Grenade Warfare

School of the Grenadier

A Guide for

Hand Bombers and Rifle Grenadiers

FOURTH FRENCH EDITION

FIRST AMERICAN TRANSLATION

Revised

BY

CAPTAIN ADRIEN GAY

2nd Zouaves Regiment, French Army

Knight of the Legion of Honor, Wearing the War Cross

Ex-Instructor at

Saint-Cyr Training Student-Officers' School—France

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The Leader

of a Bomber's Group

has an important duty.

Every soldier under command

has part of the duty

and this small unit must have

an exceptionally high morale

in order that it might be a selected group

—G. Q. G. August, 18, 1918

Marshall of France

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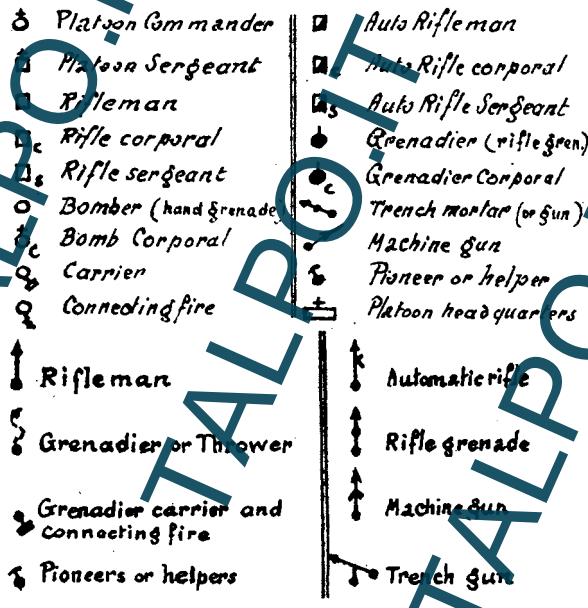

GRENADE WARFARE

SCHOOL FOR THE GRENADIER
Guide for Hand Bombers and Rifle Grenadiers

HISTORICAL-EFFICIENCY

This war has convinced us that when fighting men were placed in conditions where direct fire with flat trajectory of our strong powerful modern weapons was insufficient, they merely returned to the ancient use of war weapons and machinery.

For this reason, grenades which had been abandoned for more than a century, have come back into use in trench warfare as well as the prehistorical instruments of throwing: Catapults, slings, onagers, etc., known to be very ancient, since the Bible says that eight centuries before Christ, 2700 years ago, the walls of Jerusalem had been attacked by Ozias with machines constructed by a very clever engineer for the purpose of throwing large stones and arrows.

All authors of the Fifteenth century and the beginning of the sixteenth century in their writings mentioned a weapon of war, described as a flying mortar which was used in many sieges at that time.

When describing the siege of Rouen, by the English, under Charles the VI, (Fourteenth Century), the French chronicle Montrelet mentioned these flying mortars as being used in this siege by the forces on the defensive. It is supposed that grenades originated from bombs, fire-pots or some similar machines, but of course that supposition cannot be taken as absolutely correct, because grenades were heard of more than 50 years before bombs.

The name grenade was given to this weapon, owing to its resemblance to a pomegrenate, fruit. This fruit is composed of small grenades, red in color, and this corresponds to the shot in the grenade in use now. It was given its name

the oxidizing agent is chlorate of potash or soda or perchlorate of potash or ammonia. The combustible can be varied. In

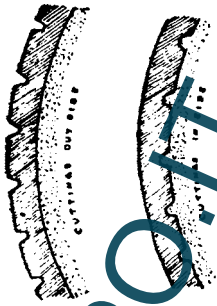

Fig. 1

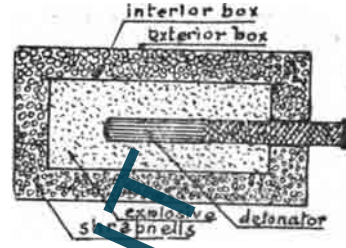

Fig. 2

the "chedrites" the combustible is castor oil, vaseline or paraffine.

3. **A firing mechanism** comprising:

(a) A detonator loaded with fulminate of mercury and a small quantity of melinite. (Fig. 3).

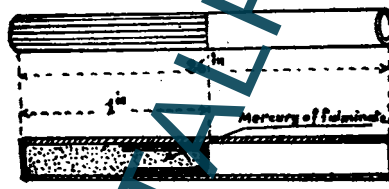

Fig. 3.

(b) A time fuse causing delayed explosion to the detonator.

(c) A process of ignition of the fuse (Generally a **primer** and a striker actuated by direct shock or by tension of a percussion spring. (Fig. 4).

III. CLASSIFICATION AND MECHANISM OF GRENADES.

As regards their ignition they are classified into two types:

(a) Percussion grenades.

(b) Time fuse grenades.

As regards their tactical employment they are classified into two types:

(a) Defensive grenades.
(b) Offensive grenades.

(A) As Regards Their Ignition.

(a) **Percussion grenades** explode by shock at the end of their course either by shock of a movable striker against a fixed primer or by shock of movable primer against a fixed striker.

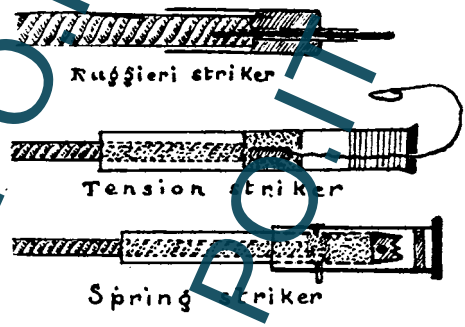

Fig. 4.

(b) **Time-fuse grenades** are supplied with a system of delayed ignition, that is to say that they explode a few seconds after the lighter has acted (on an average of 5 seconds).

Experiments on the Argonne front (grenadiers school of St. Florent) as regards their frogmentation after explosion, the F and "Mills" grenades gave the following results:

1. **Throwing an object in an open field.**—A grenade of each kind was thrown in a square room 11 feet on one side by 9 feet high, of pine boards 1 foot 8 inches in thickness and papered. It was contended that each grenade gave an average of 250 points of impact on the walls, 28 fragments perforating the boards.

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(1) In order to avoid confusion in joint attacks an agreement has been entered into by the French and British Armies that none but time-fuse grenades will be used in either service.

Percussion grenades are largely used in the Italian service.

2. **Throwing on an object placed in a trench.**—A grenade was thrown in a trench 13 feet in length, 4 feet in width and 6 feet in depth. (Fig. 5). Silhouette figures representing men in the standing position were the objectives.

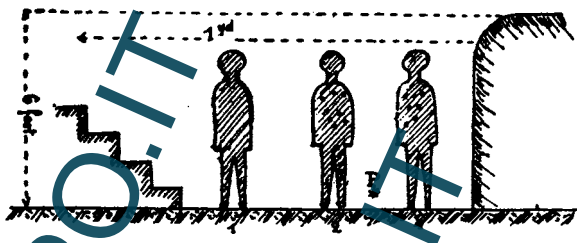

Fig. 5.

The grenade fell at the point "P" exploding upon coming in contact with the earth, lodging 13 fragments in silhouette, 17 of which were found at the height of the knee and 9 in the body. Silhouette 3 had seven fragments.

3. **Throwing on an Objective Protected by Breastwork.**

A grenade was thrown back of a breastwork where silhouette figures representing men in a prone position was the objective. (Fig. 6).

The grenade exploded at the point "P" causing a crater-shaped hole 11 inches in diameter by 5 inches deep.

Silhouette 1 had 10 fragments, one of which pierced the pine boards 1⅛ inches in thickness. Silhouette 2 had 32 fragments, two of which pierced the pine boards. Silhouette 3 had a few scratches.

No point of impact on silhouette figure 4.

But the branch of a tree 22 feet distance from the shell-crater, produced by the explosion, received 5 fragments at 6 feet and 8 feet above the ground.

(B) As Regards Their Tactical Use.

(a) **Defensive grenades** explode giving shells or splinters in plenty, and are mortal. It is necessary that they be thrown from a well protected position against splinters which rebound.

(b) The offensive grenades which are also known as assault petards.

They do not throw any splinters except the primer-plug on an average of 20 yards.

