

OFFICIAL

**A. E. F. No. 1475-4
G-5**

GAS MANUAL

Part IV

Use of Gas by Infantry

**General Headquarters
American Expeditionary Forces, France
March, 1919**

**GENERAL HEADQUARTERS
AMERICAN EXPEDITIONARY FORCES**

March, 1919.

The "Gas Manual," in six parts, is approved and published for the information and guidance of the American Expeditionary Forces. Although this manual presents the practice in the American Expeditionary Forces, its publication is not intended to convey approval for adoption in the future military service of the United States of any details of organization contained herein.

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Contents

Part I—Tactical Employment of Gases...	A. E. F. No. 1475-1	G-5
Part II—Use of Gas by the Artillery....	A. E. F. No. 1475-2	G-5
Part III—Use of Gas by Gas Troops.....	A. E. F. No. 1475-3	G-5
Part IV—Use of Gas by Infantry.....	A. E. F. No. 1475-4	G-5
Part V—Use of Gas by Air Service.....	A. E. F. No. 1475-5	G-5
Part VI—Defense Against Gas.....	A. E. F. No. 1433	G-5

TABLE OF CONTENTS.

Types of Chemical Weapons.....	Par. 1
Incendiary Grenades	2
Description	2
Tactical Use	4
Gas Grenades	5
Description	5
Tactical Use	8
Smoke Grenades	9
Description	9
Tactical Use	12
Data on Smoke Screens.....	13
Smoke Candles	14
Description	14-16
Tactical Use	17
Examples of Screens	18
3-Inch Stokes Mortar Smoke Bomb.....	19
Comparison with 4-inch.....	19
Tactical Use	20

GAS MANUAL

PART IV

USE OF GAS BY INFANTRY

USE OF CHEMICAL WEAPONS BY THE INFANTRY.

1. *Approved Types of Chemical Weapons.* The following types of chemical weapons have been approved for use by the infantry in the A. E. F.:

(1) *Incendiary Grenades.*

A—French “Grenade-Incendiaire à Main”.

B—U. S.—“Thermit Hand Grenade, Mark I”.

(2) *Gas Grenades.*

French “Suffocante et Lachrymogène” hand grenade.

B—British “No. 28, Chemical Hand Grenade, Mark II”.

C—U. S.—“Gas Hand Grenade, Mark II”.

(3) *Smoke Grenades.*

A—French “Incendiaire et Fumigène” hand grenade.

B—British, “No. 27 Hand or Rifle Grenade, Mark I”.

C—U. S.—“Phosphorous Hand Grenade, Mark II”.

(4) *Smoke Candles.*

A—British—“Smoke Candle, Mark I (L) Type S”.

B—British—“Smoke Candle, Mark II (L) Type S1”.

C—U. S.—“Smoke Torch, Mark I”.

(5) *3-inch Stokes Mortar Smoke Bombs.*

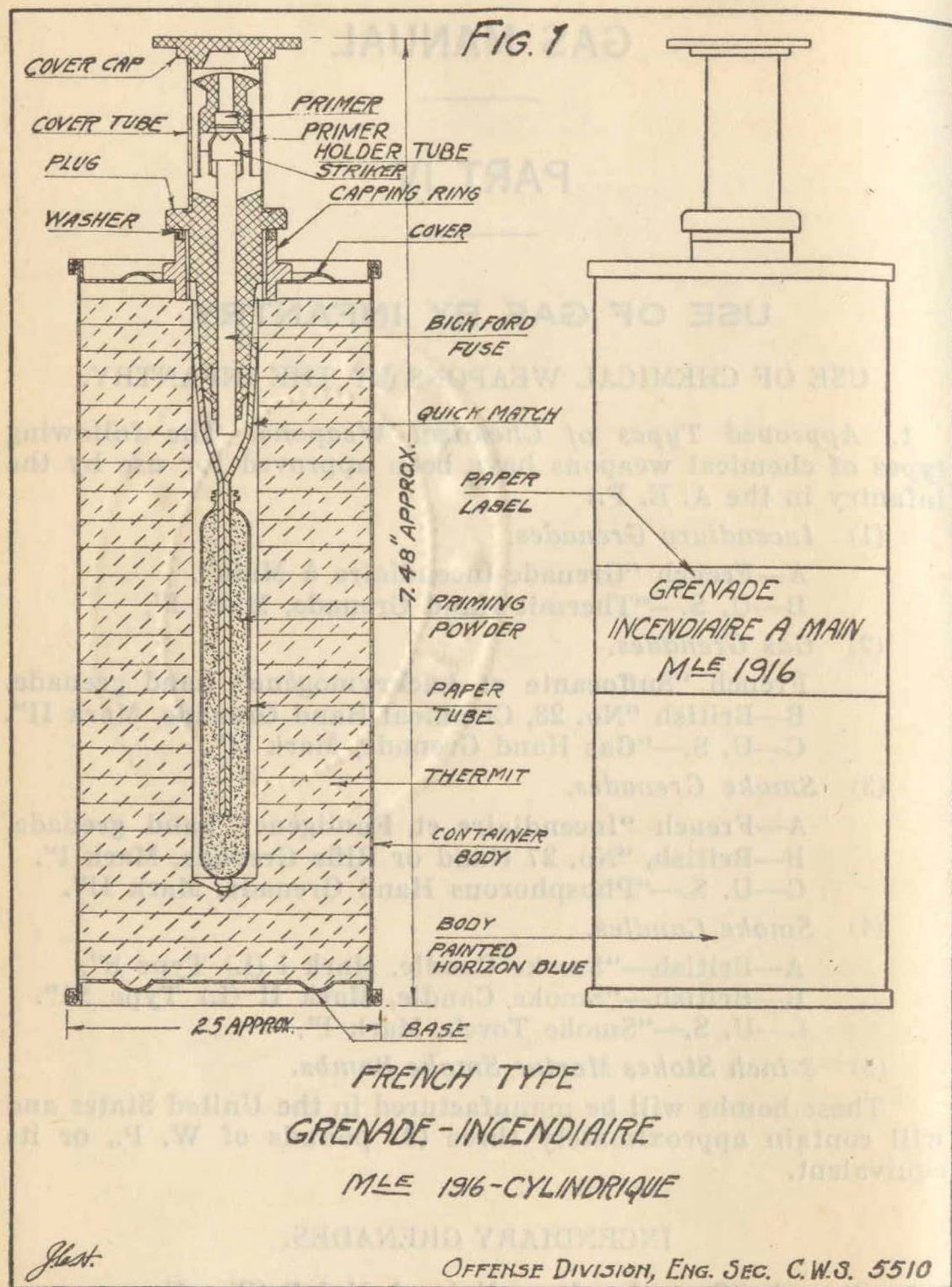
These bombs will be manufactured in the United States and will contain approximately three (3) pounds of W. P., or its equivalent.

