapter I**

### **CONCLUSIONS AND RECOMMENDATIONS**

#### **1. General**

- a. In general all weapons and equipment are performing extremely well.
- b. There should be no let-down in research and development work.
- c. The technical services of the Army Service Forces are making every effort to get closer to the problems of combat.
- d. Aerial bombing cannot take the place of artillery against point targets.
- e. The percentage of highly resistant targets confronting our troops is increasing rapidly.
- f. The clearance of mine fields and of offshore mine fields and obstacles still presents serious problems. Additional work is required.
- g. Development of means of breaching heavy concrete obstacles and massive masonry walls should be continued.
- h. There is a serious problem involved in getting tanks, combat vehicles, and trucks over rubble resulting from destruction of resistant targets. Additional work is required.
- i. Modifications or changes in present equipment are not desired unless they improve battle efficiency materially.
- j. Liaison aircraft for spotting and observing artillery fire have become practically indispensable.
- k. German development trends are progressive. Many newly developed German weapons are being encountered in Italy.
- l. There should be a progressive increase in fire power, such as 90-mm guns in the T20-series tanks, and 155-mm guns and howitzers, 8" howitzers, and 90-mm and 105-mm guns in self-propelled mounts. German armament is not static.
- m. Further development of the weapons and equipment now in the hands of troops is practicable and desirable.
- n. All weapons, equipment, and ammunition should be waterproof where practicable.
- o. Regardless of the range provided in our artillery weapons, there always will be a demand for greater range.
- p. Tanks and heavy equipment should be able to cross water obstacles without the aid of bridges. Additional work is indicated.
- q. There is a definite need for larger numbers of low-speed tractors in all theaters.
- r. There is a great demand for technical data on terminal ballistics. A handbook on this subject should be provided at an early date.

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s. Further development of the potentialities of the weapons and equipment now in the hands of troops is practicable and desirable. Some of the steps that may be taken to accomplish this objective are:

- (1) Stress first- and second-echelon maintenance.
- (2) Send training teams to theaters with new equipment when it is issued.
- (3) Provide troops with adequate technical information concerning weapons and equipment. Greater use of pamphlets such as the one on anticoncrete weapons is indicated.
- (4) Inasmuch as the organic equipment of all organizations is not always sufficient or adequate for the task, there is a need for a pool of equipment in each theater to meet special conditions and for adequate Class IV procurement by technical services.
- (5) Modification work orders which materially improve battle efficiency should be applied more promptly.
- (6) Vital information concerning uses of equipment in combat should be made available for distribution to other theaters more promptly.
- (7) It is highly essential that technical groups of not more than three persons be sent to the theaters to establish direct contact with the troops, in order that they may advise troops fully regarding their equipment.
- (8) There should be continued studies of special subjects such as jungle warfare, assault of beaches, and airborne artillery.
- (9) Calibration teams for artillery should be provided.

### 2. Army Air Forces

a. Opinion is unanimous that the combat performance, general operational characteristics, and mechanical structure of present-production airplanes are basically satisfactory.

b. The design of the bomb bays in airplanes controls the size of the bombs which have to be carried in order to obtain maximum tonnage. This problem requires study, as maximum tonnage does not always provide for the right type of bomb for a specific target.

c. The modification of new airplanes should be accomplished in the United States in so far as possible.

d. The interchange of technical information between the theater and development and production agencies in the United States should be expedited.

### 3. Chemical Warfare Service

a. The new barrel and baseplate of the 4.2" chemical mortar will better stand the strain imposed by firing at maximum range.

b. The M4 HE projectile was well liked, although, owing to the terrain encountered in Italy, it was felt that the longer range of the M3 HE projectile would be more suitable there in most missions.

c. There is a desire for a fuze which will allow the 4.2" projectile to go through small tree branches near the muzzle without detonating.

d. The portable flame thrower, E3, was well liked, although it was felt it should be more sturdy.

e. Numerous requests were made for a flame-thrower fuel that could easily be made up in the field and would not be affected by climatic conditions.

## CONCLUSIONS AND RECOMMENDATIONS

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- f. The Army Air Forces definitely need the AN-M50X-A3 explosive incendiary bomb for use against industrial targets.
- g. A 1,000-lb. smoke bomb capable of sustaining a smoke screen for 1 hour or more is desired.
- h. Smoke munitions must not flare or burn on ignition.
- i. The M2 mechanical smoke generator will not only supplement the M1 generators now in the theaters but, owing to its portability, can also be used on separate smoke missions.
- j. The assault-type gas mask should be immediately provided for all assault troops. (Action has been taken.)

### 4. Corps of Engineers

- a. Engineer officers in ETO and NATO reported that engineer equipment, with but few exceptions, was satisfactory for field use. There is a great shortage of engineer equipment in both theaters. The principal shortages are in D7 bulldozers, Brockway 6-ton treadway bridge trucks, and 5-kw. generators.
- b. Complete interchangeability of parts between the U. S. and British Bailey bridges is essential.
- c. The development and supply of adequate means of clearing mine fields should be prosecuted vigorously.
- d. Nonmetallic-mine detectors are urgently required for detecting antitank mines and small antipersonnel mines.
- e. The present standard Signal Corps SCR-625 portable mine detector requires protection from shocks received while being transported.
- f. A medium tank fitted with belt conveyors and other attachments for exploding mines with specially shaped charges, of the design proposed by NATO, should be analyzed and supplied to theaters if considered practical.
- g. The construction of the 3,000-gal. canvas water tank requires improvement.
- h. Water-tank trucks and semitrailers should be provided for use by water supply companies.
- i. Portable shower units are required for special issue to organizations.
- j. The winches on the Brockway 6-ton treadway bridge trucks of recent manufacture are provided with cast-iron sliding clutch members which break under less than rated load and thus greatly limit the tactical use of the vehicle. Some of these trucks have been received in the theater without winch assemblies.
- k. A large air bubble forms in the liquid of the lensatic compass and interferes with readings. The Infantry and Field Artillery desire that all lensatic compasses be graduated in mils as well as degrees.
- l. The glass on the wrist compass warps and prevents turning of the dial.
- m. Fire trucks and other fire-fighting equipment are apparently receiving inadequate inspection at the factories or depots. Much equipment has been received in damaged condition owing to improper packing.
- n. The 3-kva. and 5-kw. electric lighting equipment sets should be changed to provide two-conductor cables and extension leads with weatherproof connections instead of present single-conductor wire, porcelain insulators, etc.
- o. Adequate lighting should be provided for command posts.
- p. There was a great deal of enthusiasm for the tank-mounted bulldozer.

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### 5. Ordnance

In general, all ordnance items are performing satisfactorily.

**a. Small arms.**—(1) Opinion is divided in the North African theater as to the value of the carbine.

(2) Little interest was shown in carbine bayonets.

(3) The new adjustable rear sight for the carbine is in great demand and should replace existing sights in the field as rapidly as possible.

(4) Ruptured cartridge case extractors should be furnished antiaircraft troops in ETO.

(5) Body armor is in great demand for personnel engaged in clearing mine fields.

**b. Artillery.**—(1) A number of 8" guns are badly needed in Italy.

(2) A complete line of mortars, covering ranges up to 10,000 yd., should be provided.

(3) Increased range and flatter trajectory are required in the 105-mm howitzer.

(4) All artillery pieces in the Italian theater are being used at maximum range 90 percent of the time.

(5) Spare gun tubes should be procured in proportion to ammunition and should be made available to the theaters in the same manner.

(6) Sighting equipment on antiaircraft weapons provided for defense against low-flying planes is unsatisfactory and should be improved immediately.

(7) The European theater prefers the British antiaircraft "Stiffkey stick" to the M7 computing sight (Weiss).

(8) Antiaircraft artillery is being used against ground targets in the Italian theater. The day of supply of ammunition for this weapon should therefore be reconsidered.

(9) There is a need for 20-power observation telescopes.

**c. Rockets.**—(1) Action should be taken to increase the confidence of using personnel in the 2.36" rocket launcher and rocket.

(2) A standard face shield should be developed and issued with each 2.36" rocket launcher.

(3) The ability of the 2.36" rocket to withstand considerable moisture should be investigated.

(4) The 4.5" rocket launcher, T30, for aircraft has excited great interest. There are also substantial requirements for the T27 and T34 launchers for ground use.

(5) Rocket launchers for amphibious operations are urgently required. The fire power of the 8-tube T27E1 launcher should be increased by putting additional layers of tubes on top of the existing layer as desired.

(6) A series of rockets covering a range of 10,000 yd. should be developed.

(7) The German 15-cm rocket, commonly called the "Screaming Meemi," has greatly impressed our troops in Italy. Its distinctive sound has a demoralizing effect.

**d. Ammunition.**—(1) Close attention should be paid to the study of ammunition and its effect on the target and the range required to obtain desired results on specific targets.

(2) White phosphorus shell with ballistics identical to the HE are desired in calibers from 75 mm up.

(3) High-explosive ammunition with spotting smoke is needed in all calibers from 75 mm up.

(4) Illuminating shell are required for 105-mm and 155-mm weapons.

(5) High-velocity rounds are required for the 3" and 90-mm guns. The velocity should be between 3,400 and 4,000 ft. per sec.

(6) The concrete-piercing T105 fuze was very enthusiastically received in both theaters.

## CONCLUSIONS AND RECOMMENDATIONS

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(7) Fuze delay times should be studied further. There is a requirement for a fuze with automatic delay for use against resistant targets.

(8) There is a desire for 75-sec. time fuzes for use in all calibers where time of flight of the projectile is approximately 75 sec.

(9) Spare fuzes of all types should be issued to field artillery units in order that maximum effectiveness may be obtained from ammunition.

(10) The study of prematures of the M51 fuze should be continued.

(11) A hand fuze setter similar to the T37E1 should be developed for the M67 mechanical time fuze.

(12) The percentage of duds in German artillery ammunition is high.

(13) Quantities of ammunition far in excess of those anticipated are being expended in Italy.

(14) Velocity calibration teams, with equipment, should be furnished to ETO and NATO. There is an urgent need for such service in ETO in connection with sorting stocks of 105-mm ammunition.

**e. Automotive.**—(1) The medium tanks of the M4 series are well liked by the using personnel. There are, however, a number of components, such as tracks, suspension, and armament, that should be given immediate attention to improve combat efficiency. Light-weight steel tracks with chevron-type tread are required for all tanks.

(2) The medium tank, M4E6, was extremely well liked, as there is an overwhelming demand for 76-mm guns in M4 tanks.

(3) Light tanks of the M5 series are mechanically satisfactory but are subject to the same basic deficiencies as the medium tanks, M4.

(4) The 75-mm howitzer motor carriage, M8, is being used for about the same type of work as the light tanks, and the observation cited in the preceding paragraph applies almost equally to this vehicle.

(5) Using forces prefer the light armored car, M8, or the utility armored car, M20, to earlier wheeled reconnaissance vehicles but feel that the vehicles have definite disadvantages in this type of work and that a possible modification in the basic design of the light tank would provide a more satisfactory vehicle.

(6) The 105-mm howitzer motor carriage, M7, is widely used, but there is considerable opinion that the weapon is not accurate in this installation and that there is a requirement for a more satisfactory 105-mm howitzer motor carriage.

(7) In both theaters, and particularly in the Italian combat zone, there is a great demand for a self-propelled artillery mount similar to the 155-mm gun motor carriage, M12, but using the M1 gun. There is also an increasing demand for self-propelled mounts for the 155-mm howitzer.

(8) The 3" gun motor carriage, M10, is very well liked by forces using it, and they do not want to replace it with the 76-mm gun motor carriage, T70. It is desired, however, that some 90-mm gun motor carriages similar to the T71 be issued to units that are now using M10's.

(9) It was generally stated by officers who viewed the 76-mm gun motor carriage, T70, that it did not offer many advantages over the M10.

(10) Officers of combat units stated that introduction of M4A3 medium tanks into the units now using M4 or M4A1 tanks would be highly undesirable and that these vehicles should be brought to the theater and introduced by battalion replacement.

(11) To increase fire power of medium tanks and M10's, the British Armored Corps is preparing to install the 17-pdr. gun in these vehicles in large numbers.

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(12) The using troops want fire-control equipment in tanks which will provide for direct and indirect fire of great accuracy, but they desire that it be extremely simple to operate. They also desire that range finders be furnished tank companies in an approximate allowance of one per platoon.

(13) The U. S. forces did not indicate any requirement for the light tank, T9E1, although the British Army indicated that it may be used as a supplementary infantry assault weapon.

(14) The medium tractor, M4, is not liked as a prime mover. The units prefer one 7½-ton 6 x 6 prime mover truck with a medium tractor, M1, similar to the D7, per battery.

(15) Almost every officer who viewed the M4 and M5 medium tractors could see no requirement for two vehicles so similar in their characteristics.

(16) The extended end connectors for tank tracks will be wanted in quantity, as the using units believe that they will be of great value.

(17) There were a number of questions asked as to the progress of the heavy tanks of the M6 series and whether or not they would be sent to ETO.

(18) The light cargo carrier, M29, was enthusiastically received.

(19) Half-track vehicles are in considerable use as personnel and cargo carriers but could be readily replaced in most instances by 2½-ton 6 x 6 trucks. The half-track vehicles are not liked for use as gun motor carriages.

(20) The ¼-ton 4 x 4 truck is considered extremely satisfactory, and the only change desired is the addition of a 12-volt electrical system.

(21) The ¼-ton 4 x 4 amphibian truck is not liked, and there is very little application for it.

(22) The ¾-ton 4 x 4 command reconnaissance truck is not liked as well as the ¼-ton 4 x 4; however, this vehicle is giving satisfactory service.

(23) The ¾-ton 4 x 4 weapon carrier truck is considered too small for the average work which it is called upon to perform.

(24) The 1½-ton 4 x 4 cargo truck is giving very satisfactory service.

(25) The 1½-ton 6 x 6 cargo and personnel trucks are well liked by units that are using them in place of the ¾-ton 4 x 4 weapon carrier trucks, but no units would prefer them to the 2½-ton 6 x 6 cargo trucks.

(26) The 2½-ton 6 x 6 cargo truck is the most satisfactory cargo vehicle in use in all sections visited. The large prime movers are giving satisfactory service, but there is great preference for the 7½-ton 6 x 6 (Mack).

(27) The ¼-ton 4 x 4 trucks are preferred in every case to motorcycles, which are desired only for police work.

(28) It was generally believed that the Galanot-Watson traction devices will be desirable on the 6 x 6 trucks to which they are applicable.

(29) The 2½-ton 6 x 6 amphibian truck, DUKW, is considered satisfactory for landing operations but has a number of minor mechanical deficiencies which increase maintenance considerably.

(30) Amphibian tractors of the LVT type are not as well liked as the DUKW, because they do not handle as well in the water and require more maintenance.

(31) It was generally agreed that mounting rocket launchers on the DUKW and the LVT would be of great assistance in landing operations, as would mounting the 105-mm howitzer in firing position on the DUKW.

(32) Waterproofing on the M4-series medium tanks must be altered so that the rocket launcher, T34, can be fired straight ahead from landing craft.



## CONCLUSIONS AND RECOMMENDATIONS

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(33) There is intense interest in any type of mechanical mine-field clearing device. Tests will be made with the T1E1 and T1E3. Mine exploders considered the most satisfactory by the British are the Canadian Indestructible Roller, the Dynamic Petard, the Flying Dustbin, and the Crab, using counterweighted rotor-support arms.

(34) The skid pans now available for the 105-mm and 155-mm howitzers were liked by reviewing officers.

(35) Copies of modification work orders are being received satisfactorily in ETO and are being applied to vehicles when kits are available. Practically no modification kits are being received in NATO, and the using units have no idea of what the available modifications are.

(36) The standard 2½-ton 6 x 6 combination cargo and dump trucks have proved satisfactory except for the deficiencies in both the Heil and the Garwood hoist assemblies. The Heil hoists are fitted with keys in the body and hoist arm hinge pins, which slip out and are lost in service with resultant damage to the hoist and body. Both types of hoist have an excessive leakage of hydraulic cylinder oil at the hoist cylinder-head oil seal.

(37) Combat experience in Italy indicates that the majority of disabling hits on tanks are on the differential and final-drive housings; it is therefore very important that the supplementary armor for these components be made available at once.

### 6. Quartermaster Corps

a. Complaints were received in Italy that clothing is not warm or water repellent enough and that replacement is not sufficient.

b. The new map cases, heavy-duty wire cutters, and pack boards were popular in both theaters. The popularity of the wading trousers was not universal.

## **Chapter 2**

### **SPECIAL TOPICS**

#### **7. Demonstrations**

a. In all, the Board conducted five demonstrations throughout both theaters. Two demonstrations were held at Lion Mountain, Oran, North Africa, one at the Advance Command Post of the Fifth Army in Italy, and two at West Downs in England. The three demonstrations held in the North African theater included approximately 6,000 lb. of new weapons and equipment, which accompanied the Board by air. The two demonstrations in England included approximately 250 tons of equipment, which was shipped by water. All the items which were exhibited and demonstrated are listed by theater in appendix II.

b. All the demonstrations were well attended by senior officers of both theaters. A list of the key officers who witnessed the demonstrations is included in appendix III.

c. After the last demonstration in the United Kingdom, all new weapons and equipment were turned over to their respective services and were statically exhibited at various depots in the Southern Base Section for approximately 2 weeks. This procedure was followed in order that officers who could not attend the demonstrations might see the new items.

#### **8. Information From Other Theaters**

At each location visited, the Board disseminated information from other theaters at every opportunity. Generally this was initially accomplished at conferences and was followed up at meetings with individuals from time to time. An example of the procedure which was followed initially in the United Kingdom to introduce this subject is shown in appendix IV.

#### **9. Requirements**

The requirements in both theaters were established after the new weapons and equipment were demonstrated. Initial requirements were submitted by combat units and were augmented by theater services for theater levels, maintenance, and replacement. No promises were made by the Board that items could be supplied in the numbers requested or by any certain date. Tentative availability and production figures were made available by the Board in both theaters for planning purposes. The requisition procedure was explained and assistance was given by the Board in establishing requirements wherever possible. The requirements of both theaters are covered in chapter 3, and are shown by item in appendix I.

## **SPECIAL TOPICS**

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### **10. Technical Literature**

Special technical literature was assembled by the Board for distribution in both theaters. This information, which was in the form of reports and pamphlets, was left with service chiefs for distribution throughout the theaters at their discretion. Avid interest was developed, and repeated requests for more information were received.

### **11. Research and Development for Combat**

a. Interest was displayed throughout both theaters in future weapons and equipment development. Some anxiety was expressed that a reduction of development work might be favored in the United States in anticipation of the war ending or in the belief that new developments could no longer reach the theaters in time to be of assistance. Combat units are definitely in favor of continued development and research. The Board cannot recommend too strongly the necessity for continued research and development work.

b. This report contains but a few of the many combat problems requiring research and development work. The prompt solution of these problems will contribute materially not only to winning this war but to winning it with fewer casualties.

### **12. Service Board Composition**

It was the consensus that service boards should include in their membership officers who have seen actual combat service. By actually observing combat conditions, the Board discovered requirements and deficiencies which apparently were unknown in the United States and many ideas of Board members were altered. It is believed that officers who have not seen active combat service cannot possibly know or fully realize exactly what is needed in the theater of operations. It is believed, therefore, that service boards should not only include officers who have had actual combat experience but that there should be a reasonable turn-over so that officers who are familiar with recent situations will always be present.

### **13. Technical Information**

The Board observed a lack of current technical information throughout both theaters. It is possible that the information which appeared to be missing was present somewhere in the theaters, but if present at all it had not been disseminated. Examples of such technical information included the recent modifications of the 2.36" rocket launcher and the 2.36" rocket, M6A1; technical information on the M67 mechanical time fuze; proper fuze setting for various types of resistant and nonresistant targets, etc. It is believed that critical technical information can be more quickly disseminated throughout the theaters by small, highly qualified teams than by any other method.

### **14. Introduction of a New Weapon or Item of Equipment**

When a weapon or item of equipment which is substantially new in any major respect is introduced into a theater of operations, it should be accompanied by a team of highly qualified personnel. It was evident to the Board that in the past some items had been shipped to theaters without the benefit of this assistance. It is believed that the suggested procedure is necessary for safety and that it will aid materially in the rapid and proper employment of the item.

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### 15. Technical Teams

a. The effectiveness of our weapons and equipment can be materially improved. It will be noted throughout this report that this point is receiving serious consideration and is foremost in the minds of many officers. In accomplishing this objective, the help of the technical services is essential. A great deal has been accomplished by the technical services along this line, but much remains to be done. The quickest and best way of assisting combat troops is to send small groups from each service to visit troops for the purpose of discussing the weapons and equipment, answering the thousand and one questions, and informing troops regarding the capabilities of the weapons and equipment. The use of technical teams should be supplemented by the continued publication of technical pamphlets such as those already published on jungle warfare, new weapons, the effect of AP shot against concrete, the effect of standard ammunition with the T105 CP fuze against concrete, etc.

b. Equipment must never be oversold to combat troops. To do so is to invite disaster. Combat troops must always be informed of the limitations of the equipment as well as its potentialities. Troops are eager for this information. It is not a reflection on the equipment and is not so viewed by troops. Many of the criticisms of weapons and equipment are due to the fact that troops have been led to expect too much of them. For the morale of troops, it is far better to have the equipment exceed their expectations than to have it fall short of them. The use of technical teams with troops will go a long way toward solving this difficulty.

c. The presence of technical teams in a theater instills confidence in equipment and in the War Department. This is especially true if teams are present prior to an engagement. Like a football team, troops are trained to an edge for combat. They are a little nervous. The presence of technical experts is extremely comforting. The experts can answer many questions and confirm action taken with respect to technical matters, and this sustains confidence and assures the most effective use of weapons and equipment. The mere presence of teams in the theaters indicates the great interest of the War Department in the problems and success of the troops. Many remarks to this effect were made to members of the Board.

d. The use of technical teams in theaters assures rapid response to combat requirements by the technical services and the entire ASF organization. The use of such teams provides a direct and rapid means of gathering accurate, detailed technical information on the use and behavior of weapons and equipment so essential if these services are to be of greatest help to combat troops. Trends in enemy weapons and equipment and trends in our own research and development can be more quickly evaluated. Technical teams can be of inestimable service to theater and army commanders.

### 16. Mines and Obstacles

Mine fields, antipersonnel mines, and obstacles constitute a major weapon of defense that presents very difficult problems for solution. Although progress has been made in approaching an adequate solution, there is still a lot of work to be done. Time is of the greatest importance in the clearance of mine fields. The best mechanical exploder developed to date appears to be the roller type T1E3 developed by the Ordnance Department. The best one developed by the British appears to be the Canadian Indestructible Roller. It is believed that a more adequate solution lies in the use of explosives. There are several promising developments under way. Every known means of clearing mine fields should be exploited. All research and development work along this line should be given high priority.

### 17. Breaching Concrete and Massive Masonry

In order to attain certain objectives on the continent of Europe, it will often be necessary to breach massive concrete and masonry walls and fortifications. We must be able to do this promptly. The development of the T105 CP nose fuze will contribute materially to the breaching of such targets. Some of the explosive methods developed by the Corps of Engineers will also be of great value. Time is of the essence in breaching fortifications. Direct fire from calibers of 6" and up is required as well as close-in use of explosive charges developed for the purpose. In landing operations against such obstacles a tremendous concentration of fire power will probably be required. This will require the use of naval gunfire, aerial bombardment, fire from landing craft, tanks, and self-propelled mounts, and placed charges where necessary. No stone should be left unturned in developing methods of breaching such objectives.

### 18. Passage Through Rubble

There is a serious problem presented in getting tanks, combat vehicles, and trucks through rubble resulting from destruction of concrete and masonry targets. The tank dozer developed by the Corps of Engineers for use on the M4 series of tanks should be of great value for such work. In many cases there will be a precipitous drop on the back side of these walls that will be difficult to cross. The British have developed a bridge with about a 40' span to be carried on the front of a tank and dropped in place. Thought should be given to the development of means for rapid passage of tanks, combat vehicles, trucks, and troops through such obstacles.

### 19. Airborne Artillery

a. Airborne troops require greater fire power through the use of artillery such as 105-mm howitzers, 155-mm howitzers, 90-mm antitank guns, etc. Considerable work has been done by the Army Air Forces and the Army Service Forces to develop ways and means of transporting these weapons and their prime movers by air. General Borden furnished the Board copies of the report on this subject. The question was taken up immediately with the various officers in ETO concerned with decisions on such matters. General Bull, G-3, SHAEF, was interested and said that he was trying to set up a section to handle and expedite action on this subject. Considerable discussion with other officers, including Air Marshal Sir Leigh Mallory, resulted in the following reactions to the proposal:

- (1) What airplanes will be made available and in what quantity?
- (2) There are no artillery units equipped with 105-mm and 155-mm howitzers available to airborne troops.
- (3) Such airborne artillery could not be taken in during the first phase of a landing or until landing facilities and locations were adequately secured.
- (4) Where airborne troops were tied in closely in support of a landing operation such artillery was unnecessary and probably could not be taken in.

b. It would appear desirable to prosecute the development of artillery units for this purpose in the United States.

### 20. Rockets

There is a tremendous demand for rockets for air and ground use. Wherever the Board went there was evident interest in the subject. Both theaters established requirements that

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probably cannot be met this year. The demand is of such magnitude and has developed so suddenly that it is difficult to attain desired production peaks in plane attachments, tube clusters, and rockets in so short a period of time. However, a good percentage of the requirement can probably be met. The air and ground requirements are based on use in landing operations and on air-to-ground use against hangars, airplanes, boats, personnel, oil tanks, etc. There is a requirement for a series of rockets of different sizes to cover ranges to 10,000 yd. There is under development a 7.2" rocket that will go a long way toward meeting these requirements. The standard 4.5" rocket is excellent.

### **21. Mortars**

a. There is a substantial requirement for a line of mortars to cover ranges to 10,000 yd. Combat troops in Italy and in the Pacific are tremendously impressed by the value of accurate mortar fire. General Devers confirmed the value of mortars. Mortars are more accurate than rockets and offer an excellent means of countering German rocket launchers such as the Nebelwerfer.

b. The use of mortars is of great importance in fighting over the type of terrain encountered in Italy. Mortars also offer an opportunity to obtain accurate fire power in many instances where artillery cannot be employed. The emphasis on range shifts with terrain. In the southwest and south Pacific the emphasis is on accurate fire at the shorter ranges. In Italy the emphasis is on accurate fire at the longer ranges.

c. The history of this war in all theaters indicates the great value of the mortars. One of the outstanding weapons of the war in all theaters is the 4.2" mortar. A complete line of mortars is under development. This development should be pushed to a rapid conclusion in order that mortars may be available to troops at the earliest possible date.

### **22. Artillery—Wheeled and Self-propelled**

a. Artillery has come into its own and will play an ever-increasing role during the war. American artillery in action is magnificent, devastating, and thoroughly hated by the Germans. The technique of fire employed by American artillerymen is outstanding, and the results attained are a great tribute to the excellence of our shell design and the uniformity of fuze action.

b. There is a great variety of targets presented, and as the emphasis shifts from one type to another a change in the method of employment of the artillery is necessary. The emphasis is now swinging to the more resistant types of targets. In many instances this necessitates moving the artillery closer to the target and employing direct fire with the larger calibers. Thus emphasis is thrown on the self-propelled mount. Many officers who formerly opposed self-propelled mounts are now heartily in favor of them. It is essential that self-propelled mounts be provided as soon as possible for the 105-mm and 155-mm howitzers, the 155-mm gun, M1, the 8" howitzer, and the 90-mm gun. Production has started on some 90-mm guns on the gun motor carriage, T71. O.C.M. items have been processed on pilots for some of the other calibers.

c. It is not suggested that all artillery be replaced by self-propelled mounts. The need for larger numbers of the 240-mm howitzer and 8" gun is urgent. These guns complete the line of mobile artillery required and are absolutely essential.

d. It is also essential, where practicable, to increase the range of the various artillery items. It should be possible to cover all ranges to 40,000 yd. with the weapons now available. The full

potentialities of the weapons now in use must be exploited. It is understood that the Ordnance Department has already done some work along this line.

e. Owing to the high rate of ammunition expenditure and the rapidity of fire, ever-increasing numbers of replacement tubes are required. It may be possible to increase the accuracy life of tubes by chromium plating, by using double rotating bands, by using skirt-type rotating bands, by cooling and sealing the tubes by injecting some liquid ahead of the projectile, or by some other means that might be devised by research and development work. If this is possible, it will result in a material reduction in the number of spare tubes required. Some work has already been done on the 37-mm gun and the cal. .50 aircraft machine gun.

### **23. Tanks**

Combat troops have definite ideas as to what improvements should be incorporated in tank design. First, the Board inquired as to what they considered the most important features in a tank. The replies were unanimous: the gun was of first consideration; second came dependability; third—whatever armor they could get after the first two requirements were met; fourth—nothing was to be introduced in stowage or otherwise that would interfere in any way with carrying the maximum amount of ammunition. With respect to the gun for the medium tank, they demand larger caliber and higher velocity. The T25 and T26 tanks with the 90-mm gun meet the requirement for more gun power, as does the M4 tank with the 76-mm gun. With respect to ammunition, they want nothing to interfere with ready rounds and they are willing to forego watered ammunition containers if this additional protection involves reducing the number of rounds of ammunition that can be carried. The M4 tank is good and is well liked by everyone. However, the fact that the M4 is the outstanding tank of the war to date should not deter us from giving them a better one, especially when a tremendous improvement in battle efficiency may be attained.

### **24. Weapons for Assault of Beaches**

It was gratifying to note the progress that has been made in ETO in developing the use of weapons for landing operations. Although considerable progress has been made in the United States and in the theaters in providing fire power for landing operations, much remains to be done. The work done in the United States in developing floating tanks and gun motor carriages is outstanding. A few of these devices have been furnished ETO and arrived the day the Board left. The outstanding characteristic of these devices is that the guns may be used during the landing operation. The M4 tank gun with its stabilizer is one of the most accurate weapons for this purpose. Full opportunity is being utilized to fire self-propelled and tank guns from landing craft. Rocket ships developed by the British and those of our Navy provide a lot of fire power on the beaches. The addition of the self-propelled mounts recommended in this report will materially increase fire power in landing operations. This type of operation affords an outstanding use for all tanks and self-propelled mounts. Standard artillery is difficult to use and materially slows up unloading unless it can be fired from the traveling position. The Navy was contacted in Italy and England. It is wide awake to the situation and is making every effort to provide the required fire power. During landing operations naval and aerial bombardment of obstacles and offshore mine areas is essential. These types of bombardment will extend to landing areas on the beaches.

### **25. Flame Throwers**

The flame thrower is an excellent weapon for offensive use. The new portable one-man-operated flame thrower of the CWS met with instant acceptance. It is desirable that work be continued to obtain a more versatile fuel. Flame-throwing equipment for tanks is required, but it must not necessitate reduction in the fire power of the tank. Work on developing longer range flame-thrower installations for tanks is essential.

### **26. Combat Engineer Equipment**

The combat engineers have done one of the outstanding jobs of the war. They are in the thick of every battle, and their skillful accomplishment of difficult engineering feats in record time has materially contributed to the successful and rapid attainment of many objectives. Every effort should be made to equip them with as much protective equipment as possible. A great deal has already been done along this line by the Corps of Engineers. Armored cabs for tractors and bulldozers are being provided as well as several types of armored vehicles for use in laying culverts and accomplishing many other engineer jobs under fire. Body armor should be provided as requisitioned for use by personnel in clearing mine fields and booby traps, operating bulldozers, etc. This equipment should be of great assistance in reducing casualties and in enabling the men to do more work.



## **Chapter 3**

### **REQUIREMENTS**

#### **Section I**

#### **PROCEDURE**

##### **27. Scope**

a. One of the main responsibilities of the Board was to procure from the European and North African theaters requirements for new weapons and equipment. No guaranty of delivery or delivery dates was made at any time. It was explained in both theaters that the availability of items in the theaters would depend on production, distribution, decisions of the combined chiefs of staff, and the shipment priority demanded by the theater. One point made absolutely clear, however, was that all information on the established requirements would be expedited to the theaters. The theaters were told that this information would include availability and shipping dates and that if items were not available the theater would be notified immediately. **This latter point is most important, as in many instances plans for future operations involve many of the items requisitioned.**

b. No attempt is made in the following discussion to cover all new weapons and equipment of the Board or all the items requisitioned. Only the outstanding items are mentioned. Detailed information is contained in appendix I.

##### **28. Requisitioning**

The requisitioning procedure was established by a conference in Washington prior to the departure of the Board. It was determined at that time that all requisitions would be submitted in a normal manner by both theaters. This procedure would insure prompter delivery than any special procedure. To assure prompt handling during shipment, and identification of the items upon arrival in the theaters, special marking was to be assigned. This latter procedure is normal. Two copies of the requisitions were to be retained by the Board for delivery direct to Brigadier General William A. Borden, Special Assistant to the Director, Plans and Operations, for expediting and follow-up.

##### **29. Determining Requirements**

The Board assisted the theaters in determining requirements as follows:

a. All new weapons and equipment were exhibited, demonstrated, and discussed.

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b. A number of conferences were held in both theaters for the purpose of discussing new weapons and equipment. At these conferences the advantages and disadvantages of the weapons and equipment were presented and the requirements from other theaters were mentioned. The theaters were promised that they would be fully informed as to the progress of their requisitions and that they would be notified immediately whenever items were not available.

c. Tentative availability figures were discussed for information of both theaters.

d. The correct administrative procedure for requesting the items was given the theaters at various conferences and meetings.

### 30. Limitations

Since none of the weapons or equipment exhibited by the Board were available for lend-lease, only the requirements for the U. S. forces were determined. All the requirements which were submitted by both theaters are in addition to those previously requested by the theaters by requisition or cable. There is no duplication.

### 31. Differences

The attitude of the two theaters toward the Board's new weapons and equipment varied. This difference in requirements may be attributed to two causes. First, the battle experience in the North African theater has developed certain specific needs which are not anticipated by the European theater, and the future operations in both theaters vary in many respects. Second, the European theater is currently concerned with completing the equipage of its organizations with present standard equipment. This would naturally detract, to a certain extent, from any requirements for new weapons and equipment. The result is that several new items were requested by the North African theater which were not desired by the European theater.

## Section II

### ARMY AIR FORCES

#### 32. Army Air Forces Supply

a. Since the Army Air Forces supply system is generally separate from the Army Service Forces, no effort was made by the Board in either theater to bring back Army Air Forces requisitions. In many cases, cables or requisitions had already been submitted or were being submitted through Army Air Forces channels as a result of the Board's work. The requirements for fragmentation bombs and butterfly bombs for both the Eighth and Ninth Air Forces were as follows:

REQUIREMENT FOR FRAGMENTATION BOMBS

	M1	T8	T4E1	M81	M4
April.....	281,450	1,897	3,792	3,145	3,240
May.....	276,930	2,192	7,351	3,590	6,495
June.....	217,410	3,280	33,696	5,395	58,320
July.....	*347,9910	3,850	32,716	4,580	58,320

\*When quantities in this column cannot be met, fill with items in succeeding columns, and if a balance remains fill with 100-lb. bombs.

## REQUIREMENTS

### REQUIREMENT FOR BUTTERFLY BOMBS

(Ninth Air Force only)\*

	T10	T11
April . . . . .	12,000	18,000 immediately
May . . . . .	18,000	10,000 per month thereafter
June . . . . .	18,000	
July-Dec . . . .	36,000 per month	

b. All Army Ground Force items required by the air forces are included as ground force items in the requirements discussed in this chapter and in appendix I.

### Section III

#### CHEMICAL WARFARE SERVICE

##### 33. Items Requisitioned

a. One ordnance item, the M29 cargo carrier, was enthusiastically received by the Chemical Warfare Service in the European theater. A requisition for 119 of these vehicles is included in the ordnance requisitions to fill requirements for fully equipping one chemical battalion. The 4.2" chemical mortars of this battalion will be transported on M29 cargo carriers.

b. One of the most popular chemical warfare items in both theaters is the M2 smoke generator. The 316 generators shown in appendix I as being requisitioned by the European theater are in addition to the 300 requested by that theater by cable on 18 March 1944.

c. The portable flame thrower, E3, was well received in both theaters, and substantial requisitions were obtained.

d. The assault gas mask was popular in both theaters. The number requisitioned by the European theater is in addition to the 1,200 previously requisitioned.

##### 34. Items Not Requisitioned

Other chemical warfare items for which a demand exists in the European theater but which are not included in the Board's requisitions are as follows:

a. **Pot, smoke (HC), M5.**—Direct arrangements have been completed for the shipment of 974,000 smoke pots, M5. These smoke pots will take the place of 500,000 British generators, smoke, #24, which had been previously requested from the British.

b. **Pot, smoke (HC), M1 (E13).**—It is desired that this item be furnished automatically as availability permits in lieu of the present M1.

c. **Pot, smoke, floating (HC), M4A1.**—It is desired that this item be furnished automatically as availability permits in lieu of the present M4.

d. **Grenade, M18.**—This item is desired in lieu of the M16 grenade when available.

e. **Mortar, chemical, 4.2", M2A1.**—This item is desired in lieu of the present M1A1. One hundred and ninety-two mortars will be needed for replacement and maintenance.

\*Eighth Air Force coordinating with A-3 before submitting requirements.

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**f. Shell, HE, 4.2" chemical mortar, M4.**—Ten to fifteen percent of all shell shipped to the European theater should be of this type.

**g. Fuze, P.D., delay, T89.**—Thirty percent of all fuzes on HE shell shipped to the European theater are to be of this type. The European theater has requested 15,000 in addition to the balance of the theater's stocks. Only a small number of these fuzes is desired in the North African theater, as the opinion there is that the instantaneous fuze will give equal casualty effect without loss of effect due to high bursts.

### Section IV

#### CORPS OF ENGINEERS

##### 35. Items Not Requisitioned

Many of the new Corps of Engineers items of equipment which are desired were not requisitioned, as it was expected in both theaters that these items would be supplied automatically in lieu of all old items now on requisition. Such items include:

- a. Balk, steel, articulated type.
- b. Block, TNT, 1-lb.
- c. Boat, assault, M-3.
- d. Boat, reconnaissance, pneumatic, canvas, 2-man (or 5-man if adopted).
- e. Crimper, cap, M-2.
- f. Firing device, pull type, friction, T-2.

##### 36. Items Requisitioned

The European theater requisition generally covers the present requirements of that theater for engineer equipment presented by the Board. It is expected, however, that after further consideration NATO will submit requisitions for additional items. Many engineer items were requested with the full realization that the number desired was far in excess of those available according to production and availability schedules in possession of the Board.