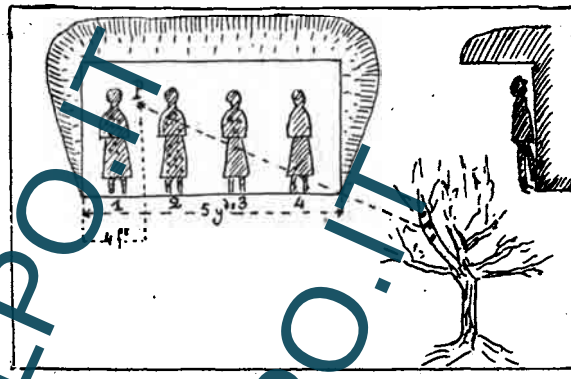

Fig. 6

They act principally by the force of the explosion. The force of this explosion is not mortally dangerous in an open field but is is a good demoralizer for the enemy by its powerful noise.

But when they explode in a trench their results are powerful. Experiments made at the grenadier's school of St. Florent demonstrated that each offensive grenade is able to mop up a trench 15 feet long. Results from this explosion resemble those obtained by an explosive detonating in a closed vase.

Experience.—An offensive grenade thrown in a trench 6 feet deep where five silhouette figures, made from sew lumber, 1''-18'' in thickness and spaced 3 feet representing men in standing position. The explosion of the offensive grenade threw 2 of the silhouette figures outside the trench and 2 of the silhouette figures were broken to bits.

The use of this offensive grenade during the most recent attacks proved the importance that they must be increased more and more.

To this classification belongs the grenades improvised with bottles or boxes of preserves filled with cheddite, the models which have been introduced by the allied armies under absolute necessity in 1914.

N. B.—The British now use only the defensive type of grenade, while the French have both the offensive and defensive types.

IV. MANIPULATION AND TRANSPORTATION OF GRENADES.

The manipulation of grenades requires many precautions. A grenade is always dangerous. The danger is the direct result caused by the ignorance of those who do not know its fabrications or its mounting.

The transportation of live grenades from the rear to the war zone is made in boxes. The grenades are not supplied with primer-plugs. These primer-plugs are put into special boxes.

Supplies for bombers engaged in combat are sent in special cases of individual compartments and not in bulk to avert danger of explosion.

V. THE PRIMING AND IGNITION OF GRENADES.

A **Fused grenade** is a grenade which has its primer-plug.

An **ignited grenade** is a grenade whose system of ignition has been actuated by the bomber at the time it is thrown.

VI. CONSERVATION AND VERIFICATION OF GRENADES.

Grenades should be kept in cases and in dry places. Avoid subterranean dumps for grenades. The cases should be elevated from the ground to insure ventilation; the roof must be absolutely rainproof.

Detonator and primer-plugs must be kept separate from loaded grenades.

Use old grenades first. Frequently renew the supplies of grenades in the trenches. Stocks older than 6 months are dangerous.

Safety plugs must not be removed until ready to be thrown.

Avoid exposing these explosives to the sunlight or in a temperature exceeding 103 or 113 degrees Fahrenheit. The paraffine which composes in part these explosives, melts at 125 degrees Fahrenheit. If the explosives are kept in the above temperature they become sticky and thus lighting becomes difficult. Likewise if they are too damp it makes ignition impossible.

The State of conservation of a perchlorate explosive is verified by constant attention, the components of these explosives are in their normal state, white. But parafine, vaseline, castor oil which constitutes the covering of these active compositions, is colored, so that when molecules of chlorate or perchlorate are poorly mixed white spots become visible. As these parts of the chlorate or perchlorate are more sensitive than the others by reason of shaking and rubbing, the explosive showing spots is then questionable and must be destroyed.

VII. HOW TO SELECT HAND BOMBERS.

All privates must be trained as bombers, but the men who are not cool-headed, the blunderers and the weak men should be considered as unable because they would be dangerous to their comrades.

Bombers must be carefully selected: it is necessary for a good bomber to be strong, energetic and animated with great courage.

To develop the physical condition of the men, the day's work should begin with calisthenic exercises and short talks on personal hygiene. This should be followed by exercises in throwing, climbing out of and running along the trenches, bayonet fighting and other movements relating to grenade fighting.

Bayonet Fighting.—Special instruction in the use of the bayonet is essential for bombers. The usual bayonet instruction given to all privates will accustom them to the use and balance of the weapon and teach the necessary movements. This, however, is not sufficient for the training of a bomber, but must be supplemented by practice in narrow trenches against living opponents. In trench warfare bombers will fight in inclosed and narrow spaces, where shock tactics are impossible. Methods in bayonet fighting similar to those of a swordsman are required, with a perfect combination of eyes, hands and feet. Practice is designed to develop ability and speed at close quarters. Contests should be arranged between men of the bombing squad, and the most proficient men should be selected as bayonet men.

VIII. HOW TO TRAIN BOMBERS AND SELECT BOMBERS.

Privates must be trained to throw grenades while standing, kneeling or in a prone position; the last position is very important in combat from shell-crater to shell-crater and requires particularly skilful physical training..

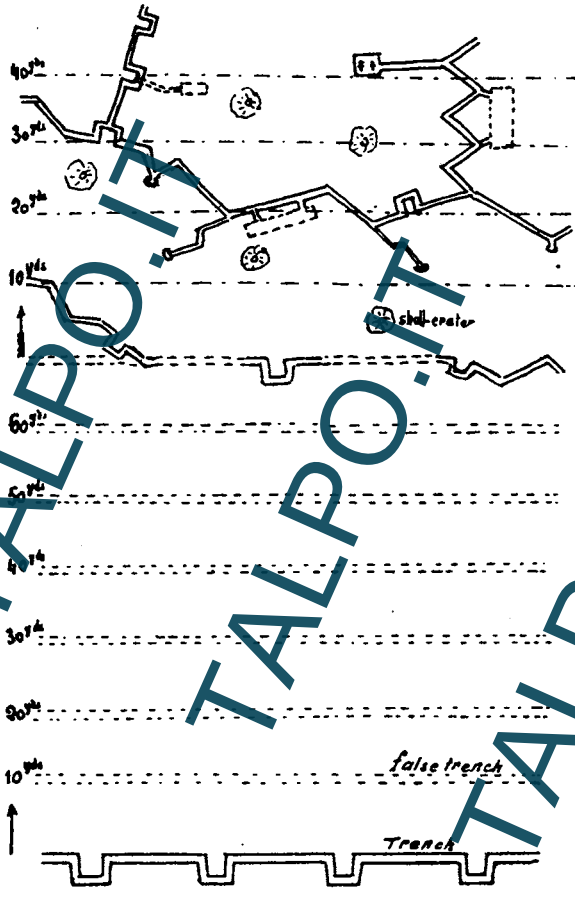

Fig. 7. Training Field for Bombers.

The training comprises three different phases:

FIRST PHASE—Physical Training and Exercise in Throwing Dummy Grenades.

Requirements:

1. Accuracy.
2. Range.

Accuracy must be first considered. Accuracy permits one to obtain maximum results with minimum consumation of grenades. It is of major importance owing to the difficulty of obtaining supplies during combat.

An increase of range comes naturally by daily training.

The different plans of these physical training are as follows:

(A) Throwing in an open field. (Fig. 7).

(a) On dummy trenches 3 feet wide placed in echelon at distances of 10 to 70 yards.

(b) An objective which may vary from 1 to 3 yards apart enclosed in these dummy trenches by flags.

(c) On trench elements, listening posts, dug-out entrances,

(B) Throwing from a trench or approach trench into dummy trenches.

(C) Throwing from a trench or approach trench into another trench or another approach trench over an open field, over traverses, or over the corner of an approach trench.

(D) Throwing from a shell-crater into a trench or into another shell-crater.

(E) Results to be obtained:

1. Throwing from a distance; at least 30 yards.

2. Throwing with accuracy and speed; 6 grenades per minute on a square target two yards on one side placed horizontally at thirty yards from starting point.

SECOND PHASE.—Training of bombers for Throwing Live Grenades.

This throwing must be preceded by training with dummy grenades such as tin cans filled with sand and adjusted with "stoppers" and "primer-plugs."

The following precautions must be taken in throwing live grenades:

(A) See that the fuses are properly adjusted to the grenades.