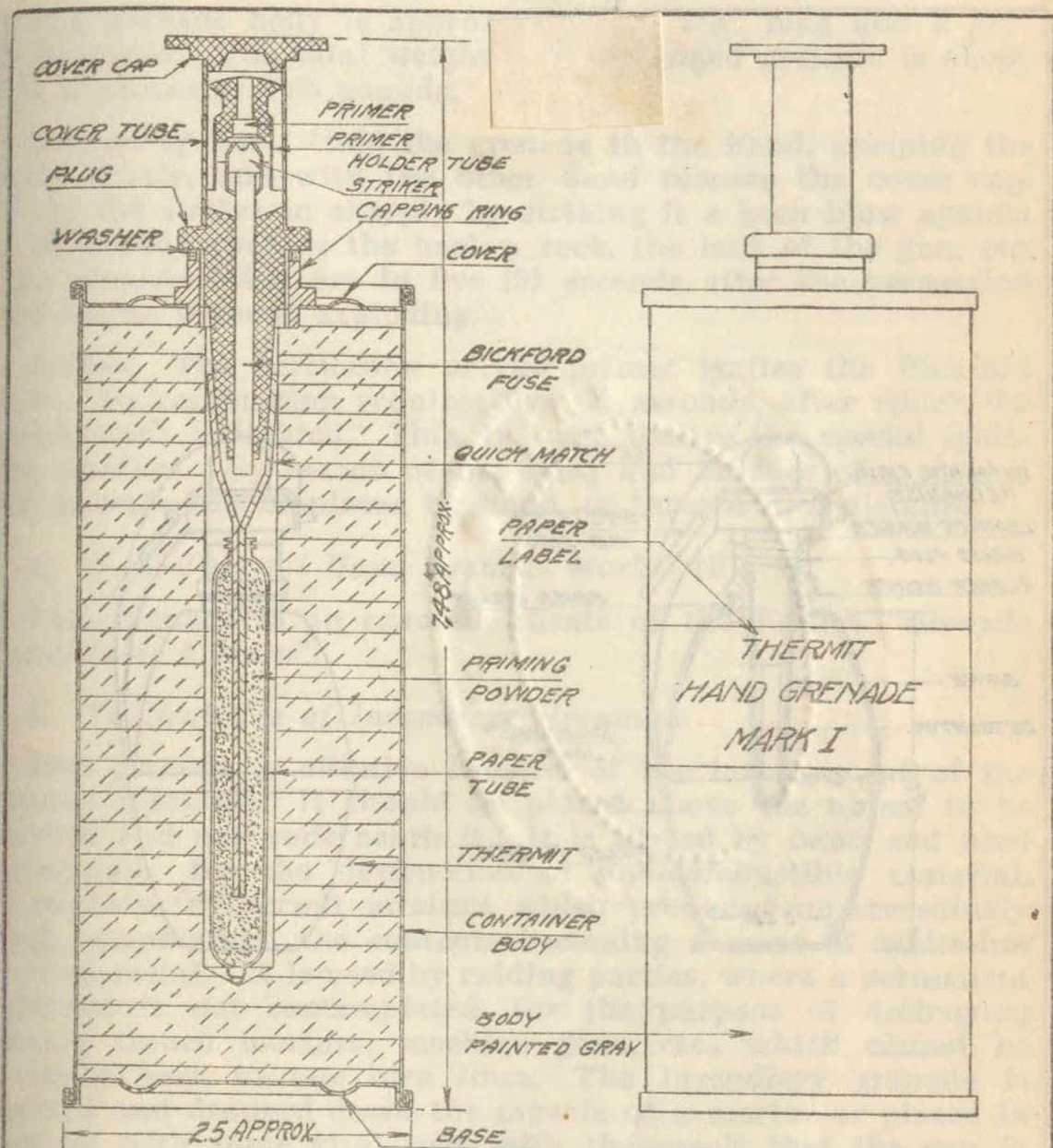
INCENDIARY GRENADES.

2. French “Grenade—Incendiaire à Main” (Fig. 1).

This grenade consists of the following parts:

(1) A cylindrical shell of tin plate to which the top and bottom are attached by crimping and soldering. In the cover is a hole into which is soldered a metallic ring, tapped to receive the firing mechanism.



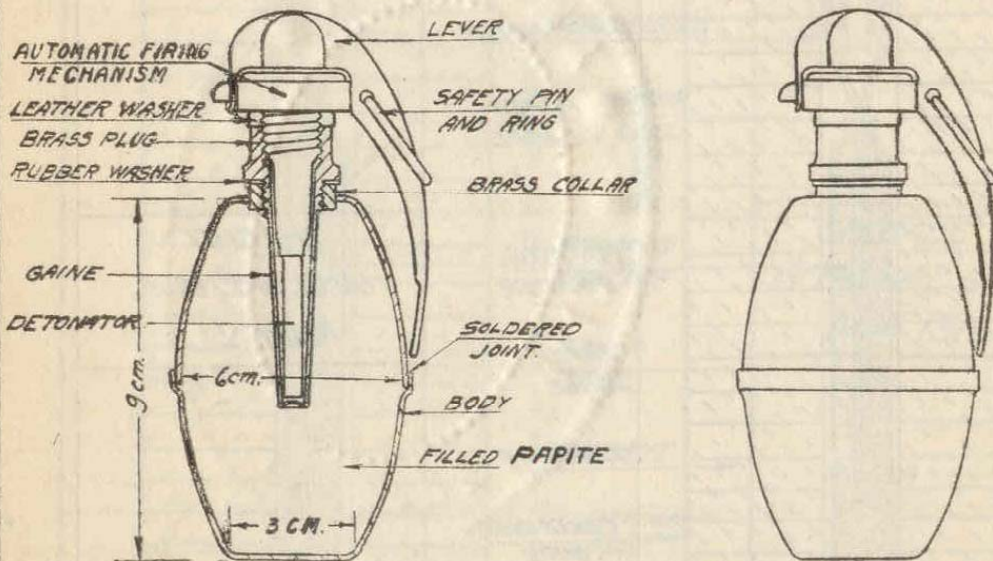


U.S. TYPE
THERMIT HAND GRENADE MARK I

glet

OFFENSE DIVISION, ENG. SEC. C.W.S. 5517

FIG. 3



FRENCH TYPE
 GRENADE-SUFFOCANTE ET LACRYMOGENE
 MLE 1916 AUTOMATIQUE

JBH

OFFENSE DIVISION, ENG. SEC. C.W.S. 5513

- (2) A percussion cap provided with a Bickford fuse.
- (3) A charge of thermit.
- (4) A mixture of special ignition material.

The grenade body is approximately 5 7/8" long and 2 1/2" in diameter. The total weight of the charged grenade is about 750 grammes or 1.65 pounds.

Method of Use. Hold the grenade in the hand, grasping the body firmly, and with the other hand remove the cover cap. Force the striker in sharply by striking it a keen blow against a hard body such as the heel, a rock, the butt of the gun, etc. The grenade takes fire in five (5) seconds after the percussion and burns without exploding.

Action. The percussion of the primer ignites the Bickford fuse. Its combustion requires five (5) seconds, after which the quickmatch is lighted. This, in turn, ignites the special igniting mixture. By reason of the delay and absence of explosion the grenade can be placed by hand, or thrown to a distance.

3. *U. S. Thermit Hand Grenade Mark I (Fig 2).*

This grenade is an exact duplicate of the French "Grenade Incendiaire à Main".

4. *Tactical Use of Incendiary Grenades.*

This grenade is effective because of the intense heat of the molten material. It should be placed above the object to be burned and not underneath it. It is placed by hand and used principally for the destruction of non-combustible material. It contains a thermit mixture which produces an exceedingly high temperature, the contents becoming a mass of white-hot molten metal. It is used by raiding parties, where a permanent advance is not contemplated, for the purpose of destroying enemy trench mortars, machine guns, etc., which cannot be brought back to our own lines. The incendiary grenade is ignited and dropped down the muzzle of a mortar or placed in contact with some vital part with the result that the gun is ruined. A few men in each raiding party should be taught how to use these grenades.

Special Uses. In destroying tanks of gas or oil, it is necessary to increase the time of burning of fuse. In such cases, to give the operators time to reach a place of safety, it is necessary to replace the cap by a piece of Bickford fuse of the desired length which can be fired with a match. For this substitution make a tube out of paper through the center of which the fuse is passed. Bind it with a thread to the collar of the grenade and then to the cord. Avoid getting the material wet during the operation.

NOTE—Grenades which have not taken fire can be picked up without danger and used again after having changed the fuse.

GAS GRENADES.