**a. Bulldozer, tank mounting.**—The bulldozer for mounting on medium tanks was the outstanding item in the European theater. This theater desired 360 of these dozers in addition to any that have already been requested. General Eisenhower expressed a personal interest in this item. The theater requested that these items be issued complete with tanks, as it was felt that tanks for the bulldozers would not be available from combat units. It was stated that troops are available for the operation of these vehicles. The North African theater did not submit a requirement on this item, as it had been previously requested.

**b. Carpet-roll torpedo.**—The European theater submitted a sizable requisition for carpet-roll torpedoes. At the time this requirement was established, the unfavorable report of the Engineer Board was discussed and the disadvantages and dangers of this item were emphasized. In spite of this discussion, 600 of these items were requested. The size of the primacord nets was to be determined in the United States.

**c. Detonator, concussion.**—The delay of the salt tablet in the concussion detonators requisitioned by ETO also is to be determined by the War Department.

## REQUIREMENTS

**d. Lighter, fuse, weatherproof, M-2.**—The European theater requested that 50,000 of the total requisition of weatherproof fuse lighters, M-2, be shipped to the theater as early as possible. It was further requested that the shipment of set No. 1, metallizing equipment, be expedited to insure delivery by 15 May 1944.

### 37. Items Previously Requisitioned

a. The following items were not requisitioned by the European theater in the total number desired, as the total number desired, or a part thereof, had been previously requested.

- (1) Block, demolition, M-3.
- (2) Bridge, floating, treadway, steel, M-2.
- (3) Cab, tractor, armored, Caterpillar, D7.
- (4) Concertina, wire roll.
- (5) Demolition equipment, set No. 5, individual.
- (6) Detonator, 15-second delay, M-1.
- (7) Heater, asphalt, trailer mounted, 3 car, 42 hp.
- (8) Lighter, fuse, weatherproof, M-2.
- (9) Body armor.
- (10) Snake, demolition, M-2.

b. The North African theater did not submit requisitions for armored tractor cabs or for the snake, demolition, M-2, as these items had been requested previously.

### 38. Water Tank

No requirements were established for the 700-gal. skid-mounted steel water tank. It was considered that the present standard 700-gal. water-tank truck is superior owing to lower combination gross weight and more satisfactory use offered by the special equipment design. The tank trucks now in the theater are in continuous use and are giving excellent service.

## Section V

### ORDNANCE

#### 39. Small Arms

a. **Gun, submachine, cal. .45, M3.**—This item was immediately popular, as would be expected, and was accepted as a timely answer to the German Schmeiser. A requisition was taken from NATO but not from ETO, as it is appearing there automatically.

b. **Gun, machine, cal. .30, Browning, M1919A6, flexible.**—This weapon was received with enthusiasm, and a substantial requisition was obtained from NATO. The European theater did not place a requisition, as this item had already been requested by cable and repeated requests have been made to expedite shipment.

c. **Grenade launchers.**—The rifle and carbine grenade launchers were well liked and were requisitioned wherever they were not being supplied automatically. In some cases where launchers had already been supplied, the supply procedure was not always correct. Some launchers were received without cartridges and others were received without instructions and range

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tables. These errors should be corrected in future issue. The new rifle grenade launcher sight, T59, was requisitioned on the basis of one for every launcher in both theaters.

**d. Body armor.**—This item was requisitioned for use in engineer combat battalions by bulldozer operators and mine-field clearance personnel.

**e. Fastener, strap, quick-release, for infantry helmet.**—Even though no proof was available that serious injuries have resulted from blast effect on infantry helmets which were securely fastened under the chin, a substantial requisition was submitted for the new quick-release fastener. Both theaters expected to equip every infantry helmet with this item, and extra quick-release fasteners, on the basis of one for each helmet for every 3 months through July 1944, have been requested as replacements by ETO.

### 40. Artillery and Fire Control

**a. Mechanism, firing, T4E2, with adapters.**—If requirements are met, every separate-loading cannon in both theaters will be equipped with the new T4E2 firing mechanism and the new cone-valve primer will replace the present standard primer.

**b. Kit, skid pan, for 105-mm howitzer, M2, and 155-mm howitzer, M1.**—The European theater desired to equip all its 105-mm howitzers, M2, and 155-mm howitzers, M1, with skid pans.

**c. Setter, fuze, hand, T37E1.**—The T37E1 hand fuze setter was universally desired.

**d. Mortar, 60-mm, with firing mechanism, T18E6, and baseplate.**—The lightness and versatility of the new 60-mm mortar firing mechanism and baseplate were appreciated, and this mortar is preferred to the present standard weapon.

**e. Extension tube, T1, for 81-mm mortar.**—The extension tube for the 81-mm mortar was found to be most welcome because of the desire to obtain longer mortar ranges. The filling of this requirement will undoubtedly be simple, as many of these extensions are now on hand. However, special effort will be required to supply the new increments which are necessary for additional range, and considerable thought should be given to the manner in which the extension and increments are issued.

**f. Periscope, M4A1.**—This item was requested by NATO in order that its modification might be expedited. The European theater desires that all new combat vehicles be equipped with this new type of periscope. No requisition was submitted by ETO, however, as the feeling was that this item would come through in due time as a modification work order.

**g. Finder, range, M9.**—A real need exists for this new range finder. It was requisitioned by NATO but not by ETO, as it is being currently supplied there.

### 41. Rockets and Launchers

**a. Rocket, HE, 4.5", M8.**—This rocket is desired in appreciable numbers for both ground and air use and has been requested especially for use in the coming amphibious operations. The number of these rockets requisitioned is for a theater level. Replacements will be requisitioned based on expenditure.

**b. Rocket, HE, 7.2", T16.**—This rocket is also desired and will be used as expected against highly resistant concrete targets. The number of these rockets requisitioned is for a theater level. Replacements will be requisitioned based on expenditure.

## REQUIREMENTS

c. **Rocket, smoke, WP, 2.36", T26.**—Presentation of this rocket was made at the right time, as white phosphorus in all forms of ammunition is now popular.

d. **Launcher, rocket, 2.36", M9.**—The European theater did not requisition this item, as it had already been requested by cable and information had been received that it would be shipped automatically when available.

e. **Multiple rocket launchers, T34, T27, and T40.**—As would be expected, these were most popular, in the order listed, and will, if the requirements are filled, undoubtedly play a most important role in future operations.

f. **Launcher, rocket, 4.5", 3-tube, AC, T30.**—This launcher is desired in both theaters in large numbers. Captain Wiedman, of Eglin Field, is visiting both theaters at this time and is demonstrating and giving instruction in the mounting and use of the T30 launchers and rockets which were taken to both theaters by the mission.

### 42. Ammunition

a. **Fuze, nose, CP, T105.**—The appearance of this fuze in both theaters was timely, as the destruction of highly resistant concrete targets is and will continue to be a most serious problem. The North African theater requested shipment of the initial issue of these fuzes by air. The European theater requested delivery of the first shipment by fast water transportation.

b. **Cartridges, API, cal. .30 and cal. .50.**—This ammunition is desired in place of all armor-piercing and incendiary cartridges. This ammunition was most popular and is desired for ground use as well as the previously established use by aircraft. It was favored by the using troops because of its effectiveness and by the ordnance service because it eliminates one ammunition item.

c. **Cartridges, tracer, night, cal. .30 and cal. .50.**—The European theater requested this item as a replacement for the present tracer ammunition. This item is desired because it is believed that its dim igniter will not reveal the weapon from which it is fired as easily as regular tracer ammunition.

d. **Shell, fixed, HE, 57-mm, T18.**—This item has been desired by both theaters for some time. A requisition for a substantial quantity was obtained from NATO. The European theater did not requisition this item, as a cabled request had already been submitted on 21 February 1944.

e. **Mines, antitank, nonmetallic, heavy and light, and antipersonnel.**—A demand has existed for all these mines in both theaters. The North African theater requested substantial quantities. The European theater did not submit a requisition, as these mines had been requested by cable on 24 February 1944.

f. **Rifle grenades.**—The colored smoke and white phosphorus rifle grenades were extremely popular in both theaters, and substantial requirements were established. Here again, white phosphorus made a timely appearance. The European theater requirements for these grenades do not appear in appendix I, since the theater felt that their need was so urgent that it should be cabled rather than placed on requisition. The European theater requirement was, therefore, established by cable on 21 March 1944. All possible haste in supply of these grenades has been requested by the theater.

g. **Shell, smoke, WP, 60-mm, T6.**—This item was immediately popular, as were all the other white phosphorus ammunition items.

h. **Primer, 19".**—The 19" primer was enthusiastically received. It does not appear on the requirements taken by the Board, as it will appear automatically in ammunition in the theaters as it becomes available.

## REPORT OF THE NEW WEAPONS BOARD

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### 43. Automotive Equipment

a. **Tank, medium, M4E6.**—This vehicle was accorded the most enthusiastic reception of any vehicle shown. General Eisenhower and General Devers both expressed a high regard for it and desired that it be supplied in quantity. This vehicle does not appear on the requisitions made from either theater, because plans for its supply were under way prior to the arrival of the Board and in ETO the exact number desired had not yet been determined and was awaiting General Eisenhower's decision.

b. **Connector, extended end, for medium tank track.**—If the requisitions for the extended end connector are filled, most of the tanks in both theaters will be equipped with it. The need for this item is very obvious; both theaters were interested in it for the purpose of materially increasing the mobility of the medium tank, M4.

c. **Carrier, cargo, light, M29.**—The M29 cargo carrier was accorded a most enthusiastic reception, as the tactical commanders foresaw tremendous possibilities in the use of this flexible vehicle. Chemical Warfare Service also desires this vehicle for transporting 4.2" chemical mortars.

d. **Carriage, motor, 76-mm gun, T70.**—A requisition was not submitted by ETO, as it is not desired that this weapon replace any weapon now in that theater. The 3" gun motor carriage, M10, was found to be most popular in both theaters, and there is no desire to replace this item with the T70. It is anticipated, however, that units will come to the theaters equipped with the 76-mm gun motor carriage, T70. This procedure is desired, and the receipt of the 76-mm gun motor carriage in this manner will be most welcome.

e. **Tractors, medium, M4, and M5.**—Neither of these items was requested by ETO, as supply arrangements had already been completed. It should be noted that neither vehicle was particularly popular. This was especially true of the medium tractor, M5.

f. **Mine exploders.**—The problem of destroying mines is now of the greatest importance in both theaters. The European theater is not interested in the mine exploder, T1E1, but is interested in the mine exploder, T1E3. This exploder was not requisitioned, as arrangements for a shipment of 50 had been made prior to the arrival of the Board.

g. **Device, traction, Galanot-Watson.**—An unexpected demand for an appreciable quantity of these devices was received from the European theater.

### 44. Items Not Requisitioned by ETO

The following ordnance items, although popular in other theaters, were not requested by ETO. It was explained that a request was not made either because the current supply problem was still to be solved or because it was felt that the advantage of the item was not great enough to justify its addition to the long list of items yet to be supplied.

a. **Cartridge, grenade, auxiliary, M7 (T18).**—This item was enthusiastically received by NATO but is not desired in ETO.

b. **Bayonets, carbine.**—In both theaters little interest was shown in any carbine bayonet other than the knife, T8, which is a combination trench knife and carbine bayonet. This was requested by NATO.

c. **Canister.**—Little interest was shown in the newly developed canister, and no canister above 75 mm was requested.

d. **Sight, adjustable, rear, for carbine.**—The North African theater desires to substitute this sight for the sights on all carbines now in the theater. This desire to replace the present sight with the new sight was not apparent in ETO.



## REQUIREMENTS

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e. **Tank, light, T9E1.**—No demand for this combat vehicle by the American forces exists in the European theater.

f. **Knife, trench.**—With the exception of the T8 knife for NATO, no trench knives were requested by either theater, as trench knives are being currently supplied.

g. **Gun, 37-mm, T32, on mount, T9.**—This gun aroused only very limited interest, and the only request received was for a limited quantity for special use in the North African theater.

h. **Mortar, 81-mm, T24 (24½" tube).**—This item, although popular in other theaters and in the North African theater, was not desired by the European theater.

i. **Gun, 76-mm, T5E1 (antitank).**—This weapon was not desired for the European theater, and it was explained that a request for its issue would not be given until more exhaustive tests were completed by the Tank Destroyer Board.

j. **Mortar, 105-mm, T13.**—No demand for this mortar existed in either theater.

k. **Sight, computing, M7 (Weiss).** No demand for this item existed in either theater. It was unpopular because it is equipped with the small one-power telescopes. In the European theater, the British "Stiffkey stick" was much more popular.

l. **Kit for mounting 105-mm howitzer, M2A1, on DUKW.**—An immediate need for this item was recognized in the North African theater. It is possible that the feeling (which may be unfounded) that the DUKW is unstable in water when mounting the 105-mm howitzer is responsible for the lack of requirement in the European theater.

## Section VI

### QUARTERMASTER CORPS

#### 45. Popular Items

Only a few quartermaster items were exhibited. Every item displayed, however, met with instant popularity in one theater or the other. The most popular items were probably the case, map, canvas, roll type, and the 9" heavy-duty wire cutters.

#### 46. Clothing

The new clothing which was worn and exhibited by the Board was not requisitioned by either theater, because it was felt that these items would be made available in lieu of present standard items as soon as possible. Great enthusiasm was shown by everyone who saw the new clothing, and no adverse comments were made by personnel from the theaters. It should be noted, however, that the Board members found that the "inside-outside" shoes leak, even when well dubbined.

## Chapter 4

### CHEMICAL WARFARE SERVICE

#### 47. General

a. Troops of the Chemical Warfare Service were doing an excellent job in both the North African and European theaters of operation. The four chemical battalions in Italy have successfully accomplished their missions by providing increased fire power for assaulting troops and by destroying point targets. At the present time, two chemical battalions are at the Anzio beachhead. One chemical battalion is with the II Corps, and one chemical battalion is attached to a French corps. The Chemical Officer of the Fifth Army stated that at the Anzio beachhead a portion of a battalion went in with the Rangers on the first wave and within 15 minutes were 2 miles inland. Mortars were carried by the standard mortar cart. On several occasions, WP was fired behind the enemy troops in order to silhouette them and provide better targets for our infantry personnel.

b. It was learned that one battalion attached to the First Army is to be equipped with 119 cargo carriers, M29.

c. Service troops are keeping their equipment in good condition and, by exceeding their normal activities, are able to provide extra services for other personnel.

(1) In addition to its normal duties, one chemical processing company, commanded by Capt. O. L. Biddle, is using its T/E impregnating equipment to provide dry-cleaning facilities for the quartermaster. At the present time this company is dry-cleaning approximately 14,000 lb. of clothing per week in addition to impregnating approximately 22,000 lb. more. It is also manufacturing 1,700 gallons of ice cream per week for the local Red Cross, saving them approximately \$2,250. per week formerly paid to a local concern.

(2) One chemical processing company, commanded by Capt. C. B. Willis, Sr., is impregnating approximately 44,200 lb. of clothing per week.

(3) One chemical processing company, commanded by Lt. J. B. Parrott, is at present operating as a maintenance shop.

(4) One section of a chemical maintenance company, commanded by Lt. A. Notorangelo, is doing an excellent job manufacturing shock-absorber slides and forks for the 4.2" chemical mortar. It is also repairing baseplates and carts for the chemical battalions in Italy. Another section of this company, commanded by Lieutenant Arnold, is drying propellant charges and cleaning 4.2" shell. To date, the section has dried approximately 200,000 propellant charges and cleaned approximately 100,000 rounds of 4.2" ammunition.

### 48. Items Requiring Immediate Attention

**a. Smoke munitions.**—(1) It is necessary that all flare be eliminated from burning smoke munitions.

(2) There is a requirement for a large smoke bomb that will burn for at least 1 hour.

**b. Portable flame thrower.**—There is an urgent need for a flame-thrower fuel that is versatile, can be easily made up in the field, and is not affected by climatic conditions. The ignition system must be improved so that the cartridges will always ignite and the cartridge cylinder revolve after each shot. The stability and sturdiness of the flame thrower must be increased without increasing its weight.

**c. 4.2" chemical mortar.**—Continued effort must be made to increase the stability of the baseplate and to decrease its weight. A fuze that is stable while passing through small branches and brush is desired for the 4.2" projectile; also desired is a fuze that can be converted from delay to superquick by a simple adjustment.

**d. Miscellaneous.**—Assault-type gas masks should be furnished all assault troops. Technical and operating instructions must be included with all new equipment shipped to the theaters; if necessary, qualified teams of instructors should accompany the items.

### 49. Items Requiring Remedial Action

**a.** After making a survey of First Army units, the Chemical Officer of the First Army stated that the following remedial action on CWS equipment was needed.

(1) An assault mask is urgently needed and should be provided without delay. This should have top priority.

(2) Protective covers should be eliminated because of the length of time required to put them on.

(3) The 1½-qt. decontaminating apparatus should be discontinued in favor of a simple expendable container with a means of applying the agent.

(4) The 3-gal. decontaminating apparatus should be withdrawn from standard T/E's and held as a Class IV item in ASP's or depots. The valve mechanism should be given further study, because it is difficult to develop adequate pressure in this apparatus.

(5) A more effective packaging for the M4 decontaminating agent should be devised. In many instances, the inner container has been completely corroded.

(6) Spare-parts allowances should be studied carefully and acted on promptly. This applies particularly to units equipped with power-driven apparatus, mechanical smoke generators, and 4.2" chemical mortars. Spare-parts kits for gas masks should be given additional consideration.

(7) Eyeshields should be perforated at top and bottom edges to prevent fogging.

**b.** Lieutenant Colonel H. F. Groen, Chemical Officer of the Mediterranean Base Section, commented on the truck, crane, swinging boom, M1.

(1) **Defects.**—The performance of this truck did not come up to expectations. A great deal of maintenance was necessary, and its capacity proved unsatisfactory. The three sets of clutch plates and the gears operating the boom are made of metal, and no replacements are available. The universal gear on the power take-off is difficult to grease, causing excessive wear on the gear and making replacement necessary. The reducer-gear housing is not bolted to the frame and rises during operation. When this occurs, the housing touches the teeth of the traversing gear and breaks them. The traversing shear pin breaks during traverse even with moderate loads unless the truck is on level ground. The cable wears rapidly during normal operation. A

## REPORT OF THE NEW WEAPONS BOARD

support should be welded to the truck bed to prevent swinging and jerking of the boom and springing of the boom and cables. The boom is incorrectly braced, and as a result the boom cannot withstand stress and becomes twisted.

(2) **Recommended substitutions.**—The trailer, chemical service, M1, and the truck, crane, swinging boom, M1, should be omitted from the T/E of the Chemical Depot Company. They should be replaced by three tractors, crane, 2-ton, M3, with trailer, full, flat bed, 8-ton. By this substitution, and the addition of eight Clark fork lift trucks, the depot company could operate more efficiently.

### 50. Items of British Manufacture

a. The British have developed and are now producing the "Crocodile" flame thrower for the Churchill tank. A similar model for the Sherman tank is under development. The "Crocodile" flame thrower for the Churchill tank replaces the cal. .50 machine gun and operates in a ball-and-socket joint. The maximum range of the gun when using thickened fuel and a  $\frac{3}{4}$ " nozzle is 125 yd.; the effective range is 80 to 100 yd. The fuel burning time is 100 seconds. When a larger nozzle and thickened fuel are used, the effective range is increased. A trailer, which may be easily jettisoned, is connected to the rear of the tank; it holds two 480-gal. fuel tanks and five cylinders of nitrogen under 3,200-lb. pressure. The working pressure is 250–300 lb. per sq. in. The "Crocodile" gun for the Sherman tank is similar to this one except that the gun is installed on the right side of the tank in the aerial mount. The gun and the gunner's periscope are synchronized. The gun has a 90° traverse, 15° elevation, and 10° depression.

b. The British thickened fuel worked excellently in the E3 portable flame thrower and gave the equivalent range of a 6-percent NaPalm mix. The British thickened fuel is manufactured as follows: 4 lb. of aluminum stearate are mixed with 12 gal. (U. S.) of gasoline. This mixture is stirred continuously while being heated to a temperature of 45° C.; when this temperature is reached, 2 lb. of xlenol are added and the stirring is continued. The temperature is then raised to 50° C. The mixture is kept at this temperature for at least 30 minutes and is then allowed to cool. The chief disadvantage of the British thickened fuel, however, is that it must be manufactured in a plant which has the proper mixing and heating facilities. At the Petroleum Warfare Research Station at Horsham, development on the lifebuoy-type flame thrower is continuing with a view to developing a model having a maximum weight of 50 lb. and a fuel capacity of 4 gal. Cartridge-type ignition is used, the cartridge cylinder containing 10 cartridges, each burning for  $2\frac{1}{2}$  seconds. Information was received through officials at this station that, to date, all captured German flame throwers, both portable and mechanized, will not take thickened fuel.

c. At the Chemical Defense Experimental Station at Porton, examination was made of the British jet gun manufactured for the expulsion of thickened HCN. Using cordite for fuel, this gun has a range of approximately 35 yd. This gun may also be used with thickened fuel as a "one-shot" flame thrower and has a range of 60 to 75 yd. The gun can eject fuel for a period of 3 seconds and weighs approximately 33 lb. This weapon should be thoroughly studied for possible use in jungle warfare.

### 51. 4.2" Chemical Mortar

a. The 4.2" chemical mortar has proved an excellent weapon, increasing the fire power of assaulting troops and destroying point targets. The new M2 barrel and the M2A1 baseplate enable the mortar to give longer service at maximum-range firing.

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b. Owing to the nature of the terrain in Italy, the baseplate sinks 4" to 6" after the first few rounds have been fired. Rocks accumulate under the baseplate and are finally forced to the apex of the spade and the corners of the baseplate. Continued firing of the mortar splits the spade and the corners of the baseplate or breaks the baseplate down the center.

c. Colonel M. E. Barker, Chemical Officer of the Fifth Army, accumulated the following statistics indicating the number of rounds that may be fired from the 4.2" mortar before repair is needed on a specific part. These figures include battle losses as well as normal wear and tear.

PART	NO. ROUNDS FIRED
Baseplate.....	500
Barrel.....	2,500
Standard.....	3,000

Failures in the baseplates occur in the following sequence:

- (1) Hooks for the tie rods are the first to break.
- (2) Handles break off.
- (3) Corner of the baseplate splits.
- (4) Baseplate splits down the center.
- (5) Apex of the V-spade splits.
- (6) Fork breaks.

d. In a report dated 16 February 1944, Colonel Barker described the remedies that he applied to eliminate the failures enumerated in the preceding paragraph.

(1) "Make the hooks attached to the plate about 3" x 4" on top of the baseplate, and provide a similar support underneath the baseplate. Make the hooks out of good quality steel. This adds about 1 lb. of weight but cures the trouble."

(2) "Replace present bulky and heavy handles with simple inverted U-hooks of 1/2" steel bars passing through the steel of the baseplate. This simplifies the baseplate and reduces the weight where weight is useless. For hand carry, two poles can be run through the hand holds and the baseplate carried like a stretcher."

(3) and (4) "Insert a triangular steel bar under the bead across the rear of the baseplate and spotweld in place. Make steel form to fit the bead. This provides at least twice the inherent strength at the point of greatest weakness. The weight saved by removing the handles is more than enough to compensate for the weight added here."

(5) "The welding of the apex of the spade to be reinforced."

(6) "The fork be made stronger."

e. Under continued firing, the shock-absorber slide for the 4.2" chemical mortar has been found to be weak in two places.

(1) The slide corners, through which the spring guide rods pass, crack.

(2) The body groove of the shock-absorber slide is cut too close to the slide bore holes. A heavier shock-absorber slide has been designed by Colonel Barker and is now being manufactured by a chemical maintenance company in Capua. A Zerk fitting has been placed in the groove portion of the slide in order to eliminate friction. Colonel Barker's letter of 16 February 1944 lists the above two defects and describes the modified design.

(a) "The present shock-absorber slide breaks at two places, viz.:

1 "The corners of the slide through which the spring guide rods pass are too weak to stand the shock of firing when the recoil springs get weak. There are too many sharp corners which crack easily.

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2 "The groove in the body of the shock-absorber slide, which fits over the band of the mortar barrel, is cut too close to one set of holes for the slide bolts. Metal is scooped out in several places, with resultant sharp angles.

(b) "The modified design eliminates sharp angles throughout. The corners are tripled in size. The groove is cut half-way between the two sets of holes for the slide bolts. Approximately 2 lb. of metal have been added to strengthen the assembly at the weak points.

(c) "The first slide made according to this design has given good service for more than 2 months now. This slide survived the destruction of one mortar barrel by a Nebelwerfer shell and is now in service on a second barrel. Eight of these slides have been made so far, using the metal from salvaged slides slightly enriched by tin and aluminum. Slides are cast in a mold material developed at the Royal Italian Arsenal, Capua. Manufacture of these slide assemblies is progressing as rapidly as possible. At the present time, each slide costs 1,500 lire (\$15.00) to manufacture, plus the time of military personnel necessary to supervise this work."

### 52. 4.2" Ammunition

a. The M4 HE projectile was well liked in both theaters. It was felt, however, that the M3 HE projectile would be more suitable for most missions on Italian terrain because its lighter weight affords a greater range. The European theater desired that 10 to 15 percent of all 4.2" HE ammunition supplied be of the M4 type.

b. The T89 P.D. delay fuze was well liked and was considered a very efficient adjunct to the 4.2" HE ammunition for use on point targets. Numerous requests were received for a fuze that could be converted from delay to superquick, or vice versa, by a simple adjustment.

c. The E39 time and superquick fuze was desired only in a very small quantity by NATO, as it was the general consensus of both theaters that the instantaneous fuze would give practically the same casualty effect without the possibility of losing the effectiveness of the round in bursts which were too high.

d. The chemical officers of the Fifth Army and the Peninsular Base Section desired a waterproof covering for the propellant charge and ignition cartridge in the new packing, to prevent the charge and cartridge from accumulating moisture due to sweating. In one depot, a number of 4.2" shell were packed with a piece of corrugated paper between the shell and the top of the box. When the shell was stored in the open, the corrugated paper collected and held moisture, causing the ammunition to rust. The Chemical Officer of the Peninsular Base Section recommended that the unpainted portion of the 4.2" projectiles be given a light electroplating of copper or some other rust-resisting metal.

### 53. Flame Thrower, Portable, M2-2 (E3)

a. The E3 portable flame thrower was generally received with enthusiasm by both NATO and ETO. On several occasions, however, when the flame thrower was being fired, the cartridge failed to rotate; in addition, one cartridge failed to ignite a 6-percent NaPalm fuel in a 10-mile wind. It is recommended that flame-thrower operators be taught that it may be necessary to ignite several cartridges in order to ignite the fuel if a strong wind is blowing the flame away from the nozzle of the gun.

b. The small hole in the metal brace between the two fuel tanks should be centered so that the hole is directly in line with the socket of the pressure regulator.

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c. The air bottle should be easily replaceable so that additional bottles can be carried close to the front lines and the flame thrower reserviced without returning it to a rear echelon. Lieutenant Colonel T. H. Magness, of ETO, has devised an excellent apparatus for carrying additional flame-thrower fuel; it consists of a 5-gal. gasoline can attached to a pack board.

d. Solid brass eduction-tube plugs are now being furnished each flame thrower, and additional plugs are in the service kits. It is believed that a simple stamping could be substituted.

e. A number of complaints were heard concerning the lack of flexibility of NaPalm fuel. A flame-thrower fuel that can be mixed easily in the field is needed urgently. Using personnel should be able to vary the viscosity of the fuel by simply changing the proportions of issue gasoline and jell mix. Variable climatic conditions should not affect it adversely.

### 54. Smoke Munitions

a. The M18 grenades were well received by both NATO and ETO. It was stated that the colors obtained were the most vivid and distinct ever seen in a colored smoke munition. Only three colors were desired by NATO in this type of hand grenade.

b. The new M1 smoke pot with the screw-type lid, the M5 smoke pot, and the M4A1 floating smoke pot were also received with enthusiasm. The smoke pots demonstrated, however, had a tendency to flare. It is essential that this characteristic be eliminated.

### 55. Mask, Gas, Assault, Service

a. The assault-type gas mask was well liked and should be provided for all assault troops as soon as possible.

b. It is understood that the Atlantic Base Section Chemical Officer has returned approximately 100,000 M1XA1 canisters to the United States and has received orders to return an additional large quantity. A study should be made at once to determine whether the cost of returning these canisters to the United States does not exceed the value obtained by salvage in the theater.

### 56. Incendiary, Pocket, M1

Colonel M. E. Barker, Chemical Officer of the Fifth Army, suggested that the lower portion of the pocket incendiary fuze be threaded to fit the chemical hand grenades. He stated that night patrols, to designate targets, could use a colored smoke grenade with a pocket incendiary fuze attached to it; by inserting the correct time fuze, the night patrols could locate the targets for the following day.

### 57. 1½-quart Decontaminating Apparatus

Lieutenant Colonel H. F. Groen, Chemical Officer of the Mediterranean Base Section, suggested that this equipment be constructed in two parts—the decontaminating apparatus proper and a second section consisting of a container for the decontaminating fluid. The container for the fluid must be made of noncorrosive material and so constructed that, when necessary, the fluid can be poured immediately into the decontaminating apparatus. A number of critical comments were heard concerning this piece of apparatus; the corrosive effects of the fluid damaged tanks and trucks.

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### **58. Incendiary Bombs**

Major G. J. Crowther, Chemical Operations Officer of USSTAF, stated that approximately 4,000 tons of incendiary bombs were dropped on targets in Europe during March by our air forces. Approximately 75 percent of this total were M47 bombs filled with IM or NaPalm and 25 percent were AN-M50A2. AN-M50X-A3 bombs are urgently needed for use with the M50 bomb and AN-M50A2 incendiary bomb in the M17 aimable cluster against industrial targets. Major Crowther further stated that they do not particularly like the 500-lb. G.P. bomb filled with PT mix, inasmuch as they desire a large number of the smaller type for area bombing. For industrial targets, they need a small bomb that will penetrate at least 3" of concrete.

### **59. Sight, M59, for 4.2" C.M.**

The M59 sight for the 4.2" chemical mortar was well received by all concerned. It was recommended that the telescope portion of the sight should be in a horizontal position and should not protrude more than 1" over the top of the barrel. It was felt that the gunner exposed himself to enemy fire by straddling the barrel to align the mortar with the present right-angle telescope.

### **60. Generator, Smoke, Mechanical, M2, 50-gal.**

The M2 mechanical smoke generator was one of the best liked items. It was felt that this generator would not only supplement the M1 generator now in the theaters but, because of its portability, could also be used on separate smoke missions. Adequate spare parts must be included with all shipments of this item.

### **61. Chemical Grenade Projector**

The Chemical Officer of the Fifth Army has designed a projector for propelling chemical grenades for use in signaling or to clear trip wires from mine fields.

a. Chemical hand grenades are used for signaling by inserting the grenade, minus the firing mechanism, in the projector and propelling the grenade with a small powder charge ignited by an electric squib.

b. Trip wires may be cleared from mine fields by substituting for the chemical grenade a weight attached to a rope and pulling the weight back toward the operator after firing. Chemical grenades may be fired to a range of 200 yd., and the weight has a maximum range of 125 yd.



## Chapter 5

### CORPS OF ENGINEERS

#### 62. General

a. The suitability of standard equipment and the need for new development were discussed with officers of the engineer sections of AFHQ, NATO, ETO, SOS, base sections of NATO, First Army, Fifth Army, and VII Corps, and with commanders of five combat engineer units that had participated in operations in the North African theater. Engineer equipment and the equipment of other services used by engineer units were considered satisfactory with but few exceptions.

b. Items requiring immediate modification or improved construction are as follows:

(1) Fixed Bailey bridge of U. S. manufacture, to permit complete interchangeability with bridge of British manufacture.

(2) Carrying case for Signal Corps SCR-625 portable antitank mine detector, to reduce damage to detector due to shocks received in transport.

(3) Tank towing attachments for M-2 demolition snake, to provide adequate strength and control.

(4) 3,000-gal. canvas water tank, to prolong its life under field conditions.

(5) Sliding clutch member of Brockway 6-ton treadway bridge truck, to reduce breakage.

(6) Lensatic and wrist compasses, to eliminate air bubbles in the liquid and to prevent warping of the glass.

(7) Fire-fighting equipment, to insure that all accessories fit the major item and to improve the export packing.

(8) Electric lighting equipment, to provide two-conductor wiring assembly for rapid field installation.

(9) Cable for controlling blade of R4 tractors, to reduce breakage of wire strands.

(10) Armored cab for D7 tractor, to provide better all-around visibility.

c. Shortages of present standard equipment are of the gravest concern to both theaters. The principal shortages are in D7 tractors, 5-kw. generators, and Brockway bridge trucks.

d. Great losses in personnel and equipment from antitank and antipersonnel mines necessitate continued vigorous prosecution of development of equipment to detect these mines and render them harmless.

### 63. Bridging

a. The M-1 floating steel treadway bridge and the fixed Bailey bridge have been used extensively with great success in Italy. Twenty-one sets of 130" double-double Bailey bridges were used to erect 80 to 90 bridges between Salerno and the Volturno River. Steel treadway bridges are considered excellent assault bridges, although several were lost on rivers in flood. It is standing operating procedure to protect the standard flooring of Bailey and heavy ponton bridges with two 4' treads of 2" timbers; 300,000 board feet of 2" timbers was stocked in the Fifth Army Depot for this purpose in February.

b. Numerous fixed line-of-communication bridges have been constructed from local materials; an example is the two-way class 40 or one-way class 70 bridge constructed over the Volturno River at Capua. The bridge is 373' long and has a 23' clear roadway. Ninety-five percent of the material, including 6" channels for floor beams and built-up steel-girder stringers, was salvaged from local stock piles.

c. United States- and British-manufactured Bailey bridges are used in Italy; however, they are stocked separately in depots because all parts are not interchangeable. The bridge of U. S. manufacture is used only on direct order of the Fifth Army Engineer—and then only when it is expected that the bridge will not be taken up for re-use. The following modifications are recommended to improve the U. S. Bailey bridge and to permit interchangeability with the British-manufactured Bailey bridge:

- (1) Provide rustproof coating on all pins, bolts, and nuts.
- (2) Provide U. S. Bailey bridges which have already been procured or are now under procurement with British-designed baseplates, bearings, and jack shoes.
- (3) Eliminate all timber cribbage; timber sufficient to provide for required cribbing material is available in theaters.
- (4) Enlarge footwalk post sockets to fit British posts.
- (5) Supply wrenches to fit both British and U. S. bolt heads and nuts. A ratchet wrench with two sockets is preferable to an adjustable crescent wrench and should be investigated for that purpose.
- (6) Insure, by closer inspection, that tolerances of panel pins and pin holes are within specifications.

d. The operations of both theaters are based on the extensive use of the steel treadway bridge with the 130" clear roadway width for the M-2 type and the Bailey bridge with the 129" clear roadway width. Consideration should be given to these limitations before any vehicle which will not cross these bridges is adopted for procurement.

### 64. Mines and Mine-field Clearing

a. German antipersonnel and antitank mines are still causing large losses in personnel and equipment. The German Schu-mine, which has been put into use recently, is an effective obstacle to the infantry in Italy. This mine contains a 200-gram TNT block, and its metallic content is so small that it is practically undetectable when the SCR-625 detector is tuned to best reception. One engineer battalion was experimenting with an expedient to provide the individual soldier with a means of clearing a path through these mines. This expedient consisted of a fragmentation or demolition grenade or a 1½-lb. TNT block on a 30' length of primacord. It is tossed out, drawn straight, and detonated, leaving a path about 10" wide through the mines. The development of

such expedients and improved equipment for clearing metallic and nonmetallic antipersonnel and antitank mines should be prosecuted vigorously.

b. The standard Signal Corps SCR-625 portable antitank mine detector is easily damaged and rendered temporarily useless by shocks when it is transported to a mine field on trucks. Some units have experienced losses of 50 percent of the detectors carried from the bivouac area to the mine-field clearing site. The detector carrying case is fitted with brackets to hold various parts of the disassembled detector. These brackets are cushioned with only one layer of felt and are fastened to the sides of the case with wood screws, which pull out. This case should be redesigned to provide for fastening the brackets to the sides of the case by means of small bolts or rivets and to provide sponge-rubber cushioning. This is a Signal Corps responsibility.

c. The North African theater has experimented with a medium tank modified to clear mine fields by exploding specially shaped charges over the mines. The charges used in the first model detonated antitank mines successfully; however, the Engineer Section, Fifth Army Headquarters, believed that the method of dropping the charges could be improved and prepared a design utilizing a medium tank fitted with two belt conveyors. This design is in the Office of the Chief of Engineers. A pilot model of this design should be constructed and tested in the United States and, if it proves successful, procurement should be made for use in NATO and ETO.

d. The tank towing and pushing accessories for the M-2 demolition snake require modification to improve their use. The 6" iron-pipe double-swivel support welded to the rear part of the tank hull should be increased in diameter so that it may resist the stress applied when lifting the towing assembly. At least 75' of sash cord, in lieu of the present 60', should be provided in the kit. An easier method for the assistant tank driver to lift the towing assembly should be investigated.

### 65. Water Supply

a. The standard water-purification equipment has given excellent performance. The 3,000-gal. canvas water tank, however, required much maintenance under combat conditions in which a water distribution point would be changed on the average of once a day. Time could not be taken to provide a floor which would permit circulation of air under the tank. This tank should be improved by the use of heavier material and rivets with large heads and with large washers which will not pull through the canvas.

b. The lack of water-tank vehicles in the T/E for the Water Supply Company should be corrected. Sufficient water for hospitals and for laundries and to supplement portable units cannot be supplied by the use of 5-gal. water cans. An example of the use of water-tank transportation was a water supply company which had not been reorganized on the new T/O & E and was hauling water from a well at the Advance Command Post, Fifth Army Headquarters, with tank vehicles at the rate of 60,000 gal. per day. Engineer officers of both theaters stated that they cannot perform the engineer function of providing an adequate supply of water if the 700-gal. tank trucks and 1,500-gal. semitrailers are not procured and provided.

c. Portable shower units are required in large quantities in the theaters for special issue to organizations. The engineer portable eight-head shower unit demonstrated in ETO was considered satisfactory, and requirement for a large number was indicated. In order that critical wheels, bearings, and axles may be reserved for equipment that must be mobile, a portable shower unit should be supplied for such special issue in lieu of the trailer-mounted unit used by fumigation and bath organizations.