Special care also that:

(a) The detonator is well fixed.

(b) The mouth of the air-hole is open.

(c) The lock spring is not rusty.

(d) The notch of the releasing lever is well clasped to the lug.

(e) The fuse is really there.

(f) The safety pin is in readiness and the extremities sufficiently open.

(B) See that the primer-plugs are solidly adjusted to the grenades.

Prepare the detonators space in the explosive by boring a hole with a small piece of wood.

(C) See that the bomber is alone when throwing the grenade. Even the instructor must move away and leave the bomber to himself. The instructor must not permit the men to throw the grenades all at the same time unless there is protection by traverses.

(D) Do not pick up and throw a grenade which has failed to explode. Destroy it at once according to indications noted on appendix I.

(E) See that the primer-plug is never hammered more than once on one grenade. After a live grenade is hammered it should be thrown immediately.

(F) The throwing of live grenades must be done under the supervision of company officers. But bombing officers should be present during the throwing to oversee and correct errors.

THIRD PHASE.—Tactical Instruction for the Squad or Group of Bombers.

All infantry men should receive sufficient instruction to enable them to pass readily and quickly to the status of grenade combat, and special instruction given to grenade squads should enable it to carry out any of the special technical operations for which grenade fighting is suitable.

After the men have received a thorough training in individual instruction prescribed above, the necessary team work will be secured by squad training.

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*See appendix III for work concerning the execution of a contest for throwing grenades.

Instruction of "Select Bombers."—In addition to the instruction given to all men of the bombing squad expert bombers receive a special course and follow a more thorough training. This special course comprises:

1. The making up of explosive charges.
2. The making of dummy grenades.
3. Utilization of foreign grenades and detonators.
4. The use of trench mortars of low power.

The special objects of the course for expert bombers is to make expert throwers with confidence in their skill; to provide men capable of organizing a grenade combat and carrying it to a successful outcome; and to provide leaders among the men to serve as examples to be imitated by their comrades.

IX METHODS OF THROWING.

The bombers may occupy, during battle, various positions. They may throw grenades into the approach trench longitudinally or either at right angles or obliquely from it. In order to meet these different conditions special methods of grenade throwing have been adopted. These methods have been derived from the British method and have been approved in the French regulations in "Combat a la grenade" of April 7, 1916.

The method of throwing is the basis of instruction of the bomber. It is of vital importance that the instructor pays constant and rigorous attention to the principles of this method. Careful observation to instruction concerning methods of priming and throwing, particularly to each type, should be given.

Execute the operation of throwing rapidly but without precipitation (on an average of 2 seconds, in the cadence of quick time).

(A) Throwing Along the Approach Trench Lengthwise.

(a) **FIRST METHOD. Throwing the grenade at the same time balancing the body without taking a run.**

Initial Position (Fig. 8).—Aim at the objective with the extended left arm with the grenade in the right hand and the right arm falling naturally by the side. The shoulder, the extended left arm, and the objective should be in the same vertical plane.*

First Motion. (Fig. 9).—Left arm forward held in the direction of the objective. Carry the grenade near the left hand.

Second Motion. (Fig. 10).—Raise left arm and extend in the direction of the objective. Describe a semi-circle with the right arm until in a vertical plane. Balance the body laterally bending the right leg and stretching the left leg forward elevating it from the ground. Follow the grenade with the eye so as not to strike side of the trench. Stretch the left leg,

Fig. 8

Fig. 9

Fig. 10

raise left heel or foot from the ground. All the weight of the body should rest on the right leg.

Third Motion. (Fig. 11).—Cast the eyes at the objective or at the aiming point, if throwing from a trench.

Fourth Motion. (Fig. 12)—With the right arm describe the arc of circle in a vertical plane, the right shoulder and the body following the movement of the arm, extending the right leg and bending the left knee. The left arm is swept vigorously downward and backward, following the left shoulder, which is sharply "refused."

Finish with the entire weight of the body in the throw. Release the grenade while executing a twist of the trunk to

---

*During instruction, place the private facing the objective. At the command:

"To throw a grenade."

"Get ready."

Execute right face, carry the right foot to the right of the left foot and raise the left arm in the direction of the objective, palm downward.

the left, right shoulder on a line with left shoulder. Turn on the right toe at the time of twisting the trunk.

N. B.—The grenade thrown under these conditions should fly in the direction in which the left arm was pointed, and the maximum range should be obtained. The right arm acts like a catapult.

The time of the throwing is about two seconds, (two motions per second).

Fig. 11

Fig. 12.

(b). **SECOND METHOD.**—**Throwing the grenade at the same time balancing the body and taking a run.**—The principle of throwing is similar to the preceding one with this one addition. At the beginning of fourth motion the thrower hops on his right foot. The range is thus increased from 3 to 5 yards.

B. Throwing Across an **Approach Trench. (Fig. 13 to 18).**

(a) **FIRST METHOD.**—Throwing with out-stretched arm.

Initial Position.—Facing the wall of a trench execute a right half face carry the right foot to the right of the left foot.

Fig. 13

Fig. 14

First Motion.—Incline the trunk downward and to the left and while in this position ignite the grenade.

Second Motion. (Fig. 13).—Carry the right arm in an outstretched position to the rear. Follow the grenade with the eye.

Fig. 15

Fig. 16

Third Motion.—Aim against objective.

Fourth Motion. (Fig. 14).—With the right arm describe the arc of a circle in a vertical plane; release the grenade

Fig. 17

Fig. 18

while executing a twist of the trunk to the left. Turn on the right to and allow the left arm to follow the movement of the body.

the entrance of which is masked. And if one goes forward too rapidly the enemy comes out and attacks you in the rear. (Fig. 34).

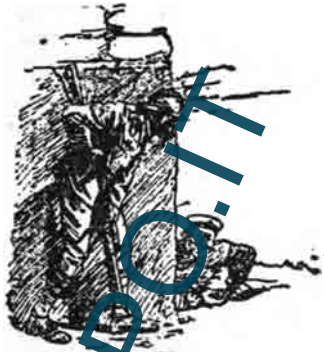

Fig. 32.

Fig. 33.

4. Verify the construction of the barrage. Sometimes the enemy pile sandbadgs on a platform made of planks or rifles, forming a bridge. The sandbags under the platform can be taken out without causing the other sandbags to slide. (Fig. 35). The enemy take out these sandbags while the watcher is looking over the top of the barricade.

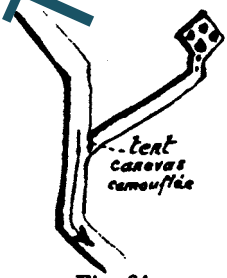

Fig. 34.

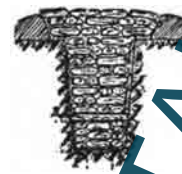

Fig. 35

5. Upon meeting a transversal trench, throw a few grenades on all sides (in b1 and b2) in series of three grenades. (Fig. 30).

Explore this transversal trench and build barricades and

keep them guarded, if the order has not been given to continue through these transversal trenches. When the enemy has gained "fire superiority," the terrain must be held by step by step progress until "fire superiority" is regained. Then increase the barrage fire to hinder the advance of the enemy, and defend the barrage, either in the approach trench itself, (Fig. 35a) or near the aforesaid trench, (Fig. 42). All bombers must be able to rapidly construct an improvised barrage, back of which they will give all resistance possible. In the meanwhile the group of workers will construct a permanent bar-

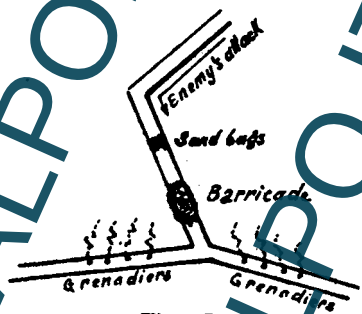

Fig. 35a.

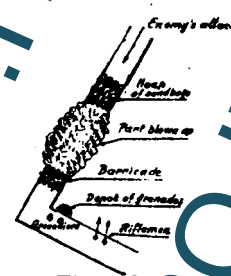

Fig. 35b.

rage, about 50 yards to the rear. Then the section of the trench, between the two barricades, should be filled, but it is, however, necessary to throw into the old approach trench, "chevaux de frises," "Brun spirals," "barbed wire," etc. The new parapets are torn down, (Fig. 35b). Thus the enemy works with difficulty, and cannot easily approach the "sap" and can only launch "counter attacks" in the open.