5. *French—"Suffocante et Lachrymogène," Hand Grenade.* (Fig. 3). This grenade consists of the following parts: The body of the grenade, the collar, the gaine, and the automatic firing mechanism. The grenade is filled with "Papite" (acrolein), a liquid gas that is both lethal and lachrymatory.

The body of the grenade is the same as the French "Grenade-Incendiaire et Fumigène, Mle. 1916 Automatique" with the exception that there is an orifice in but one end. This orifice is for the reception of a brass collar which is inserted therein and soldered to the body of the grenade.

The collar is threaded internally for the reception of a hollow brass plug which is screwed into it and thus secured in the grenade.

The gaine, made of tin is soldered to the lower part of the hollow brass plug and carries the detonator, which is the bursting charge of the grenade. A rubber washer placed between the top of the collar and the shoulder of the plug forms a liquid tight joint. The hollow brass plug is threaded internally to receive the automatic firing mechanism. A leather washer is inserted between the top of the hollow brass plug and the shoulder of the automatic firing mechanism to form a tight joint. The total weight of the charged grenade is 400 grammes or 0.9 pounds.

Method of Use. Hold the grenade in the throwing hand, the firing mechanism up, in such a manner as to secure the lever. Pass the index finger of the free hand through the ring and withdraw the safety pin.

The grenade is now armed and the bomber must take every precaution not to release the grip on the lever until the grenade is thrown.

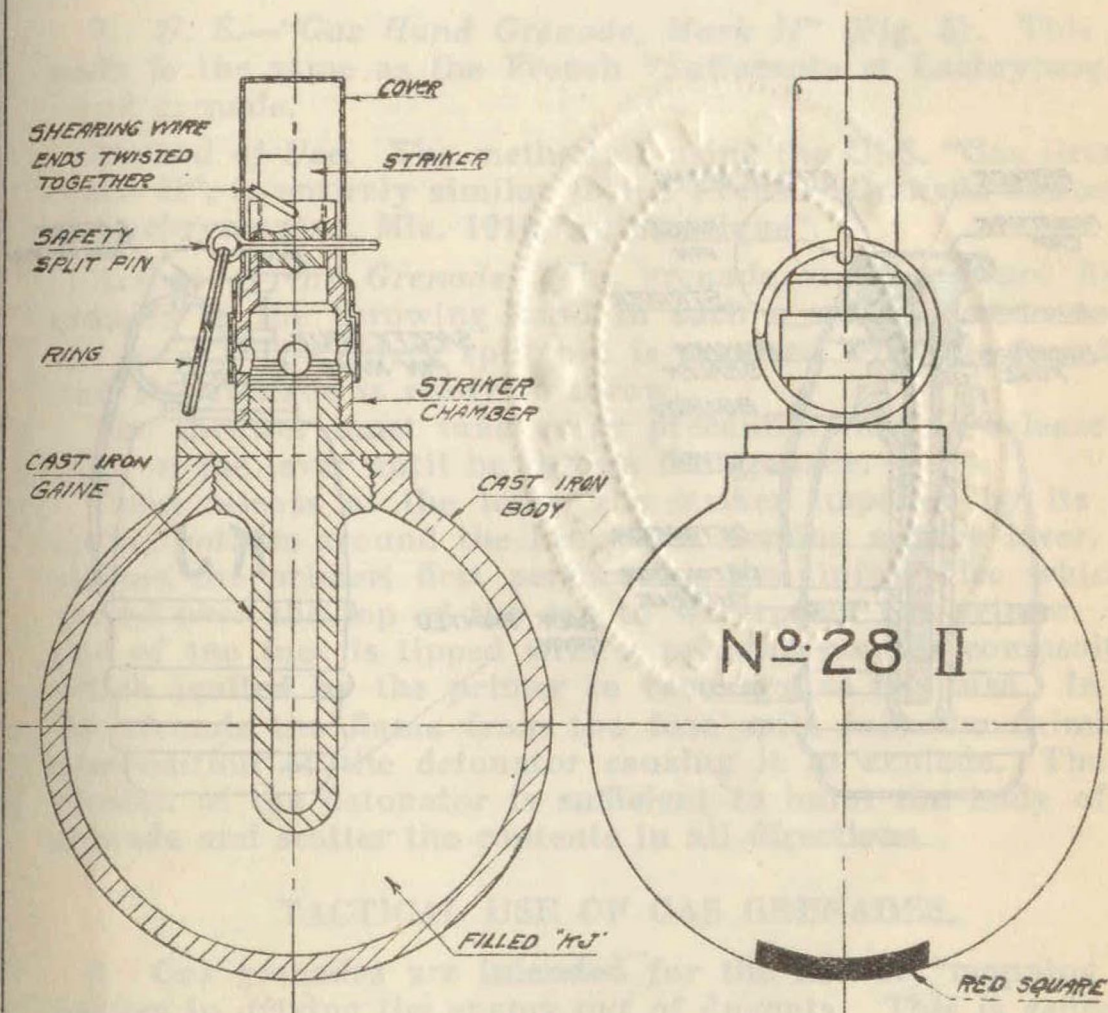
The grenade bursts five (5) seconds after the action of the automatic firing mechanism, and produces a cloud of fine particles, intensely irritating to the respiratory passages. This causes violent coughing, and does not kill or seriously injure, but has considerable moral effect.

Action of the Grenade. After being thrown, the lever, which is no longer held by the safety pin, is projected from the grenade by the bolt. The removal of the lever permits the functioning of the automatic firing mechanism which sets off the primer. The primer ignites the slow fuse, which, after five (5) seconds fires the detonator, exploding the grenade.

6. *British No. 28, Chemical Hand Grenade, Mark II* (Fig. 4). This grenade consists of the following parts: The body, the gaine, and the firing mechanism. It is filled with K. J. (stannic chloride).

The body is made of cast iron, spherical in form and 3 3/8 inches in outside diameter. A boss is cast on the body through which is tapped a hole for the reception of the gaine. The

FIG. 4

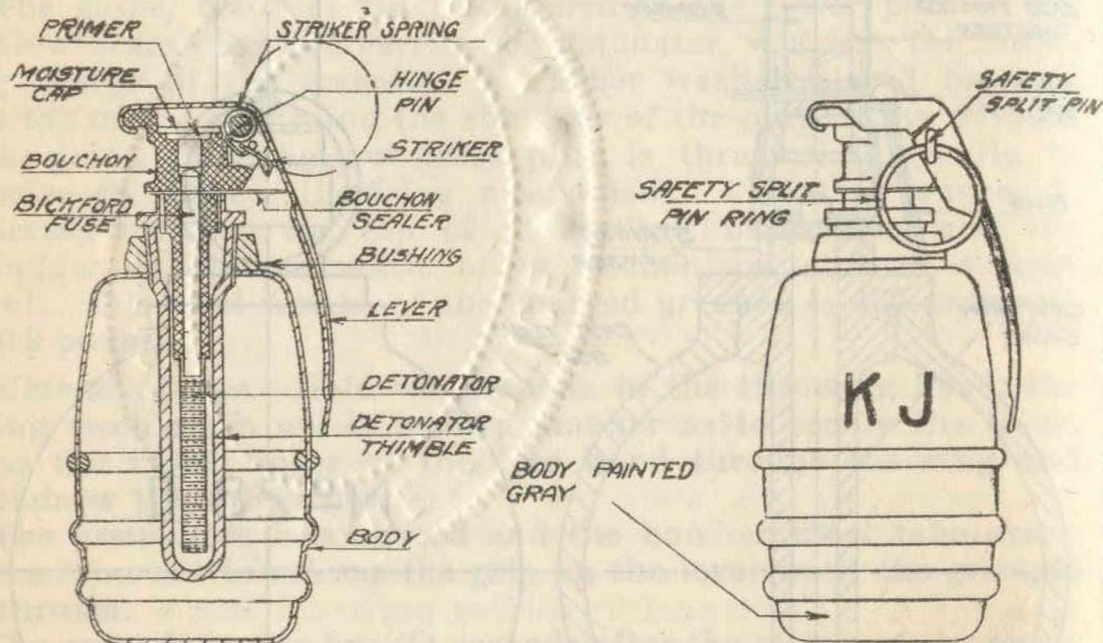


BRITISH TYPE

GRENADÉ, HAND, N° 28, CHEMICAL, MARK II

John

OFFENSE DIVISION, ENG. SEC C.W.S. 5511



U.S. TYPE
GAS HAND GRENADE - MARK II

Plot

OFFENSE DIVISION, ENG. SEC. C.W.S. 5515

✓ Eng.

gaine or detonator sleeve is also made of cast iron, on the open end of which is provided an externally threaded boss for the assembly of the firing mechanism.