### 66. Treadway Bridge Trucks

a. There is a shortage of Brockway 6-ton treadway bridge trucks in NATO and ETO. As this is due to a lack of chassis production which has existed for many months, every effort should be made to expedite production to take care of the existing theater shortage and training requirements in the United States. The construction of the steel treadway bridge depends upon the use of this truck.

b. Many Brockway trucks have been received in the theaters without winch assemblies. This production problem must be corrected, as the winch is required in the tactical use of this truck.

c. The trucks of recent manufacture are equipped with winches which have a cast-iron sliding clutch member which breaks at less than the rated load. This deficiency should be corrected by supplying winches equipped with the type of sliding clutch member formerly provided.

d. Lack of spare parts for the Brockway bridge trucks causes deadlining and cannibalization, resulting in an increased shortage of trucks. The following is a list of organizational spare parts most frequently needed and unavailable at present:

- (1) Tires and tubes (12.00 x 20).
- (2) Starter assemblies.
- (3) Bendix drives and commutator brushes for starters.
- (4) Float-inflation hoses and connections.
- (5) Trailer connection hoses.
- (6) Lug wrenches.
- (7) Transfer-case covers. (This case cover should be made of heavier material, as an undue amount of breakage is being experienced.)
- (8) Differential assemblies.
- (9) Hydraulic piston and cylinder assemblies for boom mechanism.
- (10) Winch assemblies.
- (11) First-echelon kits.

### 67. Compasses

a. On many of the wrist compasses the glass has warped and prevented the compass dial from rotating.

b. The liquid-filled lensatic compass has been received with a large bubble in the liquid, which interferes with readings. The Infantry and the Field Artillery desire that the lensatic compass be graduated in mils as well as degrees.

### 68. Fire-fighting Equipment

a. The fire-fighting units in North Africa and Italy have been used extensively, and generally the equipment has been found satisfactory. Fire trucks and other fire-fighting equipment apparently have received inadequate inspection at the factories or depots; NATO has received equipment in which the accessories do not fit the major items. Much equipment has been received in damaged condition owing to improper packing.

b. The 4 x 4 truck chassis for the light fire truck is superior to the 4 x 2. A 2½-ton 6 x 6 chassis would be an improvement, as a standard chassis would simplify maintenance and increase mobility.

c. The carbon dioxide transfer kits which are now automatically issued will not completely fill the 15-lb. extinguishers from the 50-lb. cylinders. The first extinguisher is filled to approximately 95-percent capacity, the second to approximately 80-percent capacity, and the remainder of the gas is lost. Mechanical rechargers are required. The North African theater will have a requirement for the 2½-ton carbon dioxide container when it becomes available.

d. "Water hose," 2½" (single jacket with pipe threads and 25' length), is being shipped marked "fire hose" (double jacket with NST threads and 50' length); in some cases, 2½" hose with iron couplings (normally brass) is received with pipe threads rather than NST threads.

e. Shut-offs, 2½", are being received without barrels. Threads in the tip end of the 2½" shut-off should be 1½" NST; 1½" nozzles should have 1" HP thread on the tip end. In many cases, fog and spray nozzles will not fit the hose.

f. Pumps of several makes are being received with pipe threads instead of NST threads on the outlet side. Suction hose in some cases does not fit the suction connection on the pump. No suction hose is being shipped with the class 135 pumps. Only one standard pump of each size would reduce maintenance and spare-parts problems. Pumps on fire trucks are not being properly protected for shipment.

g. Equipment that is boxed and fastened to the truck is not being properly packed for shipment; much of it is received either broken, bent, or rusted beyond usefulness. Batteries for hand lamps are always in poor condition owing to improper packaging. Some brackets on trucks for ladders and other equipment have apparently been built for types of equipment other than that being shipped with the trucks.

h. If foam could be injected at the pump instead of at the nozzle, it would be more satisfactory from an operational standpoint. Powdered foam is more effective than liquid foam.

## 69. Electric Lighting Equipment

a. There is a shortage of electric lighting equipment sets in the theaters. This is apparently brought about by the additional requirements for hospitals and for special issue over and above T/E allowances for headquarters lighting. Gasoline lanterns and electric hand lanterns are inadequate for command-post lighting, and some other means is required. Field artillery fire-control centers and division, corps, and army headquarters require generator sets. They would also be desirable for certain regimental and battalion command posts but, owing to the shortage of generators, lighting equipment such as portable command-post lamps may suffice.

b. In order to increase their usefulness for field lighting, the present standard engineer 3-kva. and 5-kw. electric lighting equipment sets should be provided with an assembly of two-conductor cables and extension leads with weatherproof connections and lamp sockets in lieu of the present single-conductor wiring, porcelain insulators, etc.

## 70. Dozer-equipped Tractors

a. Both theaters require additional D7 tractors for almost all uses in lieu of the R4, D4, and D6 tractors. Every effort should be made to supply shortages in D7's. All tractors have given excellent service.

b. A deficiency was noted in some R4's in that the cable of recent issue for controlling the angle-dozer blade was having much greater than normal wire-strand breakage. It was suggested that this is due to issue of cable without fiber core.

### **71. Armored Cab for Tractors**

a. The requirement for the armored cab in the theaters is evidenced by the number already requisitioned.

b. The demonstration cab for the D7 was mounted on a tractor operated by a driver who had taken part in the operations of an engineer special brigade in North Africa and Sicily. After operating the tractor equipped with the armored cab, he stated that he could perform dozing operations as satisfactorily as with a tractor without a cab. When operating in close quarters with other vehicles nearby, however, his all-around vision was impaired and the efficiency of the bulldozing work was decreased. To increase the all-around visibility and still retain the protection offered by the cab, it is necessary that one extra vision port be placed in the rear of the cab to the right of the operator.

### **72. Armored Engineer Vehicle**

The armored engineer vehicle was discussed at great length with engineers in ETO. The practicability of using a medium tank for other than its primary purpose by modifying it into an armored engineer vehicle for a special purpose was questioned; however, since tanks may be available for special purposes, it was considered that development and test of such a vehicle should continue and that kits should be made available. The present effective range of approximately 60' to 80' for breaching reinforced concrete beach walls, tank obstacles, and fortifications was considered inadequate and should be doubled or tripled or, if possible, increased to approximately 300 yd. The bulldozer for tank mounting should not be included as a component of the kit but left as a separate item of issue.

### **73. Metallizing Equipment**

The very slight use made of a metallizing equipment set by an engineer heavy shop company in Italy indicates that the theaters receiving this equipment should be advised that only adequately trained personnel should be used for operating this set. If necessary, trained operators from the United States should be provided when sets are shipped to the theater.

### **74. Use of Local Resources and Manpower**

a. **Prisoners of war and civilians.**—Considerable use has been made of Italian prisoners of war and civilians in the North African theater. Italian prisoners of war are being organized into engineer general service regiments, engineer separate battalions, engineer dump truck companies, and engineer water supply companies. Italian prisoners of war and civilians have done excellent work in maintenance shops. Almost all engineer units under the base section in Italy are supplemented by Italian civilians.

b. **Local production.**—All Italian local resources for production of engineer materials and equipment are being utilized as rapidly as the facilities can be rebuilt.

(1) **Lumber.**—Production of the one forestry company is being supplemented with that of local mills in southern Italy. Total output is sufficient to permit shipping a surplus to North Africa. Most of the timber milled is green, and no attempt is made to kiln-dry it, as drying is considered unnecessary.

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(2) **Cement.**—A cement plant has just been placed in operation.

(3) **Gases.**—The one gas generation unit is supplemented by locally produced oxygen and acetylene. Italian plants have provided approximately nine times as much gas as that produced by the engineer unit. Carbon dioxide for all fire-fighting equipment in Italy is also produced locally.

(4) **Bridges.**—Production is to start soon on a 32' fabricated truss girder for use in fixed bridges. This will conserve lumber, ease transportation, and speed the construction of fixed bridges through the use of longer spans.

### **75. Bulldozer, Tank Mounting, for M4A1, M4A2, and M4A3 Tanks**

This item was well received in both theaters, as evidenced by the requirements submitted. It would have proved to be an invaluable item in the combat action in Cassino by removing debris to permit the entrance of armored vehicles. (See also par. 136.)

### **76. Changes in Engineer T/E's**

a. The Engineer, Fifth Army, submitted recommendations for changes in engineer T/E's for NATO. These are attached as appendix X. The Engineer, NATO, did not have an opportunity to review these recommendations but intends to forward them through channels with his comments. Since they are based on operations of the Fifth Army in Italy, these recommendations should be considered as a guide for future changes in T/E's of Army Ground Force engineer units. It should be noted that both D4 and D7 dozer-equipped tractors are recommended for issue to the engineer combat battalion. The light tractor is requested in addition to the heavy tractor for use in constructing jeep trails in mountainous terrain; the light tractor is more easily transported for use in assault bridging operations. The great use made of locally available road-surfacing materials and the need for the construction of pile bridges are evidenced by the recommendation for issue of rock-crushing and screening plants and pile-driving equipment to the light equipment company. The inadequacy of the SCR-593 radio for combat engineers is shown in the recommendations.

b. Engineers in Italy considered the Engineer Construction Battalion T/E satisfactory except that the inclusion of 8-cu.-yd. towed road scrapers was unnecessary. In addition to the scrapers organic with aviation engineers, only a few scrapers are necessary in an equipment pool in the theater, since earth construction activities consist mainly of reconstruction and maintenance rather than construction.

c. Another comment pertinent to the Construction Battalion T/E was voiced in NATO and should be given careful consideration. Experience gained in that theater has demonstrated that colored engineer soldiers are greatly inferior to white soldiers in the operation and maintenance of mechanical equipment. A problem arises, therefore, in the reorganization of colored separate battalions and general service regiments to the new Construction Battalion T/O & E, owing to the lesser capabilities of the colored soldier and the great amount of valuable and critical equipment authorized that battalion.

### **77. Vehicle, Tank Recovery, M31 (T2)**

An expedient engineer use of this vehicle was made in an operation in Italy. A combat engineer unit preparing a road for the advance of a tank group was confronted with the task

of repairing a culvert that had been demolished by the retreating Germans. A T2 tank recovery vehicle was used to place a prefabricated culvert in order to protect personnel from small-arms fire during that part of the operation. The use of such a vehicle in conjunction with a bulldozer-equipped tank may be an expedient which could be used successfully in future operations.

## **78. Technical Assistance**

**a. Publications.**—(1) It is essential that the distribution time for all technical information between the United States and the theater be reduced to a minimum. A check made on the receipt of technical manuals and field manuals distributed by the AGO to the Engineer Section of SOS Headquarters in NATO revealed that technical manuals have been received at periods of 8, 20, 85, and 92 days following initiation of distribution in Washington and that field manuals were received after periods of 40 and 51 days. It is to be noted that this section would be the first engineer organization in the theater to receive these publications through AGO.

(2) A need was indicated by the Engineer, AFHQ, for a periodic publication covering recently adopted items of engineer equipment and items under service test or development which would be available to the theater within 6 to 8 months. The major points of interest on equipment which should be included in such a publication are:

- (a) Proper nomenclature.
- (b) One or more photos.
- (c) Brief description with pertinent dimensions and other physical characteristics.
- (d) Availability or status of procurement.
- (e) Class of supply.
- (f) Indicated basis of issue.

(3) The publication prepared by Headquarters, Army Service Forces, which includes a few items of all technical services that have been recently adopted or are under development is not being received in the theaters in sufficient quantities to reach the engineer section of the theater in time to be of great value. When it is received, it does not remain in the office a sufficient length of time to allow a thorough review by more than one or two officers of the section.

**b. Personnel.**—(1) It is considered that the development and improvement of essential engineer equipment would be aided by the travel of officers of the Office of the Chief of Engineers and the Engineer Board to oversea theaters. This would make it possible for those officers directly concerned with development of certain types of equipment, such as bridging, mine-field clearing, water supply, fire fighting, construction, etc., to obtain valuable first-hand information essential to form a proper background for their work by:

(a) Observing the equipment for the first time as it is used tactically and discussing it with the using organization.

(b) Determining what equipment and modifications are actually essential after considering such theater use and the problems involved in development and procurement.

(c) Recognizing points which are of major importance in the theater but which are considered otherwise in the United States.

(2) Sending such officers to the theaters would offer the additional advantage of lending up-to-date technical assistance to the theater engineers, possibly at a time when it would be invaluable in the immediate planning of an operation.



## **Chapter 6**

### **GROUND FORCES**

#### **79. General**

a. The information contained in this chapter was gathered at the locations listed, during the times specified:

- (1) North Africa: 5-11 Feb 44; 19-24 Feb 44.
- (2) Italy: 12-18 Feb 44.
- (3) England: 25 Feb-25 Mar 44.

b. The items enumerated below were discussed with various officers, both on the staffs and with combat units. Except where specifically noted, all were in complete agreement and were evidently thinking along the same lines.

#### **80. Field Artillery**

a. The following comments and recommendations were made:

(1) In Italy, 8" guns are needed for counterbattery and precision long-range firing. In order to conserve as much time as possible, it was recommended that equipment for one 8" gun battalion be furnished the Fifth Army immediately to permit conversion of a 155-mm howitzer battalion and that one trained and equipped 8" gun battalion be furnished the theater as soon thereafter as practicable.

(2) In Italy it was stated that one calibrating team equipped with four photoelectric-cell counter chronographs is required per field army and per theater to calibrate guns in position in order to improve accuracy of fire and to conserve ammunition.

(3) In Italy, a radio meteorological section, with equipment, is required per observation battalion to improve accuracy and efficiency of fire

(4) There is an immediate requirement for 20-power observation telescopes for fire adjustment.

(5) M6 tractors are needed.

(6) A combination 75-sec. time-and-percussion fuze is required for certain firing missions.

(7) A smoke shell, WP filled, with the same ballistic properties as the HE shell is required for all calibers and is to be used for the following purposes:

(a) Long-range spotting, and spotting under conditions of poor visibility.

(b) Casualty effect.

(c) Screening, on rare occasions.

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(8) Although no immediate need for base-ejection HC smoke shells could be foreseen, the inclusion of 2 percent base-ejection HC was recommended to take care of possible future needs, the total smoke percentage to consist of 8 percent WP and 2 percent base-ejection HC.

**Note:** Recommendations varied from 10 percent WP with no base-ejection HC to 8 percent WP and 2 percent base-ejection HC.

(9) If spare tubes are supplied to theaters in proportion to the ammunition requisitioned, tubes can be changed at the proper intervals. In the past, considerable difficulty in obtaining tubes has been experienced.

(10) Owing to the fact that data is collected and computed all night, every night, each artillery battalion requires an electric generator of at least 1,500-watt capacity, complete with lighting system. Inclusion of this equipment in appropriate T/O & E's was strongly recommended.

(11) A flash-spotting instrument similar to the British instrument is needed.

(12) There is a definite requirement for a gun motor carriage mounting the 155-mm gun, M1, on the medium-tank chassis. The European theater can foresee no requirement at this time for any self-propelled guns other than those now standardized.

(13) A flash simulator is required for dummy gun positions.

(14) Complete data are required for all types of ammunition. This should include complete firing tables, terminal velocities at various ranges, bursting radius, pattern of burst, use of fuzes, etc.

(15) A satisfactory range-deflection fan (engineer equipment) with ranges to 18,500 and 25,000 yd., scale 1:25,000, should be developed and issued.

b. Air bombardment cannot be depended upon to destroy point targets near the front.

c. In many cases, considerable dispersion has been noticeable in 105-mm howitzer ammunition. It is understood that this is due to variations in manufacture of the projectile and will be corrected in future production. However, unless some method of segregation into ballistic lots is developed, the inaccuracy of the stocks of this ammunition on hand will continue to be a handicap for some time.

d. Liaison planes have been found extremely valuable. Losses have been low. White phosphorus smoke shells approximating the ballistics of the HE shells would further increase the effectiveness of the liaison plane.

### 81. Armored Vehicles

a. **Tank casualties.**—(1) The majority of tank casualties of one tank battalion during 3 weeks of continuous action at Cassino were caused by the German 75-mm PAK 40, SP, armored. During the same period, this battalion expended 350 tons of ammunition.

(2) Other casualties resulted from the following causes, listed in the order of their importance:

(a) Terrain difficulties. Recovery prevented by mud and enemy observation.

(b) Thrown tracks. Tanks were otherwise undamaged, but enemy fire and observation prevented repair for several days.

(c) Mines.

(d) German 50-mm antitank guns.

(e) German bazookas.

(f) German antitank rifle grenades.

(3) Many of the casualties can be repaired and eventually returned to duty.

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**b. Tank, medium, M4.**—(1) The M4 tank was well liked. No new type is desired unless the improvement in military characteristics is sufficient to warrant the change and defects in present standard tanks are avoided.

(2) A desire was expressed for the following improvements on the M4 tank:

(a) A gun similar to the 76-mm tank gun in the gun motor carriage, M10.

(b) Improved suspension and tracks.

(c) Armored air cleaners.

(d) Better ballistic angle around front of transmission housing.

(e) More power.

(f) Diesel engine.

(g) Better sights and fire-control equipment.

**c. 75-mm ammunition.**—In ammunition for 75-mm tank guns, stuck cases and separated rounds are encountered about twice in each 40 rounds when brass ammunition cases are used. These occur in spite of the fact that ammunition is not unboxed until actually stowed in the tank.

**d. Cartridge cases.**—Steel cartridge cases are proving more satisfactory than the brass cases for 75-mm tank gun ammunition. This is not true of the 105-mm howitzer ammunition.

**e. Smoke shell.**—A WP smoke shell with the same ballistic properties as the supercharged HE 75-mm shell is required. A smoke shell is also required for the 3" gun.

**f. Tank destroyers.**—Tank destroyers are widely used for long-range interdiction fire.

**g. 105-mm tank howitzer.**—Although there was considerable interest in the M4 tank with the 76-mm gun, there was very little interest in the 105-mm tank howitzer. It was thought that the tank howitzer would be inaccurate, since the howitzer motor carriage, M7, used as an assault gun with tank units in Italy, has proved to be inaccurate for direct fire compared to the tank gun. It is believed, however, that a combat test of the 105-mm tank howitzer with good ammunition will result in a requirement for a tank equipped with this weapon.

**h. Tank officer.**—Although a tank destroyer officer and an antiaircraft officer are included in the Artillery Section, Fifth Army, there is no provision for a tank officer. It is believed that a tank officer should also be included, particularly in view of the large number of separate tank battalions employed. (In the United Kingdom every army and higher headquarters now includes an armored section.)

**i. Liaison aircraft.**—It was recommended that a liaison airplane be made available to each tank battalion and tank destroyer battalion in combat. The mission of such a plane would be to locate enemy antitank guns, self-propelled guns, pill boxes, natural and artificial obstacles, friendly troops and installations, disabled tanks, etc. In many situations, a liaison plane would prove most valuable and would greatly increase the effectiveness of these units.

**j. 17-pdr. gun.**—The British are installing the 17-pdr. on a large number of gun motor carriages, M10, and on medium tanks. The installation on the M10 is simple and appears to be entirely practicable. However, the tank installation results in a very crowded turret and unfavorable radio stowage. It is believed that the muzzle flash, which requires lateral observation, and the occasional breech flash-back render the installation of the 17-pdr. undesirable in the tank.

**k. Tank tracks.**—Officers of the 2d Armored Division are particularly conscious of tank tracks, the entire division having been immobilized in Sicily because tracks wore out after 250 miles. The using troops prefer the light-weight steel track with the chevron tread (T54E1). In order to prevent undue damage to British roads, rubber tracks are preferred for training.

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**l. Ammunition stowage.**—There is no interest in further protection of ammunition if it would entail any decrease in the number of rounds carried. Ready racks in the turret are particularly desired, and the tank crews are extremely reluctant to give up the ready racks, even to increase safety.

**m. Carriage, motor, 76-mm gun, M18.**—Substitution of the M18 (T70) for the M10 in tank destroyer units overseas and already trained in the M10 is not desired. New units sent to the theater might well be equipped with the M18. Consideration is being given to substituting the T71 for the M10 in certain tank destroyer units.

**n. Radio.**—Signal Corps radio, SCR 528, was recommended for the tank recovery vehicle, M32 series. Earphones now issued are unsatisfactory. Headsets must be worn for extended periods of time; therefore, it is essential that they be comfortable and capable of being worn with various types of headgear.

**o. Tank company.**—(1) It was also recommended that further study be given to the organization of tank-company maintenance sections. The following specific recommendations were made:

(a) Increase the size of the headquarters-company maintenance section.

(b) Substitute the 2½-ton 6 x 6 truck for the half-track maintenance vehicle.

(c) Organize a recovery section separate from the repair section in order that recovery of disabled vehicles may proceed during darkness and repair be effected during the day.

(2) Tank companies each require a minimum of two ¼-ton trucks for liaison, communication, and control purposes.

(3) Although it is quite unlikely that tank units will be assigned specific missions of combating enemy tanks and antitank guns, tank-vs.-tank and tank-vs.-antitank combat is often brought about by enemy counterattacks and defense installations. Owing to this fact and the fact that an increasing number of armored pill boxes and fortifications are being encountered, more powerful tank armament is indicated.

### 82. Antiaircraft Artillery

**a.** Considerable interest was shown in the sight, computing, M7 (Weiss). However, great disappointment was expressed in the telescopes provided. The following characteristics are desired in the telescope:

(1) Single-power, cross-hair reticle.

(2) Wide field of view.

(3) A construction that will avoid the "black-out" now caused by slight lateral movement of the head.

**b.** The 90-mm antiaircraft gun is often used for ground firing, and more missions of that nature are anticipated. The following composition was recommended for the day of supply of ammunition:

AA.....65%

HE.....23%

WP.....10%

APC.....2%

**Note:** It is believed that the above proportion of WP to HE is unnecessarily high. A proportion of 28 percent HE and 5 percent WP appears reasonable.

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### 83. Infantry Weapons

a. A requirement was expressed for the range finder, M9, for issue to the antitank company and the heavy weapons company. A type with a shorter base (80-cm), if as sturdy as the M9, would be a satisfactory substitute.

b. Greater range is desired for the 81-mm mortar. A WP shell with the same ballistics as the light HE shell is required.

c. The carbine is not popular with the infantry units in Italy. The main reason for this is that the personnel authorized the carbine are subject to fire chiefly from snipers, against which the carbine is ineffective. No solution or suggestions for a substitute were offered.

d. A trench knife for personnel in the antitank company was suggested, inasmuch as there is none authorized in T/O & E's currently in use. One knife, T8, with attachment for fastening to carbine, per carbine and pistol was suggested.

e. The antitank company often has need of demolitions and occasionally has difficulty in obtaining them. It was recommended that three demolition equipment sets No. 5 be issued to each antitank company for reissue to mine platoons.

### 84. Bombs

The Fifth Army indicated a requirement for a smoke bomb of about 1,000 lb. capable of producing a screening smoke for about 1 to 2 hours.

### 85. Service Boards

It is generally believed desirable that personnel of service boards include a high percentage of officers who have had experience with combat units in the various theaters. It is believed that this policy would result in stressing those features of new equipment essential for successful combat and avoiding the present tendency to strive for an unattainable degree of perfection.

### 86. Summary

The following require immediate attention:

a. Study of 105-mm ammunition with a view to division into firing lots at the battery position.

b. Development, procurement, and issue of WP smoke shells of all calibers.

c. Application of all available tank modifications to improve fire control and accuracy.

d. Accelerated production of tanks with 76-mm guns at the expense of those with 75-mm guns.

## **Chapter 7**

### **ORDNANCE**

#### **Section I**

#### **GENERAL**

##### **87. Ordnance Service**

The outstanding service being rendered by ordnance units with the Fifth Army warrants special mention. The attitude of the ordnance establishment with the Fifth Army is not to stand on formalities or to look for a reason why a job cannot be done but rather to do any essential work at any time and place. These organizations do not wait for combat troops to bring in their weapons and equipment for maintenance or repair; instead, they pick up items right at the front and return them to the front after necessary maintenance and repair have been completed. As a result of this willingness to take on any and all work that may be offered regardless of the difficulties involved, the ordnance establishment with the Fifth Army has gained a splendid reputation.

##### **88. Spare Parts**

A shortage of spare parts was encountered by the Board in both theaters. This problem was entirely disregarded by the Board, and no data were accumulated, as Col. W. J. Morrissey, who is assigned to G-4 of the General Staff, is making a tour of both theaters with a board of officers for the purpose of studying the entire spare-parts problem.

##### **89. Field Suggestions**

The Board received reports that frequently when suggestions are submitted in the field the person submitting the suggestion never receives a reply. It was pointed out that this procedure is discouraging and often demoralizing, and it was requested that a procedure be established for promptly acknowledging suggestions and for informing the person making a suggestion as to its outcome.

##### **90. Command Posts**

In the Italian theater, many types of command-post trucks and trailers were inspected. All of these have been constructed in the theater. The prevalent type was built from an ordnance

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shop or maintenance truck. These trucks were equipped with a cot across one end, a desk and map boards on one side, and cushion seats on the other. They also contained a clothes closet and a wash basin with hot and cold running water. During operation and when these vehicles were parked, a tent was constructed adjoining the rear end of the vehicle. This tent usually contained maps and afforded working space for staff personnel. The entire arrangement seemed to be most practical and certainly increased the efficiency of the officers so equipped. At the time of departure of the Board, 70 of these vehicles were being constructed in the ordnance shops at Naples. In view of this large number, it is believed that some degree of standardization was probably developed.

### Section II

#### SMALL ARMS

##### 91. General

To date, all small-arms items have been in limited use in the North African theater and have been used only in training in the European theater. The extent to which small arms are being used is reflected by the ammunition expended. Based on a recent 30-day period, the following was the average expenditure per day per active weapon in the Fifth Army:

WEAPON	ROUNDS
Carbine.....	2.1
Rifle.....	2.6
Cal. .30 machine gun.....	62.9
Cal. .45 submachine gun.....	5.7
Cal. .50 machine gun.....	12.9
Grenades.....	.25

Based on this limited use, favorable comments were received on all but a few small-arms items, and it was reported that all small-arms items are functioning satisfactorily.

##### 92. Carbine

The opinion as to the worth of the carbine is divided. Many officers expressed a high regard for this weapon, whereas others look upon it more or less as a toy with insufficient striking power. The officers in this latter group would rather carry a rifle or a submachine gun, and a few prefer the pistol. It is believed that more information on the striking power and accuracy of this weapon should be supplied the theaters. The adjustable rear sight was immediately popular in both theaters, and a large demand for this item was established.

##### 93. Bayonet

Little interest was shown in any type of bayonet for the carbine in either theater, although a request was made by the North African theater for the knife, T8, which is a combination trench knife and carbine bayonet. The new, short M1 bayonet for the rifle is preferred to the old, long bayonet. No breakage difficulty with this bayonet was reported. It should be remembered, however, that this bayonet has not seen extensive use in either theater, as there has been very little hand-to-hand combat.

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### 94. Grenade Launchers

a. The grenade launchers were well received in both theaters, as was the T59 sight, which forms a part of the new rifle grenade launcher set. Some of the M8 launchers for the carbine had already been received in both theaters. In the North African theater, the launchers were received without instructions and without cartridges. Instructions for the M1 launcher on the M1903 rifle had not been received by some of the officers encountered. One officer asked about the purpose of the rings on the launcher. Others said that they had never seen a range table for the launchers, and it was also reported that some of the grenade-launcher kits were received without launchers. Undoubtedly FM 23-30, dated 14 February 1944, will reach both theaters at an early date. It should be pointed out that in chapter 2 of the manual, Rifle Grenades, mention is made of the use of the auxiliary grenade cartridge, M7, with the carbine, and range tables are given for the use of the auxiliary cartridge, M7, with the carbine launcher, M8. It is understood that proof tests indicate that the carbine is not sturdy enough to withstand the shock of firing with the auxiliary cartridge, M7.\*

b. In Italy the Board was given informal information that the silver star had been awarded to a sergeant who had projected rifle grenades with ball ammunition. Time was not available to verify this information, and exact details were not at hand. It is not known whether the sergeant used complete ball ammunition or the round less the projectile. Proof records indicate that the use of ball ammunition with the M9A1 grenade will result in a premature. It is believed, however, that in an emergency, and in the absence of proper grenade cartridges, cal. .30 ball ammunition could be used for launching a grenade provided the projectile was removed from the case. It is suggested that this emergency measure be tested and proper information supplied to the field. The North African theater showed considerable interest in this expedient, as it was anticipated that occasions would arise where grenade cartridges would not be available.

c. During the firing of five grenades from a carbine launcher at one demonstration, two carbines were disabled. In one case, the hammer spring plunger became disengaged from the hammer. The second disability was caused by the breaking of the sear. No reports of malfunctions of this type were received by the Board. However, at that time the carbine launchers had not yet been used. It is understood that during proof tests many malfunctions of the first type occurred. It is suggested that the theaters be given this information so that it will be fully understood that the practice of launching grenades in the carbine is an expedient and that the carbine was not designed for this purpose.

d. One Signal Corps officer stated that the M8 launcher for the carbine would be of special use with Signal Corps units, as the launcher could be used for launching ground signals from carbines, which are already part of the basic equipment for the unit, thereby eliminating the ground launcher as an item of equipment.

e. In Italy, the Chemical Officer, Fifth Army, reported that a chemical grenade projector was being used in destroying antipersonnel mines. (See appendix XI.) A small projectile is fired attached to a cord. The cord is used to pull the projectile back to the point of firing, thereby setting off mines which are attached to trip wires. At that time Col. G. G. Eddy suggested that the M11A1 practice grenade be used for this purpose. Since the return of the Board to the United

\*TB 9X-12, 1 November 1943, Preliminary Instructions, Grenade, Rifle, Smoke (WP), T5, which is now receiving circulation and which is inclosed with boxed grenades, rifle, smoke (WP), T5, also lists ranges for the T5 grenade when used with the carbine launcher, M8, and the auxiliary cartridge. Neither these preliminary instructions nor the field manual mentioned above give any warning concerning the use of the auxiliary cartridge with the carbine launcher, nor is any mention made that this combination should be used only in emergencies.



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States, investigation reveals that this means of projecting the cord has been successfully tried at Aberdeen Proving Ground. It is suggested that this information be published and furnished the Italian combat zone.

### **95. Gun, Machine, Cal. .30, Browning, M1919A6, Flexible**

A real demand exists in both theaters for the M1919A6 machine gun. This weapon is entirely acceptable as a light machine gun until such time as a weapon meeting all the requirements of a light machine gun is available.

### **96. Gun, Submachine, Cal. .45, M3**

The simplicity, reliability, and ease of operation of this weapon were recognized immediately. A real demand was submitted by NATO; in the European theater this weapon is now arriving with troops. This submachine gun should be a real answer to the German Schmeiser.

### **97. Gun, Machine, Heavy Barrel, Cal. .50**

Prior to one of the demonstrations in the North African theater, it was found that heavy-barrel cal. .50 machine guns furnished by a local unit would function automatically only when elevated. Information was received which indicated that this occurrence was not unusual and that many of the heavy-barrel cal. .50 machine guns require honing before they will operate properly horizontally and when depressed. It is suggested that this possible deficiency be investigated.

### **98. Helmet**

In the combat area of the North African theater, there existed a feeling that the German helmet is superior to the present M1 helmet in resistance to penetration. It is suggested that comparative tests with various types of ammunition and fragments be conducted.

### **99. Fastener, Strap, Quick-release**

It was apparent that the rumor of broken necks resulting from blast under helmets which were securely fastened had gained some foothold in both theaters. The Board reported that this rumor had no foundation and that proof tests at Aberdeen Proving Ground did not uphold it. Nevertheless, for psychological reasons, only the quick-release fastener for the helmet was demanded, and if requisitions are filled, every helmet in both theaters will be equipped with this item.

### **100. Body Armor**

a. A new use for body armor was established. The Corps of Engineers desired this item for use by bulldozer operators and mine-clearance personnel. Some type of eye protection was also desired. The Ordnance Officer, ETO, showed the Board a metallic type of eyeshield with narrow slits for vision.

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b. Consideration is also being given to equipping liaison-plane pilots and their artillery observers with body armor to protect them mainly from friendly fire. While the Board was in Italy, a report was received that an artillery officer who was observing from a liaison plane was killed by cal. .30 ammunition behind our own lines.

### Section III

#### ARTILLERY AND FIRE CONTROL

##### 101. General

a. All artillery in the Italian theater is being employed in a manner different from that which was formerly considered conventional. All separate-loading howitzers and guns are being used at maximum range 90 percent of the time instead of 20 percent of the time as originally expected. Also, almost all weapons are emplaced as far forward as possible in order that maximum ranges may be fully utilized.

b. The extensive use of maximum ranges is, as would be expected, resulting in accelerated erosion (in some cases), deterioration of gas-check pads, and wear on recoil mechanisms. The effect of this type of use on gun tubes, gas-check pads, and recoil mechanisms is clearly indicated by the expenditure of these items shown in appendix VII.

c. The average day's expenditure of ammunition for artillery weapons is much higher than was originally expected. Ammunition for many weapons is being rationed in order that the day's expenditure may be reduced. For example, during the month of January, the ration of ammunition for 155-mm guns, M1, was 23.8 rounds per day. When for a 2-day period this restriction was raised, the expenditure was 41 rounds per day per active gun. During the month of January, 105-mm howitzers, M2, averaged 52.5 rounds per day per active howitzer and 4.5" guns averaged 43.2 rounds per day. These figures give some idea of the activity of artillery pieces now in action in the Italian combat zone.

d. The use at extreme ranges of weapons emplaced well forward has made artillery-fire observation from observation posts difficult if not impossible. As a result, liaison planes are being used to a maximum for this purpose. These planes carry an artillery observer who is in constant radio communication with ground batteries. This method has proved itself most successful; it is possible only because of the overwhelming air superiority which our forces possess.

e. Higher velocity guns are in great demand. Work has been initiated toward obtaining higher velocity by boring a 90-mm tube for a 3" projectile. It is believed that this design will give a velocity of 3,400 to 4,000 ft. per sec. The design of a sabot for the 90-mm gun is most desirable, and work on this design has been initiated. A requirement also exists for a higher velocity, flatter trajectory round for the 105-mm howitzer. A 25-lb. shell with a muzzle velocity of 2,000 ft. per sec. is required. Many comments were heard with regard to new high-velocity German weapons.

f. Major General Crane, Artillery Officer, NATO, gave an interesting comparison between the effectiveness of bombing and artillery fire. He stated that when bombers come over there is always warning of their approach and personnel in the target area have sufficient time to take cover. When the bombing is finished, unless direct hits have been scored, personnel emerge uninjured and go about their normal duties. He pointed out, however, that when an artillery shell strikes an occupied area it completely demoralizes all persons in that area, as they have

no way of telling when the next shell will come over. It was pointed out that the use of an enemy airfield had been denied by our intermittent artillery fire from one gun. General Crane's intention was, of course, to show clearly that aerial bombing cannot replace artillery fire.

g. A distinct need for some means of calibrating artillery weapons was encountered in both theaters. This was especially true in Italy where the quantity of ammunition fired daily is such that gun erosion is relatively rapid and gun tubes are replaced frequently. It seems that this problem would best be solved by teams of ordnance experts equipped with portable velocity-measuring equipment. This solution was heartily indorsed in both theaters. It is anticipated that not only will these teams be able to calibrate artillery weapons while they are actually being used against the enemy but that, in addition, available technical information on gun wear and wear-velocity relationships will be accumulated. At the present time, guns are being calibrated by actual firing. This procedure is using appreciable quantities of ammunition which may be saved by the new method. One such team has already departed for the European theater for the purpose of assisting in solving the 105-mm ammunition problem.

### **102. Self-propelled Artillery**

a. The need for more self-propelled artillery was most evident, and items were requested by both theaters. Most interest was shown in the development of a new self-propelled 105-mm howitzer and in a self-propelled 155-mm howitzer, M1, and a self-propelled 155-mm gun, M1. The new self-propelled 105-mm howitzer should include more traverse and be more maneuverable than the present M7, and the howitzer should be mounted in the center of the carriage. The combat units consulted are looking forward to the introduction of the 90-mm gun motor carriage, T71.

b. The distinct advantage of self-propelled artillery over towed artillery is its ability to move into position and to move out before German counterbattery work can be effected. Even artillery officers who previously opposed self-propelled artillery now agree that it has advantages for certain uses, that it is necessary, and that present self-propelled carriage design, mobility, and dependability make the development of additional self-propelled mounts highly desirable.

### **103. Carriage, Motor, 3" Gun, M10**

This item was most popular and received the highest praise. No substitute for this weapon is desired. It was reported that on one occasion a high concentration of German shellfire was placed near a battery of several of these weapons and, although there were several near misses, no casualties resulted from this encounter and none of the equipment was damaged.

### **104. Mortars**

A demand for mortars covering all ranges up to 10,000 yd. was received. The new light 60-mm mortar embodying the T18E6 firing mechanism was immediately popular, and substantial requisitions were initiated. Some demand was created for the extension of the 81-mm mortar for the purpose of increasing its range. The 105-mm mortar was not popular, because it was felt that a longer range than this weapon gives would be desirable. Our troops are much impressed with German mortar fire, and the effectiveness of the German weapons has undoubtedly contributed to the demand for more and longer range mortars by our combat forces.

### **105. Antiaircraft Artillery**

a. As a result of our overwhelming air superiority in the Italian combat area, many anti-aircraft artillery weapons are available for firing on ground targets and are being used for this purpose. This practice has created a requirement for a percussion element in the M43 mechanical time fuze and a hand fuze setter similar to the hand fuze setter, T37E1.

b. A serious complaint was received from both theaters against the sighting systems on light antiaircraft equipment. These systems are the sighting system, M6, on the combination gun motor carriage, M15A1; the Navy reflector sight, Mk. IX, on Maxson turret mounts; the sighting system, M3 (forward-area sight), for the 40-mm gun, M1; and the telescopes, M7 and M64, on the computing sight, M7, which were introduced by the Board. It was stated that the telescopes, M7 and M64, are too limited in field of view. It was also stated that the mounting and gear mechanism of the sighting system, M6, are weak and unreliable. The Navy reflector sight, Mk. IX, is too limited in field of view and is not satisfactory for planes traveling over 250 m.p.h. The sighting system, M3, on the 40-mm gun, M1, is unsatisfactory because there are no 400-m.p.h. speed rings. In the European theater, arrangements have been or are being made to replace all the M3 sighting systems with the "Stiffkey stick" or the "Peca sight." Combat units are improvising sights for the combination gun motor carriage, M15A1, and the Maxson turret mount. Examples of the types of sights that are being improved in the Italian combat zone are included in appendix IX.

c. The computing sight, M7 (Weiss), was unpopular in the European theater because it is equipped with the M7 and M64 telescopes, and the consensus was that it is complicated, particularly for firing at diving and climbing targets. It was received with only lukewarm interest in the North African theater, mainly because it was equipped with the M7 and M64 telescopes. One of these sights was left for trial with the antiaircraft command in Italy.