As soon as the barricade is finished, its protection is in the hands of auto-riflemen, reinforced by a few bombers and if need be, rifle-grenade men. (Fig. 36).

Means used to regain "fire superiority" consists in drawing the enemy into an ambuscade, and pit against him a larger number of throwers.

3. Preparation for an Assault on a Hostil Trench.

An assault is usually a combined action executed under cover of a powerful artillery fire. But sometimes a part of

XIII. Nomenclature and Technical Use.

A. EXPLOSIVE GRENADES.

1. **Fuse Grenades** { defensive { Grenade Model 1915 F1; Grenade Model C. F. } offensive Grenade Model 1915 O. F

2. **Percussion Grenade.** Used only for trench mortars.

1. **Grenade Model 1915 F.1.**

Consists of a cast iron oval shaped body with exterior serrations to facilitate fragmentation.

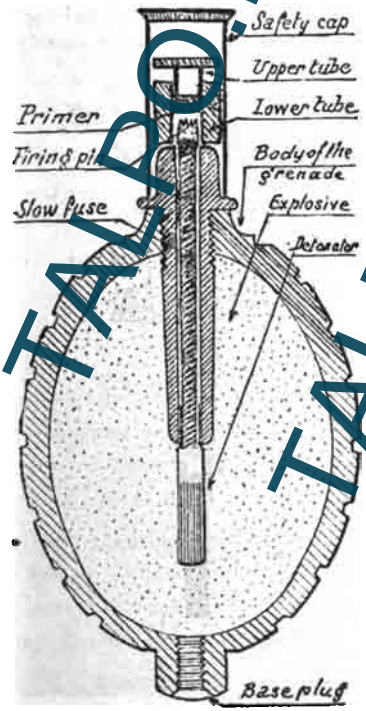

Fig. 44.

The primer-plug is screwed into the body.

Primers in use are as follows:

Metal primer model 1915.

Automatic primer, model 1916, B.

The second is intended to supercede the first.

A. Metal Primer, Model 1915. (Fig. 44).

1. **Description.**—It consists of a lead and tin tube at the lower end of which is a slow fuse covered with detonator. At its upper end an igniting outfit consisting of two concentric tubes sliding one over the other. At the bottom of the upper tube a priming piece; on the extreme end of the lower tube one notch of the striker.

A cap or spindle assures protection to the lighter.

2. **Lighting.**—Take the grenade with the right hand, withdrawing the cap. Strike the upper tube against a hard object, releasing it immediately.

The burning of the primer lights the fuse which burns

primer is transmitted to the fuse through the central-canal of the anvil, and produces the explosion of the detonator and of the grenade. A protecting cover (10) is fastened to the body with waterproof coating for the striker and keeps the primer from being affected by humidity.

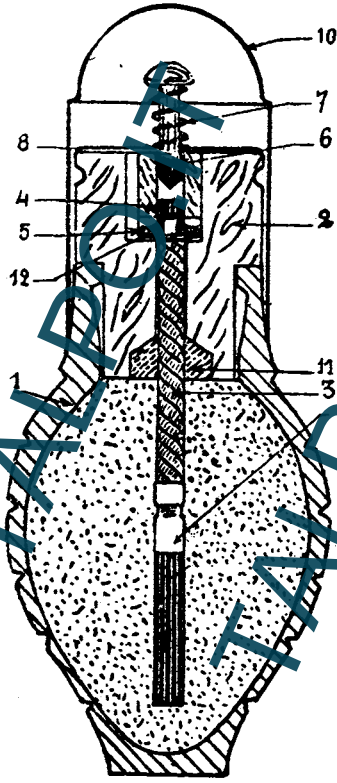

Fig. 50.

11, joint; 12, spring buffer.

2. **Lighting:**

1. Take the grenade in the right hand, and strike head of striker on a hard object or on the body of another grenade held in left hand. This shock ignites the grenade and smoke is admitted through the air hole in the cork.

2. After the shock, throw the grenade without switching it from one hand to the other. Throw the grenade even if same should per chance fail to emit smoke.

4. **Remarks.**

Total weight of the loaded grenade, 1 lb., 4 ounces.

Charge of explosive, 3 ounces.

Length of burning, 4 to 5 seconds.

Grenades are transported already loaded and primed, in cases of 20.

Never unpack the grenades beforehand, so as to avoid the air-hole being closed up.

2. Uncovered grenades, in trenches, and not used, will be recovered and sent to the "Parcs des Grandes Unites," to be destroyed.

3. Be careful, before each throwing exercise to examine the condition of grenades, especially see that the air-hole is not blocked.

4. The forming of barrage fire with C. F. grenades is the same as with F1 grenades.

3. **Offensive Grenade, Model 1915, O. F. (Fig. 51 and 52).**

1. **Description.**—Avoid shaped tin body, 0.118 inches thick. Use the same primer-plug as for F1 grenades, (metal primer or automatic primer).

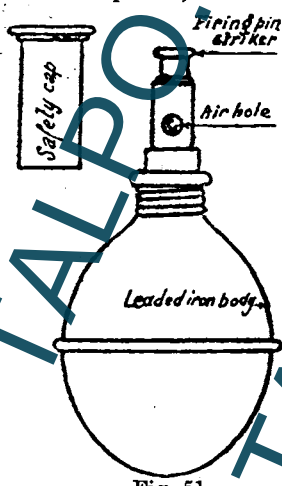

Fig. 51.

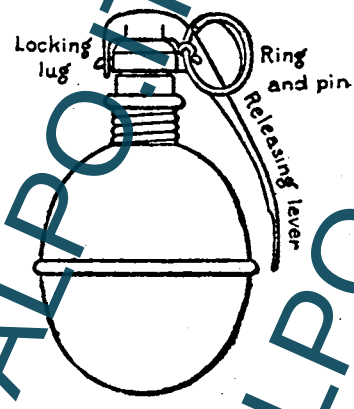

Fig. 52.

2. **Lighting.**—The O. F. grenade is lit and thrown by the same method as the F1, as it is provided with the same lighter.

3. **Remarks.** 1. Total weight of the loaded and primed grenade, about one-half pound.

Charge of explosive, 5 ounces.

Length of burning, 5 to 6 seconds.

Shipment in separate cases, 200 grenades or 500 primer plugs.

All soldiers must be able to make a defensive barrage at

35 yards distance at an average of 1 man each 10 yards interval with O. F. grenades.

General Remarks on Fuse Grenades.

It sometimes happens that the explosion of a fuse grenade will not occur at the normal time (5 to 7 seconds). For purposes of instruction it is best to wait 12 to 15 seconds before coming to a conclusion of a misfire.

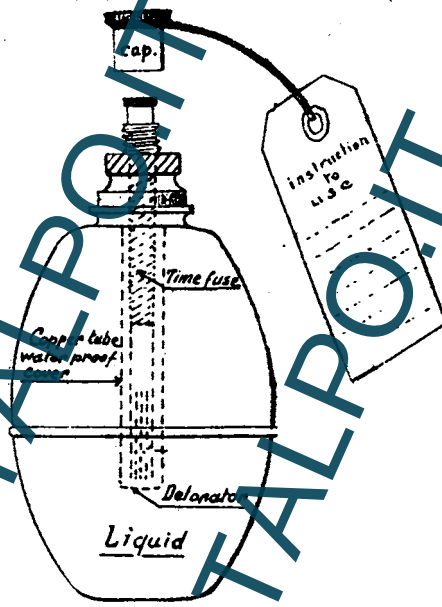

Fig. 53.

These delays are generally caused by too thorough crimping of the detonator on the time fuse. This crimping having broken the train column of powder of the fuse and the fire. Instead of being transmitted rapidly by the powder, it is transmitted slowly by the wick thereby causing delay.

(B) Suffocating, Intoxicating and Tear-producing Grenades.

Little or non-intoxicating grenades whose component ingredients are, chloride, bromine, anhydride of sulphur and nitric acids, but can render closed or poorly ventilated areas untenable.