The firing mechanism is similar in construction to that used on the British "Grenade, Hand or Rifle, No. 27, Phosphorous, Mark I".

Method of Use. When used as a hand grenade its manipulation is the same as the British No. 27.

The effect of the grenade is essentially the same as the French "Grenade-Suffocante et Lachrymogène, Mle. 1916, Automatique".

7. U. S.—"Gas Hand Grenade, Mark II" (Fig. 5). This grenade is the same as the French "Suffocante et Lachrymogène" hand grenade.

Method of Use. The method of using the U. S. "Gas Grenade Mark II", is entirely similar to the French "Grenade-Suffocante et Lachrymogène, Mle. 1916, Automatique".

Action of the Grenade. The grenade and lever are firmly grasped in the throwing hand in such a manner as to secure the lever. The safety split pin is removed with the free hand and the grenade is ready to throw.

The thrower must take every precaution not to release the grip on the lever until he throws the grenade.

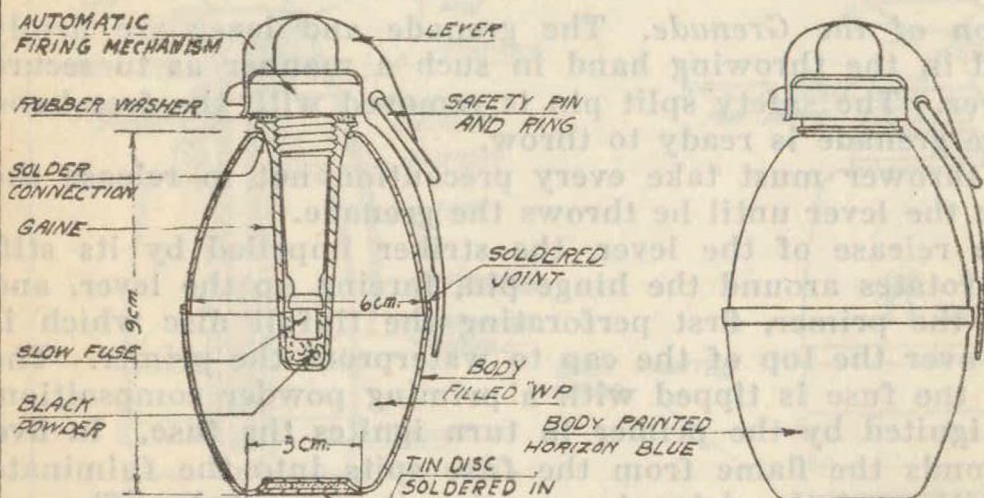
Upon release of the lever, the striker impelled by its stiff spring rotates around the hinge pin, forcing up the lever, and strikes the primer, first perforating the tinfoil disc which is sealed over the top of the cap to waterproof the primer. The end of the fuse is tipped with a priming powder composition, which ignited by the primer in turn ignites the fuse. In five (5) seconds the flame from the fuse spits into the fulminate composition of the detonator causing it to explode. The explosion of the detonator is sufficient to burst the body of the grenade and scatter the contents in all directions.

TACTICAL USE OF GAS GRENADES.

8. Gas grenades are intended for the use of "mopping up" parties in driving the enemy out of dugouts. This is generally more effective than blowing in the dugouts with a charge of high explosive. A cloud is formed which violently attacks the eyes, nose and throat and penetrates to a large extent the enemy respirator. While not fatal, the fumes are unbearable in a close space, and the enemy is forced to come out choking and blinded. Four or five grenades should be carried by two men in each squad of a "mopping up" party. Upon coming to an enemy dugout, which is suspected of being inhabited, three or four grenades are tossed inside the entrance without exposing the grenadiers to fire from below.

Occasionally they may be found of value in driving the enemy from a machine gun nest or strong point, when such a position is located downwind.

FIG. 6



TACTICAL USE OF GAS GRENADES.

FRENCH TYPE
 GRENADE-INCENDIAIRE ET FUMIGENE
 MLE-1916-AUTOMATIQUE

ghet.

OFFENSE DIVISION, ENG. SEC. C.W. 5514

SMOKE GRENADES.

9. *French "Incendiaire et Fumigène" Hand Grenade (Fig. 6).* This grenade consists of the following parts: The body, the gaine, and the automatic firing mechanism.

The body, ovoid in form, is nine centimeters long, and six centimeters in diameter, at the center. It is made of two ogival caps of tin, set, clasped and soldered to each other around the edges of their large bases. At each end of the gaine which is soldered in place and the other for the insertion of the filling charge. After filling, the hole is hermetically sealed by a disc of tin soldered to the body of the grenade.

The gaine, made of special metal, holds the charge of explosive powder. It is threaded on the interior to receive the fuse plug which forms the body of the firing mechanism.

The firing mechanism is automatic but is without a detonator. The fuse requires five (5) seconds for combustion.

A rubber washer placed between the upper flange of the gaine and the shoulder of the fuse plug, forms a tight joint for the grenade.