### **106. Mount, Machine Gun, Multiple, Cal. .50, M51**

This mount was not at all popular in the European theater, because of its lack of mobility. It was reported that during amphibious operations it bogs down because of its weight and that special ramps are necessary for loading it into various landing craft. Consideration is being given by the First Army to removal of the turret from approximately 600 of these mounts for remounting on half-track personnel carriers, M2.

### **107. Gun, 90-mm, M1A1, with Mount, Gun, Antiaircraft, 90-mm, M1A1**

This weapon has proved generally satisfactory. The European theater, however, reports that the spring rammers are mechanically unreliable and that they are rarely used. It was also reported that fuze setters frequently cannot be mounted in the retaining brackets without direct modification. It would appear that closer inspection in this respect is necessary prior to shipment. A request was received for a tool for removing from the gun chamber projectiles which have become separated from the cartridge cases. A protective fuze cup which could be attached to the cleaning staff and which would bear only against the body of the shell would be one solution. A complaint was also received that steel drill rounds are causing considerable damage to the face of the chamber. It was suggested that this deficiency could be corrected by the use of brass noses on all drill rounds.

### **108. Howitzer, 105-mm, M2A1**

The rifling of some howitzers in the European theater has become gouged. It was explained to the artillery personnel there that this damage was undoubtedly caused by the primer retainer ring in the cartridge case coming free during fire and that this defect had already been discovered during proof firing. It was further explained that this defect resulted from improper assembling and that corrective action was already being taken.

### **109. Howitzer, 105-mm, M3**

Several units in the European theater reported that the 105-mm howitzer, M3, elevated during firing and that this condition was partly corrected by the use of heavy chassis grease in place of the normal elevating-mechanism lubricant. This condition and the solution for it should be investigated.

### **110. Binoculars, M7 and Mk. 21, Navy**

Some interest was shown in these two items, especially for use by aircraft spotters and for observation use at dawn and dusk. There was no request made, however, that these items replace the present M3 binoculars. Some queries were received as to whether or not the two new binoculars would be equipped with mil scales.

### **111. Waterproofing**

The Board visited the waterproofing school in the European theater and was much impressed with the work being done there. It was noted that asbestos compound is being used instead of water-pump grease. This substitution is for standardization purposes, since asbestos compound is also used to waterproof tanks and vehicles. Admiralty cloth, which is being obtained from the British, is being used instead of vinylite. The admiralty cloth used seems to be superior to the vinylite covers in durability, resistance to abrasion, and ease of application.

### **112. Guns, 8"**

The 8" gun is generally needed in the Italian theater. Almost all the artillery in that theater is now massed along the front lines. Because of their long range, 8" guns can be emplaced in the rear of this massed artillery and thus used more effectively. In addition, their long range would be capable of reaching out as far as any German weapon now in use in that theater. At the present time our combat units are being outranged by the German 17-cm gun.

### **113. Spare Gun Tubes**

Considerable discussion was encountered in the Italian theater concerning the issue and use of spare gun tubes. The combat troops encountered could not understand the viewpoint of the supply services, which was that too many gun tubes were being used. The combat units felt that the tubes were worn out and had fired the expected number of rounds and that the supply service did not realize the frequency with which the guns were being fired. Regardless, it seems logical that the tubes should be procured in proportion to ammunition and made available to the troops in the same manner.

Section IV

ROCKETS AND LAUNCHERS

114. General

Intense interest in rockets was encountered in both theaters, and the multiple rocket launchers excited great interest. A large demand was established for larger caliber rockets for both air and ground use. The German 15-cm rocket, commonly called the "Screaming Meemie," greatly impressed our troops in Italy. It was credited with longer range than it possesses and probably also with greater destructive effect. Unquestionably its distinctive sound has had a considerable demoralizing effect upon our troops. Actually, many of the rounds recovered were found to have gone low order. (See fig. 50, appendix V.)

115. 2.36" Rocket and Launchers

a. The feeling existed in both theaters that the 2.36" rocket had been oversold. This feeling was accompanied by question as to the effectiveness and accuracy of the 2.36" HE AT rocket. In view of this, the Board incorporated a 2.36" rocket show into each demonstration. The entire renovation of the original launcher and rocket was explained. The explanation included a description of the new wagon-wheel pulpit trap and its function. To demonstrate the safety of the launcher, a launcher which had had two rocket motors exploded within the wire-wrapped portion was exhibited. Two bazookas were then fired at a tank at an 80-yd. range. Amazement was expressed by many spectators at the accuracy and results which were obtained by inexperienced rocket operators. Each demonstration included the firing of six rounds, and it was the exception when there were less than six hits.

b. Many types of eye and face protection have been improvised by combat troops using the 2.36" rocket launcher. Some enlisted men use motorcycle goggles. Others use a modified gas mask, the bottom of which has been cut away; still others use the gas mask as issued. One officer stated that he had obtained excellent results with the use of a plexiglass shield attached to the end of the launcher. Some enlisted men are using celluloid or plastic face shields. Some shields are made to cover the eyes only, whereas others cover the entire face. It was reported that the frustrum of a cone, which had been placed on some launchers, does not serve its purpose. It is believed that this problem should be solved completely and that an item which will afford ample face protection at all temperatures should be developed and issued without delay.

c. Brigadier General Arthur H. Rogers, of the North African theater, reported that early in the Italian campaign a number of the 2.36" rockets carried by his men failed to function. General Rogers stated that these rockets had been carried in ammunition carriers, which hold eight rockets, four in back and four in front. He said that these rockets had been carried fins up, with the fins exposed, and that undoubtedly they had been dragged through mud and water. It was General Rogers' opinion that the rockets which failed to function failed because moisture entered the motor, although he was not certain that the electrical connection had not been loosened. It is believed that in view of this report the 2.36" rocket should be given thorough proof tests for resistance against moisture. General Rogers also told the Board of a new way in which he employed the bazookas of his organization during the early part of the Italian campaign. He said that he formed bazooka hunting teams. These teams employed 10 to 12 bazookas in

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one group and went hunting at night. He said that their operation was most successful and that the ambushing of stationary German combat vehicles in this fashion was relatively simple. He spoke very highly of the 2.36" rocket and launcher.

### **116. Rocket, HE, 4.5", M8**

Great interest was shown in this rocket. It was demonstrated from the T27 launcher in North Africa and from the T27, T34, and T35 launchers in the United Kingdom. The ability of this rocket to cover an area when fired from multiple launchers was fully appreciated, and it was felt that it would be most valuable in supplying fire power during amphibious operations. This rocket was so popular that the total required will undoubtedly exceed the availability.

### **117. Rocket, HE, 7.2", T16**

This rocket was accorded limited popularity in both theaters. It was desired for use mainly against highly resistant targets, as the destruction of such targets is now a primary problem and any promising method is most welcome.

### **118. Launcher, Rocket, 4.5", T27E1 (8-tube)**

This launcher was immediately popular in both theaters, and its suggested use on amphibious vehicles such as DUKW's and LVT's was well received. In the North African theater, it was requested that this launcher be supplied with two additional banks of eight tubes each in order to increase its fire power. Every effort should be made to grant this request.

### **119. Launcher, Rocket, Multiple, 4.5" (60-tube)**

This launcher was accorded immediate interest, and a requirement was quickly established. Senior officers in both theaters displayed a personal interest in this item. At present the water-proofing stacks on the medium tank prohibit the firing of this launcher to the front; it must be fired to one flank so that the rocket blast will not blow down the stacks. Further development work is necessary to alter these stacks so that this launcher may be fired straight ahead from landing craft. Work on this alteration should be expedited.

### **120. Launcher, Rocket, Artillery, 4.5", T35 (Single-tube)**

This launcher and rocket aroused very little interest in the European theater, and no requirement was established. In the North African theater, however, a small requirement was established for a special purpose. It was generally felt in both theaters that the main benefit from rockets can be derived from multiple-tube launchers.

### **121. Launcher, Rocket, 7.2", T40**

A limited number of these launchers was requested by ETO for use on medium tanks against highly resistant targets.

Section V

AMMUNITION

122. General

a. All types of ammunition are receiving the highest praise by combat troops. It was evident that our troops felt that their ammunition is generally superior in every respect, including fuzing, to that of the Germans. Our units report numerous German duds. German prisoners substantiate this same feeling, as they report that very few of our rounds are duds and they feel that the fragmentation of our high-explosive ammunition is excellent.

b. A need for more condensed and better presented information on artillery ammunition was encountered. It is believed that a pamphlet including information on terminal ballistics, projectile types, fuzing, etc., would be extremely worth while.

c. A demand exists for a fuze with automatic delay. The resistance of targets that are being encountered varies so greatly that the ideal fuze delay cannot be determined in advance, and greater efficiency would result from a fuze which would establish proper delay automatically.

123. Small Arms

a. Tracer ammunition is used very little by the ground troops in the Italian theater. It was reported that the use of tracer ammunition consistently attracts enemy fire upon the weapon in which the tracer ammunition is used. The mission which visited the southwest Pacific received similar reports. In the Italian combat area, practically all of the pre-belted ammunition is being changed to eliminate tracer. It is believed that in the interest of economy, tracer ammunition should not be included in pre-belted ammunition, as much less work will be involved in adding tracer ammunition in the field than in eliminating it.

b. In the European theater, a request was made for night tracer in place of standard tracer. It is believed that the feeling there was that this ammunition, which traces very dimly during the first part of its trajectory, will be less likely to reveal the position of the firing weapon.

124. Artillery

a. **White phosphorus.**—A distinct demand was received for all types of white phosphorus ammunition. White phosphorus is desired in all types and calibers. In addition, it is desired that the white phosphorus ammunition have the same ballistics as high explosive. It would be used in a dual purpose—for adjusting fire and, simultaneously, for its casualty effect. For example, one 4.5" gun battery reported that on occasions as many as 40 rounds of ammunition had been used in adjusting fire. It was felt that just a few rounds of white phosphorus would have spotted impacts for an aircraft observer and an appreciable quantity of ammunition would have been saved. White phosphorus ammunition has also been used in the Italian theater at night for back-lighting enemy positions.

b. **High-explosive, smoke.**—An urgent request was received for high-explosive shell with a smoke spotting charge in all calibers. The justification for this ammunition is the same as that described above for white phosphorus, as considerable difficulty in spotting high-explosive ammunition has been encountered. The demand for this type of ammunition has been so great



that the Peninsular Base Section has been modifying the 3" HE shell, M42A1, to include a smoke spotting charge. This ammunition is most popular with the combat units, and its manufacture will undoubtedly continue until such ammunition is otherwise supplied. A complete description of the manufacture of this ammunition is included in appendix VIII.

**c. Illuminating projectiles.**—A demand exists for illuminating projectiles in all calibers from 75 mm up. It was realized that this is more or less a long-range program, and it was requested that highest priority be given to 155-mm and 3" illuminating projectiles. Substantial requirements were established for the 155-mm illuminating projectile which was shown by the Board in the European theater.

**d. Drop test of fuze, P.D., M51A1.**—Both theaters reported prematures with shell, HE, M107, with fuze, P.D., M51A1 (drop tested). It appears that the drop test for this fuze is not reliable and that a more dependable test should be developed.

**e. Shell, HE, M56, w/fuze, P.D., M53, 81-mm mortar.**—Reports were received that numerous duds are being experienced with the M56 HE 81-mm mortar shell. It was felt that possibly moisture was getting into the fuze or that the shell was striking on soft ground and the delay fuze setting was causing it to burst underground so that the report could not be heard by the mortar crew. It is believed that this reported condition is worth investigating.

**f. Mortar fuzes.**—A demand was received for fuzes for all mortar ammunition which have both superquick and delay settings and which will allow the projectile to pass safely through twigs and brush for a distance of 100 yd. from the muzzle of the mortar.

**g. Fuze, nose, CP, T105.**—The concrete-piercing nose fuze, T105, was enthusiastically received in both theaters. Both theaters requested that as many as possible of these fuzes be shipped immediately by the most rapid means practicable. The introduction of this fuze was most timely, as considerable difficulty with resistant targets was being encountered in Italy.

**h. Spare fuzes.**—Battery commanders stated that they could use their allotted ammunition much more effectively if they were authorized a supply of spare fuzes of all types. This procedure will allow the most efficient use of the projectiles which are on hand, and it is recommended that such a supply of fuzes be established within each battery.

**i. 75-sec. time fuze.**—In both theaters requests were received for 75-sec. time fuzes for all calibers where the time of flight of the projectile at maximum range approximates 75 sec. This demand has undoubtedly resulted from the present long-range use of artillery in the Italian combat area.

**j. 90-mm ammunition.**—The use of antiaircraft artillery on ground targets as described in paragraph 105a dictates a revision of the day of supply of ammunition for the 90-mm anti-aircraft gun. It was suggested in the Italian combat area that a day's supply should be 65 percent AA, 10 percent WP, 2 percent APC, and 23 percent HE shell fuzed for ground targets.

**k. Torpedo, Bangalore, 81-mm, T1.**—Requisitions for the torpedo, Bangalore, 81-mm, T1, were received from both theaters in spite of the fact that this item has not been indorsed by the service board. The fact that this item originated in the North African theater may have influenced the requirement that was established by that theater. Certainly the British use of Bangalore torpedoes influenced the demand which was created by the European theater. Colonel Nixon, Ordnance Department, of the North African theater, suggested that the Bangalore torpedo be constructed with long metal strips running its entire length parallel to its axis. He believed that the addition of these strips will materially aid the wire-cutting ability of the torpedo.

**l. High-velocity ammunition.**—A requirement exists for a higher velocity, flatter trajectory round for the 105-mm howitzer. A 25-lb. shell with a muzzle velocity of 2,000 ft. per

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sec. is required. There also exists a requirement for a higher velocity round for the 90-mm gun for ground use. It is believed that this requirement can be met with a sabot projectile which would obtain a velocity of 3,400 to 4,000 ft. per sec.

### Section VI

#### AUTOMOTIVE

##### 125. General

a. The tanks of the M4 series are well liked by the using personnel, and they do not want a new tank unless it will offer very greatly improved military characteristics. There are, however, a number of components, such as tracks, suspension, and armament, that should be given immediate attention to improve combat efficiency. The using troops desire the following improvements in tank characteristics, listed in order of importance:

- (1) Fire power.
- (2) Mechanical reliability.
- (3) Armor protection.

b. It should be noted that American troops are not particularly interested in thicker armor or in protected ammunition stowage, as it is generally felt that complete protection cannot be obtained and that the price to be paid for more protection would be undesirable from a standpoint of maneuverability.

c. In both theaters, and particularly in the Italian combat area, there is a great demand for self-propelled artillery mounts similar to the 155-mm gun motor carriage, M12, using the M1 gun. There is also an increasing demand for self-propelled mounts for the 155-mm howitzer.

d. The using troops want fire-control equipment in tanks that will provide for direct and indirect fire of great accuracy but will be extremely simple to operate. They also want range finders to be furnished tank companies, approximately one per platoon.

e. There is intense interest in any type of mechanical mine-field clearing device. Tests will be made with the T1E1 and the T1E3. The mine exploders considered most satisfactory by the British are the Canadian Indestructible Roller, the Dynamic Petard, the Flying Dustbin, and the Crab, using counterweighted rotor-support arms.

f. Modification work orders are being received satisfactorily in ETO and are being applied to vehicles as available kits permit. Practically no modification kits are being received in NATO, and the using units have no idea of what the available modifications are.

g. In general, there is very little first- and second-echelon maintenance. This is largely due to lack of personnel which can be assigned to this work; usually this results in an increase in the work passed up to higher echelons.

h. Combat experience in Italy indicates that the majority of disabling hits on tanks are on the differential and final-drive housings; it is therefore very important that supplementary armor for these components be made available at once.

##### 126. Medium Tanks

a. **Tracks.**—The most serious deficiency found in the M4 series of medium tanks is in the tracks. Operation of these vehicles over the irregular terrain of the Italian peninsula demon-

strated that it is very difficult to conduct tactical operations unless extreme care is taken to proceed over terrain that will not cause track throwing.

(1) In many cases, tanks operating across slight slopes have thrown one or both tracks and have become completely immobilized under enemy fire. There was no other damage to these vehicles, but they could not be recovered because of the difficult terrain and covering enemy fire. In several cases, the Germans were able to fire upon these tanks at their leisure until they were destroyed. Fortunately for the using troops, on most of the occasions when tracks were thrown the tanks were in positions where repairs could be made without danger.

(2) Some of these tanks are equipped with the nonreversible rubber-block track, T51, which is unsuited for tactical operation, and the tank crews will not use grousers unless forced to do so.

(3) The all-steel tread interrupted-grouser track, T49, is also being used, but its chief drawbacks are that it offers little side-slip resistance and often becomes packed with mud and loses almost all grouser action.

(4) The most satisfactory tracks used to date are the rubber-chevron grouser type, T48, and the all-steel chevron treads, T54E1 and T54E2, although tracks which have even more grouser action than these would be preferable.

(5) The consensus of all officers interviewed in ETO and NATO was that lightweight steel-chevron grouser tracks with rubber backing for the bogie path would be the ideal type for present suspensions.

(6) There is a very great need for a wider track (approximately 23") that would be center-guided or so guided that track throwing would seldom occur.

(7) All armored force personnel believe that rubber-block track is suitable only for strategic operation and that, in general, track-block failures on the rubber-chevron tracks are so numerous that the use of steel tracks is preferable.

(8) Extended end connectors for the medium-tank track will be popular with using forces, and personnel operating track-laying vehicles were very glad to see them. Although it is felt that these connectors are only an expedient and will not overcome the basic deficiencies of the track, they will increase flotation and grouser action, which is one of the most necessary improvements on the tank tracks.

**b. Suspension.**—Suspension is giving very little difficulty. There have been a few failures of the volute springs, but since these failures do not immobilize the tank during tactical operation, they are not regarded as extremely serious. Failure of bogie wheels is apparently increasing; as a rule, however, the life of the tires is equal to that of the tanks (average: 1,000–1,500 miles). It has been found that failure of bogie tires is almost completely unpredictable, and a blow-out may occur at any time during the life of the vehicle. There seems to be a greater tendency toward failure during the first 500 miles of operation than during subsequent operation. Because of the difficulties of the terrain and the possibility of track throwing, it is generally impossible to operate a tank when a blow-out occurs. The suspensions themselves have been found to be more reliable than those on the British and enemy vehicles.

**c. Engines.**—The life of engines in the Italian combat zone is approximately 210 hours. Most tank crews are satisfied with the engines (R-975-C1 Continental) but would like 60 to 100 additional horsepower. Maintenance of the Continental engine is not high, and most engines will operate over 200 hours with practically no attention.

**d. Power trains.**—(1) After the termination of operations in the desert, there was a noticeable decrease in the number of clutch failures; extremely few are occurring now. Most

clutches give satisfactory service during the life of the engine. The types of clutches in service vary, although they are all of the Lipe design and most of them include the new ventilated flywheel ring and concentric throw-out bearing. The tanks operating in Italy do not have the over-center clutch, and pedal pressures are still too high. Almost all of those operating in England have this modification.

(2) With better operation of clutches, the amount of transmission trouble in Italy has decreased greatly. Gear shifting has become considerably easier, and the synchronizer cones are operating properly. In England, however, there are so many tanks in operation with old-style clutches, or with clutches that drag slightly, that apparent and actual transmission difficulties are considerable. Usually, the difficulty arises because the synchronizer cones are being forced to stop a dragging clutch. With the installation and proper adjustment of new-type clutches in all vehicles, transmission difficulties will decrease and almost disappear, particularly when the transmissions in use with old clutches are rebuilt.

(3) Other units of the power trains have presented few problems. Among armored force personnel, it is thought that higher speed reverse gears would be of great advantage in tactical operations; it would then be possible to back out of an untenable position at a relatively high speed. At present it is necessary to jockey the tank around to face the opposite direction. A speed of about 10 m.p.h. would be satisfactory.

**e. Armament.**—All the tank crews and armored battalion officers feel that the German tank guns are superior in all respects and particularly in their muzzle velocities. They believe that the 75-mm PAK 40 has more than double the muzzle velocity of our 75-mm gun, M3. There is an overwhelming request for increase in tank-gun muzzle velocities and for installation of 76-mm guns in medium tanks of the M4 series. Mechanical operation of the guns has been excellent.

**f. Fire control.**—(1) Because of the excessive dispersion which occurs with the M4 periscope, firing of tank guns is confined almost entirely to the artillery method of sensing and locating bursts and giving corrections in mils to the gunners. The average dispersion which occurs as a result of slack in the periscope holder and linkage extends 4 mils in both planes. This dispersion is so great that guns do not stay bore-sighted with the telescope after any operation. The modification consisting of a spring between the periscope holder and turret will be greatly welcomed. The officers who saw the M4A1 periscope liked it extremely, but all were emphatic in saying that only one reticle pattern should be used and that if these new periscopes are used the telescope mounted on the gun mount should have the same reticle.

(2) There is very little use of the coaxially mounted telescope; the dispersion which results from its use is even greater than that experienced with the M4 periscope. In addition, the optics of the M55 telescopes are unsatisfactory, resulting in unsatisfactory light-transmission characteristics. Furthermore, most gunners report that it is very difficult for them to get their heads into proper position for sighting through the coaxial telescope. When tanks are operating in combat, the crash helmet is always worn; in most cases, the steel helmet without liner is worn over the crash helmet.

(3) About 75 percent of the tanks in England are equipped both with azimuth indicators and with the M9 range quadrant. Less than half of the tanks in Italy are equipped with the azimuth indicator, and few have the M9 range quadrant. Both of these items are essential equipment in this theater.

**g. Crew comfort.**—(1) The seats for the tank driver and assistant driver are satisfactory, although seats with slightly higher backs, better form fit, and deeper cushions would be desired.

The gunner's seat should be given the same improvements. The tank commander's seats are completely unsatisfactory and, except in rare cases when the vehicle is standing, are never used. In a great many cases, both of these seats have been removed entirely because they hinder the tank commander. The loader's seat is also unsatisfactory and should be redesigned to be more comfortable and to permit variation of positions. At present it is seldom used.

(2) The crew members do not use their safety belts except when it is absolutely necessary. Grips placed in the turret would be of great benefit to the crew. They do not desire additional padding, as they consider it a fire hazard.

(3) The tanks used by the American units are all M4's or M4A1's, and they have very good circulation of air through the fighting compartment and into the engine compartment. Furthermore, since the tank commander keeps the turret hatch open during most operations, no additional ventilation is required.

(4) There is a growing belief that the turret basket is not as essential as it was formerly considered. The latest British pilot tank, A41, has no turret basket.

**h. Ammunition stowage.**—Except for the ready rounds in the turret, the ammunition stowage is unsatisfactory and should be improved. Experience in Italy indicates that 2 rounds out of every 40 in the stowage bins will separate, creating a very serious fire hazard and making it difficult to remove the rest of the rounds from the stowage bin. When going into combat, the crew invariably puts a full complement of ammunition in the floor of the turret basket because they are anxious to carry a very large quantity of ammunition. Tank crews are very little concerned with protection of ammunition and consider accessibility and quantity of primary importance.

**i. Machine guns.**—(1) The bow machine gun is much used in combat operations, although all crews agree that this weapon is extremely hard to fire accurately and would like some means of sighting to be provided. As it is known that the tanks draw fire and that the bow machine gun is never used unless the position of the tank is known to the enemy, it was suggested that, to improve accuracy of fire, the percentage of tracer be increased to 50 or 100 percent.

(2) Crews exercise extreme care in preparing cal. .30 ammunition for the two machine guns; as a result, stoppages seldom occur except when the tanks have operated for a considerable distance before the ammunition is used.

(3) Crews report that accurate collimation of the coaxial gun with the periscopic sight is generally impossible; therefore, the mount which permits accurate adjustment of the coaxial machine gun will be welcomed.

(4) At present, the anti-aircraft machine gun is not considered essential in Italy. It should be realized, however, that in this command the Allied forces have complete air superiority. A mount for the cal. .50 machine gun that would permit firing at ground targets with ease is desirable.

**j. Turret hatches.**—The tank commander's cupola and second turret hatch are welcome improvements and will probably result in a smaller number of casualties to tank commanders, since they enable the commanders to operate the tanks with the hatches closed. Opinion as to the desirability of placing the anti-aircraft machine gun on the loader's side was divided; combat results will indicate whether or not this position is satisfactory.

**k. Stowage.**—Most of the stowage locations are satisfactory, although additional stowage space is desired. The camouflage-net rack on the rear bustle is considered a valuable improve-

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ment. Greater accessibility to stowage bins would be desirable. Floor stowage bins should be located so that the entrance of water and dirt would be kept to a minimum.

**l. Armor.**—(1) Opinion on proper armor thicknesses was divided. Armored force troops generally regard the present armor as adequate. They do not want to sacrifice maneuverability, speed, or flotation to gain additional armor protection. If armor protection could be increased without the loss of the above characteristics, it would be desirable.

(2) The British desire a much thicker armor, and the Churchill tank is being modified to provide 6" to 8" of frontal armor. It should be pointed out that most British armored vehicles do not provide the protection through obliquity found in the American vehicles.

(3) From observation of medium tanks operating in Italy, it is apparent that the enemy is concentrating its fire on differential and final-drive housings; more than 60 percent of disabling hits are in these areas. Since none of the tanks in combat in this theater have the new thicker differential housing, it is extremely necessary that the V-front supplementary armor with final-drive pads be made available as soon as possible.

**m. Sand shields.**—The sand shields supplied with medium tanks are of no value in present operations in the European and North African theaters. Usually, the crews remove them prior to operation of the tank. A simpler shield which will not hinder track movement over muddy terrain should be provided for the front and rear of each tank.

**n. Flotation.**—The present flotation characteristics of medium tanks are unsatisfactory, and tracks should be provided that will reduce ground pressure to 10 lb. per sq. in. or less. At present it is extremely difficult to operate in areas which the retreating Germans have deliberately flooded, and many tanks have bogged down. This difficulty might be alleviated by increasing the length of the tracks. Although this change would necessitate a longer hull and modified suspension, experience has proved that the medium tank, M4A4, can be controlled and maneuvered as readily as the shorter medium tanks. No tactical reason has been advanced which would preclude the possibility of making tanks several feet longer.

**o. Maneuverability.**—Greater maneuverability and ease of control for medium tanks are desired by the U. S. forces, although they have not established a requirement for skid turns, as the British have. Practically none of the tanks used in Italy have the double-anchor steering brakes, although all personnel would like them.

**p. Accessories.**—(1) The instruments and gages furnished with the medium tanks usually do not operate properly, and their quality is below expectations. Difficulty is experienced with engine oil-pressure gages. Vehicles are generally operated even though one gage has failed, and repairs are made only when both the pressure gage and the low-oil-pressure warning light have failed.

(2) Pioneer and Hull compasses furnished with the tanks are of no value; none was found that would remain in calibration, and officers revealed that although considerable time was spent in calibrating these instruments, they are of no value as navigation aids.

(3) The provision of armor for the air cleaners is a most necessary modification. Damage to air cleaners by shell fragments has been extremely frequent, and replacements are difficult to obtain.

(4) Auxiliary generators are used extensively and are giving satisfactory service, although replacements are hard to obtain. The fuel filler neck for the gasoline tanks of these units should be altered so that entrance of water and mud will be kept to a minimum.

**q. Modifications.**—(1) The presence of certain modifications can be checked by making a visual inspection of the tank; others are of such a nature that disassembly of parts or com-

ponents is necessary to ascertain whether the modifications have been made. In order that a permanent record of modifications may remain with the tank at all times and be so located that it will not be lost, it is recommended that a plate of brass or other soft metal, listing these modifications, be located on or within the tank.

(2) Using forces state emphatically that they do not want any modifications that will not materially increase the efficiency of the vehicles.

**r. Development.**—Many of the officers encountered in the theaters requested information on development work. This information was discussed with them, and two things were apparent: they were aware of the necessity for conducting developments of new vehicles and components, and they considered a large development program an aid to morale. Many officers stated that they were anxious to see tanks of the T20 series sent to the theaters for service in combat.

### **127. Tank, Medium, M4E6**

a. This modified version of the medium tank, M4A1, was universally liked by all personnel who saw it. The modified turret was considered an outstanding improvement. Although it is realized that this new turret does not provide much more room, its seeming roominess will benefit crew morale, and the modification makes operation within the turret much easier.

b. The fire-control equipment in this tank was considered very satisfactory and far superior to that in use at present. Nearly all personnel in armored units believe that the 76-mm gun is a vital necessity for medium tanks, and they would be willing to sacrifice some ease of ammunition handling to gain this high-velocity gun.

c. Some criticism was expressed concerning the M42A1 HE shell used in 3" guns; since it is less effective than the M48 HE 75-mm. It was hoped that, as more 76-mm guns are shipped to the theater, the bursting effect of the HE round would be increased.

### **128. Light Tanks**

The light tanks, M5 and M5A1, are giving extremely satisfactory mechanical performances, but considerable difficulty is encountered with the track and suspension system on these vehicles.

a. Although the incidence of track throwing is not as great on light tanks as it is on medium tanks, all the other objections noted above for medium-tank tracks apply to these vehicles.

b. A wider track that will reduce ground pressures below 10 lb. per sq. in. should be made available for light tanks.

c. Fire-control equipment on the light tanks is more satisfactory than that on the medium tanks, but this is due largely to the type of work in which the tanks are used. Most light-tank operations are reconnaissance missions or decoy missions to draw enemy fire. The using units believe that a vehicle more suitable for reconnaissance work should be supplied, and they were enthusiastic about the possibility of converting light tanks into reconnaissance vehicles similar to those shown them in photographs of projects at Aberdeen Proving Ground.

### **129. Carriage, Motor, 75-mm Howitzer, M8**

Since this vehicle is mechanically the same as the light tank, M5, the information in the preceding paragraph is applicable. This vehicle is preferred to the light tank, however, for

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reconnaissance work and close-in infantry support, largely because it affords better vision and fires a much superior HE round. There is a requirement for some kind of protection over the turret of these and other open-turret vehicles to block the entry of enemy grenades.

### **130. Car, Armored, Light, M8**

Although the light armored car, M8, and its modified counterpart, the utility armored car, M20, are preferred over earlier wheeled reconnaissance vehicles, there are several basic disadvantages to these vehicles. There is a strong opinion that a track-laying vehicle, possibly a modification of the light tank, M5, would be more suitable for use in reconnaissance. It is found that the armored cars are underpowered, and a number of situations have developed where help was necessary. The suspension has been generally unsatisfactory, and maintenance has been extremely high. The steering systems are not heavy enough for operation over rough terrain, and failures have been frequent. The most serious objection to the use of these vehicles is that mines cause them very heavy damage; the floor below the driver and assistant driver will not withstand the blast of a mine explosion and the results are frequently fatal to these members of the crew.

### **131. Carriage, Motor, 105-mm Howitzer, M7**

As the basic mechanical difficulties found in the medium tanks apply similarly to this vehicle, there is no need for further discussion on these points. Use of this vehicle as an assault weapon has resulted in criticism of the accuracy of its fire; some of the dispersion may be due to ammunition, as noted in the artillery section of this chapter. There is a demand for the 105-mm howitzer in a self-propelled mount that would provide extreme accuracy.

### **132. Self-propelled Mounts**

There is a tremendous demand for self-propelled mounts similar to the 155-mm gun motor carriage, M12, but incorporating the 155-mm gun, M1. The tactical situation near Cassino indicated that these vehicles would have been of great help, inasmuch as they could advance to fire from a forward salient and then withdraw rapidly as counterbattery fire became dangerous. It was noted throughout the theaters visited that the demand for self-propelled mounts for heavy artillery is growing rapidly; it is well within the realm of possibility that there will be a demand for the 8" gun so mounted. There is a very definite requirement for the 155-mm howitzer on a self-propelled mount.

### **133. Carriage, Motor, 3" Gun, M10**

a. This tank destroyer vehicle has become very popular with the using forces, and they feel it is satisfactory except for its mechanical deficiencies, which are peculiar to vehicles on the medium-tank chassis. The organizations which are using this weapon do not want it replaced with the 76-mm gun motor carriage, M18 (T70). This is in keeping with the general view of tactical commanders that no weapon replacements should be made unless they offer a tremendous advantage in military characteristics over the weapons presently employed. In this regard, it is believed that the 90-mm gun motor carriage, T71, will offer the necessary advantage and it is desired that a number of M10's be replaced by T71's.



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b. Almost none of the M10's in the combat zone have either the azimuth indicator or the range quadrant. Inasmuch as these vehicles are being used almost entirely as emplaced artillery, these instruments for control of indirect fire are vitally necessary. There is also a requirement for a panoramic telescope on these vehicles.

### **134. Carriage, Motor, 76-mm Gun, M18 (T70)**

The tank destroyer and armored force personnel who examined this vehicle offered the observations that the armor is too thin and that the power train is too complicated. Although the objection to the armor thickness is valid, there should be no exception taken to the power train until there has been considerable combat or unit operational experience. Reviewing officers felt that the introduction of these vehicles into the theater should be with troops trained on them in the zone of the interior and in no case should the M18's be issued as replacements for the M10's. It was noted by several officers that the silhouette and suspension of this tank destroyer vehicle are very similar to a number of the German self-propelled mounts, and a complete recognition course on the M18 would be necessary for units already in the field. The fire-control equipment on this vehicle was thought to be entirely satisfactory, although there was some requirement for a panoramic telescope. The tracks and suspension evoked considerable comment, especially when it was demonstrated that the tracks could not be thrown even under severe treatment and that the riding qualities of the vehicle were extremely good. There was no indication as to whether the increased speed would be a desirable characteristic, but the greater ease of control was very well liked.

### **135. Tank, Medium, M4A3**

A discussion of the Ford engine in this tank revealed the fact that using units do not desire replacement of the radial engines used in the M4 and M4A1. They are satisfied with the radial engines, as noted in paragraph 126c, and do not feel that there would be enough advantage, from a tactical standpoint, to be derived from a new and more powerful engine to warrant additional training and change in operating procedure. It was universally agreed that these would be desirable vehicles if they were introduced into the theater with replacement battalions or divisions.

### **136. Bulldozer, Tank Mounting**

a. It is believed that the tank-mounted bulldozer will be extremely valuable in all types of operations, including probable future landing operations. In many cases it has been found that after a fortification or strong point has been reduced by artillery fire it is not possible for vehicles to cross the resultant pile of rubble and it requires the use of bulldozers to clear a passage. The use of the tractor-mounted bulldozer is satisfactory, but personnel losses are extremely high and it is very difficult to make the bulldozer as immune to small-arms fire as medium tanks. It might also have an application in preparing hull-defiladed positions in combat where there is little cover. Use of these tank-mounted bulldozers on such vehicles as the 155-mm gun motor carriage, M12, or in conjunction with them would greatly assist in preparing positions.

b. It was found by trial installation that the bulldozer which was furnished could be mounted satisfactorily on any medium tank of the M4 series and that there were no technical difficulties encountered in making the installation.

### 137. Installations of 17-pdr. Gun

The British Armored Corps at the Department of Tank Development and the Fighting Vehicle Proving Establishment is making trial installations of the 17-pdr. gun in the gun motor carriage, M10, and the medium tank, M4A4. They are proposing eventually to equip 1,500 gun motor carriages, M10, and 2,100 tanks, M4A4, with the weapon. It is worth mentioning that this gun has excellent armor-piercing qualities. The 17-pdr. projectile, however, does not contain a bursting charge and is suitable only for hole punching. At present the HE shell for this gun is unsatisfactory; several new rounds are under development.

**a. In gun motor carriage, M10.**—(1) An examination of this installation disclosed that it is mechanically satisfactory and should not reduce the fighting efficiency of the vehicle in any respect. It is true that this gun projects farther into the turret than the 3" gun and that it is somewhat wider across the breech ring, but there is still ample room for the crew of three in the turret.

(2) The mechanical part of the installation was made in the M10 with relatively few changes. The standard cradle received the tube of the 17-pdr. after .02" had been bored out of the brass liner in the cradle. This made the tolerance between tube and liner between 0.010" and 0.015", which is usual. To adapt the gun to the recoil mechanism of the M10, lugs were doweled and bolted to the sides of the breech ring in order that the recuperator rods might be affixed to it. The standard elevating and traversing mechanisms were used with very slight changes to provide certain required clearances. The regular firing mechanism was adapted in minor respects for use with this gun. The breech of the gun is installed in vertical position and is provided with automatic ejection. It is believed that the present vertical position will not offer hindrance to loading. The installation at present includes 22 rounds of ammunition in each sponson and 3 rounds on each side of the rear of the turret, making a total of 50 rounds. It should be noted, however, that the ammunition stowed in the sponson is alternately placed; that is, projectiles point in both directions (front and rear) in the stowage racks. The recoil guard folds upward to permit the crew to move around more readily in the turret when they are not in combat. As the tube of the 17-pdr. is of small diameter where it passes through the mantel, a casting closing this gap to a large extent was welded onto the mantel. The gun uses a muzzle brake and a 75-lb. counterweight just to the rear of the muzzle brake. Rotation of the gun is prevented by means of a steel rod screwed into the breech ring and sliding in a bushing mounted on the cradle.

**b. In medium tank, M4A4.**—This is an entirely different type of installation. To perform it, it was necessary to manufacture a completely new cradle and gun mount. The gun is installed with the breech in the horizontal (normal) position. It is also provided with automatic ejection and has standard electrical firing. Because the breech ring projects farther into the turret and because the gun has approximately 2" more recoil than the 75-mm gun, it was necessary to remove the radio from the rear of the turret. The rear of the radio bulge was cut out, and an armored box of 1" plate was welded to the rear of the turret for the radio installation. In this installation the ammunition is carried in the lower hull in a slanting position with the projectiles down. (The 17-pdr. round is 34.76" long and weighs 37 lb.) Loading of the piece cannot be accomplished with ease. The interior of the turret is quite restricted, and the crew members do not have adequate room. In addition, this gun has a great deal of muzzle flash. During firing trials there has been considerable flash-back in the turret, and it is possible that the automatic ejection will have to be done away with or the cam changed. From the standpoint of crew comfort and efficiency, this gun cannot be considered a good installation; however, it is no more overcrowded

than certain other British installations. It must be noted that to accommodate the 78 rounds located in the hull, the space occupied by the assistant driver's position must be used for stowing ammunition. The bow gun is removed, and a section of 1" plate is welded over the opening in front of the hull.