Suffocating grenades are composed of formic acid, benzyle bromide, and bromacetone.

It is necessary to use them cautiously and judiciously to compel the enemy to evacuate his dug-outs, and various places of shelter.

I. Suffocating Grenade, Model 1916. (Fig. 53).

1. **Description.**—Oval shape, made of lead, the primer plug or automatic lighter model 1916 of the grenade F1. The detonator is in fact the only explosive.

2. **Lighting.**—For igniting see model F1. Can be thrown 40 yards without danger in an open field.

3. **Remarks.**—Avoid throwing against wind, which would cause the return of suffocating vapors.

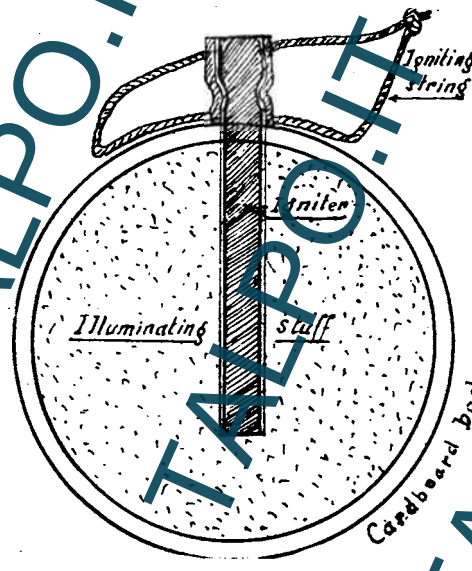

Fig. 54.

Total weight, 14 ounces.

Transported in cases of 25, all loaded. Automatic plugs are carried separately.

Weight of special liquid, 7 ounces.

Total weight, Approximately 14 ounces.

Average range, 30 to 40 yards.

C. Lighting Incendiary and Smoke-Producing Grenades.

I. Lighting Grenades. (Fig. 54).

To illuminate the field in a close attack, to surprise an audacious patrol.

These weapons are composed of a cardboard rocket, 2.5 inches in diameter, weiht, 9 ounces, with a time fuse with its exterior extremity crimped in a brass tube, containing a phosphorous primer.

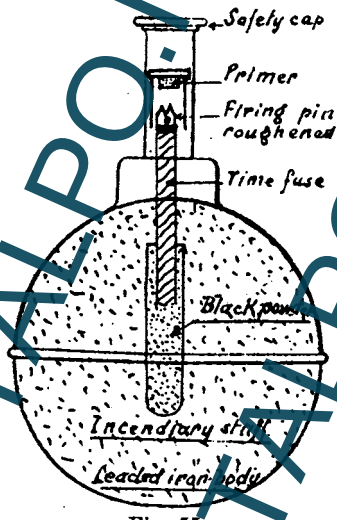

Fig. 55.

The grenade is filled with an illuminating chemical composed of magnesium powder or of aluminum and iron sesquioxide. The paper is varnished black. The lighting is made by a scratcher held in the left hand.

This rocket-grenade is thrown with the hand. It illuminates very extensively for about a minute and a half, within a radius of 20 yards.

II. Incendiary Grenades.

To ignite combustible objects, sufficiently dry, clear a rifle range from straw, bushes, underbrushes, etc. The debris is used by the troppers up of trenches to set fire to shelters, and to the sheltered personnel. Thus a smoke producing effect is produced. They are composed of phosphorous, chloride of sulphur, gasoline and petroleum.

(a) Incendiary Grenade, 1916 A.B. (Old Model), (Fig. 55).

1. **Description.**—It is at the same time incendiary and smoke-produsing. Spherical body, made of tin, porcussion metal primer-plug. At the bottom of the central tube which holds the lighting primer, place a small quantity of black powder, which at the same time favors explosion of the spherical tin body, and the lighting of the material which is made of white phosphorus mixed with carbonized sulphur.

2. **Use.**—For the igniting and the throwing of this grenade see grenades 1915 F1.

Avoid throwing against the wind. The smoke emitting therefrom is very thick, and dense, but not asphyxiating. It forms an excellent screen, useful when launching attacks to mask certain activities.

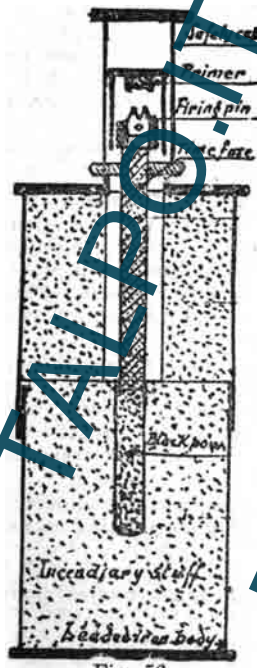

Fig. 56.

3. **Details.**—Total weight, 1 lb., 9 ounces.

Weight of special material, 1 lb., 1 ounce.

Average range, 25 to 35 yards.

Avoid throwing against the wind. Use for mopping up shelters or to defend barricades when the wind is favorable.

(b) Incendiary Grenade with Automatic lighter. Model 1916 (New Model).

1. **Description.**—Composed of an oval shape body made of tin, same as the suffocating grenade 1916 model. Loaded with white melted phosphorus, and containing an automatic lighter 1916 B model without detonator. The explosion of the grenade is obtained, by the aid of a charge of black powder, contained in a tube in which the primer is screwed.

2. **Use.**—Same as the automatic lighter grenade model 1916.

3. **Details.**—Transported in cases of 50, already charged and primed. Do not unscrew the primer-plug.

Weight of special material, 11 oz.

Total weight, approximately 16 ounces.

Average range, 30 yards.

(c) Incendiary Cylindric Grenades., Model 1916. (Fig. 56).

1. **Description.**—Composed of a cylinder box, made of tin, loaded with calorite (powder of aluminum substance mixed with

2. **Use.**—Uncover the cylinder, placing it in a vertical position, primer upward, and ignite the priming fuse.

3. **Details.**—They are carried to the troops in cases of 50, standing on end, primer up, in 10 rows of five each.

(b) Smoke Producing Cylindric Grenades, Bouchet Type. (Fig. 58).

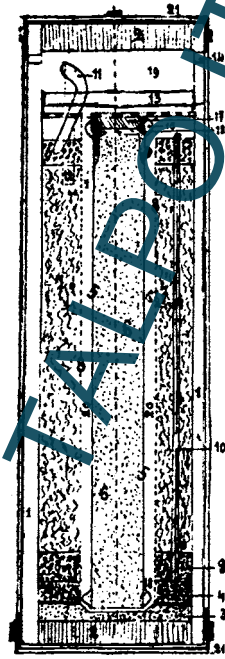

Fig. 58.

1. **Description.**—Composed of a cardboard cylinder, perforated on one end. This cylinder contains 9 ounces of fumigating mixture, composed of metal-salts, trichloride of antimony, chloride of aluminum and 40 ounces of combustible material such as

Lighting is affected by a small time fuse, 6 inches long, at the end of which is a lighting apparatus, a small metal cap, designated to protect the fuse from humidity.

At the other extremity are 2 pieces of the time fuse notched in, in such a way that the fuse is buried in the upper layer of the primer.

The grenade is 13 inches long and 4 in. in diameter; weighing 6 pounds. The length of smoking is about 2½ minutes.

A paraffined paper envelope covers the whole and enables the grenade to be exposed several hours to rain.

2. **Use.**—Pull on end of the rope, the covering tearing, uncovering the grenade.

Withdraw metallic cap, and recovering the primer.

Lay grenade down, raising its upper end where air holes are.

Light primer.

Under ordinary conditions, even in a strong wind, place the grenades at intervals of 2 yards to obtain cloudy effects.

3. Usual information for the establishment of a plan for replenishment:

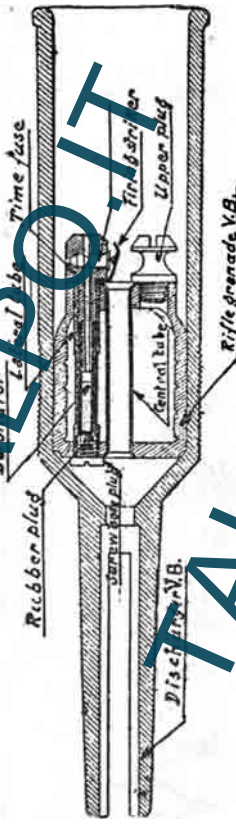

Fig. 67a.