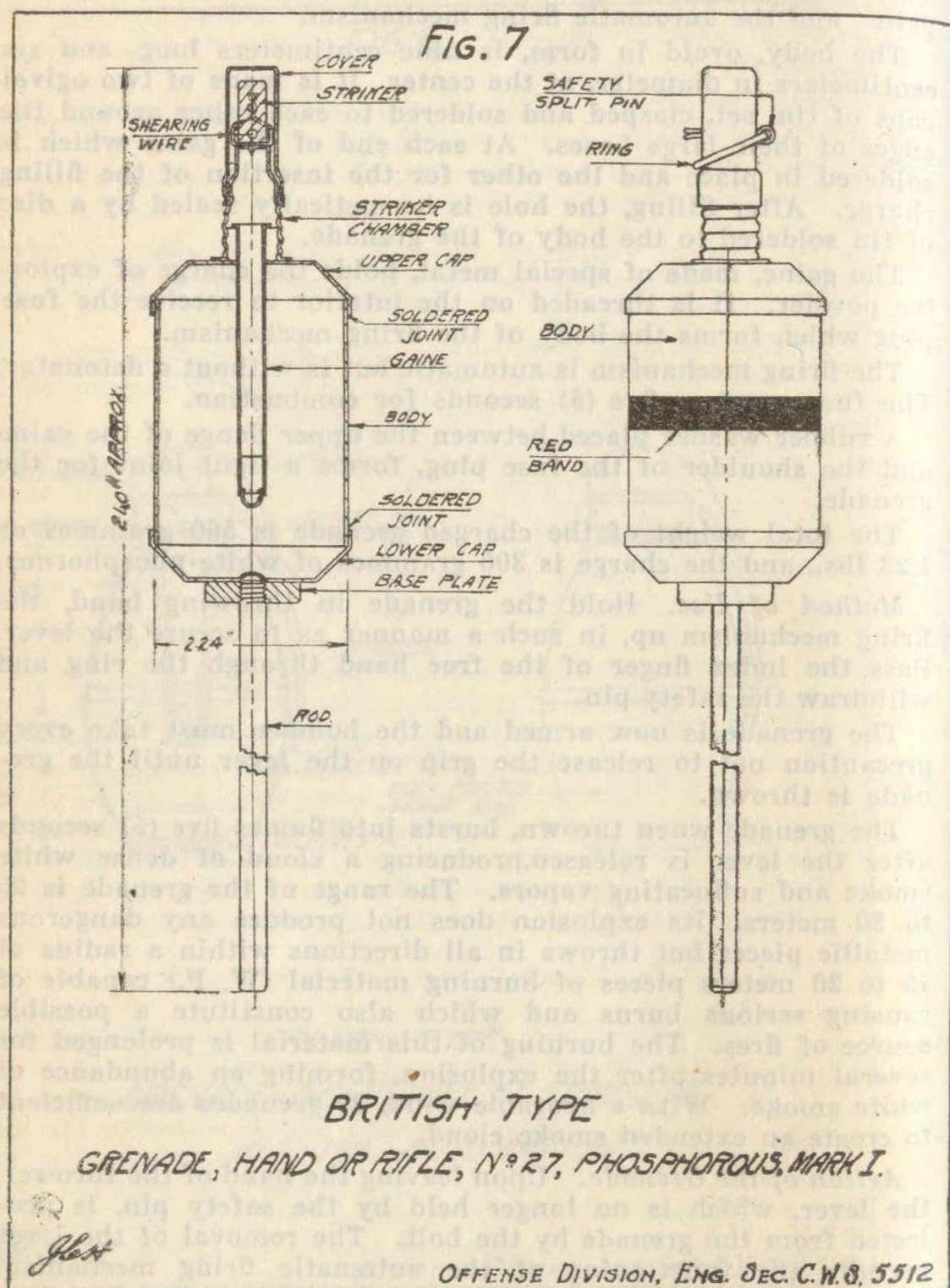
The total weight of the charged grenade is 560 grammes or 1.23 lbs., and the charge is 300 grammes of white phosphorous.

Method of Use. Hold the grenade in throwing hand, the firing mechanism up, in such a manner as to secure the lever. Pass the index finger of the free hand through the ring and withdraw the safety pin.

The grenade is now armed and the bomber must take every precaution not to release the grip on the lever until the grenade is thrown.

The grenade when thrown, bursts into flames five (5) seconds after the lever is released, producing a cloud of dense white smoke and suffocating vapors. The range of the grenade is 25 to 30 meters. Its explosion does not produce any dangerous metallic pieces but throws in all directions within a radius of 15 to 20 meters pieces of burning material (W. P.) capable of causing serious burns and which also constitute a possible source of fires. The burning of this material is prolonged for several minutes after the explosion, forming an abundance of white smoke. With a favorable wind, 20 grenades are sufficient to create an extended smoke cloud.

Action of the Grenade. Upon leaving the hand of the thrower, the lever, which is no longer held by the safety pin, is projected from the grenade by the bolt. The removal of the lever permits the functioning of the automatic firing mechanism which sets off the primer. The primer ignites the slow fuse which after five (5) seconds ignites the black powder charge in the gaine. This explodes the grenade with sufficient force to scatter the burning contents over a radius of 15 to 20 meters and at the same time produces an intense and suffocating vapor within a radius of 5 to 6 meters.



10. *British "No. 27, Hand or Rifle Grenade, Mark I."* (Fig. 7). This grenade consists chiefly of the following parts: the body, the gaine, and the firing mechanism.

The body of the grenade, cylindrical in form, is about $3\frac{3}{4}$ inches long and $2\frac{1}{4}$ inches in diameter. It is made of tinned plate and is capped on either end with dished tinned plate stampings somewhat heavier than the metal forming the body. To the lower cap, forming the base, is soldered a steel plate approximately $\frac{1}{4}$ inch thick. This steel plate is tapped to receive a rod fifteen (15) inches long and of the proper diameter to fit the bore of the service rifle. The rod is used only when the grenade is projected with a rifle. The rods are issued detached from the grenades in the ratio of 60% of the grenades.

To the upper cap, forming the cover of the body, is soldered a spigot, externally threaded to hold the firing mechanism.

The gaine is inserted through the spigot and the cover, and is soldered to the spigot.

The primer rests on top of the spigot and is held in place by the striker chamber. The primer is crimped to the fuse, on the other end of which is crimped the detonator, the fuse and detonator extending into the gaine. The striker is held by a shear wire. Over the entire firing mechanism is placed a metal cover, to prevent accidental discharge, the cover being held in place by means of a retaining pin and ring. A small hole is provided in the cover cap for filling. This is sealed with a disc of tin. The filling charge is about 400 grammes of white phosphorous.

Method of Use. (a) As a Hand Grenade. The cap over the firing mechanism is removed after withdrawing the retaining pin. The striker is then struck against any solid object, as the heel of the boot, the butt of the gun, a rock, etc. The shock shears the small restraining wire and the striker point fires the primer and starts the fuse burning.

(b) As a Rifle Grenade. The stem is attached by screwing it into the base plate of the grenade as far as it will go. The protecting cap is then removed, exposing the striker. A blank cartridge furnished for this purpose is next loaded into the rifle, after which the grenade rod is inserted into the muzzle of the rifle and pushed down as far as it will go. The butt of the gun is set against some solid object, such as the bottom of the trench, a sandbag, etc., and the elevation adjusted according to the range desired. Upon the discharge of the rifle the setback shears the small restraining wire, permitting the striker point to impinge upon the primer thus igniting the fuse which in five (5) seconds fires the detonator.

The maximum range is obtained with the rifle held at 45 degrees. Shorter ranges may be had by either raising or lowering this elevation. Under favorable conditions, ranges up to 230 yards are obtained.

These grenades are packed unassembled in three boxes, marked respectively W. P. 1, W. P. 2 and W. P. 3. W. P. 1 contains 12 grenades. W. P. 2 contains 12 tins, each tin containing 12 detonating sets. W. P. 3 contains 48 rods and 4 tins each containing 12 blank cartridges.

Directions for the use of the No. 27 W. P. grenades as hand grenades are found in box W. P. 1, and for use as rifle grenades in box W. P. 3.

The effect of this grenade is similar to that of the French Grenade "Incendiaire et Fumigène Mle. 1916, Automatique."

11. U. S. "Phosphorous Hand Grenade Mark II." (Fig. 8). This grenade is essentially the same as the French "Incendiaire et Fumigène," hand grenade.

Action of the Grenade. See U. S. "Gas Hand Grenade, Mark II."

TACTICAL USE OF SMOKE GRENADES.

12. *General.* Smoke grenades have been primarily designed as infantry weapons for offensive operations both as incendiary and smoke producing articles. They are suitable for burning dugouts, blinding machine guns, or screening small local attacks. Due to their scarcity, their use in producing smoke screens is uneconomical. These grenades on exploding scatter burning phosphorous over a circle of 15-20 meters radius.

Used as Rifle Grenades. The British Grenade—"No. 27, Hand and Rifle Mark I", is the only chemical grenade which has been designed for rifle projection. The other smoke grenades described are designed for hand projection only.

The rifle smoke grenade is most effective in brush or wooded country, particularly where the terrain is undulating, thus permitting a detachment of grenadiers to crawl within range of a machine gun without exposing themselves to severe fire. Unless there is natural cover at the firing point rifle pits should be scooped out so that the grenadiers will have protection from machine guns.