### **138. Fire Control**

a. Troops using armored vehicles in combat need direct and indirect fire control, particularly in medium tanks and gun motor carriages. The present system of indirect fire control, using the azimuth indicator, M19, and the range quadrant, M9, is considered very good; when all units are equipped with these instruments, the requirement for indirect fire control will be practically fulfilled.

b. Requests are increasing for panoramic telescopes for gun motor carriages, especially if these carriages are used for long-range interdiction fire. This installation has been made on some M10 gun motor carriages by the using British forces. As noted in paragraph 125d, the direct fire-control installations now in use are not completely satisfactory and do not provide the accuracy inherent in the armament.

c. In the Italian combat zone, approximately 45 percent of the medium tanks are being used as assault weapons and are making frequent sorties into enemy strong points. The rest of the vehicles are being used as artillery. Some of these are employed for indirect fire on area and point targets, and the rest, employing direct fire, are used for close-in infantry support. Because of the lack of indirect fire control, direct fire is employed at ranges up to 4,000 yd. where terrain permits. It must be remembered that these vehicles are not basically artillery pieces; therefore, the fire control provided must be essentially simple and require no training in field artillery methods for the crews.

d. The range finder, M9, is an extremely popular item, and officers in the armored units as well as other units agree that it should be furnished to tank battalions. The requirement for this instrument will be approximately one per platoon.

### **139. Tank, Light, T9E1**

a. No demand was apparent for the light tank, T9E1. Much information concerning it has been disseminated in the United Kingdom. The British have equipped one training battalion with this vehicle and found the same serious mechanical limitations as were discovered in tests of this tank at Aberdeen Proving Ground.

b. Several officers of the British Armored Corps indicated that the T9E1 tank could be used satisfactorily as a supplementary infantry assault weapon and that there has been and will be more training in that type of operation. They are aware of the defects in design and feel that modifications should be made before many are issued. These officers believe that the vehicle has an effective life of 300 to 600 miles of combined strategic and tactical operation.

### **140. Tractor, Medium, M4**

a. The medium tractor, M4, is not liked as a prime mover by using units in Italy and England. Although no serious mechanical deficiencies have developed, the tracks are particularly disliked. These vehicles are equipped with the all-steel tread interrupted grouser track, T49,

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which does not operate well across slippery slopes. In several instances tractors have overturned crossing slopes while pulling 155-mm howitzers. Some of the difficulty may be due to lack of training on the part of using personnel, as these units did not have adequate time to train with the vehicles after they were received.

b. Trailing idlers have had a high percentage of failures. The rims split off and the spokes break. Most of these failures have occurred in coast artillery units which employ the M4 medium tractor to tow the 90-mm gun. These units also state that the tractor has an extreme rearward tilt when towing the 90-mm gun, and they believe that stiffer rear springs should be supplied. It is recommended that pintles be installed on both front and rear of tractors and prime movers to assist in jockeying guns into position.

c. Nearly all the units using the M4 medium tractor stated that they would prefer the 7½-ton 6 x 6 as a prime mover with one medium tractor, M1 (preferably the D7), per battery.

### **141. Tractor, Medium, M5**

Because its military characteristics are very similar to those of the medium tractor, M4, personnel who saw the M5 tractor agreed almost unanimously that there was no requirement for it. It was frequently stated that the M4 tractor has all the performance characteristics of the M5 and some that the M5 does not have. The lower ground pressure of the M4 tractor also makes it more desirable. The M5 tractor should be produced in a much lighter design or with medium-tank tracks, which will give better flotation.

### **142. Tank, Heavy, M6**

Information on the development of heavy tanks of the M6 series was requested by a number of officers. All of them hoped that the development of these vehicles would continue and that at least one or two companies equipped with these tanks would be sent to the European theater.

### **143. Carrier, Cargo, Light, M29**

Next to the medium tank, M4E6, this vehicle was accorded the most enthusiastic reception. Tactical commanders and company officers of assault units could foresee tremendous possibilities in a vehicle that can literally go anywhere and at the same time tow or carry a load of approximately ½ ton. The Chemical Warfare Service is very anxious to use this vehicle to transport the 4.2" chemical mortar.

### **144. Half-track Vehicles**

The half-track vehicles and cargo carriers are used considerably in the theaters as command vehicles, personnel carriers, and antiaircraft mounts and are giving satisfactory mechanical performances. Except for use as antiaircraft mounts, however, they could readily be replaced by 2½-ton 6 x 6 trucks. Half-tracks are liked as command vehicles because they contain much room for radio installation, but all commanders believe that a better vehicle could be provided. These vehicles are seldom used over difficult terrain, because track throwing has been frequent and the unit ground pressure of the vehicles is too high for satisfactory performance in mud.

**145. Truck, 1/4-ton, 4 x 4, Command Reconnaissance**

This vehicle is thoroughly satisfactory to all personnel except that they would like 12-volt electrical systems and armored floors that would resist mine explosions. The vehicle is giving excellent service performances, owing partly to very good first- and second-echelon maintenance. Maintenance has been successful because drivers like the vehicles and are anxious to keep them running and because components are readily accessible for maintenance.\*

**146. Truck, 1/4-ton, 4 x 4, Amphibian**

This vehicle is not satisfactory for any use, particularly amphibious. Attempts to use it as a substitute for the other 1/4-ton 4 x 4 have been unsatisfactory because maintenance is high and hull difficulties multiply rapidly.

**147. Truck, 3/4-ton, 4 x 4, Command Reconnaissance**

This truck is in wide use with satisfactory results, although the 1/4-ton truck is preferred and would be used as a command vehicle if satisfactory radio installations could be made. The incidence of bearing failures is higher on this vehicle than on all others in use, although it cannot be considered abnormal when the high mileage operated and difficult terrain are taken into consideration. The location of the spare tire is considered very unsatisfactory, and there have been cases where drivers have been unable to get out under strafing fire from enemy aircraft. The weapon carrier version of this same truck is generally considered unsatisfactory, as the cargo space is too small for the average work that it is called upon to perform.

**148. Truck, 1/2-ton, 4 x 4, Cargo**

From a standpoint of continued service with low maintenance, this vehicle is probably giving the most satisfactory performance of any in use. They are, however, seldom used in the front-line areas where the terrain is extremely difficult. Many of these vehicles were seen which had operated in excess of 35,000 miles and were still in fair mechanical condition. Most of these trucks were still operating on their original tires, although these tires were becoming very smooth.

**149. Truck, 1 1/2-ton, 6 x 6, Personnel and Cargo**

This truck is considered a very satisfactory vehicle by units that are now using it. Infantry units that are employing it as a prime mover for the 57-mm gun consider it very good and state that they are now able to haul the gun into positions that were formerly inaccessible. In much of their operation, they mount the armor for the gun behind the driver, holding it in place by 2" x 4" stringers; this gives the driver some protection from strafing aircraft fire. In most cases, this truck has been issued as a replacement for the 3/4-ton 4 x 4 weapon carrier truck and,

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\*Jeep-stealing is commonplace in Italy. The Board heard stories of jeeps disappearing from every location visited. Most of the jeeps are stolen in the rear areas and eventually find their way into the front-line areas. Many ingenious devices in addition to the ignition lock have been devised to prevent theft. However, no entirely satisfactory means has been discovered. In some cases where it was impossible to move the jeep by any other means, wreckers and transporters were used.

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to use the words of a using unit, "There is no comparison between the two vehicles." No units that are using the 2½-ton 6 x 6 truck, however, are willing to exchange it for this vehicle.

### 150. Truck, 2½-ton, 6 x 6

This cargo vehicle and prime mover is so well liked by all troops and officers that it may be considered the most satisfactory cargo and personnel truck in use by the Army. Although there are no outstanding mechanical deficiencies encountered in the operation of these trucks, because of the large number of them in operation and the very great mileage which they aggregate, mention will be made of the outstanding mechanical failures which are occurring. About 65 percent of the work on these trucks and on most other cargo vehicles is on the following components:

**a. Radiator.**—Radiators become loose on their mounts, and the lower tanks break off. This difficulty is ascribed to a lack of first- and second-echelon unit maintenance in keeping mounting bolts tight.

**b. Brakes.**—There is a relatively high incidence of relining work, refacing and replacing of brake drums, and hydraulic-cylinder and fluid-line replacement. Consideration should be given to mounting larger brakes with heavier drums on these vehicles.

**c. Engine.**—The greatest problem in maintaining engines is the replacement of connecting-rod bearings. Failures of connecting-rod bearings are not so high as to be considered an outstanding deficiency and, in fact, are not as high as on the ¾-ton 4 x 4 truck. An investigation into causes of the bearing failures which occur reveals that they are generally due to the following five causes:

(1) The most serious cause of engine-bearing failures is a driving habit which is almost universal. Drivers approaching an intersection, or desiring to slow down from any speed, will double-clutch and shift down into the next lower speed and will then use the engine as a brake, thus picking up the engine speed by the consequent excessive acceleration. Questioning of drivers reveals that this is the accepted method of driving and is done mainly to reduce brake difficulties.

(2) There is considerable overspeeding of the engines in the lower gears, although this practice is not as widespread as the one noted above.

(3) There is still a considerable number of A-C mineral-type oil filters being used, although these are to be discarded.

(4) Oil changes are not being made at proper intervals, and frequently trucks will operate 4,000 or 5,000 miles with oil being added instead of changed. This is due for the most part to the fact that many trucks are operating nearly 24 hours a day and there is little or no time for essential maintenance.

(5) There has been some improper installation of bearings, but as the personnel are becoming more and more familiar with installation of insert bearings, failures due to this cause are being reduced.

### 151. Trucks, Prime Mover

The 4- and 6-ton 6 x 6 prime movers are giving satisfactory service but have clutch failures out of proportion to mileages operated. There is a very great preference for the 7½-ton 6 x 6 truck as a prime mover where the larger prime movers are authorized in the T/O & E, and this large prime mover is doing an excellent job.

### **152. Motorcycles**

There is little use of motorcycles for dispatch service. It was stated that the frequency of injuries to personnel is greatly reduced by the use of  $\frac{1}{4}$ -ton trucks and much more satisfactory messenger service is obtained. Motorcycles are desired only for military police work.

### **153. Galanot-Watson Traction Devices**

Because of the widespread use of  $2\frac{1}{2}$ -ton and larger 6 x 6 trucks in muddy and irregular terrain, there was great interest in these traction devices and the forward units were anxious to have them issued. They feel that these will be of great aid in moving these trucks forward under their own power; at present it is often necessary to tow them with crawler-type tractors or other track-laying vehicles.

### **154. Truck, $2\frac{1}{2}$ -ton, 6 x 6, Amphibian (DUKW)**

a. This  $2\frac{1}{2}$ -ton 6 x 6 amphibian truck is considered satisfactory for landing operations or for amphibious cargo transportation but has a number of mechanical deficiencies that reduce availability and increase maintenance. Most amphibian truck companies have as many as 50 percent of their vehicles on deadline at any time. An examination of three amphibian truck companies during February 1944 showed that out of 150 DUKW's, 46 were on deadline because of brake-seal failures and 25 were on deadline for manifold, clutch, and pillow-bearing failures. It may thus be readily noted that the highest incidence of failure is on wheel seals, which will not operate for more than 30 to 60 miles on land without failures. Pillow bearings on the propeller shaft cause considerable trouble, and a number of attempts have been made to lubricate these by other than standard methods to increase the life of the bearings. There has also been a large amount of hull damage due to scraping of the hulls on the stone walls that border the narrow roads in the United Kingdom. Welders sufficiently skilled to repair these seams are very difficult to obtain. It was generally recommended that use of DUKW's in training operations be restricted to an absolute minimum and that their use as cargo carriers on land be discontinued entirely until actual tactical operations are commenced. On the DUKW's that were seen in England, the central inflating system was not in operation, owing to failure of seals. An examination of maintenance work on these vehicles disclosed that they require approximately three times as much first- and second-echelon maintenance as the  $2\frac{1}{2}$ -ton 6 x 6 cargo trucks. Observation of the operation of these vehicles disclosed that the crews are generally maintenance-minded, and it was noted that at every halt necessary lubrication was provided.

b. Officers of amphibian truck companies feel that a crew of two is too small for the DUKW and that the number should be increased to three or four. They also are of the opinion that radio should be provided in order to correlate more closely the operations between ship and shore. Even in practice operations, it has been noted that there is a tendency for DUKW's to bunch up after they have completed unloading the first vessel to which they are assigned.

### **155. Landing Vehicle, Tracked**

This vehicle is not as well liked as the DUKW by personnel in the United Kingdom for several reasons:

- a. It does not handle as well in water and will not weather as heavy surf as the DUKW.

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b. It requires a great deal more maintenance, although the T/O & E of the Amphibian Truck Company would not be changed if LVT's were used. (It should be noted that all the experience on LVT's has been on the Roebling type, which uses a water-cooled Hercules engine.)

c. Operation of the LVT on land is more difficult where the vehicles have to proceed over miles of stones or paved roads. It is not anticipated that any considerable number of LVT's will be available in the European theater.

### **156. Fire Power on Landing Craft**

In the North African theater, there was a great deal of enthusiasm for mounting the T27E1 rocket launcher on the DUKW and LVT, and for firing the 105-mm howitzer from the DUKW. Personnel in the European theater agreed with this view on the launcher but are not interested in mounting the 105-mm howitzer on the DUKW. Considerable information has been disseminated in these theaters regarding the capsizing of a number of DUKW's which were carrying 105-mm howitzers during landing operations in Italy. A check of the actual occurrences revealed that every incident in which a DUKW capsized was due to poor seamanship on the part of the driver. In several cases it was found that these DUKW's were being towed by other landing craft because of failures of pillow bearings and propeller-strut bearings.

### **157. Launcher, Rocket, Multiple, 4.5", T34 (60-tube)**

Tests with the T34 rocket launcher on a medium tank, M4A1, show that when this tank is equipped with the standard fording stacks the rocket launcher can be fired only broadside, as firing forward causes the fording stacks to be blown loose from their mountings on the rear of the tank. As it would be highly unsatisfactory to attempt to turn broadside during landing operations, it is necessary that a modification to the fording stacks be devised at once in order that these launchers may be fired straight ahead.

### **158. Mine Exploders**

a. There is intense interest in all theaters in any type of mine-field clearing devices. A number of "cobbled up" expedients have been and are being tried in Italy and England, but no one of these has proved satisfactory. There is one mine-field clearing company (engineer) operating near Cassino with 12 Scorpions, and the objections are generally the same as those which have been found in test. There was very great interest in the mine exploders, T1E1 and T1E3, although mine-clearing personnel do not believe that either of these exploders can be operated successfully over the type of terrain being encountered. German mine-placement tactics vary considerably, and in several instances personnel have encountered detonators located about 12' to 15' from what they believed to be a 100-lb. block of TNT.

b. The British Armored Corps is doing a great deal of experimentation with mechanical mine-clearing devices and has several that appear to be promising.

(1) Probably the most satisfactory of these is one known as the "Canadian Indestructible Roller." This mine exploder utilizes two rollers, one ahead of each track, that are pulled by a beam projecting ahead of a medium tank. The rollers are approximately 18" in diameter and 18" wide. They are so mounted that when a mine is detonated the roller goes up and around the beam on its mounting arm and, as the tank proceeds, the roller digs in and returns to proper position. This exploder has successfully withstood explosions of double Tellermines.



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(2) They are also conducting work on the "Flying Dustbin," which is projected from a "Dynamic Petard." This is a device very similar to our "Flying Pig," utilizing a spigot mortar and a large HE projectile which is hurled 50 to 100 yd. ahead of the vehicle on which it is mounted.

(3) They have overcome a great many objections to the "Scorpion," which they now call the "Crab," by counterweighting the rotor-support arms.

(4) They are also experimenting with the "Wurlitzer," which is merely a device that projects lengths of pipe filled with a high explosive.

(5) Another device which presents possibilities is mounted on a half-track and consists of a section of empty fire hose from 100' to 250' in length. This hose is projected ahead of the vehicle by means of mortar and is then filled with a liquid explosive. A detonator is placed on the end of the hose, and the charge may be exploded by rifle fire after the vehicle has moved to a safe vantage point. Their tests with large disks have not been successful, and at present they are not conducting any experiments with this type of exploder.

### 159. Modification Work Orders

Modifications are being applied to vehicles in England as rapidly as kits become available, and most of the vehicles being issued to the armored and other units include all the modifications now authorized. There are very few modification kits being received in the North African theater, and the using units are not familiar with what modifications are available.

### 160. Maintenance

a. With the exception of combat vehicles, there is very little first- or second-echelon maintenance in the theaters—particularly in the combat zones. In almost every case, all available personnel is being used in cargo transportation or actual tactical or supply operations, and there is no personnel available to perform maintenance work on a routine basis. This causes vehicles to require more extensive repairs than they should when they are returned to the ordnance third- and fourth-echelon shops. It has been found in practice that it is frequently quite difficult to determine whether a vehicle being returned for repair should go to a third-, fourth-, or fifth-echelon shop. The opinion was expressed several times that three groups of maintenance should be provided as follows:

- (1) Using-arm maintenance.
- (2) Ordnance support maintenance.
- (3) Base-shop maintenance.

b. A check of vehicles deadlined in the Peninsular Base Section in the North African theater showed that approximately  $5\frac{1}{2}$  percent of 9,100 vehicles were out of service because of required repairs or lack of parts.

### 161. 2½-ton Dump Trucks

These dump trucks are reported by engineer units as being satisfactory except that there is a serious deficiency in the mechanism of the Heil hoist assembly. It has been found on these hoists that the trunnion locking pins drop out either by breaking off or through wear. This causes a deformation of the hoisting assembly when the load is applied. Also, no provision was made in this model for lubrication, and the articulating parts wear very badly. In particular,

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the upper bearing of the lift assembly gives trouble. The supporting members leading from the center to the upper bearing are only  $\frac{3}{8}$ " wide with an additional  $\frac{3}{8}$ " for bearing surface. This was found to be inadequate, as the bearing bores rapidly become oval shaped. Less difficulty has been encountered in the Garwood hoist assembly. Both of these hoists leak very badly at the top oil seal on the cylinder, and in operation it is found necessary to replenish oil daily.

### 162. Tank Transporters

a. In moving medium tanks in England, the M19 tank transporter has been found more satisfactory than the M25. This is entirely due to the greater over-all width of the M25 tank transporters, as a facility in the 3d Armored Division has disclosed no serious defects in approximately 4,000 miles of use by each vehicle. It has been noted that the carburetors on the tractor truck require more ordinary maintenance, but the condition is not considered serious.

b. The M19 tank transporter has a very serious deficiency in that the brakes on this combination are totally inadequate for strategic operation when transporting medium tanks. It has also been found that proceeding down steep hills with the transporter in low gear is not good practice, as there is a great deal of engine overspeeding with consequent bearing failures. General practice on descending hills is to leave the transmission in top gear and to use the trailer brakes as sparingly as possible or not at all.

## Section VII

### AVIATION ORDNANCE

#### 163. Small Arms

a. Cal. .30.—The use of cal. .30 machine guns in aircraft is virtually a thing of the past.

b. Cal. .50.—In general, Army Air Force officers fully appreciated the value of their cal. .50 aircraft machine guns, but a mistaken idea that the 20-mm aircraft cannon reaches out farther than the cal. .50 machine gun was encountered. Full information on this subject should be supplied. Colonel Philip Schwartz informed the Board that no two Army Air Force organizations belt cal. .50 ammunition the same. Some organizations prefer one tracer to five incendiary; others, one tracer, one incendiary, and three armor-piercing. In fact, almost every combination exists. As a result, the cal. .50 linking-delinking machine, M7, is in high demand. The issue of cal. .50 armor-piercing incendiary ammunition will aid in standardizing belt loading. The air forces feel that the new cal. .50 armor-piercing incendiary ammunition is a great improvement and desire that it be supplied as early as possible. The use of green lumber for packing has caused some difficulty because its excessive moisture content condenses on the inside of the case.

c. Body armor.—The Army Air Forces are very enthusiastic about body armor. Some crews were using their body armor to stand on for protection from underneath. Pads of similar construction are now being furnished for that purpose. Consideration is being given to supplying curtains of body-armor construction to be placed immediately to the rear of the pilot and co-pilot.

#### 164. Gun, Automatic, 37-mm, M9 (Aircraft)

Little interest was shown in this automatic aircraft cannon. As it is understood that additional information will be supplied the theaters by the Ordnance Department in the near future, no special effort to introduce this weapon was made by the Board.

**165. Bombs**

**a. General.**—(1) It was explained by Colonel Schwartz that present bomb-bay design is dictating the type of bombs that are being carried. Present bomb-bay construction is such that the maximum total load of bombs that may be carried are of the 500-lb. type. If smaller bombs are carried, the maximum total weight is much lower. Consequently, 500-lb. bombs are being used to a maximum even when the type of target being attacked requires bombs that are smaller or of another type. It is believed that possibly this situation has created a false impression that smaller bombs are no longer desirable. Colonel Schwartz believed that smaller bombs have a very definite advantage in many situations and that they should not be eliminated from production schedules.

(2) Although there have been some accidents recently during the handling of bombs and the loading of bombs into bomb bays, it was reported that in general the belief is that present bombs are sufficiently safe. Colonel Schwartz states that he believes that the solution to this problem is training. He has been conducting an intensive training program, and since it was initiated no further accidents have occurred.

**b. Bombing tables.**—A request was received for the extension of all bombing tables to cover high altitudes; for example, the tables for the 20-lb. fragmentation bomb must be extended to 30,000 ft. There is some doubt as to the accuracy of the present table at 20,000 ft.

**c. Butterfly bombs.**—This item is most popular with the Army Air Forces. The German butterfly bomb is highly respected in the United Kingdom. At many locations, pictures of the German butterfly bomb may be seen with a vivid warning that these bombs should not be touched.

**d. Fragmentation bombs.**—The new fragmentation bombs, including the 260-lb. M81 and the 85-lb. T9 with the T8 cluster and T3 adapter, were extremely popular and are being requisitioned by the Army Air Forces through Army Air Force channels.

**166. Fuzes**

**a.** It was reported that the .08-sec. delay is sometimes excessive. A shorter delay is desired and should be developed for the armor-piercing bomb.

**b.** It is believed that the T38 bomb fuze is giving too many failures. Wing Commander Skinner, RAF, reported that in his opinion the fuze is failing as a result of breakage of the ampule nugget. He believes that it breaks as a result of rapid temperature changes. He states that ampule thickness varies from .005" to .035", that there can be leakage at the seal, and that moisture can soften the plastic. He also believes that breakage may result from the safety balls concentrating the load, from poor tolerances on the firing pin, or from inspection, at which time either the plug may be put back too tightly or the tolerance washer may be left out.

**167. Rockets**

**a.** In general the 4.5" aircraft rocket launcher, T30, excited great interest among the senior officers, although there were a few who questioned the effectiveness of rockets launched from aircraft. This latter viewpoint may be based partly on the fact that to date rockets launched by German aircraft against our planes have not been particularly effective. There are many in the theater, however, who believe that the rockets requested should be used for air-to-ground firing and that this use during the invasion will prove highly desirable. There was some concern

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over the loss of plane speed caused by the launchers. It was agreed that the fact that the entire rocket equipment may be jettisoned will in some measure compensate for the loss of speed it causes. The Board left two T30 aircraft launchers in ETO with a substantial supply of 4.5" rockets, M8, and arranged for a similar shipment to NATO, which arrived prior to the departure of the Board to the United States. Captain Weidman, of Elgin Field, followed the Board into both theaters, where he supervised the mounting of the launchers and gave instructions in their handling and use.

b. General Timberlake, of NATO, believes that the 4.5" rocket could be mounted on the B-25 airplane and that it may be superior to the 75-mm aircraft cannon.

## **Chapter 8**

### **QUARTERMASTER CORPS**

#### **168. General**

The information and conclusions contained herein are based on informal conferences with the staff, unit commanders, officers, and enlisted men of the Fifth Army and upon observation.

#### **169. Case, Map, Canvas, Roll Type**

This item, now a limited-procurement item for issue to armored units, tank destroyer units, and mechanized cavalry units, elicited favorable comment from officers in all branches. It was generally considered superior to the despatch case now issued. It was suggested that a longer strap be provided to permit slinging the case over the shoulder. It is recommended that each service board be directed to submit recommendations concerning a basis of issue.

#### **170. Trousers, Wading**

This item is desired not only for operations on beaches but also for those at river crossings, bridgeheads, etc., of which there will be a considerable number in Italy. A theater stockage is desired, and a definite requirement was set up for NATO.

#### **171. Packboard, M43**

Little interest was displayed in this item, as it was generally felt that more efficient transportation can be effected by animal pack train.

#### **172. Cutter, Wire, 9", Heavy-duty Type**

This item has been requested by ETO and had not been seen in NATO. A sufficient number was requisitioned to fill requirements. It is recommended that this wire cutter be service-tested by the Engineer Board and the Infantry Board to determine whether it should be standardized to replace the wire cutter, M1938.

### 173. Cover, Canteen

The cover, canteen, was found satisfactory in NATO for carrying hand grenades and was so employed. Although standardization of the canteen cover for this purpose is not indicated, the fact that it can be used for other than its intended purpose should be considered in its procurement and issue.

### 174. Clothing

a. **General.**—(1) All the new items of clothing which were exhibited and worn by members of the Board excited considerable favorable comment everywhere. The outstanding items were the pile jacket and the turtle-neck sweater. The only advantage of the “inside-outside” shoes appeared to be the comfort with which they may be worn when new. Even when well dubbed, these shoes were far from waterproof. Exposure to water for only a short time resulted in wet feet.

(2) It was reported that in the mountainous areas of Italy the new combat suit could be worn even during the summer months. It was also reported that the old standard field jacket did not provide sufficient warmth and that present clothing should be more water repellent. There were insufficient combat suits in stock to equip all the troops engaged in combat in Italy. Clothing at the front was generally worn and ragged. Unit commanders were greatly concerned over their inability to provide adequate, serviceable, warm clothing for their men. The excellent quality of clothing worn by captured Germans provided an unfavorable contrast.

b. **Assault jacket.**—(1) In the European theater, the Board was shown an assault jacket which had been developed in that theater. Colonel Brewster, who is assigned to G-3 in ETO, is sponsoring the development and procurement of this jacket. The United States Medical Corps personnel in that theater assisted in designing the weight distribution. The jacket has received thorough tests during assault training in England. Colonel Brewster stated that arrangements can be made with one small British concern for the manufacture of 10,000 per month.

(2) The jacket is made of canvas, is of hip length, and has large arm holes. It has three buckles down the front which are designed for quick release. There is a strap on each shoulder for holding slung equipment. In front there is one pocket on each side for carrying cal. .30 ammunition. Below these pockets there are pockets for carrying hand grenades, three in each pocket, or a total of six. In front on each side there are eyelets for carrying the pistol and holster and the canteen cover and canteen. In back, and uppermost, there is a pocket which will carry an engineer demolition kit or any other item of similar weight and size. Below this pocket there is a small pocket for personal articles and, to one side, a pocket for a first-aid kit.

(3) An effort was made to bring one of these jackets back to the United States. However, none was available at the time of the Board's departure. Colonel George F. Doriot, Chief, Research and Development Division, Office of the Quartermaster, has been given the above information.

### 175. Rations

There was little complaint with regard to rations. The several suggestions for improvement submitted are enumerated below:

a. The three meat components of the C ration are too nearly alike and provide too little variety. The substitution of pork and beans, or spaghetti, for the beef and vegetable stew was recommended.

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- b. The lemonade extract in the K ration is never used. Substitution of coffee was recommended.
- c. The dextrose tablets in the K ration are not popular. Improvement of the flavor was recommended.
- d. Improvement of the flavor of the cracker component of the K ration was recommended.

### 176. Preparation and Serving of Food

a. The following methods of preparing and serving food were used, depending upon the situation:

- (1) Heating C and 5-in-1 rations by means of individual (vehicular) cooker.
- (2) Preparing in company kitchens and carrying forward in insulated food containers, M1941.
- (3) Serving directly from company kitchens.

b. Unit commanders were not favorably disposed toward dispensing with any of the above methods. They feel that a wide choice of methods permits the most efficient rationing in any given situation.

### 177. Conclusions

a. With the exception of the supply and quality of clothing, present and proposed quartermaster items are satisfactory.

b. The new combat uniform, consisting of the water-repellent combat trousers, the water-repellent field jacket, M1943, the pile jacket, and the cap, will satisfy the needs of combat troops. Immediate action should be taken to furnish units in combat with these items.





## Appendix I

### REQUISITIONS BY NORTH AFRICAN AND EUROPEAN THEATERS FOR ITEMS DEMONSTRATED

#### CHEMICAL WARFARE SERVICE

ITEM	NATO	ETO
Flame thrower, portable, M2-2 (E3).....	900	1,506
Compressor, air, for flame thrower.....		4
Kit, service, for portable flame thrower, M2-2.....	150	251
Cartridge, ignition, for portable flame thrower, M2-2.....	5,000	45,000
Generator, smoke, mechanical, M2, 50-gal.....	300	316
Incendiary, pocket, M1.....	4,000	
Incendiary, safe-destroying, M1.....	25	3,500
Mask, gas, assault, service, new type.....	1,500	126,000
Mortar, chemical, 4.2", M2A2, w/carts.....	192	
Fuze, P.D., delay, T89, for 4.2" C.M. shells.....	15,000	
Fuze, T and SQ, E39, for 4.2" C.M. shells.....	10,000	
Pack, mule, E7, for 4.2" C.M.....	12	
Sight, M59, for 4.2" C.M.....	200	
Pot, smoke, (HC), M5.....	120,000 (at rate of 20,000 per month)	

#### CORPS OF ENGINEERS

ITEM	NATO	ETO
Adapter, priming, explosive, M-1A1.....		750,000
Armored engineer vehicle w/o tank and w/o dozer blade.....		60
Asphalt drum heater.....		4
Block, demolition, chain, M-1.....		100,000
Block, demolition, M-2.....		750,000
Block, demolition, M-3.....		600,000
Boat, landing, pneumatic, rubber, 10-man.....		75
Boat, power, twin screw.....	3	

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ITEM	NATO	ETO
Boat, reconnaissance, pneumatic, canvas, 2-man.....	600	
Box, sign, interior illuminated, electric.....		1,800
Bulldozer, tank mounting, for M4A1, M4A2, M4A3 tanks (w/tanks).....	50	360
Cab, motor grader, armored.....		50
Carpet-roll torpedo (w/blowers, 1 per 10 rolls).....		600
Charge, demolition, Navy, Mk. 13 (Reddy Fox).....		500
Compass, vehicular, navigational, illuminated.....		50
Compass, vehicular, general purpose, illuminated.....		500
Conveyors, 24-in., flat belt, 50-ft. long, power driven.....		100
Demolition equipment, set No. 5, individual.....	725	5,500
Demolition equipment, set No. 7, electrical.....	50	1,050
Detector, antitank mine, portable, nonmetallic mine AN/PRS-1 (Dinah)....		5,000
Detector, antitank mine, vehicular (mounted on ¼-ton 4 x 4 truck).....		640
Detonator, concussion.....	2,600	11,000
Diving outfit, set No. 3.....		150
Explosive, shaped charge, T-3.....		25,000
Firing device, pull type, friction, T-2.....		150,000
Firing device, pull release type, M-3.....		75,000
Flare, landing, electric, dry cell, w/separate liquid to form electrolyte solution.		11,000
Flare, road, electric, dry cell, w/separate liquid to form electrolyte solution....	25,000	25,000
Hypochlorination unit, automatic, portable, 2-100 GPM.....		95
Kit, portable, water analysis.....		300
Kit, sign reproduction, w/sign chest.....	32	525
Lamp, electric, portable, command post.....		1,400
Lamp, electric, flasher.....		15,000
Lighter, fuse, weatherproof, M-2.....	20,000	500,000
Marker, luminous, radioactive, type II, 1¾", bolt back.....		100,000
Metallizing equipment, set No. 1.....		20
Mine probe, M-1.....	4,000	20,000
Mine-field marking set.....		600
Odograph, land, 6-volt, w/cables.....		25
Pile driving rig, steel, skid mounted, 55-ft. lead.....		15
Pipeline equipment set for 2 ½-ton truck.....	9	30
Propelling unit, barge, outboard type, 40 hp.....		50
Pumping and hypochlorination unit, portable, gasoline engine driven, 50 GPM.		50
Repair equipment, set No. 7, pneumatic float, large size.....		200
Shower unit, field, portable, w/heater, 8 shower heads.....		750
Signs, traffic, paper, plain and reflectorized.....		10,000
Snake, demolition, M-2.....		150
Sniperscope.....		150
Snooperscope.....		150
Stake, delineator, reflector mounting, w/reflector, retro-directive.....		130,000
Tractor, wheeled, w/clearing unit.....	6	
Trailer, 4-wheel, special, tandem, 7-14-ton 4-dt.....	3	30
Truck, tractor, 4-ton, 6 x 6, 4-dt, 172-in. wheelbase, w/cab protector and winch, front mounted.....	3	
Tramway, aerial, light, M-2.....	4	
Truck, flat bed, 4-ton, 6 x 6, 4-dt, 172-in. wheelbase, w/A-frame, cab protector, and winch, rear mounted.....		18
Winch, tractor mounting, double drum, w/gypsy spool.....	6	50

# REQUISITIONS FOR ITEMS DEMONSTRATED

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	ITEM	NATO	ETO
<b>Small Arms</b>			
Adapter, grenade, projection, M1.....			20,000
Armor, body (less helmet).....	180		1,440
Fastener, strap, quick-release, for infantry helmet.....	1,404,000		4,143,444
Gun, machine, cal. .30, Browning, M1919A6, flexible.....	965		
Gun, submachine, cal. .45, M3.....	7,300		
Holster, pistol, cal. .45, M7.....	2,000		16,675
Knife, T8, w/scabbard and all components requisitioned to use as bayonet....	10,000		
Machine, linking-delinking, cal. .50, M7.....			11,000
Mount, machine gun, AA, cal. .50, T91E3.....			13,258
Sight, adjustable, rear, for carbine.....	296,625		
Sight, T59, for rifle grenade launcher.....	47,982		116,196
<b>Artillery and Fire Control</b>			
Binocular, Mk. 21, Navy.....	1,550		
Binocular, M7.....	2,500		
Extension tube, T1, 81-mm mortar.....	332		500
Finder, range, M9.....	278		
Gun, 37-mm, T32, on mount, T9.....	100		
Kit, for mounting 105-mm howitzer, M2A1, on DUKW.....	108		
Kit, mod., on holder for periscope, M4, w/telescope.....	2,111		
Kit, skid pan, for 105-mm howitzer, M2.....			814
Kit, skid pan, for 155-mm howitzer, M1.....			593
Mechanism, firing, T4E2, w/adapters.....	419		1,584
Mortar, 60-mm, w/mechanism, firing, T18E6.....	1,533		2,385
Mortar, 81-mm, T24 (24 1/2" tube).....	250		
Setter, fuze, hand, T37E1.....	2,652		2,075
<b>Rockets and Launchers</b>			
Fuze, rocket, P.D., M4, SQ-0.015 sec. delay, w/booster, auxiliary, M1.....	108,000		
Fuze, rocket, P.D., M4A1, SQ-0.1 sec. delay, w/booster, auxiliary, M1.....	11,000		
Kit, for mounting launcher, T27E1, on DUKW.....	150		
Launcher, grenade, M7.....	16,059		
Launcher, rocket, 2.36", M9 (T21E2).....	11,864		
Launcher, rocket, 4.5", T27E1 (8-tube).....	250		675
Launcher, rocket, multiple, 4.5", T34.....	200		350
Launcher, rocket, artillery, 4.5", T35, w/rocket, M8, w/fuze, M4A1.....	7,000		
Launcher, rocket, 4.5", CIT-120, rail for DUKW.....	75		
Launcher, rocket, 7.2", T40.....			69
Launcher, 7.2", four-barreled, T16.....	8		
Rocket, barrage, 4.5", CIT (Navy).....	25,000		
Rocket, HE, 4.5", M8.....	110,000		370,000
Rocket, HE, AT, 2.36" M6A3.....	162,000		
Rocket, smoke, WP, 2.36", T26.....	25,500		20,000
Rocket, HE, 7.2", T16, w/fuze, 147 (Navy), and plastic explosive.....	1,000		18,000

# REPORT OF THE NEW WEAPONS BOARD

ITEM	NATO	ETO
<b>Ammunition</b>		
Canister, fixed, T17, 57-mm gun, M1	5,800	31,000
Canister, fixed, T30, 75-mm how., M1, M1A1, M2, and M3		9,200
Cartridge, API, cal. .30, T15 (8 per clip)	2,530	Replace
	thousands	cal. .30 AP
Cartridge, API, cal. .30, T15 (5 per clip)	8,625	Replace
	thousands	cal. .30 AP
Cartridge, API, cal. .30, T15 (225 per belt)	11,575	Replace
	thousands	cal. .30 AP
Cartridge, API, cal. .50, M8 (T16) (240 per metal-lined box)	4,380	Replace
	thousands	cal. .50 AP
		and incendiary
Cartridge, grenade, auxiliary, M7 (T18)	55,000	
Cartridge, tracer, night, cal. .30, T10		Replace
		cal. .30 tracer
Cartridge, tracer, night, cal. .50, M10 (T12)		Replace
		cal. .50 tracer
Fuze, nose, CP, T105	55,000	100,000
Fuze, nose, CP, T105, w/booster, M21A1	65,000	
Grenade, rifle, smoke, colored, T8E1 (red, green, orange, violet)	5,250	
Grenade, rifle, smoke, colored, T12, streamer type (red, green, orange, violet)	5,250	
Grenade, rifle, smoke, WP, T5E1	20,500	
Grenade, rifle, smoke, HC, T6E1	10,500	
Increment, propellant, M1, 81-mm mortar shell, M43A1, M44, M45, and M45B1	27,500	
Increment, propellant, M2, 81-mm mortar shell, M56, and M57	9,500	
Mine, AT, HE, NM, M5, w/fuze, M5	50,000	
Mine, heavy, AT, HE, T6E1, w/fuze, T8E1	100,000	
Mine, grenade, AT, T7, w/fuze, T7	50,000	
Shell, fixed, HE, M63, for 37-mm gun, T32	75,000	
Shell, illuminating, 155-mm, T21, for 155-mm how., M1		6,200
Shell, smoke, WP, 60-mm, T6	48,600	
Torpedo, Bangalore, projectile, 81-mm, T1	3,000	2,000

## Automotive

Carrier, cargo, light, M29		1,529
		(w/141 conversion amphibious kits)
Connector, extended end, for medium tank track with 1 1/4" pin	300	200,000
	sets	connectors
Device, traction, Galanot-Watson		1,085 sets
Kit, conversion, 12-volt, truck, 1/4-ton, 4 x 4	20	250

## QUARTERMASTER CORPS

ITEM	NATO	ETO
Case, map, canvas, roll type	3,300	1,000
Cutter, wire, 9", heavy-duty type	8,400	11,785
Packboard, M43, w/attachments and quick-release strap		10,000
Trousers, wading	12,000	