(a) Replenishment by man power. One carrier is able to carry 40 V. B. grenades, weighing 42 pounds.

(b) Replenishment by mules.— A mule can carry 1 case of 100 grenades, V. B., 114 pounds, divided into 2 loads or bundles.

(c) Replenishment of a company. If one man carries 40 V. B. grenades in four sandbags (42 pounds), the replenishment of the company will be accomplished by four men making four trips. This replenishment is often useless, upon the occupation of the objective; few V. B. grenades are used even in the course of the attack if no strong point is encountered.

2. Technical Use.

I. Miscellaneous.—The rifle grenade is a part of all infantry equipment. Every man must be well drilled in its use. The number of dischargers issued is limited by their weight and the limitations of ammunition supply. The V. B. grenade has the advantage that it is not very cumbersome and that it is fired by means of the ordinary ball cartridge.

II. Description (Fig. 67a).—The V. B. grenade is thrown with the aid of a discharger "tromblon," fitted on an infantry rifle, using service cartridges. This discharger is a cast piece of steel adjusted to the muzzle of the rifle. It has an opening permitting the space for the front sight. The grenade is a fuse typed steel

precautions must be taken to have the access of rifle ranges sufficiently long enough to have a minimum range of 5,000 yards, so as to avoid accidents.

A blank cartridge loaded with B N 3 F powder can be used to fire a R. G. To obtain similar results as with the ordinary cartridge the plunger must be set at 45 degrees.

II. THE MANDREL D. R. AND ITS GRENADE.

(Fig 68 and 69).

This grenade differs from the V B on the following points:

It fits onto a "mandrel" instead of being put into a discharger. It has a percussion fuse. It is fired by a special blank cartridge instead of an ordinary ball cartridge. It

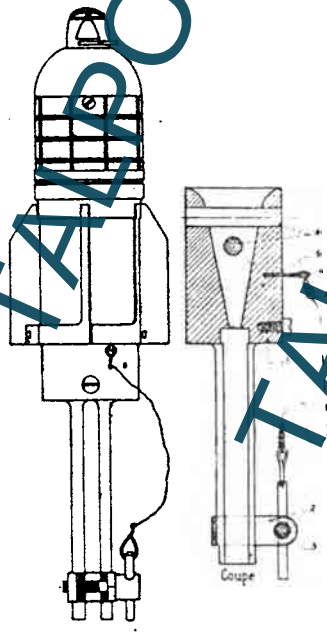

Fig. 68.

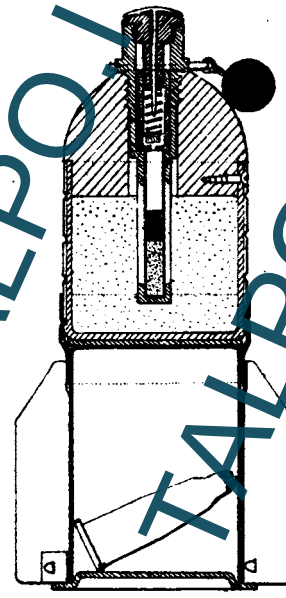

Fig. 69.

is more cumbersome ,but has twice the range and is more effective. It has a cast-iron body, elongated toward the front by a wooden ogive and a fuse and toward the rear by a swaged

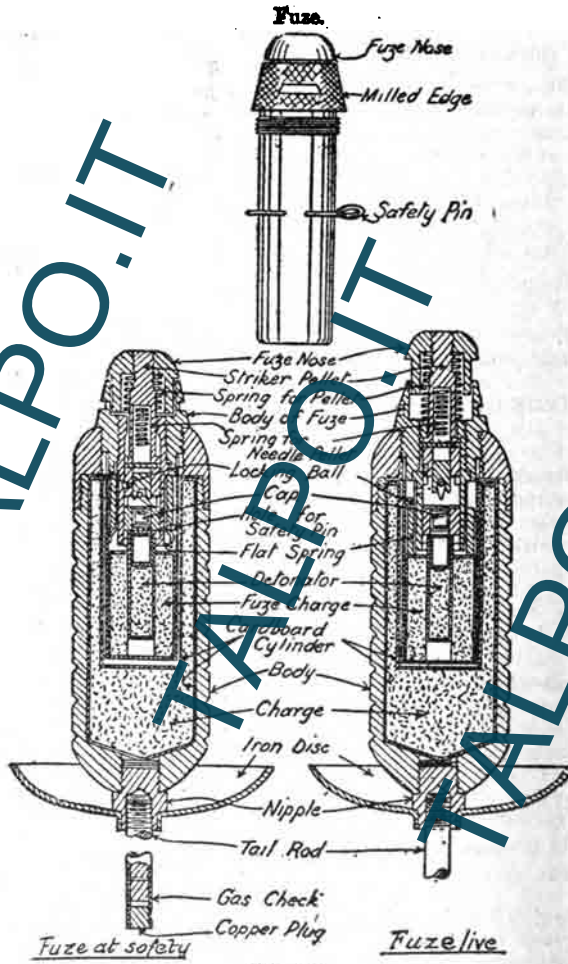

Fig. 74.

acting under the pressure of its spring, moves forward out of the body together with the nose of the fuse. At the same time the needle pellet spring pulls up the needle into the firing position.

2. The striker pellet is prevented by its spring from being driven back onto the cap until impact.

II. Use:

1. Unscrew plug by means of the key, pull the two-pronged safety pin from the fuse, and screw the fuse in slowly and carefully by means of the key .

2. Lower the grenade carefully into the barrel.

3. Insert special cartridge in the breech.

4. Fix the rifle at the required elevation.

5. Fire the rifle.

To render useless: Unscrew fuse from the grenade.

III. Details—

1. A German rifle, 98 or 88.05 only can be used.

2. Care must be taken that the grenade is not dropped, especially on the tail rod, as then it is liable to become "live," and will therefore detonate on firing. It should be carried head uppermost by the grenade, not by the rod.

3. The special rifle grenade cartridge must be used, and in no case a ball cartridge.

4. Tail rods which jam or rub when being placed in the barrel must not be used, and no force is to be employed.

5. Damp tail rods should be dried before use. All rods should be firmly screwed in.

Warning: Grenades with live fuses should not be fired or touched. They are easily recognizable, as the nose of the fuse will be found sticking out (compare figs. left and right). Grenades in this condition should be destroyed as soon as possible.

6. Weight, about 2 pounds.

7. Maximum mean range: 380 yards.

General Remarks.—Non-exploded grenades must not be picked up; they must be destroyed immediately.

3. NEW GERMAN RIFLE GRENADES.

A rifle grenade similar to the French Grenade is now in process of manufacture; and will soon be used at the front.

As per information gathered from a deserter, asphyxiating grenades were issued to his regiment, and are 3 times as large as the oval shaped grenade, at the same time very light and also containing tear producing gases.

GERMAN SMALL THROWING MORTARS.

1. The Germans were the first to use trench mortars for throwing all kinds of grenades at long distances. The power of projection being obtained by the tension of a spring:

The Grell mortar had a range of 90 yards.

The Simon mortar had a range of 300 yards.

Later the Germans constructed small mortars, manned by crews of infantrymen. The propulsion is obtained either by tension of a spring, compressed air or gas pressure from the deflagration of a charge of powder.

3. Large and mine throwing engines are called "minneuwerfer."

4. "Medium strength" mortars are used like the minnenwerfer, to complete destruction begun by the Artillery.

There are two models (1915 and 1916). Both (Granatenwerfer) mortars throw the same grenade (model 1915) (Tourterelle), and a third one that has just been put into use.

Model 1916 deserves special mention and description.

(A) GRENADE THROWER MODEL 1916 (GRANATENWERFER M. 1916) (Fig. 75).

Throwing the Grenade Model 1915 called "Tourterelle." (Fig. 76).

The "Granatenwerfer" or "grenade throwers" used by the Germans, in trench warfare, as trench mortars, but their perfect mobility enables them to use these in open warfare.

Our enemies have two models: 1915 model and 1916; the latter is much lighter and easier to handle. Both fire a serrated grenade, having at its head a long instantaneous percussion fuse, and at its base, a tube with three tiny wing-shaped projections.