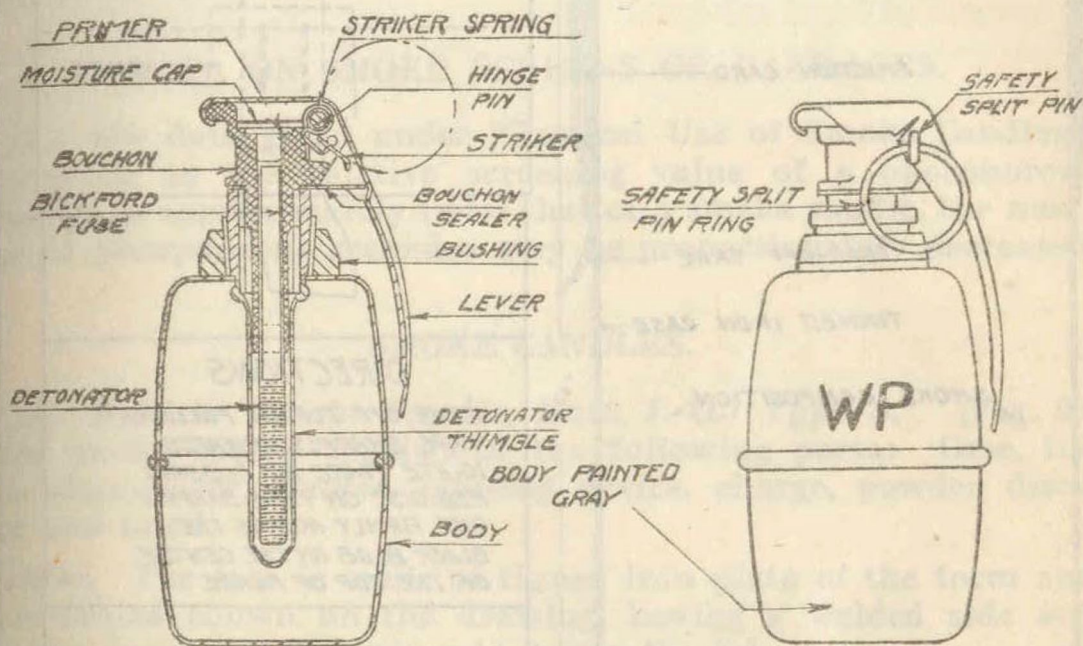
Two or three grenadiers should keep up a continuous fire upon the machine gun attacked. Others are designated to work their way into close striking distance from whence they can rush the gun from the flank, under cover of the smoke.

The rifle grenade is most effective when burst ten or fifteen feet above the ground.

The smoke generated by the burning phosphorous cuts off the machine gun from the possibility of direct fire. This effect may often be obtained, even though the strong point is out of range, if it is possible to work into a position to the windward so that the smoke will drift over the point to be screened.

If an attack is held up by hostile machine guns, their position might be indicated by firing single rifle grenades toward them, targets being thus provided on which fire from other weapons can be directed.

FIG. 8



U.S. TYPE

PHOSPHOROUS HAND GRENADE MARK II

glett

OFFENSE DIVISION, ENG. SEC. C.W.S. 5516

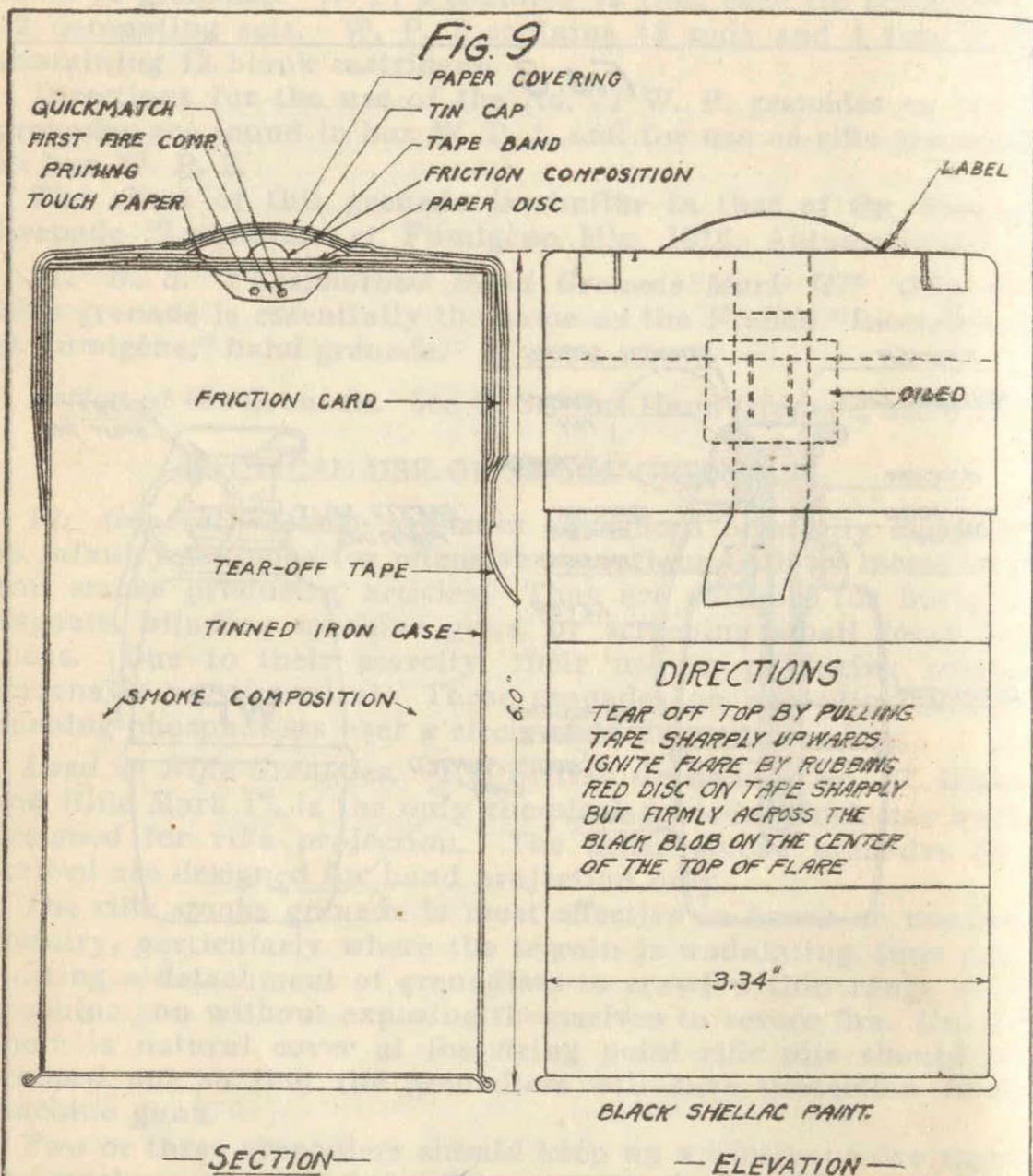


Figure 5.
U.S. Smoke Substitute Candle.

Two men in each squad may be trained to use these grenades and they should carry ten each in an advance.

Used as Hand Grenades. All of the smoke grenades previously described can be used as hand grenades.

The principal use of the phosphorous hand grenade is as a follow-up of a rifle grenade, for the maintenance at short range of the smoke cloud when taking a strong point. The smoke given off by the rifle grenades permits the grenadiers to advance to a point where the hand grenades may be used.

A minor use for the hand smoke grenade is in "mopping up" the enemy dugouts, although the gas grenade is more effective for this purpose.

DATA ON SMOKE SCREENS OR BARRAGES.

13. See data given under "Tactical Use of Smoke Candles". Inasmuch as the relative screening value of a phosphorous grenade is approximately twice that of a smoke candle, the number of phosphorous grenades may be proportionately decreased.

SMOKE CANDLES.

14. *British "Smoke Candle, Mark I. (L) Type S."* (Fig. 9). This smoke candle consists of the following parts: Case, lid, tin plate cover, striker, igniting device, charge, powder discs, cap and band.