## Appendix II

### LIST OF ITEMS DEMONSTRATED AND EXHIBITED IN THE NORTH AFRICAN AND EUROPEAN THEATERS

No.	ITEM	WHERE SHOWN	
		NATO	ETO
1	Bayonet, carbine, T4	X	X
2	Bayonet, carbine, T5	X	X
3	Bayonet, carbine, T6	X	X
4	Bayonet, M1, w/scabbard, bayonet, M3A1	X	X
5	Knife, trench, M3, w/scabbard, trench knife, M8 (plastic)	X	X
6	Knife, T8	X	X
7	Holster, pistol, cal. .45, M7	X	X
8	Holster, pistol, cal. .45, M3	X	X
9	Binocular, M7	X	X
10	Binocular, Mk. 21, Navy	X	X
11	Armor, body (sets, less helmets)	X	X
12	Fastener, strap, quick-release, for infantry helmet	X	X
13	Machine, linking-delinking, cal. .50, M7		X
14	Packboard, M43, w/attachments and quick-release strap	X	X
15	Carbine, cal. .30, M1A1 (collapsible stock and adjustable rear sight)	X	X
16	Cartridge, carbine, tracer, cal. .30, T24	X	X
17	Gun, machine, cal. .30, Browning, M1919A6, flexible	X	X
18	Gun, submachine, cal. .45, M3	X	X
19	Gun, submachine, 9-mm, M3	X	X
20	Cartridge, ball, 9-mm, M1, 15-grain bullet	X	X
21	Cartridge, API, cal. .30, T15	X	X
22	Cartridge, API, cal. .50, M8 (T16)	X	X
23	Cartridge, tracer, night, cal. .30, T10		X
24	Cartridge, tracer, night, cal. .50, M10 (T12)		X
25	Cartridge, headlight, cal. .50, T1E1	X	X
26	Cartridge, shot, cal. .45, M15	X	X
27	Launcher, grenade, M1, M7, and M8	X	X
28	Sight, T59, for rifle grenade launcher	X	X
29	Signals, ground, smoke, T38 through T42	X	X
30	Grenade, rifle, smoke, colored, T8E1 (red, orange, violet, green, and yellow)	X	X

# REPORT OF THE NEW WEAPONS BOARD

No.	ITEM	WHERE SHOWN	
		NATO	ETO
31	Grenade, rifle, smoke, colored, T12, streamer type (red, green, violet, and yellow).....	X	X
32	Adapter, grenade, projection, T1, for chemical grenades.....	X	X
33	Adapter, grenade, projection, T2, for chemical grenades.....	X	X
34	Adapter, grenade, projection, M1.....	X	X
35	Signals, ground, star parachute, M17A1 to M22A1.....	X	X
36	Signals, ground, star cluster, M51A1 and M52A1.....	X	X
37	Grenade, rifle, smoke, WP, T5E1, and HC, T6E1.....	X	X
38	Cartridge, rifle, grenade, cal. .30, M3.....	X	X
39	Cartridge, grenade, carbine, cal. .30, M6.....	X	X
40	Cartridge, grenade, auxiliary, M7 (T18).....	X	X
41	Grenade, smoke, white (HC), AN-M8.....	X	X
42	Grenade, smoke, colored (red, green, violet, orange, and yellow).....	X	X
43	Grenade, smoke, hand (WP), M15.....	X	X
44	Pot, smoke (HC), M1 (E-13 w/screw top).....		X
45	Pot, smoke (HC), M5.....	X	X
46	Pot, smoke, floating (HC), M4A1.....		X
47	Incendiary, pocket, M1.....		X
48	Incendiary, safe-destroying, M1.....		X
49	Generator, smoke, mechanical, M2, 50-gal.....		X
50	Mask, gas, assault, service, new type.....	X	X
51	Launcher, rocket, 2.36", M9 (T21E2).....	X	X
52	Rocket, HE, AT, 2.36", M6A3.....	X	X
53	Rocket, HE, AT, 2.36", T12.....	X	X
54	Rocket, smoke, WP, 2.36", T26.....	X	X
55	Mortar, 60-mm, w/mechanism, firing, T18E6.....	X	X
56	Shell, smoke, WP, 60-mm, T6.....	X	X
57	Mortar, 81-mm, T24 (24 1/2" tube).....	X	X
58	Extension tube, T1, 81-mm mortar.....	X	X
59	Fuze, T and SQ, T88, 81-mm mortar.....	X	X
60	Torpedo, Bangalore, projectile, 81-mm, T1.....	X	X
61	Hook, grappling, projectile, 81-mm, T1.....		X
62	Cutter, wire, 9", heavy-duty type.....	X	X
63	Mortar, 105-mm, T13, on mount, T12.....	X	X
64	Shell, HE, 105-mm, T17 (mortar), w/M53E3 fuzes.....	X	X
65	Setter, fuze, hand, T37E1.....	X	X
66	Mortar, chemical, 4.2", M2A2.....	X	X
67	Shell, HE, 4.2" chemical mortar, M4.....	X	X
68	Fuze, T and SQ, E39, for shell, HE, 4.2", M3.....	X	X
69	Sight, M59, for 4.2" chemical mortar.....	X	X
70	Gun, 37-mm, T32, on mount, T9.....	X	X
71	Shell, fixed, HE, M63, 37-mm gun, T32.....	X	X
72	Shell, fixed, HE, 57-mm, T18.....		X
73	Gun, 76-mm, T5E1 (antitank) (to be fired w/round w/19" primer).....		X
74	Shell, fixed, HE, M42A1, w/fuze, P.D., M54, 19" primer, 76-mm guns, M1, M1A1, M1A2.....		X
75	Projectile, fixed, APC-HE, M62, w/fuze, B.D., M66A1, and tracer, 76-mm guns, M1, M1A1, M1A2.....		X

# ITEMS DEMONSTRATED AND EXHIBITED

No.	ITEM	WHERE SHOWN	
		NATO	ETO
76	Shell, semifixed, smoke, HC, B.E., M84, w/fuze, P.D., M54, 105-mm how., M3 (airborne).....		X
77	Kit, skid pan, for 105-mm how., M2.....		X
78	Canister, fixed, T17, 57-mm gun, M1.....	X	X
79	Canister, fixed, M2, 37-mm gun, T32.....		X
80	Canister, fixed, T30, 75-mm how., M1, M1A1, M2, and M3.....		X
81	Canister, fixed, T3, 76-mm gun, M1, M1A1, M1A2.....		X
82	Canister, fixed, T22, 90-mm gun, M1, M1A1, M2, M3.....		X
83	Canister, semifixed, T18, 105-mm how., M2, M2A1, M3, and M4.....	X	X
84	Kit, waterproofing, for 105-mm how., M2A1.....		X
85	Mechanism, firing, T4E2, w/adapters.....	X	X
86	Shell, illuminating, T21, 155-mm how., M1 (w/fuze).....		X
87	Kit, skid pan, for 155-mm how., M1.....		X
88	Primers, cone-valve, T22.....	X	X
89	Gun, automatic, 37-mm, M9 (aircraft).....		X
90	Mount, machine gun, cal. .50, AA, T91E3, lightweight.....		X
91	Mount, machine gun, multiple, cal. .50, M51.....		X
92	Mount, trailer, machine gun, multiple, cal. .50, M55 (T81E1).....		X
93	Gun, automatic, 40-mm, M5 (airborne) w/Weiss sight.....		X
94	Sight, computing, M7 (Weiss), for 40-mm AA gun carriage, M2.....	X	X
95	Shell, fixed, HE, M71, w/fuze, M43A4, 19" primer, 90-mm gun, M1, M1A1, M2, and M3.....		X
96	Projectile, AP, T10, for 8" how., M1.....		X
97	Fuze, nose, CP, T105.....	X	X
98	Launcher, rocket, 4.5", T35E1.....	X	X
99	Launcher, rocket, 4.5", T30.....		X
100	Rocket, HE, 4.5", M8.....	X	X
101	Bomb, incendiary, 4-lb., AN-M50X-A3 (sectionalized).....		X
102	Bomb, incendiary, 4-lb., AN-M50X-A3 (sectionalized).....		X
103	Bomb, incendiary, magnesium, 2-lb., AN-M52 (sectionalized).....		X
104	Bomb, incendiary, magnesium, 2-lb., AN-M52X (sectionalized).....		X
105	Bomb, chemical, M74 (sectionalized).....		X
106	Bomb, fragmentation, 85-lb., T9, w/adaptor, cluster, T3, w/fuzes.....	X	
107	Adapter, cluster, T3, for cluster, bomb, T8.....		X
108	Bomb, incendiary, 100-lb., M47A2 (sectionalized).....		X
109	Bomb, incendiary, 100-lb., M47A2 (PT filled).....		X
110	Bomb, fragmentation, 260-lb., AN-M81 (T10).....		X
111	Cluster, bomb, T8.....		X
112	Cluster, bomb, T11 (butterflies), and fuzes, bomb, T47, T48, and T49 ..	X	X
113	Adapter, cluster, M12 (T10).....	X	X
114	Adapter, cluster, T3 (for cluster, bomb, T8).....		X
115	Bomb, 500-lb., incendiary, T2E1, M76 (PT mix).....		X
116	Fuze, bomb, T41 (tail).....	X	X
117	Fuze, bomb, T56 (nose).....	X	X
118	Mine, antipersonnel, M2A3 (inert).....	X	X
119	Mine, antipersonnel, M2A3B2.....	X	X
120	Firing device, pull type, friction, T-2.....	X	X
121	Firing device, pull release type, M-3.....	X	X

# REPORT OF THE NEW WEAPONS BOARD

No.	ITEM	WHERE SHOWN	
		NATO	ETO
122	Mine, AT, HE, NM, M5 (inert), w/chemical fuze, M5 (inert)	X	X
123	Mine, heavy, AT, HE, T6E1, w/fuze, T8E1	X	X
124	Mine, light, AT, T7, w/fuze, T9	X	X
125	Detector, antitank mine, vehicular (mounted on 1/4-ton 4 x 4 truck)		X
126	Detector, antitank mine, portable, nonmetallic, type D		X
127	Detector, antitank mine, portable, nonmetallic, type E		X
128	Mine probe, M-1	X	X
129	Carpet-roll torpedo		X
130	Snake, demolition, M-2		X
131	Demolition equipment, set No. 5, individual	X	X
132	Demolition equipment, set No. 7, electrical	X	X
133	Crimper, cap, M-2		X
134	Lighter, fuse, weatherproof, M-2	X	X
135	Adapter, priming, explosive, M-1A1		X
136	Detonator, 15-second delay, M-1	X	X
137	Block, demolition, chain, M-1		X
138	Block, demolition, M-2		X
139	Block, demolition, M-3		X
140	Explosive, shaped charge, M-2A1		X
141	Flame thrower, portable, M2-2 (E3)	X	X
142	Cartridge, ignition, for portable flame thrower, M2-2	X	X
143	Kit, service, for portable flame thrower, M2-2		X
144	NaPalm fuel, for portable flame thrower	X	X
145	Charge, demolition, Navy, Mk. 13 (Reddy Fox)		X
146	Detonator, concussion	X	X
147	Radio detonator		X
148	Metallizing equipment, set No. 1		X
149	Hypochlorination unit, automatic, portable, 2-100 GPM		X
150	Shower unit, field, portable, w/heater, 8 shower heads		X
151	Odograph, land, 6-volt, w/cables, on 1/4-ton 4 x 4 truck		X
152	Compass, vehicular, navigational, illuminated		X
153	Flare, road, electric, dry cell, w/separate liquid to form electrolyte solution		X
154	Flare, landing, electric, dry cell, w/separate liquid to form electrolyte solution	X	X
155	Box, sign, interior illuminated, electric		X
156	Stake, delineator, reflector mounting, w/reflector, retro-directive		X
157	Marker, luminous, radioactive, type I, 1", clip back		X
158	Marker, luminous, radioactive, type II, 1 3/4", bolt back		X
159	Signs, traffic, paper, plain and reflectorized (sets)		X
160	Kit, sign reproduction, w/sign chest		X
161	Lamp, electric, portable, command post		X
162	Boat, assault, M-3		X
163	Boat, reconnaissance, pneumatic, canvas, 2-man	X	X
164	Boat, reconnaissance, pneumatic, canvas, 5-man		X
165	Boat, landing, pneumatic, rubber, 10-man		X
166	Bridge, floating, treadway, steel, M-2		X
167	Ferry, set No. 2, treadway, M-2		X



# ITEMS DEMONSTRATED AND EXHIBITED

No.	ITEM	WHERE SHOWN	
		NATO	ETO
168	Kit, conversion, 12-volt, truck, ¼-ton, 4 x 4		X
169	Device, traction, Galanot-Watson (sets)		X
170	Tractor, medium, M4		X
171	Tractor, medium, M5		X
172	Carrier, cargo, light, M29		X
173	Kit, for mounting 105-mm howitzer, M2A1, on DUKW		X
174	Launcher, rocket, multiple, artillery, 4.5", T27E1, on DUKW	X	X
175	Tank, light, T9E1		X
176	Tank, medium, M4A3		X
177	Bulldozer, tank mounting, for M4A1, M4A2, and M4A3 tanks		X
178	Kit, winterization, for medium tank, M4, M4A1		X
179	Kit, winterization, for medium tank, M4A3		X
180	Kit, waterproofing, for medium tank, M4A1		X
181	Kit, waterproofing, for medium tank, M4A3		X
182	Tank, medium, M4E6 (w/T93 sight, watered ammunition containers, new cast front plate, and modified turret)		X
183	Connector, extended end, for medium tank track, with 1 ¼" pin	X	X
184	Carriage, motor, 76-mm gun, T70		X
185	Target, pneumatic, car, half track		X
186	Target, pneumatic, tank, light, M5		X
187	Target, pneumatic, car, scout, M3A1		X
188	Cab, tractor, armored, caterpillar, D7		X
189	Periscope, M4A1	X	X
190	Finder, range, M9	X	X
191	Kit, modification, for periscope, M4	X	X
192	Grenade, incendiary, AN-M14	X	X

## **Appendix III**

### **PARTIAL LISTS OF ATTENDANCE AT DEMONSTRATIONS**

#### **ETO DEMONSTRATION**

**14 March 1944**

##### **SHAEF**

General Dwight Eisenhower  
Major General H. R. Bull  
Major General H. B. W. Hughes  
Major General West  
Brigadier General B. C. Dunn

Colonel E. N. Clark  
Colonel F. A. Heywood  
Colonel N. M. Lack  
Colonel Adrian St. John  
Colonel W. G. Saville

##### **BRITISH WAR OFFICE**

Major General Bond  
Major General Clark  
Major General Rolls  
Major General Weeks  
Brigadier General Barry

Brigadier General Gibson  
Brigadier General Marriott  
Colonel Geddes  
Colonel Samboy  
Colonel Timmis

Colonel Wood

##### **ETOUSA**

Lieutenant General J. C. H. Lee  
Major General Everett Hughes  
Major General C. R. Moore  
Brigadier General R. C. Coupland  
Brigadier General W. B. Palmer  
Brigadier General P. E. Peabody  
Brigadier General E. M. Powers  
Brigadier General H. B. Sayler

Brigadier General William Weaver  
Colonel M. W. Brewster  
Colonel J. W. Davis  
Colonel G. S. Eyster  
Colonel Earl S. Gruver  
Colonel J. K. Mitchell  
Colonel W. E. Potter  
Colonel Frank F. Reed

Colonel Hugh W. Rowan

## DEMONSTRATION ATTENDANCE LISTS

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### FROM NATO TO ATTEND ETO DEMONSTRATION

Colonel D. J. Crawford  
Colonel C. S. Shadle

Colonel R. V. Shepherd  
Colonel Manom Wumi

### USSTAF

Major General James H. Doolittle  
Major General W. E. Kepner  
Brigadier General S. E. Anderson  
Brigadier General Richard A. Nugent  
Brigadier General Elwood R. Quesada

Colonel Frank M. Mayo  
Colonel Wilmer B. Merritt  
Colonel Jerome J. Oleksiw  
Colonel Philip Schwartz  
Colonel Richard E. Sims

### NAVY

Commander Harvey S. Bennet  
Commander Gorczyk

Commander Robert Halperin  
Commander Robert A. Turner

### VIII CORPS

Brigadier General John E. McMahon  
Colonel Frank T. Searcy

Colonel Gaifer B. Jones

### TUSA

Brigadier General Edward S. Ott  
Brigadier General S. T. Williams  
Colonel J. M. Garrett, Jr.

Colonel Fremont S. Tandy  
Colonel David L. VanSycle  
Colonel E. T. Williams

Colonel W. R. Green

### FUSA

Lieutenant General Courtney H. Hodges  
Major General J. L. Collins  
Major General Charles H. Corlett  
Major General Leonard T. Gerow  
Brigadier General Clift Andrus  
Brigadier General William B. Kean  
Brigadier General A. C. McAuliffe  
Brigadier General Mourice Rose  
Brigadier General George D. Shea

Brigadier General D. A. Stroh  
Colonel P. C. Bullard  
Colonel W. A. Carter, Jr.  
Colonel J. D. Coughlan  
Colonel W. J. D'Estinosa  
Colonel Charles E. Hart  
Colonel John B. Madeiras  
Colonel Truman C. Thorson  
Colonel George S. Wear

### FUSAG

Lieutenant General Omar N. Bradley  
Brigadier General Franklin A. Kibler  
Colonel Bjarne Furuholmen  
Colonel Martin F. Hass

Colonel John C. McArthur  
Colonel Harold A. Nisley  
Colonel E. L. Strohbehn  
Colonel E. K. Wright

## **REPORT OF THE NEW WEAPONS BOARD**

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### **BRITISH 21 ARMY GROUP**

Major General Richards  
Brigadier General Batten  
Brigadier General Morley

Brigadier General Rawlins  
Colonel Cole  
Colonel Grylls

### **ORAN DEMONSTRATION**

**11 February 1944**

### **OFFICERS FROM ALLIED FORCES HEADQUARTERS**

General Sir Henry Maitland Wilson, Commanding General, Allied Forces Headquarters  
Lieutenant General Clark, (BR.)  
Lieutenant General Jacob L. Devers, Deputy Commanding General, NATO, and Commanding General, NATOUSA  
Major General Colter, 85th Div.  
Major General Crane, Artillery Officer, NATOUSA  
Major General Larkin, SOS  
Major General Arthur R. Wilson, MBS  
Brigadier General Adcock, G-4, NATOUSA  
Brigadier General Barr, Chief of Staff, NATOUSA  
Brigadier General Brown, Cavalry  
Brigadier General John Coffee, Ordnance, MBS  
Brigadier General Elliott  
Brigadier General Ford, Deputy Chief of Staff, NATOUSA  
Brigadier General Gillem  
Brigadier General Noce, G-3, NATOUSA  
Brigadier General Raney, Cavalry  
Brigadier General Arthur H. Rogers, Director of Training, MBS  
Brigadier Cowley, (BR.)  
Colonel Gibson, G-3, at NATOUSA  
Colonel Ross, G-3, at Allied Forces Headquarters

## **Appendix IV**

### **IDEAS FROM OTHER THEATERS WHICH WERE DISSEMINATED IN THE NORTH AFRICAN AND EUROPEAN THEATERS**

#### **Section I**

##### **INFANTRY**

1. Use of the canteen cover to carry three hand grenades. (NATO)
2. Improvising small pipe as mortar to launch chemical hand grenades for signaling and to launch a weight which is pulled in to release trip wires of antipersonnel mines. (NATO)
3. Rolling submachine gun with wrists to obtain fire coverage of area. (NATO)
4. Use of tree mount for cal. .30 and cal. .50 machine guns. (Southwest Pacific)
5. Use of rifle grenade launcher with practice grenade, M11, tied to a ball of string (take string from inside of ball), to be used as a drag to clear trip wires and antipersonnel mines. (Aberdeen Proving Ground)
6. Use of modified gas mask as a face shield for firing the 2.36" rocket launcher. (NATO)
7. Organize bazookas into night hunting teams against tanks. (NATO)

#### **Section II**

##### **AMPHIBIOUS OPERATIONS (EXCEPT MINE DESTRUCTION)**

8. Use of gas masks with rubber hose extension and tin cans for underwater mine clearing. Men have been under 10' of water 3 to 4 hours. (Central Pacific)
9. Placing men from a destroyer on a landing craft to throw grappling hooks 30' to 40' for counter-mining. (Central Pacific)
10. Resorting to point-blank artillery and naval gunfire if heavy concrete defenses are to be put out of action prior to assault. (Central Pacific)
11. Maximum use of naval gunfire in landing operations. Five-inch naval guns should be provided with armor-piercing ammunition and appropriate fuzing. (Central Pacific)
12. Use of mortars of various types, including the 4.2" and the newly developed 105-mm, to provide early fire power from DUKW's and from the beach. (NATO)

## REPORT OF THE NEW WEAPONS BOARD

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13. Use of air bombings to neutralize offshore mine fields. The intervalometer should be set to get distances of 16' to 20' between impacts with the 100-lb. general-purpose bomb with delayed fuze. (Central Pacific)
14. Intense use of forward observers, high-powered binoculars, night lighting facilities for command posts, and liaison airplanes to improve artillery fire control. (NATO)
15. Making sleds of wood or metal with high freeboard, skids, and a towing cable to float a 1,000-lb. load to the beaches and towing it from the beaches without unloading. (Aberdeen Proving Ground)
16. Making sleds to mount 4.2" mortar. Firing while coming in and then towing the sleds into position. (Edgewood Arsenal)
17. Waterproofing standard trailers to float one-half of their rated capacity. (Aberdeen Proving Ground)
18. Firing 155-mm gun motor carriages, M12, and two M4 tanks or a combination of various gun motor carriages from LCT. (Aberdeen Proving Ground and NATO)
19. Use of steel landing mats on beaches when necessary for traction. (Central Pacific)
20. Firing all tanks and self-propelled mounts from LCM's and other landing craft. (Aberdeen Proving Ground and NATO)
21. Converting large landing craft into heavily armed anti-aircraft gunboats using 40-mm and 20-mm navy mounts. (Central Pacific)
22. Use of 5" common naval projectile (.02 sec. delay) against resistant targets. (Central Pacific)
23. Use of 60 percent delay and 40 percent instantaneous fuzing (or 70 percent and 30 percent, respectively) against resistant targets. (Central Pacific)
24. Mounting 37-mm gun with turret from M3 light tank on PT boats.
25. Firing the 105-mm howitzer, M2A1, from LCT. (NATO)
26. Mounting every kind of gun possible on landing craft. Weapons suggested are: rocket launchers; cal. .50 machine guns; Maxson turrets; 20-mm, 37-mm, and 40-mm guns; and 75-mm and 105-mm howitzers. (Several theaters)
27. Use of submarines for reconnaissance to supplement aerial photographs. (Central Pacific)

### Section III

#### MINE DESTRUCTION

28. Development of fuze clips armed with primacord to detonate mines. (Central Pacific)
29. Use of tanks to clear paths through antipersonnel mines to permit the passage of infantry. (NATO)
30. Throwing forward a hand grenade or TNT block on a 30' length of primacord and detonating it to clear a path through German Schu-mines. (NATO)
31. Using a small weight tied to a ball of string for the individual soldier to throw in front of him to clear antipersonnel mines, trip wires, etc. (Aberdeen Proving Ground)
32. Providing metal eyeshields or face shields for men assigned to mine-field clearing. (ETO)
33. Providing body armor for men clearing mine fields. (Aberdeen Proving Ground, Engineer Board, and NATO)
34. Preparing primacord nets to detonate mines. Nets about 10' by 20' are rolled up on a rod, carried on front of tanks, and unrolled by gravity on beaches to detonate mines. (Central Pacific)
35. Using the following methods to destroy the butterfly bombs dropped by Germans:
  - a. Attaching a cable between two armored vehicles and dragging the area. (Aberdeen Proving Ground)
  - b. Use of submachine gun, rifle, or carbine fire. (Aberdeen Proving Ground)
  - c. Constructing a shield mounted on rollers which a man may push in front of him while he detonates mines with a pole. (Japanese idea)
36. Use of body armor on bulldozer and mine-clearing service operators for protection. (NATO)

## IDEAS FROM OTHER THEATERS

### Section IV

#### ARTILLERY AND TANKS

37. Firing WP ammunition at night behind enemy troops to back-light them as targets. (NATO)
38. Firing the 75-mm howitzer up to 85° elevation to clear masks. (Southwest Pacific)
39. Making the following modifications on the 105-mm howitzer carriage, M2, to improve operation in soft jungle terrain (Southwest Pacific):
  - a. Increasing flotation by using tires from B-25 airplane (these tires are vulnerable) or 9.00 x 20.00 dual wheels with standard GMC studs.
  - b. Using a third wheel from the 1-ton trailer under spades for winding into position.
40. Use of skid pans for artillery in very soft ground. (Southwest Pacific)
41. Use of strengthened 1-ton trailer with pintle for conveying ammunition. (Central Pacific)
42. Use of M10 gun motor carriage for long-range interdiction fire. (NATO)
43. Use of M10 gun motor carriage as accompanying gun to support infantry attack. (NATO)
44. Use of tanks as accompanying guns to support infantry, with extremely close liaison achieved by the following (NATO):
  - a. Use of field-telephone wire lines from the tank battalion command post to the infantry command post, with a switchboard in some instances.
  - b. Use of remote-control devices to operate radios of the 500 series. The battalion commander and one of his staff at an observation post remotely control the radio in the command net.
45. Modification of the periscope linkage in tank fire-control systems. Modification kits are available for this. (NATO)
46. Laying one artillery piece on an airfield to deny use of that field more effectively than by the intermittent use of aircraft.
47. Use of pintles on front of tractors to aid in jockeying guns in difficult positions. (NATO)

### Section V

#### General Items

48. Use of cellophane gas capes as map covers and as waterproof protection for the detection element of SCR 625 (portable mine detector). (NATO)
49. Use of pocket incendiary delay fuze to ignite grenades left by forward night patrols for designating targets. (NATO)
50. Use of ¼-ton 4 x 4 truck as a litter carrier by mounting two litters, one on each side. (Central Pacific)
51. Use of M14 incendiary grenade to mop up bunkers. If a short piece of primacord and a nonelectric detonator are attached to this grenade, it will explode after burning for approximately 20 sec., scattering molten metal. This grenade cannot be picked up and thrown back. (NATO)
52. The chemical warfare clothing impregnating company is using its equipment for dry-cleaning uniforms. This keeps personnel trained and equipment in operating condition. (NATO)
53. Use of captured water trailers to transport water down to battalion distribution points in order to reduce congestion at water distribution points. (NATO)
54. Use of grappling hooks to be fired from 81-mm mortar to clear wire. (NATO)
55. Use of grousers of 5" x 5" angle iron on low-speed tractors. (Central Pacific)
56. Use of T2 tank recovery vehicle to place culvert during enemy small-arms fire. (NATO)
57. Use of Bailey-bridge footwalk lashed to 6-man pneumatic reconnaissance boats as expedient assault footbridge. (NATO)

## **REPORT OF THE NEW WEAPONS BOARD**

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58. Complete knowledge of target, ammunition and fuzing, proper range, and weapons. Only fire power on the target with the right ammunition, fuzes, and ranges pays dividends in reduced casualties and rapid attainment of objectives.

59. Providing a hole in pillbox floor into which to kick grenades and other time-fuzed missiles so that they may explode without harm to occupants. (Japanese idea)

### **Section VI**

#### **Bombing**

60. Improvising mine bomb cluster for 20-lb. fragmentation bomb. Improvising drag plates to straighten out bombs for low-altitude bombing. (Southwest Pacific)

61. Improvising a 3-min. tail fuze to permit the squadron to complete low level attacks. (Central Pacific)

62. Use of 60 percent instantaneous, 35 percent delay, and 5 percent assorted long delay against runways, airplanes, light structures, etc. Do not use bombs over 500 lb. Use some fragmentation bombs. (Central Pacific)

63. Use of 1,000-lb. SAP or Navy bombs against concrete 3' to 7' thick. General-purpose bombs are very ineffective when used against heavy concrete or similar structures. Usually a general-purpose bomb will break up if thrown into yaw when passing through resistant targets such as heavy reinforced factory construction. General-purpose bombs can be used effectively against heavy targets if dropped alongside and not permitted to strike directly on target. Get target within bomb crater. (Aberdeen Proving Ground and theater)

64. Starting to fire the 75-mm gun in the B-25 airplane at 6,000 yd. and firing at the rate of 27 shots per minute (very good results). (South Pacific)

65. Incendiary bombs dropped on pillboxes are ineffective. (National Defense Research Council)

### **Section VII**

#### **Effective Use of Materiel**

66. It is apparent from studies of combat in all theaters that maximum effectiveness is not being obtained from our materiel, including ammunition and equipment.

67. An improvement of 10 to 15 percent in the effective use of existing weapons will pay greater dividends than the introduction of some new gadget.

68. Of all the factors involved, the ammunition items offer the greatest opportunity to improve the effectiveness of weapons. Every effort should be exercised through command channels to assure that officers know their ammunition, the number of rounds and ranges required to obtain desired results, and the effect attainable when using various fuzes against various targets. This entails a study of exterior and terminal ballistics as covered in various technical regulations, training manuals, and range tables. The War Department will expedite preparation of short pamphlets on appropriate subjects.



## Appendix V

### PHOTOGRAPHS

#### Section I

ETO DEMONSTRATION, 14 March 1944



FIGURE 1. Some of the artillery used in the demonstration.



FIGURE 2. Close-up of 76-mm antitank gun.



FIGURE 3. Center of demonstration line, showing some of the combat vehicles in demonstration.



FIGURE 4. Left end of demonstration line. This was the static part of the ETO demonstration, which was divided into chemical warfare, engineer, ordnance, and quartermaster sections.



FIGURE 5. Audience at demonstration included Generals Eisenhower, Bradley, and Lee and high-ranking British officers.



FIGURE 6. Rocket launchers, including the 60-tube T34, have just been fired, and Colonel Eddy has just asked Lieutenant Davis to fire 76-mm gun in the medium tank, M4E6.

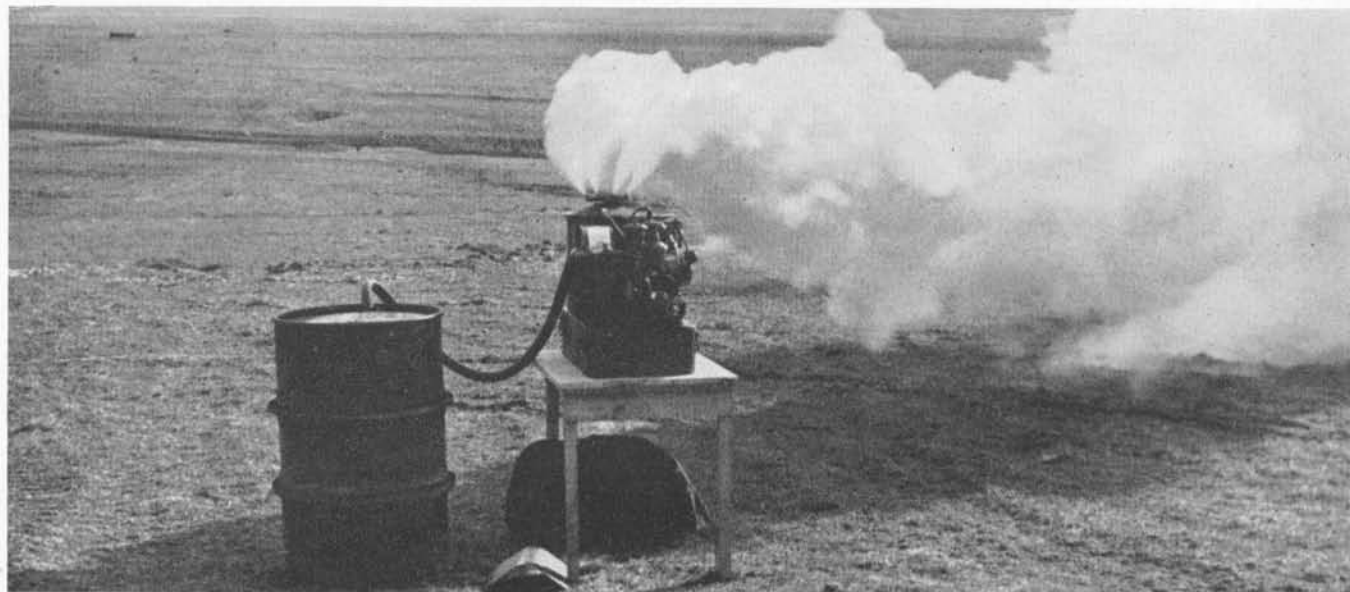


FIGURE 7. Smoke generator, M2, in action.

**Section II**  
**DEMONSTRATION IN ITALY, 17 February 1944**

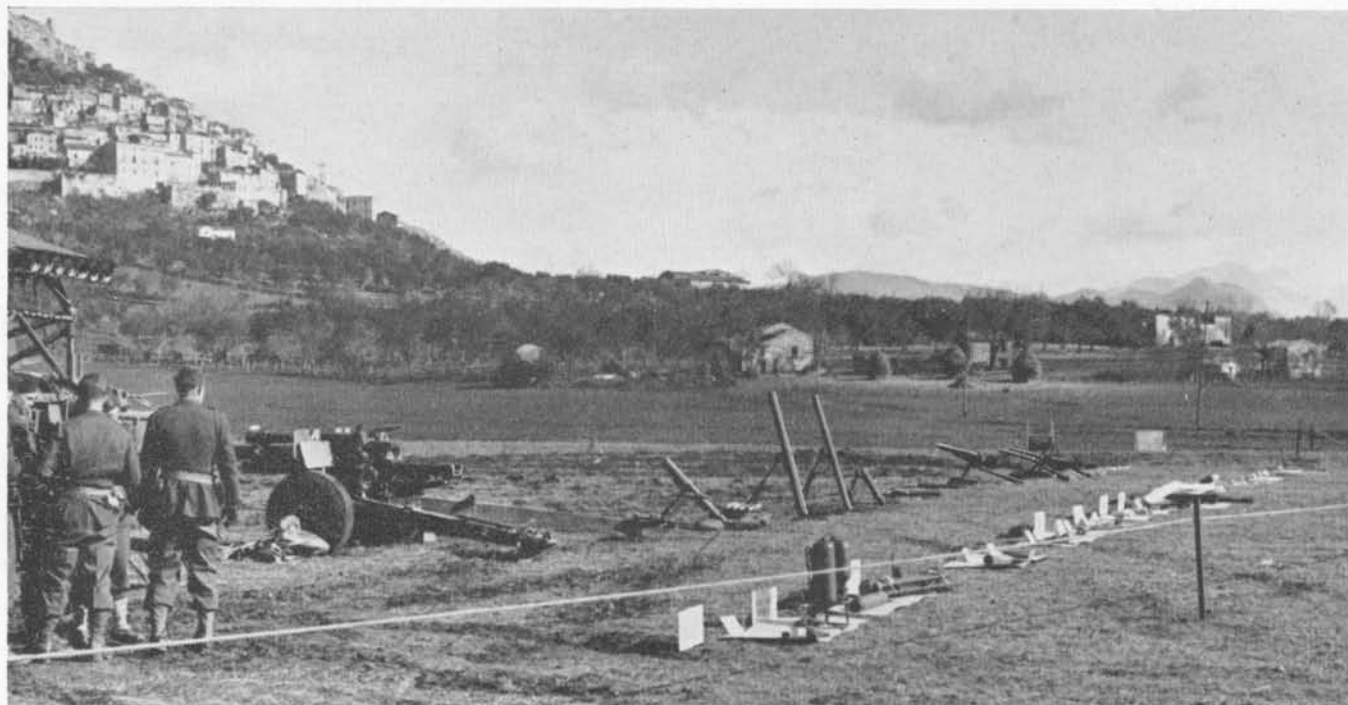


FIGURE 8. General view of firing line. The town of Pressenzano is on the hillside.



FIGURE 9. View of firing line during demonstration.



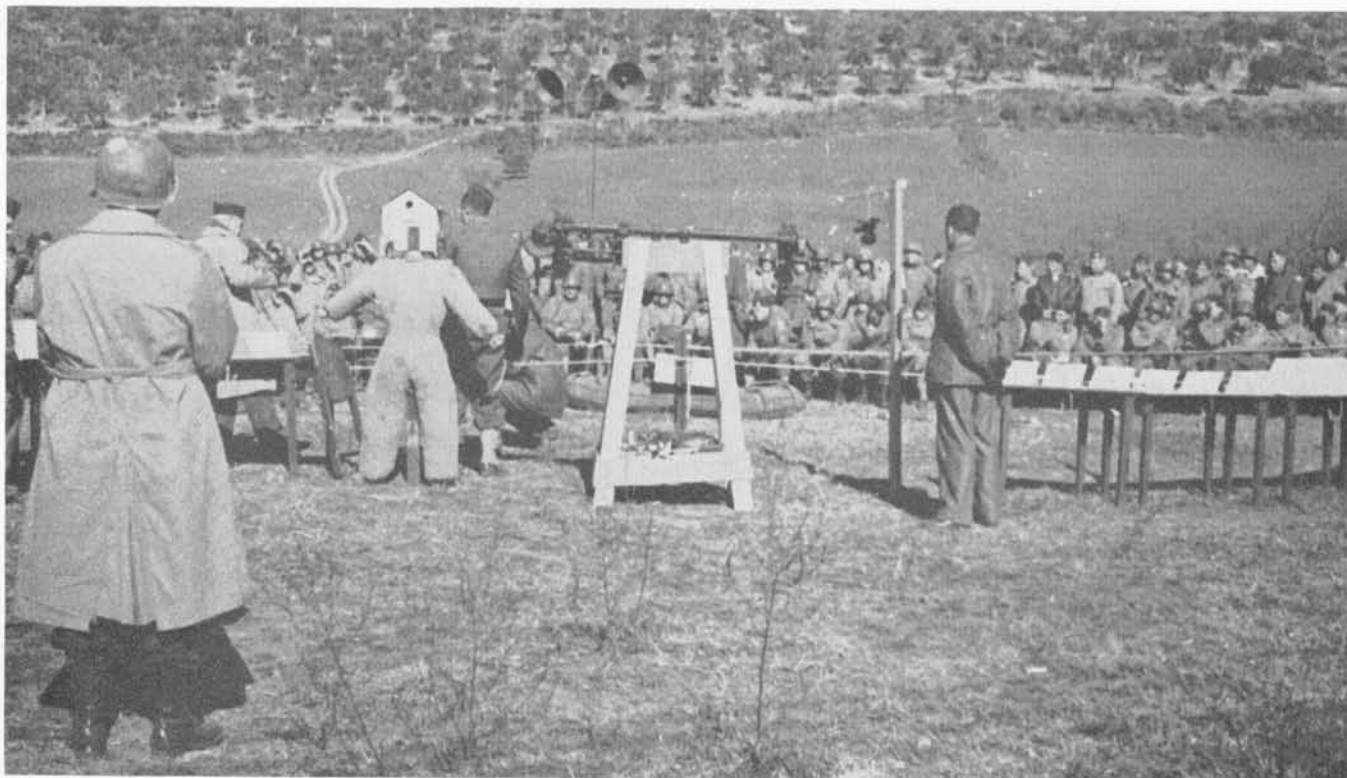


FIGURE 10. Static demonstration; Colonel Eddy discussing items with officers from front-line organizations in helmets and battle dress. Dummy wears body armor.