They throw a smokeless powder grenade.

The grenade thrower, Model 1916, complete, weight but 80 lbs.

48 pounds for the apparatus thrower.

32 pounds for the platform.

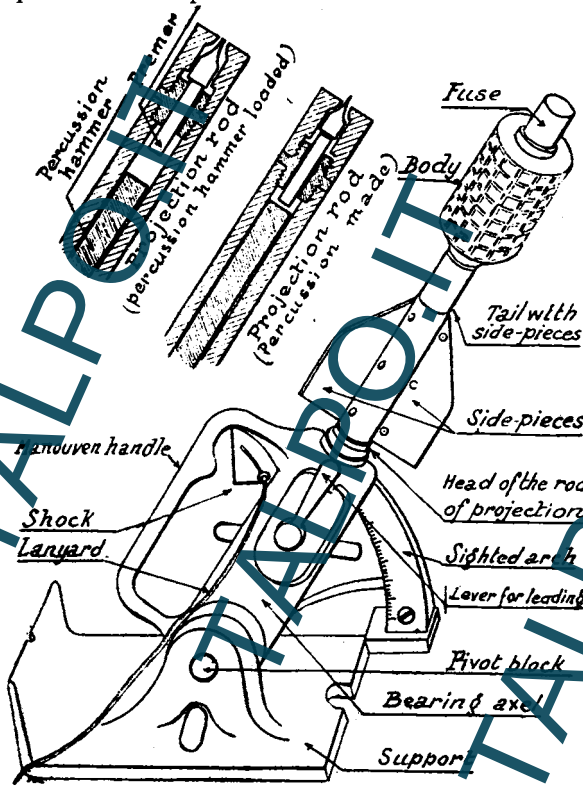

Fig. 75.

From whence easy changes of positions are possible, the shelter of the mortar, when the position of the piece is definitely located. The grenade thrower is carried around with the use of only one hand.

1. **Description.**—(Fig. 75). The mortar is composed of:

The throwing apparatus.

The platform.

The apparatus for throwing comprises:

The projection rod.

The **pivot block with securing parts.**

The **frame with graduated (sighted) arch and an aiming notch.**

The platform consists of:

A **baord** with recoil checking axle spade at the head.

A **tappet disk with a watch front** knurled, on a pivot on the front end of the board.

In the projection rod the following.

The placing of an immovable point of the striker.

The canal of the rod from the percussion hammer.

In lowering the lever of the apparatus, a ramp brings the percussion hammer backwards.

The mechanism is **at the loading** and at **the safety lever.** When the lever is brought back, the safety pin is affected and the mechanism is cocked.

To release the percussion hammer, take care to:

1. To take shelter (very important to stay under cover, as splinters from the cartridge sleeve rebound as far as 10 yards.

2. Work the trigger by means of the lanyard. The release is made as soon as rocking takes place, independent of the sway of the spring.

After firing the head of an indicator rod will show slightly, projecting from the cylinder pin. The appearance of this indicates that the mechanism is unloaded.

II. Projectile. (Fig. 76).—The grenade model called "Tourterelle) is composed of a grenade body (1) of malliable cast-iron with a grasping rail (7) at the head of which is a compartment (5) for throwing cartridge (6).

The percussion fuse consists of:

A fuse case (8), which has a compartment at the bottom (3) for a **detonator** (4) above and over this detonator a relay **wax** plug (13) in a sliding plunger sleeve, **carrying a strikor** (9) away from the **primer** (11) by the aid of a **spring** (10). A screwed plug (16) protects the primer.

A safety pin (15) prevents all premature percussion .

The projecting cartridge (6) resembles that of the infantry rifle model 1898 (bullet extracted), holding 3 grains, 2 of powder.

III. Equipment and Percussion.—During transportation, the grenade has a fuse attacked, but the detonator is not in its compartment (3). The priming is done only by order and when an attack is expected.

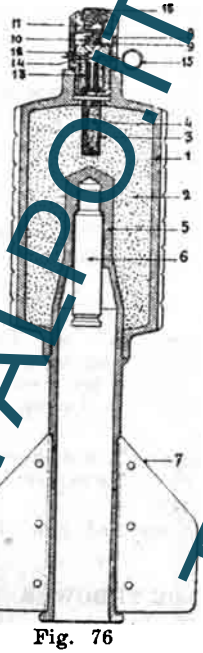

Fig. 76

The bolt pin is taken off only when the grenade is placed on the projection rod.

The explosive is a type of ammonia nitrate and tolite.

For throwing, the grenade is placed on the projection rod, cased in the grasping tail, the end of the rod directly in contact with the head of the cartridge.

When firing, (see above) the percussion hammer, freed, strikes the firing pin which strikes the cartridge cap the powder is lit and the gas without emitting on the side of the rod, pushes the grenade which is thrown out of the rod in a prolongation of the same direction.

IV. Maneuvers of the Mortar.

Consists of the following operations:

(a) **Installing the platform.** On the ground, the end of the plank in the ground, handle in front, level and horizontal; platform must be immovable during the firing.

(b) **Place apparatus for throwing.**—Place on platform in order that the front end is exactly inserted into the buffet-disk. The clamp of this disk is in the hollow of the frame.

(c) **Aiming at a target.**—Turn apparatus on a pivot the same time as the tappet disk so as to aim directly at the target.

(d) **To aim high.**—Give angle of fire.
(e) Load, and place on "Safety."
(f) Pass lanyard clasp through peephole of the trigger.
(g) Place grenade, already primed, on projection rod.
(h) Detach safety pin from fuse.
(k) Lower safety notch.
(i) Take shelter.
(m) Pull the trigger with the lanyard.

V. Distance and precision in firing.—The maximum distance is from 300 to 450 yards.

The minimum distance is from 50 to 85 yards.

Range schedules apply to 2 kinds of firing:

Fire curved firing, which extends from 50 yards to 300 yards.

Fire giving a flat trajectory, 150 yards to 300 yards.

As regards width of flight in which all shots go:

Radius of 3 to 5 yards.

Distance of 50 yards.

VI. Tactical Use.—The "granatenwerfers" are installed in small saps behind the first line; fired from an uncovered position, and can look for protection against fire from enemy artillery, only by changing places. They are separated from each other a distance of 20 yards.

During an attack, the "granatenwerfers" are brought to the front with machine guns and light "minenwerfers." They are attached to the second assault crew.

In 1916, each German regimental troop had two of these mortars.

(B) NEW GERMAN GRENADE THROWER.

As per information received from the British Army, a new grenade thrower, (Granatschnelleverfer), "rapid fire grenade throwers," has been recently put into use by "Fritz."

A smooth bored gun loaded from the breech.

Caliber: 39mm.

Range: Minimum, 650 yards.

Loaded from the breech by means of a 6 shot automatic loader, easily manipulated with the hands.

(5). Quick enough to give good results when not confined and slow enough to give good results when confined.

(6). Convenient in form and consistency for packing and loading and for making up charges of different weights.

The third and fourth of the above requirements are antagonistic and must be compromised.

General Nomenclature.—

(A) MIXED POWDERS

(a) Nitrated Powders.

1. **Ammonal.**—(Shills British grenades explosive). An excellent explosive, and non-sensitive to shocks. Largely used in British Army.

It is one of the most powerful explosives known, and has, in a high degree many of the most important requisites for military use.

Its composition is:

Nitrate of Ammonium	70%
Aluminum Powder	25%
Charcoal Powder	5%

Good fragmentation, gives little smoke, and offers good resistance to dampness. Is detonated by the aid of a [illegible] explosive and does not light only at a high temperature.

2. German "ovides" grenade explosives.

Its composition is:

Black powder	65.8%
Byryta nitrate	8.9%
Perchlorate of Potassium	20.8%
Aluminium powder	4.5%

The chlorate mixture is decomposed by the heavy explosive, which produces this black powder, and forms several charges of petards in line connected by detonating fuses. The powder lights by mere contact with a body in ignition and thus does away with the fuse of a detonator.

3. **Explosives for Cylindrical hand grenades with handle and German rifle grenade. (1913 and 1914).**

Composed of—

Nitrate of ammonia	78%
Trinitrotoluol (T. N. T.)	15%
Dynamite	7%

The two latter bodies increase the explosive power of the former.