Case. The case is made of tinned iron plate of the form and dimensions shown on the drawing, having a welded side and bottom seam and four plugs to secure the lid.

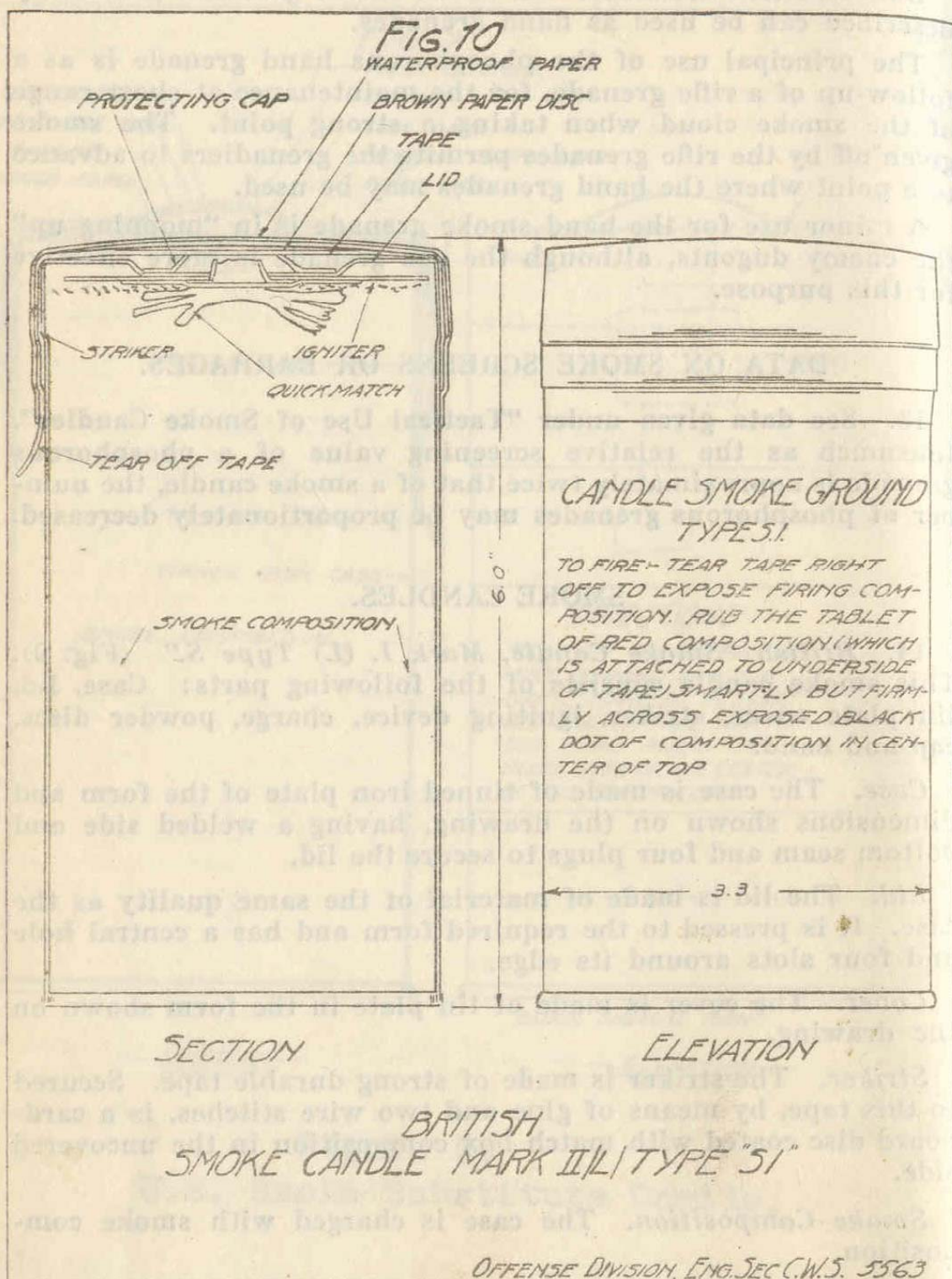
Lid. The lid is made of material of the same quality as the case. It is pressed to the required form and has a central hole and four slots around its edge.

Cover. The cover is made of tin plate in the form shown on the drawing.

Striker. The striker is made of strong durable tape. Secured to this tape, by means of glue and two wire stitches, is a cardboard disc coated with match box composition in the uncovered side.

Smoke Composition. The case is charged with smoke composition.

Method of Operation. Tear off the top by pulling the tape quickly upwards. Ignite the flare by rubbing the red disc sharply and firmly across the black blob on its center. This operation ignites the match material which in turn ignites the quick match, which sets fire to the fire composition for lighting the smoke mixture. This burns and gives off a smoke for three minutes.



15. *British "Smoke Candle Mark II. (L) Type S-1."* (Fig. 10). This candle consists of the following parts: Case, lid, projector, friction thimble, striker, and igniting arrangement.

Case. The case is made of tinned iron plate of the form and dimensions shown on the drawing and has a welded side and bottom seam.

Lid. The lid is made of stamped tinned plate and fits tightly on the case.

Protection and Friction Thimble These parts are stamped from tinned plate, the projector being slotted to allow for the passage of the tape and striker arrangement.

Striker. The striker is made of strong tape, to which is fastened by means of glue and two wire stitches, a cardboard disc, coated with match box composition. A piece of paper is secured to the tape on the same side as the disc in such a manner as to cover the striker.

Smoke Composition. The case is filled with about 3 pounds of smoke composition in a plastic or semi-fluid condition.

Method of Operation. To fire, tear off tape to expose firing composition. Rub the tablet of red composition, which is attached to the underside of the tape, smartly across the black blob of composition in the center of the top of the candle. This operation causes the match material to ignite the igniter which sets fire to the smoke composition. This burns and gives off smoke for five minutes.