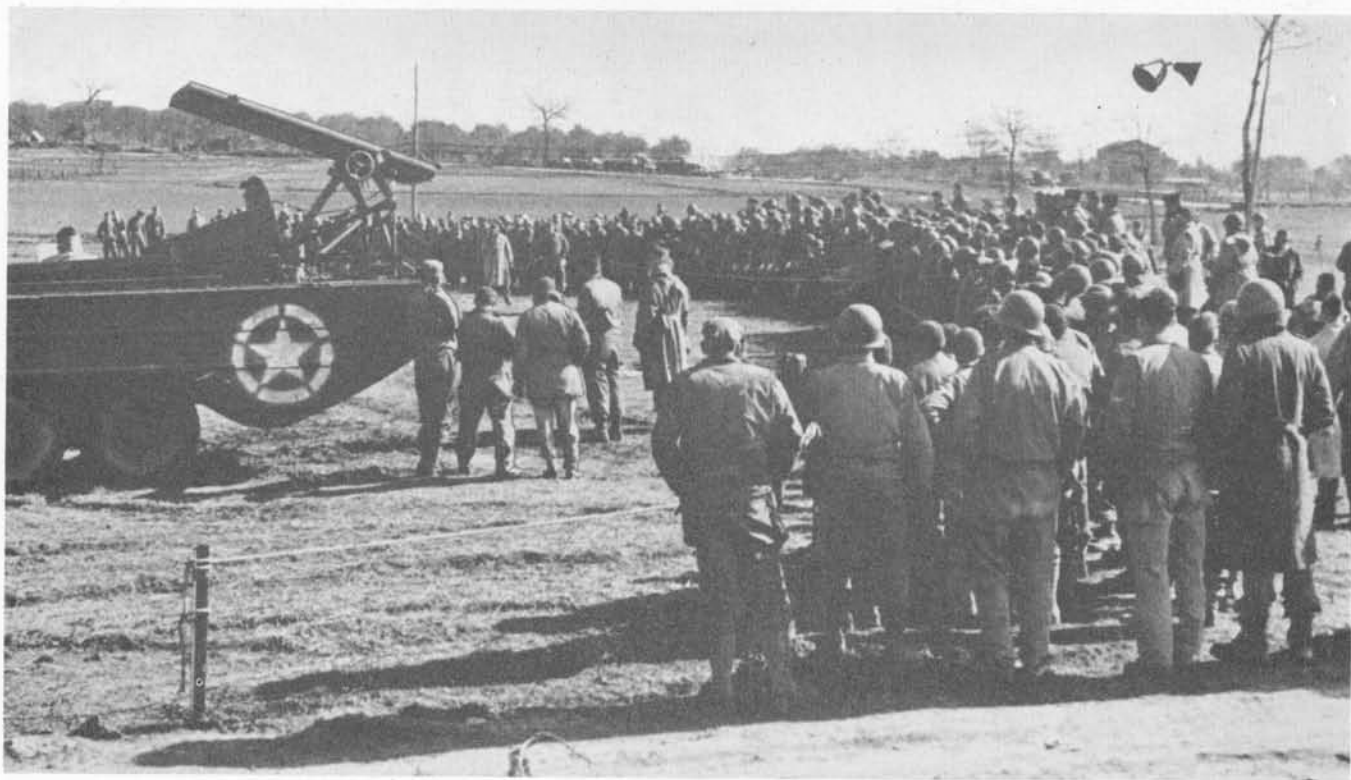


FIGURE 11. View of firing line showing T27E1 rocket launcher (8-tube) mounted on DUKW.

### Section III

#### SECOND ORAN DEMONSTRATION LION MOUNTAIN AREA, 8TH REPLACEMENT DEPOT MEDITERRANEAN BASE SECTION, 11 February 1944

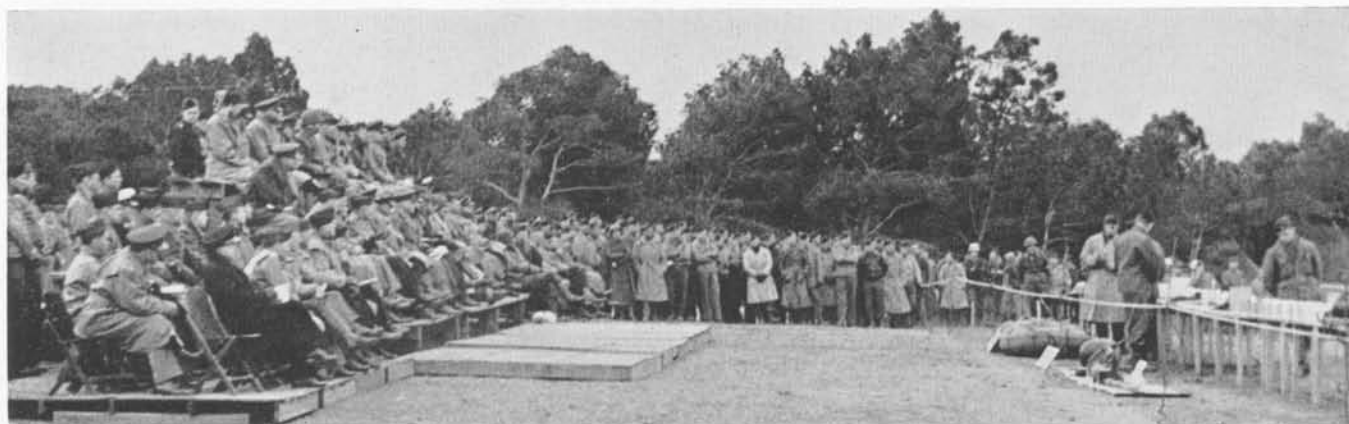


FIGURE 12. Spectators viewing static demonstration with talk by Colonel Eddy.



FIGURE 13. Close-up of static demonstration.

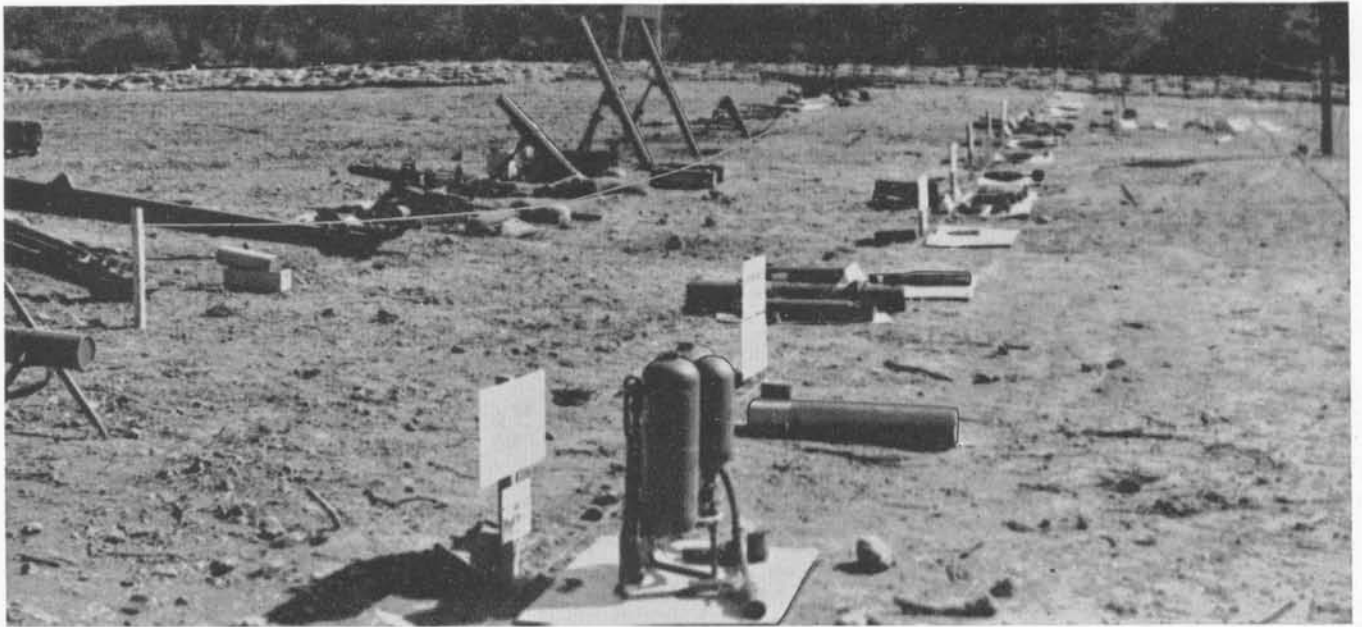


FIGURE 14. Firing line from left end.

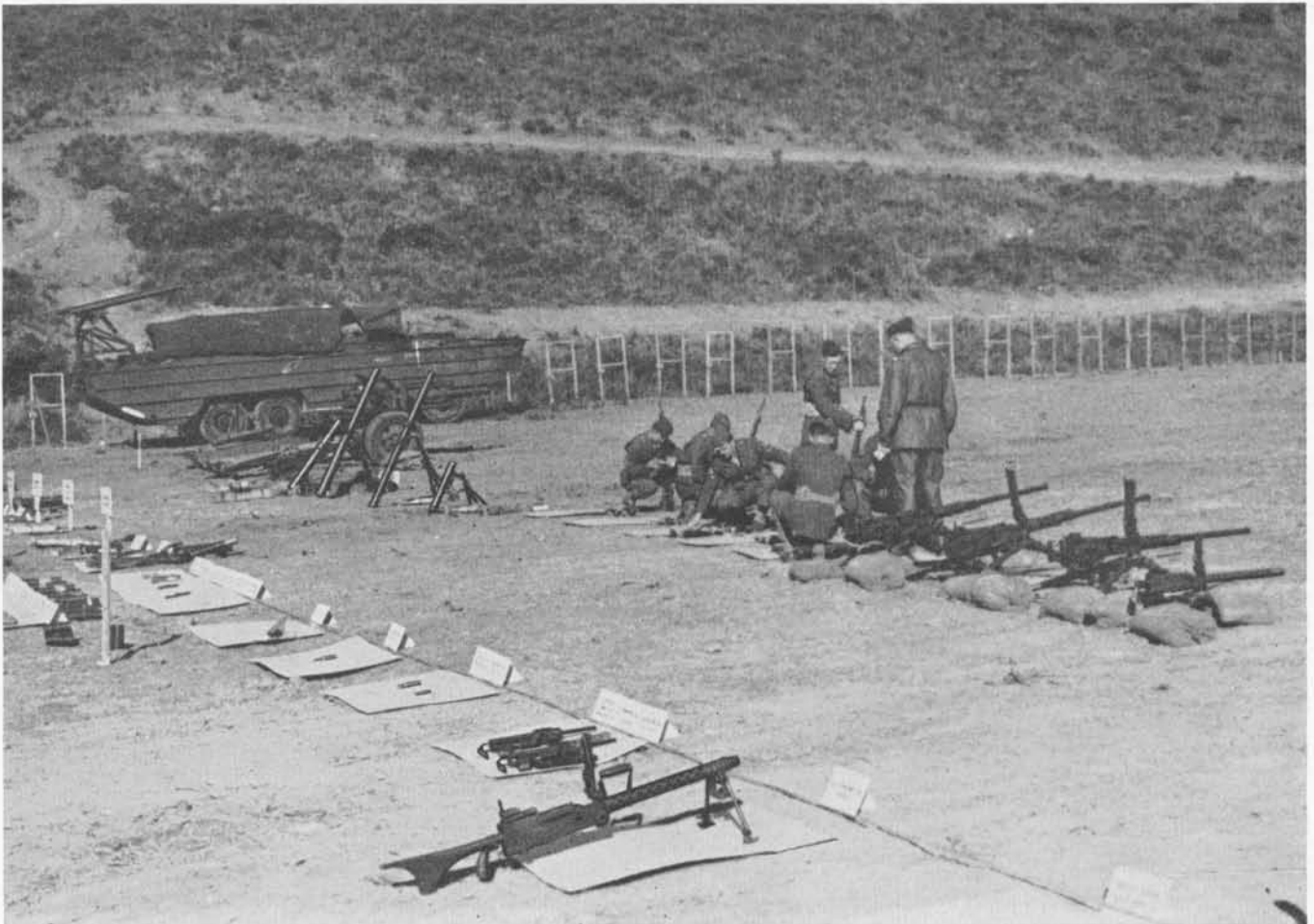


FIGURE 15. Firing line from right end.







FIGURE 18. Main highway from Naples to Fifth Army front. Highway is two lane all the way.



FIGURE 19. Typical road in Fifth Army area. The town of Pressenzano is in the background.



FIGURE 20. One of many German pillboxes about  $1\frac{1}{2}$  miles north of Cassino facing east.



FIGURE 21. Tank gunfire on Monastery Hill. Castle is on the left. Target was the road leading to the monastery.



FIGURE 22. Command post of a tank battalion near Cassino.

#### **Section V**

#### **ITALIAN FIFTH ARMY AREA**

#### **Chemical Warfare Service Equipment**



FIGURE 23. 4.2" chemical mortar baseplates damaged in action awaiting repair.



FIGURE 24. 4.2" chemical mortar baseplates damaged in action awaiting repair.



FIGURE 25. 4.2" chemical mortar base-cap cups and forks damaged in action.





FIGURE 26. 4.2" chemical mortar barrels damaged in action.

**Section VI**  
**ITALIAN FIFTH ARMY AREA**  
**Corps of Engineers Equipment**



FIGURE 27. Field modification of a water supply unit's tank vehicles to increase cargo capacity of organic transportation.



FIGURE 28. Field modification of a water supply unit's tank vehicles to increase cargo capacity of organic transportation.



FIGURE 29. Two-way class 40 or one-way class 70 bridge constructed by engineer general service regiment over the Volturno River at Capua. Bridge is 373' long with 23' clear roadway.



FIGURE 30. Two-way class 40 or one-way class 70 bridge constructed by engineer general service regiment over the Volturno River at Capua. Bridge is 373' long with 23' clear roadway.



FIGURE 31. Water well drilled and operated by engineer water supply company at Fifth Army Advance Command Post. Distribution of water from this installation by tank trucks and trailers averages 60,000 gallons per day.





FIGURE 32. German Schu-mine.



FIGURE 33. German plywood antipersonnel mine in open position showing one of the three fragmentation plates, igniter, and explosive. This type was manufactured in Italy.



FIGURE 34. German plywood antipersonnel mine in armed position. This type was manufactured in Italy.



FIGURE 35. Fifth Army Engineer Section exhibit of captured German and Italian mines.



**Section VII**  
**ITALIAN FIFTH ARMY AREA**  
**Ordnance Materiel**



FIGURE 36. Tanks in action at Cassino, 15 February 1944.



FIGURE 37. Tanks in action at Cassino, 15 February 1944.



FIGURE 38. Knocked out tanks at Cassino, 15 February 1944.



FIGURE 39. Track thrown during night approach about two miles north of Cassino. Tank was not damaged otherwise, but enemy observation prevented repair.

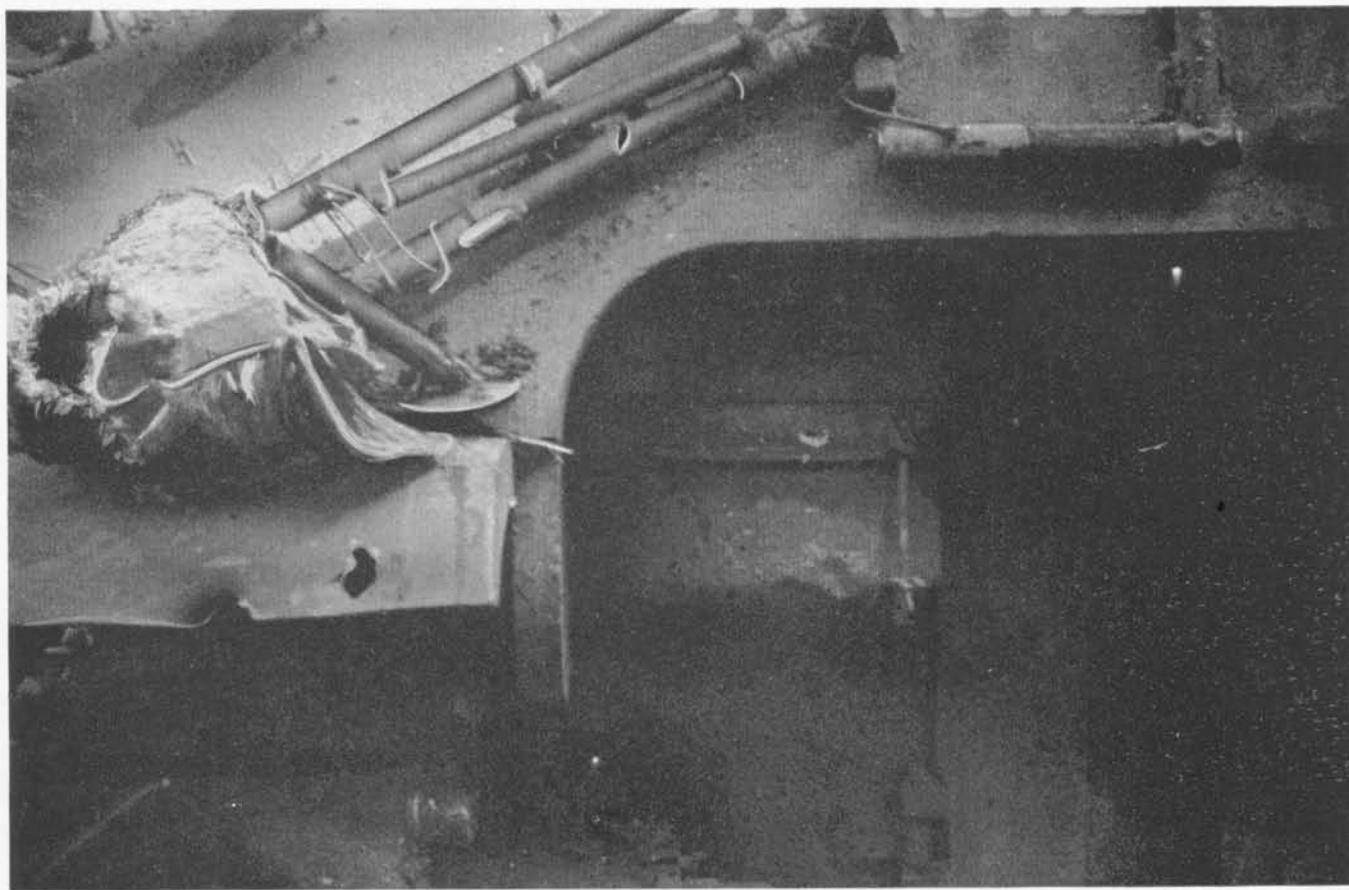


FIGURE 40. Damage to machine-gun tripod and air cleaner caused by near miss of HE shell. Principal damage caused by artillery fire was to air cleaner.



FIGURE 41. Tanks stuck in mud on plain, northeast of Cassino.



FIGURE 42. Two penetrations by German 75-mm AT projectile. Lieutenant Colonel H. W. Sweeting, battalion commander, holds the two slugs.

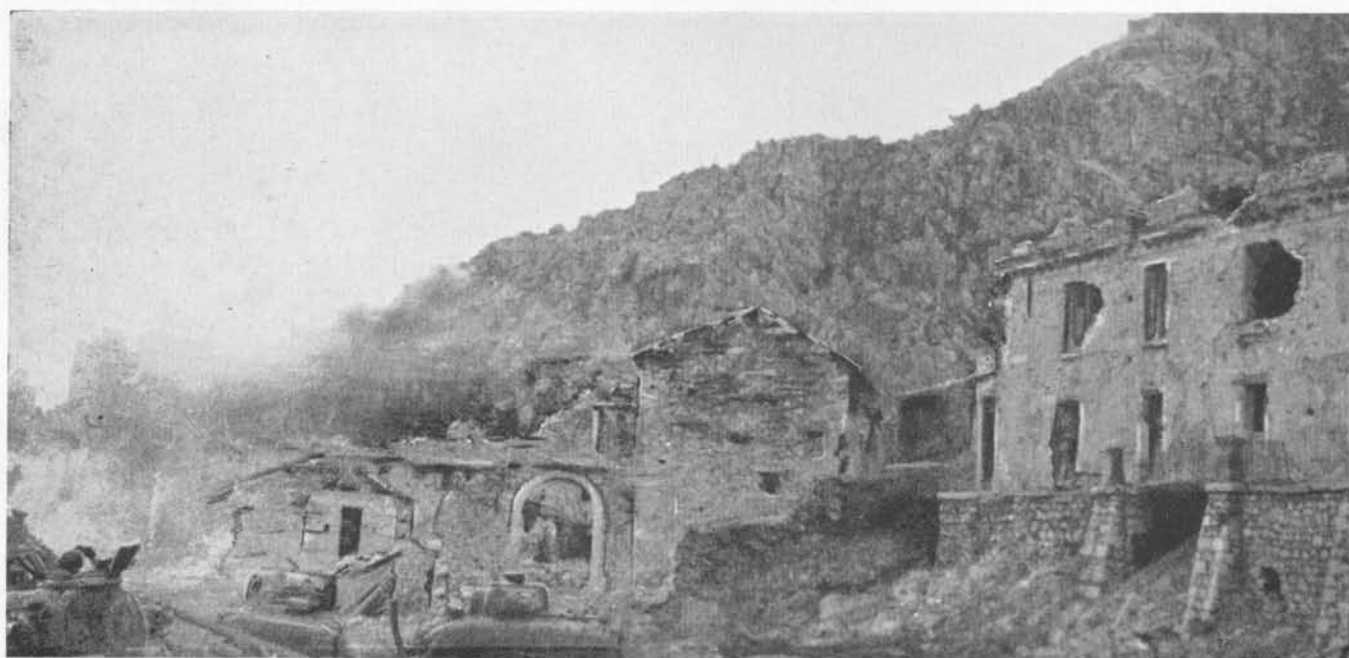


FIGURE 43. Tanks in action in Cassino.





FIGURE 44. Tank with damaged track abandoned near Cassino. No other damage apparent. Unit designation painted out.



FIGURE 45. Tank with damaged track abandoned near Cassino. No other damage. Unit designation painted out.



FIGURE 46. Captured German self-propelled gun. Later used as target for bazooka demonstration.



FIGURE 47. German self-propelled 75-mm PAK 40 AT gun captured near barracks north of Cassino.

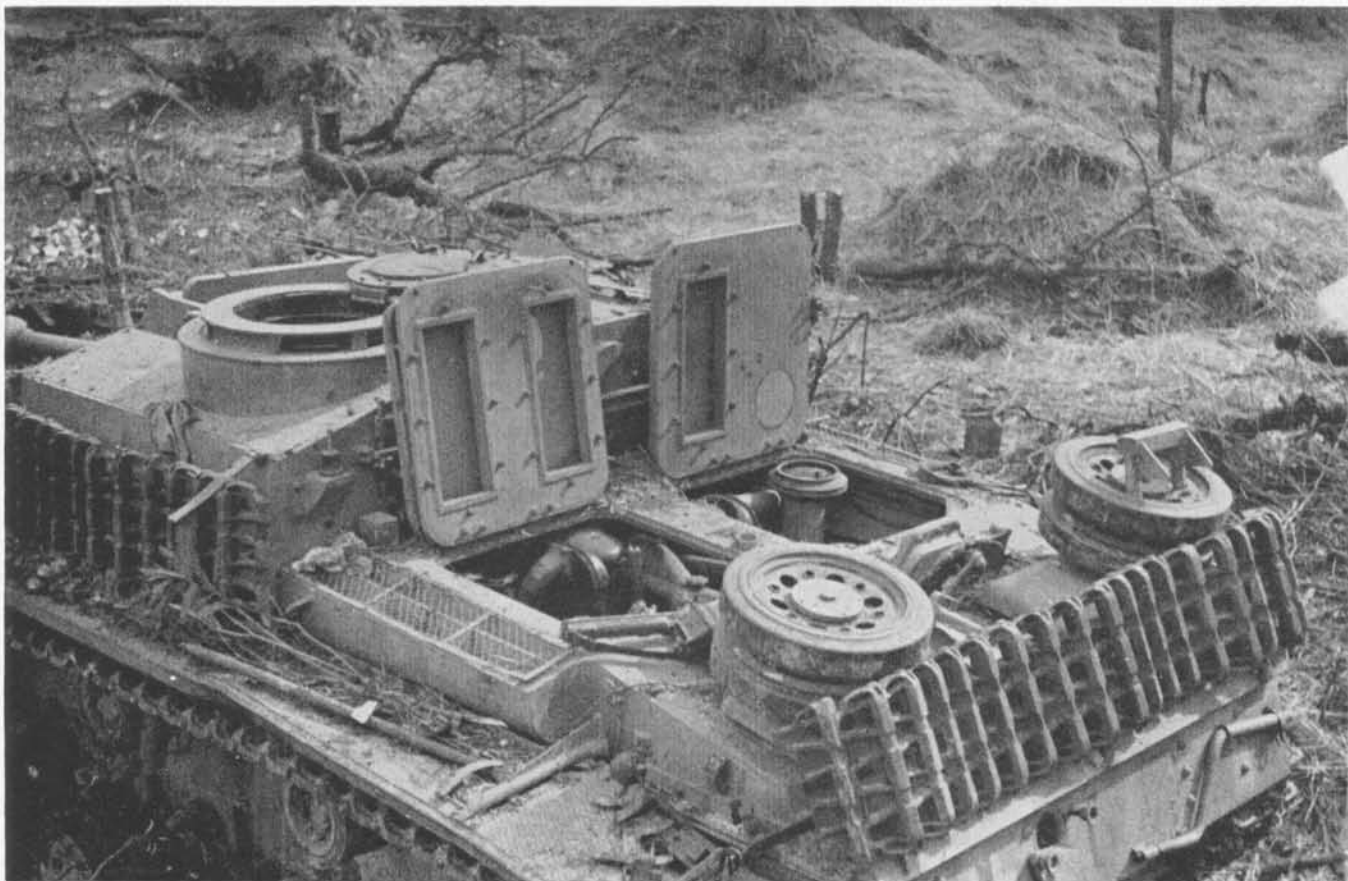


FIGURE 48. German self-propelled 75-mm PAK 40 AT gun captured near barracks north of Cassino.



FIGURE 49. German self-propelled 75-mm PAK 40 AT gun captured near barracks north of Cassino.



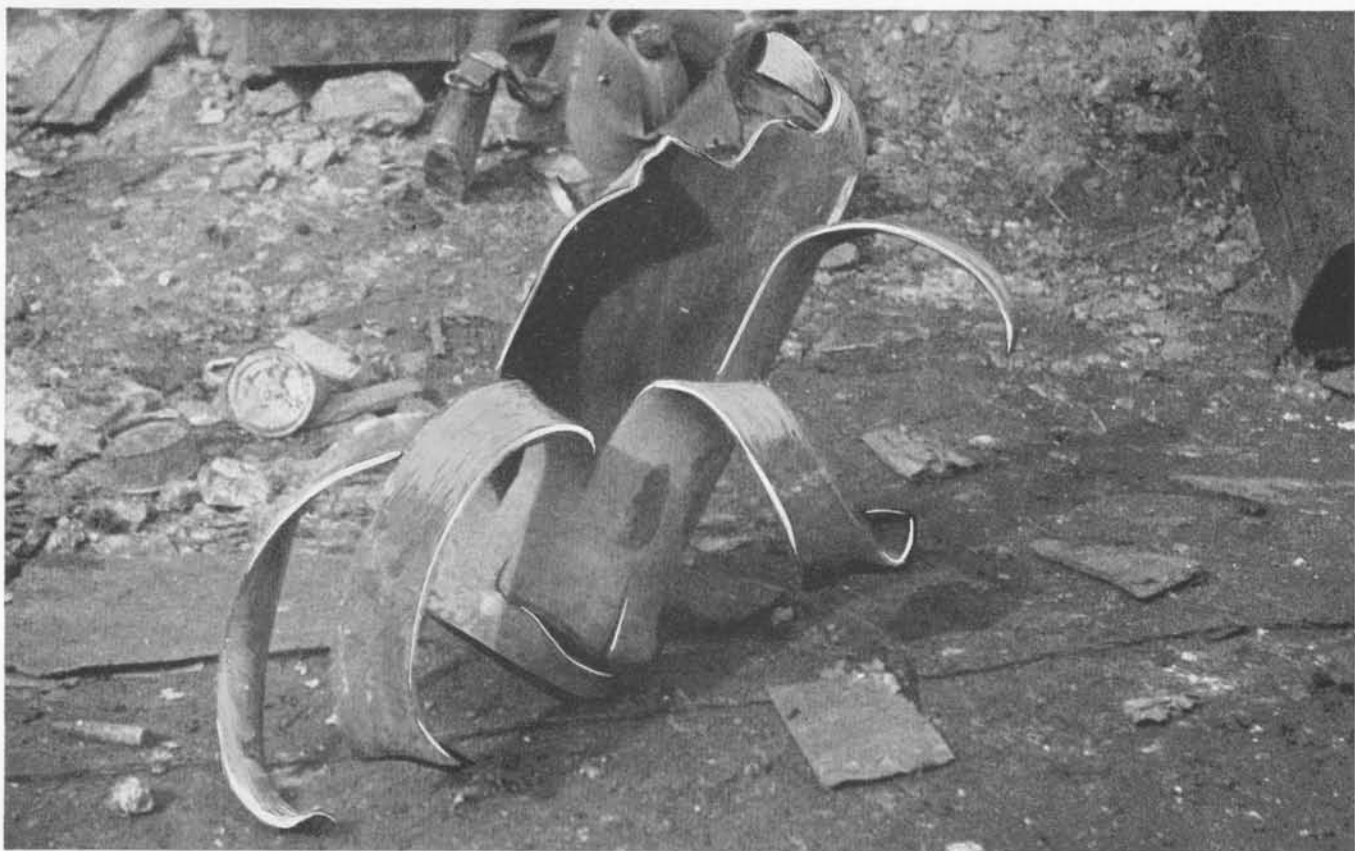


FIGURE 50. Nebelwerfer ("Screaming Meemie") shell found 1 mile north of Cassino, 15 February 1944. Low-order detonations such as this were common.

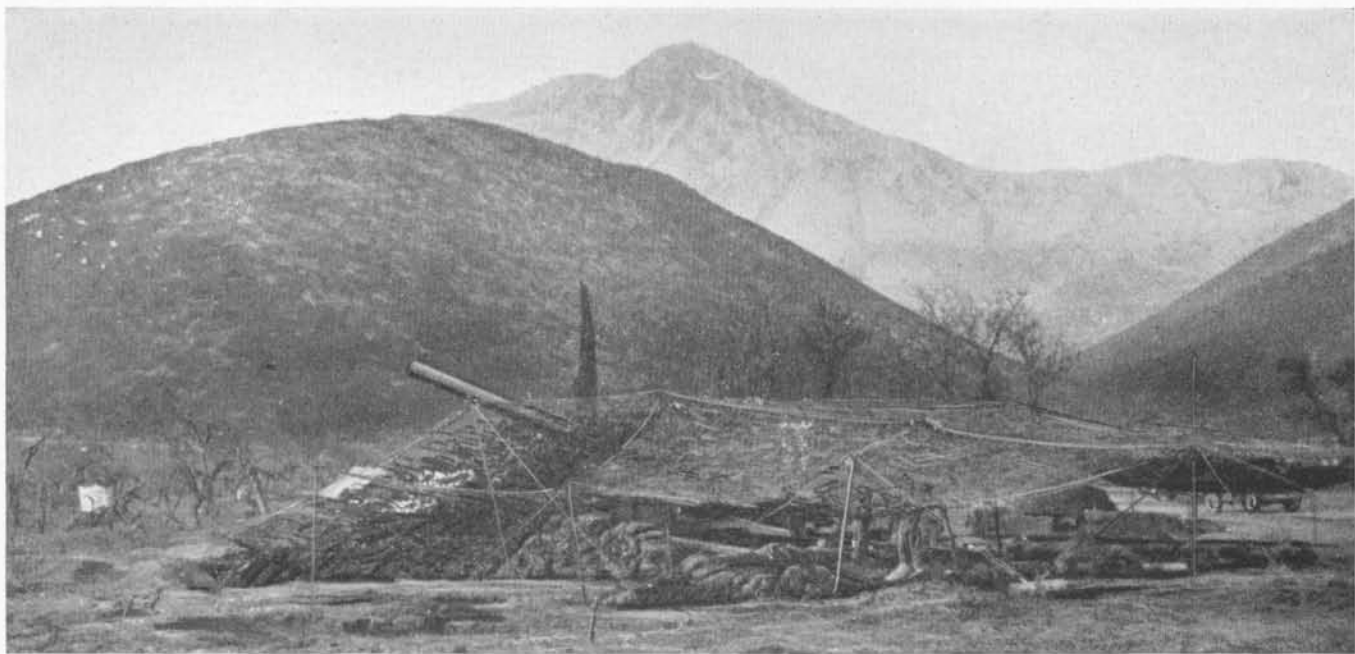


FIGURE 51. 240-mm howitzer emplaced in Fifth Army area. This recently emplaced weapon was one of the first battery of this caliber to arrive in Italy. Note mountains in background.





FIGURE 52. 240-mm howitzer emplaced in Fifth Army area. This recently emplaced weapon was one of the first battery of this caliber to arrive in Italy.



FIGURE 53. 240-mm howitzer emplaced near the Cassino front in Italy. This howitzer is one of two which recently arrived in Italy.

## Appendix VI

### HISTORY OF THE NEW WEAPONS BOARD

17 Jan 44—31 Mar 44

The formation of the New Weapons Board was directed by the Secretary of War on 17 January 1944. The general mission of the Board was to visit the North African and European theaters of operations for the purpose of furnishing information on new developments and new materiel.

Colonel George G. Eddy, O-12108, Ord. Dept., Director, The Ordnance Research Center, Aberdeen Proving Ground, Maryland, was named Chairman of the Board. The other members were as follows:

Lt. Col. August Schomburg	O-18422	Ord. Dept.
Lt. Col. Sidney G. Brown, Jr.	O-18393	Army Ground Forces
Lt. Col. A. W. Meetze	O-270842	CWS
Major J. P. Marshall	O-900409	AC
Major Elmer L. Claussen	O-355810	CE
Major David W. Hoppock	O-341109	Ord. Dept.
1st Lt. John H. Davis	O-917227	Ord. Dept.

Steps were immediately taken to assemble technical information and equipment for shipment overseas with the Board. Arrangements were made with the Air Transport Command, AAF, to assign to the Board a C-54A cargo plane which would carry the Board to NATO, remain with the Board while in NATO, and transport the Board to ETO. Another plane was to return the Board to the United States.

The items to be demonstrated and discussed were selected, and a catalog was prepared. The number of items selected, including chemical warfare, engineer, ordnance, and a few quartermaster items, totaled 220. It was determined that approximately 80 of these items could be included in a 6,000-lb. load to accompany the Board by air to NATO and that a shipment of approximately 250 tons, including heavier equipment and almost all the items listed in the catalog, would be shipped by water to ETO, to arrive there at approximately the same time as the Board members arrived from NATO by air.

Captain E. J. Losco, O-378280, Ord. Dept., Captain L. T. Gibbs, O-375146, Ord. Dept., and four sergeants from Aberdeen Proving Ground were detailed to accompany the water shipment and to assist in the demonstration in ETO.

The Board, with 6,000 lb. of equipment and a library of technical information including 100 copies of the secret catalog, left Aberdeen by air at 0815, 4 February 1944, and arrived in Algiers on 6 February, reporting to Lt. Gen. Jacob L. Devers, Commanding General, NATOUSA, who received the mission most cordially. He directed Brig. Gen. David A. Barr, his chief of staff, and Maj. Gen. Arthur R. Wilson, Commanding General, Mediterranean Base Section, to assist the Board in putting on two demonstrations at Oran and one for the Fifth Army in Italy.

On the evening of 6 February, the Board flew to Oran and was very cordially received by General Wilson. The next 2 days were spent in preparing for the demonstrations. The first of these was held on Thursday, 10 February, at Lion Mountain, the location of the 8th Replacement Depot. It was attended

## HISTORY OF THE NEW WEAPONS BOARD

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by about 425 officers from units in training and from SOS headquarters. Although primarily for junior officers, this first demonstration was attended by Major General Wilson, Brig. Gen. Arthur H. Rogers, and many field-grade officers.

The next day, 11 February, the second demonstration was held at Oran. This demonstration for the higher-ranking officers, including General Sir Henry Maitland Wilson, General Devers, and General Barr, was originally planned for only 50 officers, but more than 300 attended.

Aided by the splendid cooperation and enthusiasm of all concerned, particularly of those officers and enlisted men from the 8th Replacement Depot assigned to help in the project, both demonstrations went very smoothly.

The remaining items for exhibit were repacked in the plane, and on Sunday, 13 February, the Board flew from Oran to Naples, encountering considerable rough weather en route and stopping briefly in Sicily.

In Naples, arrangements were made with Brig. Gen. Arthur Pence, Commanding General, Peninsular Base Section, and officers of the staff of the Fifth Army to put on the demonstration at the Advance Command Post of the Fifth Army, which was located near Pressenzano. This demonstration was held on Thursday, 17 February, with the help of six ordnance noncommissioned officers from Oran who had assisted in the two demonstrations there and who were assigned to the Board for the demonstration in Italy. During this week, members of the Board had many opportunities to discuss the performance of weapons in the hands of troops and the requirements for new and improved types with Fifth Army officers and enlisted men who had been using the equipment in battle. From the standpoint of learning about performance of equipment, this was by far the most valuable week spent by the Board.

The Board left Italy on Saturday, 19 February, for Algiers, taking with it the tentative requirements of the Fifth Army. The NATO conference on requirements was held on Monday, 21 February, in Algiers. Owing to the vigorous assistance of Col. D. J. Crawford, Ordnance Officer, NATO, and the intense interest of General Barr, General Noce (G-3), General Adcock (G-4), and others, firm decisions on requirements for new weapons were quickly reached. These decisions were transmitted to Headquarters, SOS, at Oran. When the Board members left NATO from Oran on 24 February, they were able to take copies of the requisitions with them. One of these copies was sent by courier to Washington; other copies were transmitted through regular channels.