Explosive is very sensitive to shock, sensitive to low temperature, detonates by aid of wave explosive.

(b) **Chlorated Powders.**

Chlorates used are in general, potassium chlorates, sometimes sodium chlorates. Explosives most frequently used are the "cheddites." In these explosives the chlorate is rendered less sensitive to shocks by enveloping same in a greasy animal or vegetable matter previously colored, and a nitrated derivative is sometimes added.

Cheddites are sensitive:

1. To dampness.
2. To high temperature.
3. To violent shocks.

They light, causing small flames, without detonating, but detonate violently if they are pulled up. (Ex. La Pallice Catastrophe).

Do not affect metals and detonate under the influence of wave explosives.

There are two cheddites in use in France.

One is composed of:

Mononitronaphtalene	12%
Castor Oil	8%
Chlorate of potassium	80%

The other is composed of:

Chlorate of potassium	90%
Vaseline	3%
Glycerine or palaffine	7%

The latter is the most popular and more commonly used, for loading French grenades on account of its facility of fabrication, and its inexpensiveness.

Cheddites detonate very poorly if piled up.

Germans use for the loading of their "Lenticular grenade" an explosives which is similar to a French paraffined cheddite.

Composed of:

Chlorate of potassium	78%
Dinitrotolene	10%
Paraffine	12%

In more recent fabrication of grenades paraffine has been substituted by sawdust.

Chlorate of potassium	72.5%
Trinitrotolene	18.5%
Sawdust	8.7%

(C). Perchlorated Powders.

Of these mixtures, the most frequently used is what is called a "blue explosive."

Very popularly used for loading bombs or trench mortars "58."

Composed of:

Ammonia perchlorate	61.5%
Chile Saltpeter	30%
Paraffine	8.5%

Other chlorate explosives exist, but we will mention only those for loading of machines for warfare.

(B) Chemically Prepared Powders

(a) **Organic nitrated substances.**

1. **Nitro-cellulose,** (Cotton Powder in French; Gun Cotton in U. S.

Above is obtained by treating the cotton cellulose with nitric acid.

In appearance resembles cotton. Burns instantaneously in exposed atmosphere leaving no residue. When dry it detonates very easily by shock. Is unstable and constantly decomposing.

All modern smokeless powders are chiefly composed of nitro-cellulose. They have been made consistent, rendered less sensitive to shocks, and do not break up when mixing nitro-cellulose with the gelatin.

Nitro-celloses used are divided into 3 classes. Their degree of nitrification is:

C. P., C. P. I., or C. P. 2, (Designating Cotton Powder)..

The French (B) powder is made of C. P., dissolved in a mixture of sulphuric ether, alcohol and non-dissolvable C. P. 2.

German powder is a mixture of C. P. 1, and C. P. 2, both dissolved in acetic ether.

British, American and Italian powders are a mixture of C. P. I. and C. P. 2, and nitro-glycerin dissolved in acetone.

These powders resist shocks and are less sensitive to dampness than black powders.

They light in exposed atmosphere without detonating, giving off little smoke and leaving little residue.

They detonate in enclosed vessels.

2. **Nitro-Glycerine.**

Obtained by treating glycerin with nitric acid.

Detonate by shock and is very inconsistent. It fuzes at high temperature.

To utilize same, it has to be absorbed by a porous material. Either inactive, sand or broken brick.

Or active, pitch, rosin, nitro-cellulose, nitrates.

Dynamite.—Dynamite consists of a grannular ball usually called dope in the trade, partly saturated with nitro-glycerin. Dynamites are classed according to the percentage by weight of the nitro-glycerin contained at 75% dynamite, 60% dynamite, etc.

The dope may be an inert substance having no function except as a vehicle for the glycerin or it may be, and usaully is, a combustible substance contributing to the chemical reaction and improving the strength and character of the explosion. Dopes of this kind are usually nitrate of rodium or potassium. All American dynamites are of this class.

(b) **Carbide of nitrated hydrogen.**

Carbide hydrogen, extracted from oiled tar by distillation (phenol and benzol) treated by nitric acid, gives a whole series of explosives.

Most frequent in use are picric acid and trinitrotoluene

1. **Melinite. (Picric Acid)**

Does not detonate easily by shock, but detonates at the speed of 7600 yards per second under the influence of conjugated explosive, and the breaking effects are very considerable.

2. **Triton or Trinitrotoluene or Trinitrotoluol or Trotyl.**

Resists more to shock than melinite. Is advantageous to melinite in that when coming in contact with metals it does form picrates which are resistive to shock.

Known in France as "Tolite." Called T. N. T. in America.

American grenades are loaded with T. N. T.

Is made by the successive nitration of toluene and coal tar derivative. It is a neutral compound, very stable of great strength, yet highly insensitible.

3. **Jovite.**—An American powder of this class seems to come as near meeting all military requirements as any explosive now known. It is unaffected by heat, cold, concussion,

or water. The gases of explosion are less deleterious than those of dynamite and produce no headaches.

Jovite may be had of strength equal to 20, 40 and 60% dynamite.

Note.—Nevertheless the most successful military explosives thus far introduced belongs in this class picric powders, for example, the French melinite, the English lyddite, the American Triton or T. Xyl or T. N. T., the Austrian ecrasite, the Japanese Shimose, and others.

C. BLACK POWDER.

The series end by mention of black powder composed of:

Coal	2.5%
Saltpeter	75%
Sulphur	12.5%

Very consistent and regular.

Its rapidity of combustion is universally proportional, according to size of grains. No breaking power, giving only mechanical results only well rammed. Black powder was used for loading French and German spherical grenades, which grenades no longer existt.

II. FIREWORKS.*

(Generic term for primers, fuse, detonators and any pyrotechnic means of communicating fire).

To ignite an explosive, that is to say to produce a decomposition, parts of it must be raised at a fixed temperature.

This is done:

I. By lighting a part of the explosive and favoring the elevation of the temperature and the pressure of ramming.

II. Or by a shock. The shaking brought about by the shock on the molecules decomposes them and they then explode. Their explosion gives a shock to the neighboring molecules and the phenomena continues.

The explosion spreads at various speeds, according to the explosives. This speed is called "corrugated or wave explosive."

Shock can be brought about mechanically or by an explosive.

The artifices are set in motion by means of a lighter composed of fulminate of mercury. This lighter is called the

*Or artifices.

fulminate lighter or **detonator.** Fire is carried to the detonator by a time fuse, being lit by an igniter.

The detonator may be ignited by shock, the shock being given by a percussion plug.

1. **Detonation.**—A brass tube filled with the following composition:

Fulminate of mercury	0 gr 3
Pulverised Melinite	0 gr 3
Compressed Melinite	0 gr 3

Fulminate is very sensitive to shock, the slightest friction causes it to detonate. It detonates at a comparatively low temperature (248 degrees F.)

Breaks easily.—Fulminate must be handled with exceptional care and precaution.

2. **Bickford** or **Safety fuse** is used to ignite the fulminate. It consists of a powder thread wrapped with a waterproof tape. A double wrapping or double tape is preferred. This fuse may be used in wet holes, but for under water use it should have a continuous rubber coating.

Time fuse burns at an average rate of 3 ft. per minute, but the rate is not regular and when time is important the rate of burning should be tested.

3. **Igniters.**—The fuse is lit either by direct contact of a burning body, by lighter, or by the Ruggieri igniter, tension or rotation method.

All igniters contain a certain amount of fulminate of mercury, a body, designed to cause this fulminate to light (broken glass) either by friction and by help of a black gun powder to transmit the fire.

4. **Percussion Plug.**—When the detonator is put into action by shock, a metallic pointed stem is attached to the end of the fulminate, and can be violently thrown on the fulminate when the time arrives to cause the lighting of the detonator.

6. **Detonating Cord.**—This cord is a lead tube about 0.2 of an inch in diameter, filled with triton. The cord can not be set off by friction, fire, or any ordinary shock. It requires a blasting cap properly attached to it to detonate it but when it is once set off the explosive wave travels throughout its length with such rapidity (6500 yards per second) as to be practically instantaneous. Such extreme care is necessary to obtain success