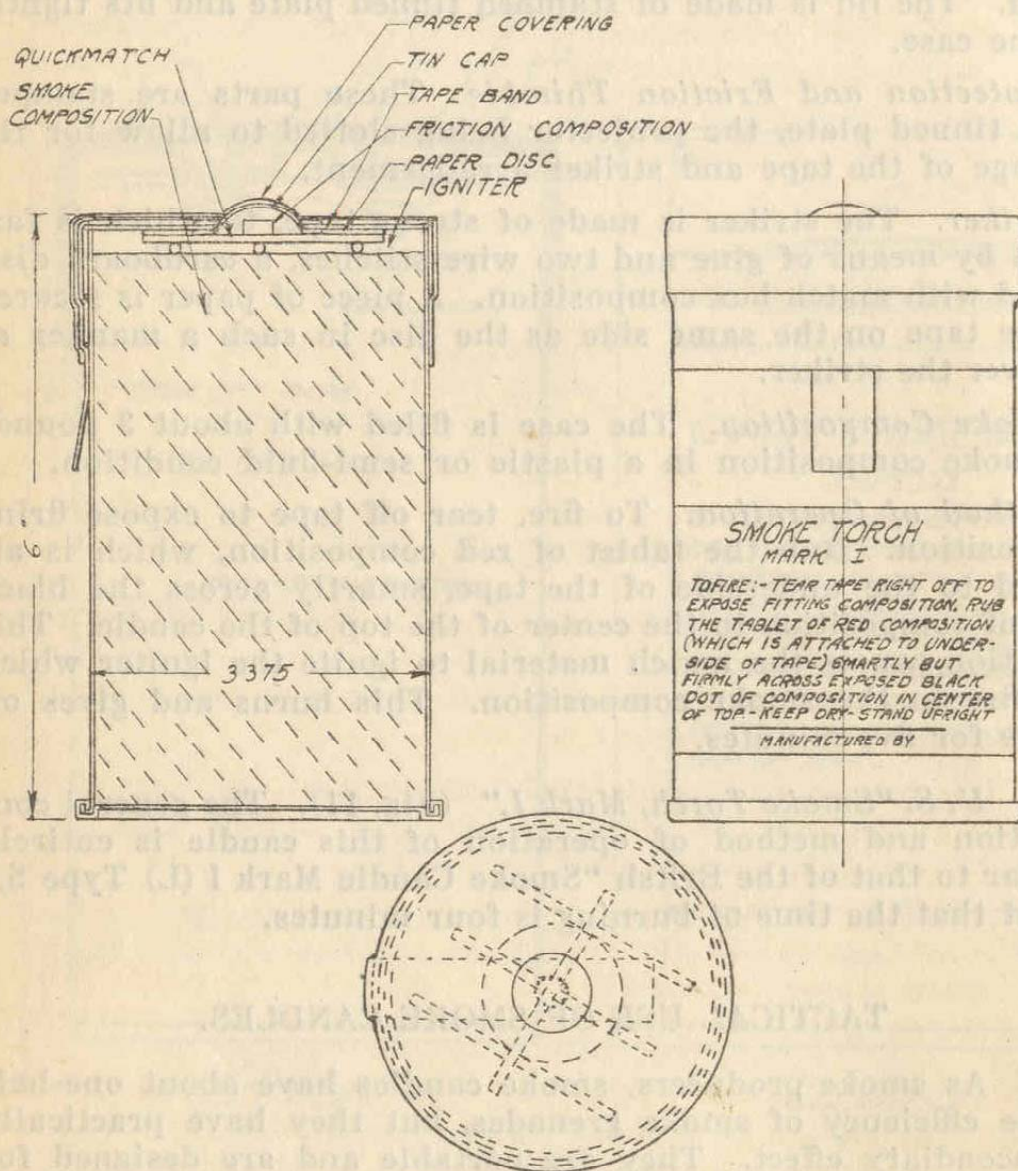
16. *U. S. "Smoke Torch, Mark I."* (Fig. 11). The general construction and method of operation of this candle is entirely similar to that of the British "Smoke Candle Mark I (L) Type S," except that the time of burning is four minutes.

TACTICAL USE OF SMOKE CANDLES.

17. As smoke producers, smoke candles have about one-half of the efficiency of smoke grenades, but they have practically no incendiary effect. They are portable and are designed for use by infantry in active operations. They are useful for blinding machine guns, for screening local attacks, and for simulating gas attacks. They may be used for concealing concentrations of guns or troops, battery positions or areas, or putting up a smoke barrage along the flank of an attack.

An operation with these candles should be carried out by a squad under the direction of a competent gas officer who makes wind observations and decides whether the candles may be used to advantage. At least 500 candles should be used for even a small operation. The number started at the beginning should make a dense cloud, and this can then be reinforced by fresh generators as required.

FIG. 17



U.S. TYPE
SMOKE TORCH-MARK I

S. S. S.

OFFENSE DIVISION, ENG. SEC. C.W.S. 5519

The number of smoke grenades or smoke candles required to form an effective screen depends upon the considerations enumerated in Part II, Group IV, under Sub-heading "Smoke Screens." No definite rules can be laid down as to the exact quantities of smoke producing substances required to form a screen, as conditions vary greatly, but the following examples are given for guidance:

18. *Examples of Smoke Screens.*

(1) Object to be concealed: Concentration area on a front of 2,000 yards.

Direction of the wind: Parallel to the enemy's front and steady.

Velocity of the wind: Six to eight miles an hour.

Material available: Smoke cases Type "S."

A smoke screen should be formed 4,500 yards long and 400 yards in front of the forward edge of the concentration area.

Groups of two men each should be placed 50 yards apart on the line of the intended screen. Each group should light four smoke cases every two minutes. Thus if the screen is to be maintained for a period of two hours, 21,600 smoke cases will be required.

Personnel required: 180 men, apart from those required for the transport of material.

The men should take advantage of any cover available and each group should be provided with a watch.

(2) Object to be concealed: Concentration area on a front of 2,000 yards.

Direction of the wind: Towards the enemy and steady.

Velocity of the wind: Six to eight miles per hour.

Material available: Smoke Cases, Type "S".

A good smoke screen should be formed 4,500 yards long and 400 yards in front of the forward edge of the concentration area.

Men should be posted singly 25 yards apart along the line of the intended smoke screen. Each man should light two smoke cases every two minutes and should throw them in such a way that no gaps occur. Thus, if the screen is to be maintained for a period of two hours, 21,600 smoke cases will be required.

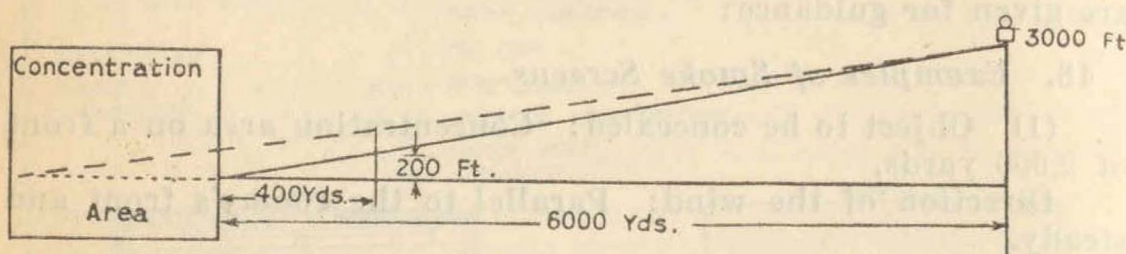
Personnel required: 180 men, apart from carrying parties for material.

Note:—This screen is more effective than the one described in Example 1.

(3) Object to be concealed: Concentration area on a front of 2,000 yards, from a balloon at an altitude of 3,000 feet and 6,000 yards distant.

(a) With the wind blowing parallel to the front or towards the enemy if the smoke screen is formed 400 yards in front of the forward edges of the concentration area, it would be neces-

sary for it to be 200 feet high in order to conceal the forward edge of the concentration area from the balloon, and much more than that to conceal the rear edge. A certain amount of screening effect might be reduced by bursting 4-in. Stokes bombs in the air, but this method cannot be relied upon and is not economical.



(b) With a wind blowing from the direction of the enemy, the cloud would drift over the area to be screened and the troops would therefore be concealed in the cloud. This might be objectionable owing to the possibility of confusion.

Consequently, it will seldom be possible to use smoke successfully to screen areas from hostile kite balloons unless there happens to be a considerable rise in the ground between the balloon and the object to be concealed.

3-INCH STOKES MORTAR SMOKE BOMBS.

19. The 3-in Stokes mortar smoke bomb has been approved for use but is not yet available.

The 3-in. and 4-in. Stokes mortar bombs will compare approximately as follows:

	Amount of W. P.	Maximum Range
3" Smoke Bomb.....	about 2.5 lbs.	1800 yards
4" Smoke Bomb.....	about 7.0 lbs.	1160 yards

TACTICAL USE OF 3" STOKES MORTAR SMOKE BOMBS.

20. These 3" Stokes Mortar Smoke Bombs will be available for use by the infantry in the future. This will place in the hands of the infantry a means of forming smoke barrages at greater ranges than is possible with the rifle grenade. The use of the 3-in. Stokes mortar smoke bomb will therefore economize on guns if they are used wherever possible, as they will be used from the front line trenches and will have a maximum range of approximately 1,800 yards. The fact that these smoke bombs will be entirely under the control of the infantry operates as an additional advantage in that smoke barrages will at all times be available to cover the retirement of daylight raiding parties.

It will also be possible to carry the mortars forward together with a supply of the smoke bombs to provide smoke screens in the large stages of an infantry advance.