During all of the time in NATO, the members of the Board, and Colonel Eddy in particular, executed the three other missions of the Board besides that of demonstrating new weapons. Many complaints were received about the spare-parts situation, but this subject will not be covered in this report, because a special mission on spare parts, headed by Col. W. J. Morrissey, was in both NATO and ETO at the time the Board visited these theaters.

After 2 days spent in Oran writing reports and memorandums (and attending a very pleasant dinner given to the Board by General Wilson), the Board left Oran for England via Casablanca, arriving at Prestwick, Scotland, on the morning of Friday, 25 February, and reaching London late that afternoon. The cargo airplane was released at Prestwick. The service rendered to the Board by the Air Transport Command and the crew of the plane, headed by Maj. Don L. Hurst, was indispensable in executing the Board's mission in NATO.

On Saturday morning, 26 February 1944, Colonel Eddy reported to Gen. Dwight L. Eisenhower. After considerable discussion of the mission with Colonel Eddy, General Eisenhower directed that only one major demonstration be put on and that it was to be for high-ranking officers in order that other ranks would not become unduly excited about new materiel, actual delivery of which might require a long period of time.

It was ascertained that the shipload of equipment for the ETO demonstration would arrive within the next few days. As soon as its arrival was definite, dates were set for a conference with the high-ranking officers of General Eisenhower's staff and for the demonstration.

On Tuesday, 7 March, the conference with General Eisenhower and about 40 members of his staff was held in London. On this occasion, Colonel Eddy outlined the mission of the Board, mentioned its experience in increasing the effectiveness of existing weapons in the other theater, described a number of

## REPORT OF THE NEW WEAPONS BOARD

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weapons to be demonstrated, and outlined the need for determining requirements promptly. At this same time, motion pictures of the new weapons were shown.

The next day, members of the Board (except Colonel Eddy, who followed several days later) departed for the Royal Artillery West Down Range at Tillshed, the site of the demonstration. Equipment from the boat shipment began to arrive late the next day, and the days until Monday, 13 March, were fully occupied with preparations for the demonstration. The amount of equipment demonstrated is indicated by the fact that the demonstration line was 540 yd. long. One hundred and twenty enlisted men from the 3d Armored Division were assigned to assist in unpacking the weapons and preparing them for demonstration and to participate in the demonstration itself. All this personnel was most helpful.

A preliminary demonstration was held on Monday, 13 March 1944, at the direction of G-3, ETO, and was attended by General Lee, Commanding General, ETO, officers of his staff, and officers of the 3d Armored Division.

The formal demonstration for General Eisenhower and approximately 150 members of his staff was held on Tuesday, 14 March. Unfortunately, it rained quite hard, but the demonstration went off smoothly and General Eisenhower stated that he was extremely pleased with the conduct of the demonstration and with the materiel shown. He was particularly interested in the medium tank with the 76-mm gun, the 60-tube rocket launcher, T34, and the bulldozer for the medium tank. The interest expressed in other items is reflected in the requisitions and in other sections of this report.

Arrangements were made to leave most of the items demonstrated in the depots of the technical services, to be used at the direction of the chiefs of the technical services. A few days later it was determined that each of the technical services would set these items up as static exhibits. Stock Control Division, ASF, has been notified of the disposition of this materiel.

After the demonstrations, the Board returned to London. For the next few days, time was spent in discussing various problems connected with the mission of the Board with officers of the various staffs in London, in visiting field installations, including First Army Headquarters and First Army field units, and in preparing for the conference on requirements.

The conference on requirements was held on Friday, 24 March, and arrangements were made to have copies of the requirements delivered to the Board on Tuesday, 28 March.

During the last week in England, members of the Board visited a number of British establishments, including the Department of Tank Design, the British Proving Ground at Shoeburyness, the Woolwich Arsenal, and many other establishments. A separate report on these visits is being submitted to the Chief of Ordnance. They also discussed with many officers of the various staffs in England the performance of existing weapons and technical requirements for new weapons.

Members of the Board were impressed by the intense interest shown by officers in England in new weapons and in new uses for existing weapons. This interest is reflected in detail in the requirements established and in other parts of this report. The technical libraries and copies of the catalog were left with the chiefs of the technical services for their use and dissemination.

After a final conference between General Eisenhower and Colonel Eddy, the Board departed from London on Wednesday, 29 March. The technical library and some equipment that had to be returned to the United States were taken along. At Prestwick, a C-54 passenger plane was assigned to the Board, and the return to the United States made without incident. The plane arrived at Aberdeen Proving Ground, Maryland, at 1105, Friday, 31 March,—8 weeks from the date of departure.

## Appendix VII

### AMMUNITION AND MAJOR COMPONENT EXPENDITURES

TABLE 1

Ammunition Expenditure for Fifth Army as Reported by Ammunition Division, Peninsular Base Section\*

TYPE OF WEAPON	DAILY EXPENDITURE PER WEAPON, IN ROUNDS
Cal. .30 carbine.....	2.1
Cal. .30 rifle.....	2.6
Cal. .30 machine gun.....	62.9
Cal. .45 submachine gun.....	5.7
Cal. .50 machine gun.....	12.9
37-mm AA gun.....	10.4
37-mm tank and AT guns.....	3.4
40-mm AA gun.....	5.3
57-mm AT gun.....	4.5
60-mm mortar.....	6.7
81-mm mortar.....	17.5
Rocket launcher.....	.25
Grenade launcher.....	.25

TABLE 2

Ammunition Expenditure for Fifth Army as Reported by Ammunition Division, Peninsular Base Section\*\*

TYPE OF WEAPON	NO. WEAPONS SUPPORTED	DAILY EXPENDITURE PER WEAPON, IN ROUNDS
75-mm gun.....	613	6.5
75-mm howitzer.....	158	29.1
3" gun.....	324	15.9
90-mm gun.....	132	14.1
105-mm howitzer, M2A1.....	433	60.0
105-mm howitzer, M3.....	36	45.6
4.5" gun.....	24	37.2
155-mm gun, M1.....	96	24.2
155-mm howitzer, M1917-18.....	56	32.5
155-mm howitzer, M1.....	160	29.2
8" howitzer.....	20	33.9
240-mm howitzer.....	12	7.2

\*Covers a 30-day period—1 Jan to 31 Jan 1944.

\*\*Covers a 45-day period—1 Jan through 14 Feb 1944.

# REPORT OF THE NEW WEAPONS BOARD

TABLE 3

Issue of Artillery Materiel Components per Gun for a 100-day Period.

TYPE OF WEAPON	PAD,	BARREL	MECHANISM,	EQUILIBRATOR
	GAS-CHECK (OBTURATOR)	ASSEMBLY	RECOIL	ASSEMBLY
105-mm howitzer, M2A1.....		.9305*	.375	.0138
4.5" gun, M1.....	4.16	1.04	.25	
155-mm gun, M1.....	3.50	1.11	.167	.447**
155-mm howitzer, M1917-18.....	3.18	.125	.0312	
155-mm howitzer, M1.....	.794	.0187	.0812	.0312
8" howitzer, M1.....	3.83	.542	.125	1.08

\*This figure includes barrel assemblies for 105-mm howitzer, M2A1 and M3.

\*\*This figure includes equilibrator assemblies for 155-mm gun, M1, and 8" howitzer, M1.

## Appendix VIII

### MODIFICATION OF SHELL, HE, M42A1 (3" GUNS), W/FUZE, P.D., M48, FOR HC SMOKE\*

The use of the 3" antitank gun mounted on the M10 gun motor carriage in a secondary role as a field piece necessitated the employment of a smoke shell for observation. For this purpose, the M42A1 HE shell was modified by drilling a  $1\frac{5}{16}$ " hole into the TNT to within  $\frac{3}{4}$ " of the base of the shell and filling the hole with HC smoke, which was tamped to the level of the booster cavity. Successive steps of this modification, from the unpacking of the ammunition to the completion of the projectile, are illustrated in the following photographs.



FIGURE 1. The boxes of 3" HE are opened, and the empty cases are re-marked by stencil.



FIGURE 2. The projectile is removed, and the container is stenciled and repacked in the cases.

\*Developed by Milton W. Hedrick, 58th Ordnance Ammunition Company; manufactured at the rate of 250 rounds per day by Peninsular Base Section Ordnance Depot No. 1.



FIGURE 3. The fuze is unstaked by means of a staking pin and chain vise.

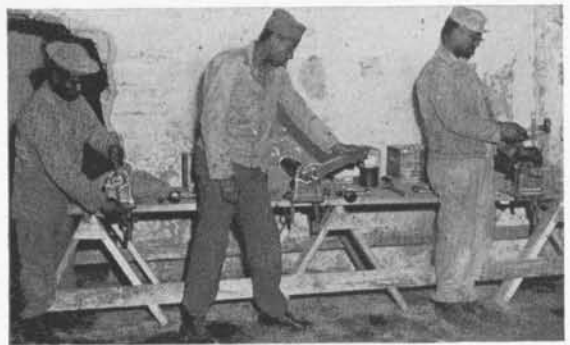


FIGURE 4. The fuze wrench is applied and the fuze removed. The fuze is then retouched with a file to remove burrs.



FIGURE 5. The set screw is then removed by means of a breast drill, and the booster is taken out and packed into fuze and booster box.

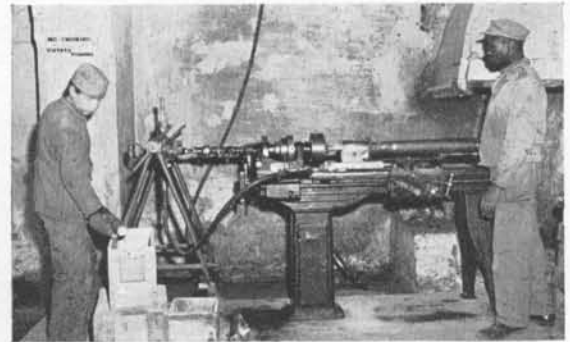


FIGURE 6. The round is placed in a special lathe operated by compressed air. (The lathe is tied in with an air drill; when air is applied, the drill furnishes power for the lathe at slow speeds.)

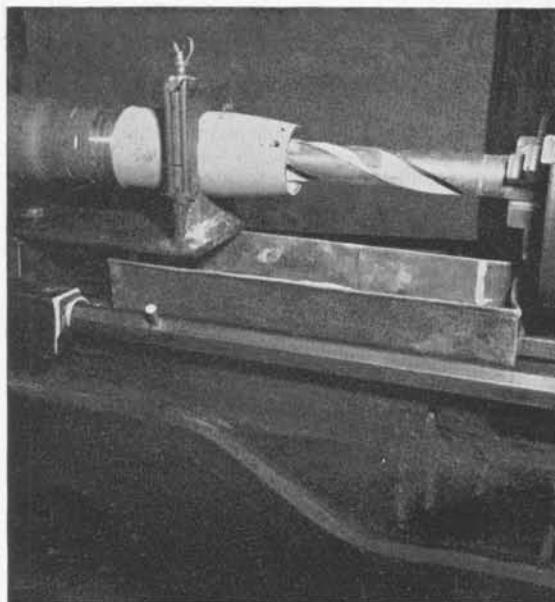


FIGURE 7. The projectile is covered by a form-fitting copper cover, and a copper tray is placed under the drill to catch the TNT that is removed.

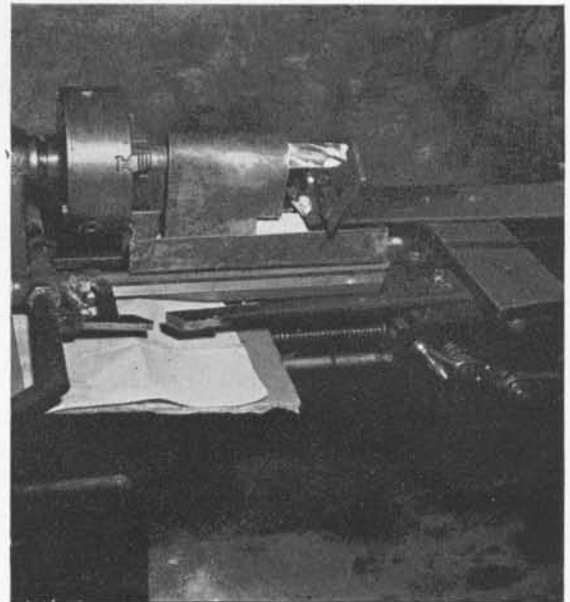


FIGURE 8. A cut-out (which automatically shuts off the power) stops the drill. The operator then knows that the drilling has reached the proper depth.





FIGURE 9. The shell is placed in a specially constructed copper-covered rack which has holes to fit the projectile end. The HC smoke is poured in and packed down with a wooden mallet and a wooden tamping pin.

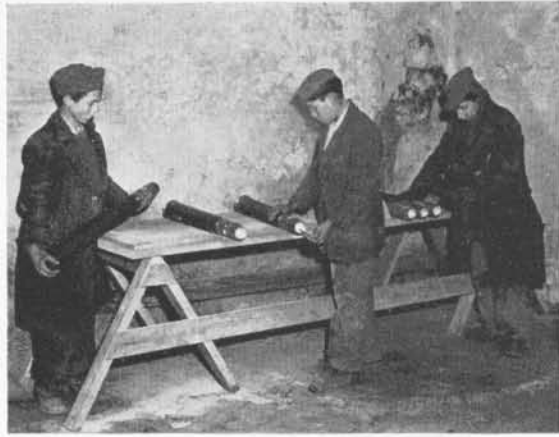


FIGURE 10. One man cleans out the excess HC smoke that might have accumulated in the threads, and a second man runs a tap wrench into the set-screw threads to remove burrs.

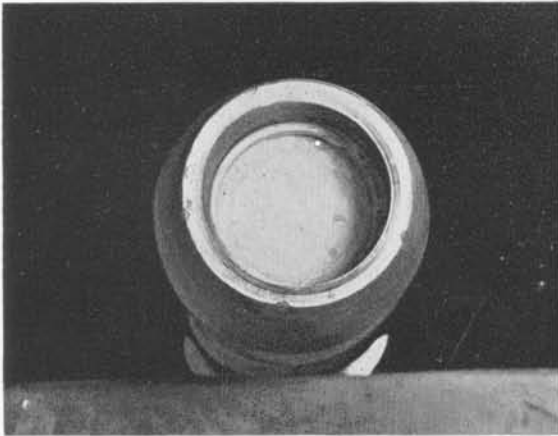


FIGURE 11. The shell is ready for reassembly.



FIGURE 12. The completed projectile is marked with a white stripe, and the shell is placed in the restenciled container.

## Appendix IX

### ANTI-AIRCRAFT SIGHTS

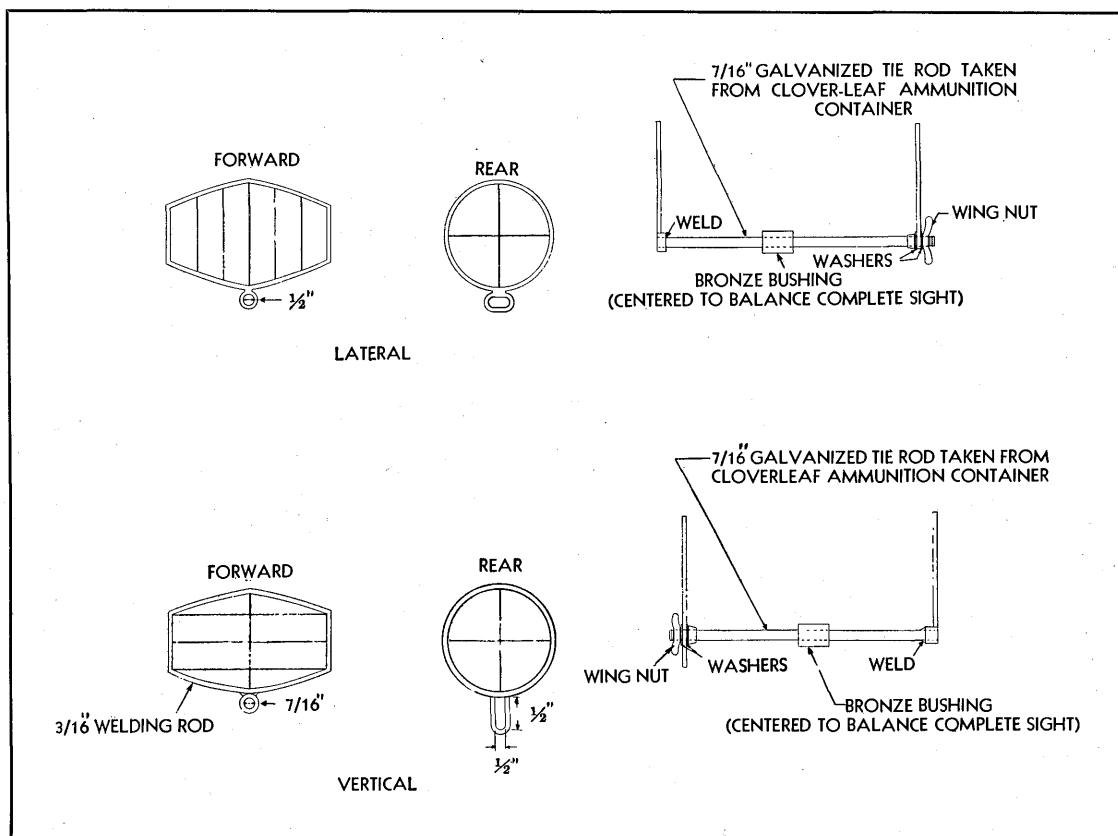


FIGURE 1

Forward-area Sights for AA Guns

# ANTIAIRCRAFT SIGHTS

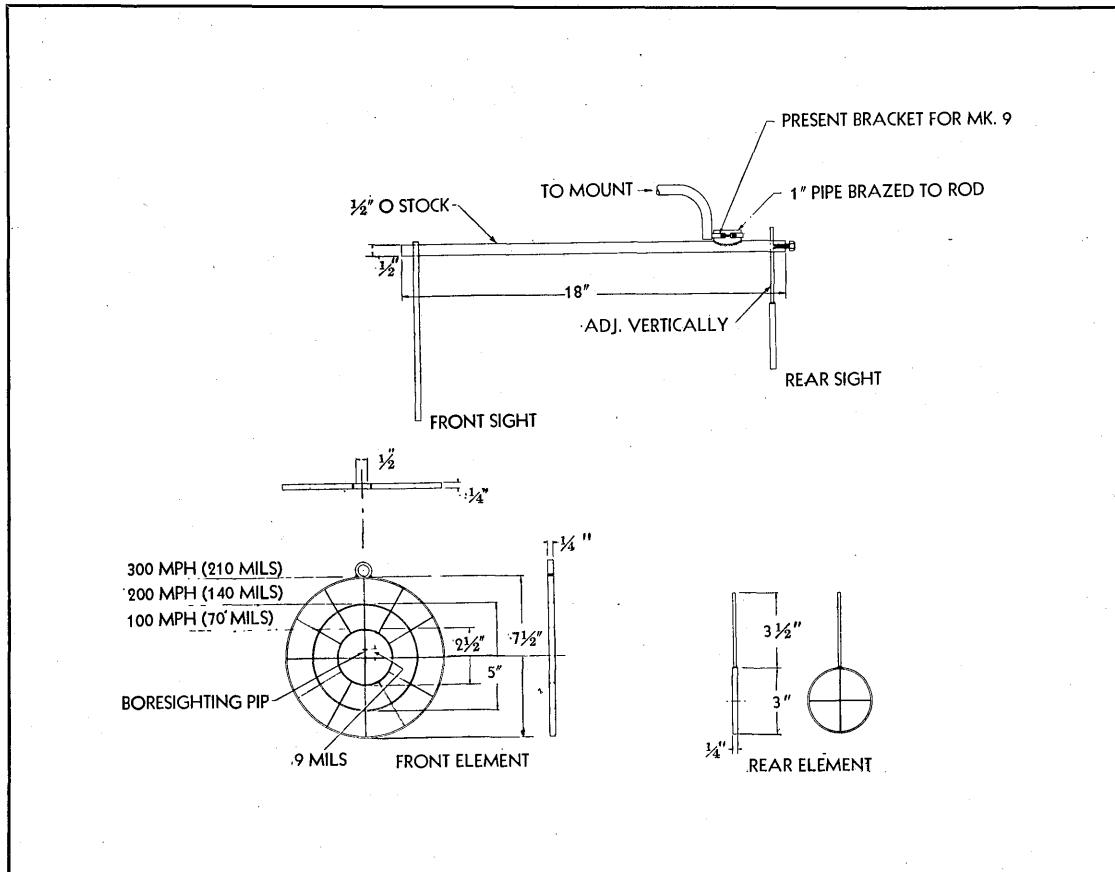


FIGURE 2

Sight Proposed for Multiple M.G. Mounts, M45 and M33

## **Appendix X**

### **RECOMMENDATIONS FOR CHANGES IN ENGINEER T/E'S FOR NATOUA\***

The following lists of recommended changes in T/E's of engineer units include only those of which we feel certain. Other items which are not satisfactory at present are under study and will be reported upon as soon as possible.

#### **Engineer Equipment**

##### **(1) Engineer Combat Battalion (T/O & E 5-15, 15 July 43)**

Add 1 Shop, equipment, motorized, general purpose, per battalion.

Add 3 Tractors, diesel engine driven, 70 to 90 DBHP, w/angledozer, per battalion.

Add 3 Semitrailers, low bed, 20-ton, per battalion.

Add 1 Set, drafting and duplicating, per company.

Substitute 3 Tractors, crawler type, diesel engine driven, 35 DBHP, w/angledozer, for 3 Tractors, crawler type, gasoline engine driven, 35 DBHP, standard, complete with bulldozer, per battalion.

Correct deficiencies in pneumatic tools as follows:

Put heavier pistons in spaders.

Increase number of spare parts per set.

##### **(2) Engineer Light Equipment Company (T/O & E 5-367, 22 July 43)**

Add 2 Plants, rock-crushing and screening, 2-unit, primary and secondary, pneumatic mounted.

Add 2 Graders, towed, leaning wheel type.

Add 1 Set, pile-driving, steam or diesel operated, Vulcan No. 2, or equivalent.

Add 1 Set, pile-driving, drop hammer type, 3,000-lb. hammer.

Substitute 6 Tractors, crawler type, diesel engine driven, 70 to 90 DBHP w/angledozer for 2 Tractors, crawler type, gasoline engine driven, with bulldozer and 4 Tractors, crawler type, diesel engine driven, 70 to 90 DBHP, w/angledozer.

Substitute 2 Compressors, air, towed, pneumatic mounted, 315 cfm. for 2 of the 6 Compressors, air, motorized.

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\*By Colonel Frank O. Bowman, Fifth Army.

## CHANGES IN ENGINEER T/E'S

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### Other Equipment

#### (1) Engineer Combat Battalion (T/O & E 5-15, 15 July 43)

- Add 3 Trucks, 6-ton, prime mover, per battalion (to pull D-7 dozers).
- Add 1 Trailer, 1-ton payload, 2-wheel, watertank, 250-gal., per company.
- Add 1 Radio, SCR 193, mounted in an additional truck,  $\frac{1}{4}$ -ton, 4 x 4, per battalion (for Bn-to-Div net; used by Div Engr).
- Add 1 Converter, M209, per radio set capable of transmitting CW messages.
- Delete Radio, SCR 593, throughout. (This is important and universally concurred in.)
- Tests of radio equipment are now being conducted, and further recommendations will be submitted.
- Increase Telephones, EE8, from 5 to 10 per battalion.
- Add 4 Trucks,  $\frac{3}{4}$ -ton, weapon carrier (for water supply).
- Delete 2 trucks,  $2\frac{1}{2}$ -ton, cargo (formerly water supply).

#### (2) Engineer Light Equipment Company (T/O & E 5-367, 22 July 43)

- Substitute 10 Semitrailers, low bed, 20-ton for 2 Trailers, full flat bed, 8-ton, and 8 Trailers full flat bed, 16-ton.
- Substitute 10 Trucks, 6-ton, prime mover, 2/winch, for 2 Trucks, 4-ton cargo, w/winch, and 8 trucks, 6-ton, prime mover, w/winch.

#### (3) Engineer Dump Truck Company (T/O & E 5-88, 17 May 43)

- Add 1 Axe, general purpose, for  $2\frac{1}{2}$ -ton truck.
- Add 1 Shovel, general purpose, for  $2\frac{1}{2}$ -ton truck.
- Add 1 Chain, tow, per  $2\frac{1}{2}$ -ton truck.
- Add 1 Tube, flexible nozzle, gasoline-filling, per vehicle.
- Add 1 Truck,  $\frac{3}{4}$ -ton, 4 x 4, weapon carrier (for chief mechanic).
- Add 2 Trucks,  $\frac{1}{4}$ -ton, 4 x 4, command reconnaissance (for platoon leaders).

#### (4) Engineer Topographic Company, Corps (T/O & E 5-167, 1 April 42)

- Add 5 Radios, SCR 300 (for survey crews).
- Add 2 Trucks,  $\frac{3}{4}$ -ton, 4 x 4 weapon carrier (for Survey Platoon).

#### (5) Engineer Topographic Battalion (Army) (T/O & E 5-55, 17 Nov 43)

- Add 6 Radios, SCR 300 (for survey crews).

## Appendix XI

### CHEMICAL WARFARE SERVICE MODIFICATIONS AND PROPOSALS

#### Section I

#### CHEMICAL GRENADE PROJECTOR\*

##### Directions for Use

##### 1. Uses

The projector may be used for:

- a. Signal purposes. To indicate targets on the ground, use colored smoke by day and M14 incendiary grenades by night. The M15 WP grenades may be used for air burst, day or night.
- b. To set fire to dry buildings or grass areas with incendiary and phosphorus grenades.
- c. To clear trip wires from a mine field, using the slug and attached rope.



FIGURE 1

\*Designed by Col. M. E. Barker, CWS. Use of grapnel suggested by staff of the 1st Armored Division.

## 2. To Project Grenades

The projector can be used to fire burning-type chemical grenades, M6, M7, M8, M14, M16, and M18, and exploding-type WP grenades, M15.

**a. First method for burning-type grenades.**—Remove the firing mechanism from the grenade. Tear off the small squares of tape from the holes on top of the grenade. Stuff a bit of loose paper in the central hole from which the firing mechanism was unscrewed to prevent the starter powder in the top of the grenade from pouring out. Place the powder charge in the bottom of the projector with the lead wires straightened out inside the barrel. Place the grenade in the projector, *fuze end down*, with the lead wires between the grenade and the walls of the projector. Point the projector at the target and dig in the back or the front of the base to get the elevation and range desired. Scrape the ends of the squib lead wires until bright copper is visible. Splice the squib lead wires with a 3' length of assault-type telephone wire if it is desired to get farther away from the projector when firing. Then step to the side and touch the two ends of the lead wires to the two poles of the electric battery furnished. This fires the powder charge, which consists of an electric squib buried in a tablespoonful of medium-grain black powder contained in a paper bag. The grenade is ignited by the powder blast and burns as it passes through the air.

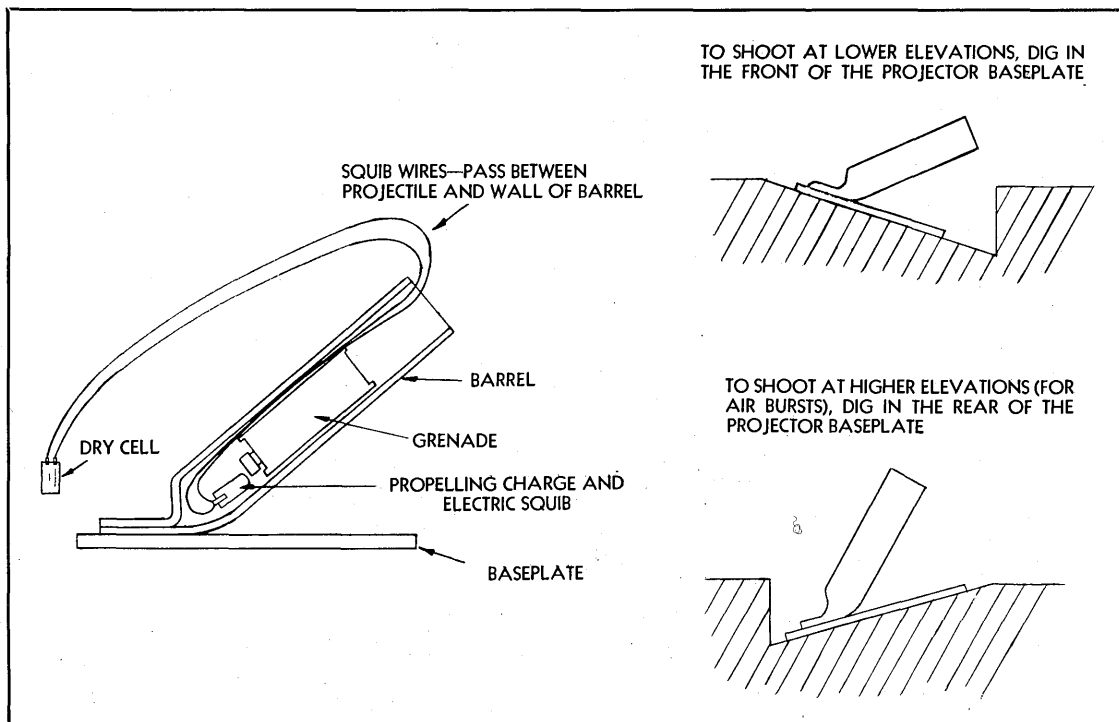


FIGURE 2

**b. Second method for burning-type grenades.**—Remove the striker of the firing mechanism, leaving the cap and the delay element in place. Load and fire as indicated above. Sample grenades prepared in this way are included in each grenade-projector kit.

**c. For M15 (exploding type) WP grenades.**—Fire as indicated in the second method for burning-type grenades. To get an air burst for signal purposes, shoot the grenade high into the air by elevating the projector to about 60°. This is done by digging out the dirt under the back of the projector baseplate.

### 3. To Drag for Trip Wires

- a. Load the slug and propellant in the barrel in the same manner as a grenade, with the wire and rope attachment up.
- b. Pay the rope out on the ground back and forth in front of the projector as shown in figure 3.

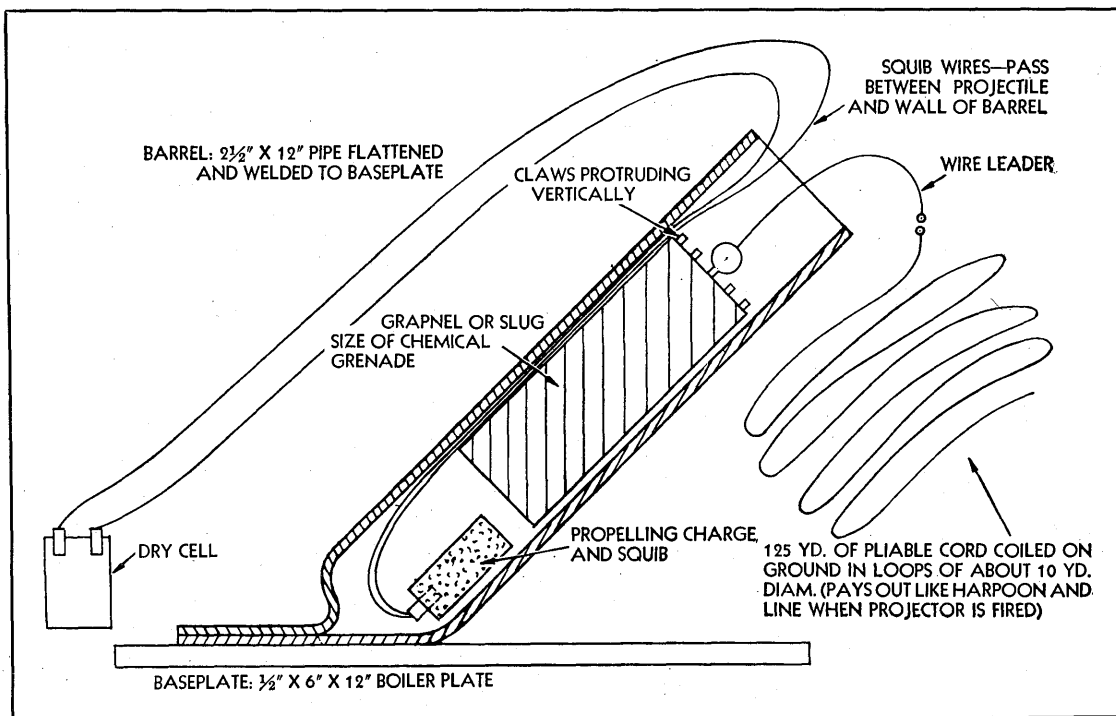


FIGURE 3

c. Shoot at 45° elevation unless tree limbs intervene; then emplace the projector to shoot under the limbs.

d. After firing, pull the slug back with the rope. The projections on the head of the slug will catch trip wires and fire the mines. Take cover while pulling the slug toward you.

**Note:** It is possible to throw the slug into the mine field by hand and then walk back with the rope for a hundred yards and pull the slug through the field to clear out trip wires. With a little practice the slug can be thrown 40 yd. or farther.

### 4. Range

- a. The burning grenade can be fired to a range of about 200 yd.
- b. The M15 exploding grenade can be fired for a ground range of about 125 to 140 yd. or an air burst about 100 yd. high. This is limited by the fixed delay of about 3 1/2 sec. in the fuze.
- c. The slug, with attached rope, which pays out like a harpoon line, gives a maximum range of 100 to 125 yd.



### 5. Contents of the Kit Box

Each chemical grenade projector box contains the following:

- 1 projector
- 2 slugs with ropes attached
- 3 chemical grenades (prepared for firing)
- 2 cans of propellant charges (40 charges)
- 1 battery for firing
- 1 small roll of wire

### 6. Cautions

- a. Clean the inside of the projector barrel after every four or five shots. Oil the inside of the projector barrel after each firing exercise.
- b. Clean the mud from the projector slug after each shot before reloading the projector.
- c. Do not try to shoot the grenade from the projector with the firing handle in place.
- d. Instructors should become proficient in the use of this grenade projector before giving demonstrations to units.

## Section II

### FRANGIBLE INCENDIARY GRENADES\*

#### 7. Description

Two models of these grenades have been developed and manufactured in some quantity. In all, about five thousand have been made up. These two models are described in the following paragraphs.



FIGURE 4

\*Designed by Col. M. E. Barker, CWS. Manufactured by a chemical depot company under the supervision of 1st Lt. Andrew Bedo, CWS.

## REPORT OF THE NEW WEAPONS BOARD

a. **Fifth Army model.**—(See fig. 4.) This model is made by taping a firestarter, M1, to any kind of bottle available. The bottle is filled with ordinary gasoline. To fire this grenade, the top of the firestarter is removed and the match head ignited by the scratcher disk assembled in the top of the firestarter, or the side of a safety match box can be used to ignite the match head. The bottle must be thrown *at once*, since ignition is accomplished by the sputtering hot flame of the match head rather than by the firestarter proper. This is an easily constructed, sturdy munition which is quite safe to handle and functions well under adverse weather conditions.

b. **Third Division model.**—(1) This model was designed to meet the specifications of the Commanding General, 3d Division. It consists of a squat pint bottle filled with 80-octane gasoline jellied with two packages of NaPalm per 50 gal. of fuel. Ignition is accomplished by a special igniter made as follows:

"The open end of a pull-through lighter (engineer issue) is stuffed with eight pieces of Italian 20-mm propellant powder. German plastic powder sheets are cut into strips 6" long and 1" wide. These sheets are about  $\frac{3}{8}$ " thick. A small bar of wood about  $\frac{1}{8}$ " square and 1" long is cut with a notch in the middle and the wire of the pull-through lighter is laid in the notch to form a 'T'. The modified pull-through lighter is laid between two sheets of the powder. Heavy waterproof paper from a gas-resistant sack is cut to form, and a slit is made for the handle of the lighter to pass through. The paper is then folded and the igniter taped to the side of the bottle with the bottom of the paper cup left open."

(2) To fire this munition, hold the grenade in the right hand, pull the lighter with the left hand, and throw the bottle against a tank or pill box. The bottle must be thrown against a hard surface to insure breakage. A long hot flame lasting about 5 sec. comes from the burning powder, which insures ignition of the filling. The "applesauce" filling sticks to the vehicle or surface and burns fiercely. Several grenades can be thrown to build up a very large, hot fire on the target.

### Section III

#### FIELD DRIER FOR POWDER, GAS MASK CANISTERS, ETC.\*

##### 8. Description

a. The heater of this drier consists of a 30-gal. drum as a firebox with a 55-gal. drum assembled around the firebox and welded to make a gastight annular space between the two drums. Any kind of fuel available

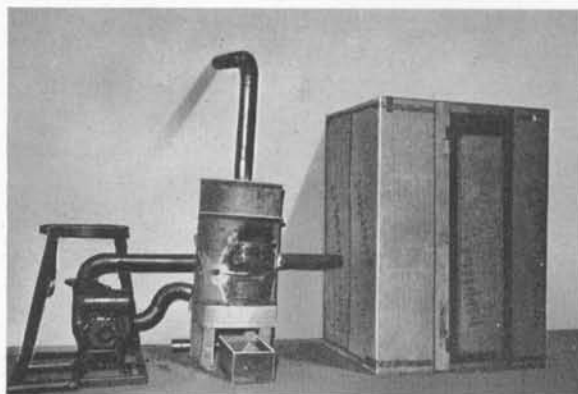


FIGURE 5

\*Designed by Col. M. E. Barker, CWS. Constructed by chemical maintenance companies. Several now operating.

## CHEMICAL WARFARE MODIFICATIONS

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can be used. The drier proper consists of a large box, made from scrap lumber salvaged from packing boxes, sheathed on the outside by Italian insulating board. Shelves and hooks are provided inside the drier box. Air is forced through the heater and drier box by a gasoline-engine-driven blower borrowed from an M-2 collective protector.

b. About 250 cu. ft. of hot air per minute pass through the drier, and a very steady temperature of about 150° F. is maintained in the box. The air intake for the blower has been placed near the outside of the heater to get the maximum efficiency from the fuel used.

### 9. Use

This apparatus has been used very successfully in a tent at a forward ASP to dry powder, packaging material, and all kinds of material that has become wet. In the maintenance shop it is used to dry gas-mask canisters, gas-mask carriers after washing, and other things, including the personal laundry of the men.

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