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**HANDBOOK  
OF ENEMY AMMUNITION**

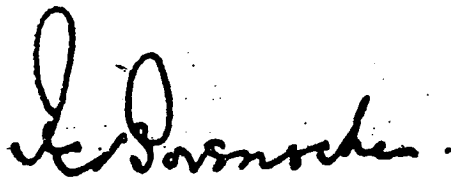
**PAMPHLET No. 7**

ITALIAN FUZES, GAINES, SHELL, CARTRIDGES,  
PRIMERS AND DETAILS OF SHELL MARKINGS  
GERMAN PRIMERS, SMALL ARM AND GUN  
AMMUNITION

*By Command of the Army Council,*

THE WAR OFFICE,

*5th June, 1943.*



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## ITALIAN MARKINGS ON A.P., H.E., HOLLOW CHARGE AND SHRAPNEL SHELL (Fig. 1)

The following markings have been met with in the course of examining captured Italian shell of the above-mentioned types. The types bearing these markings are of recent manufacture. The markings of earlier types do not always conform to the system.

### Basic Colours of Body

With each of the types the body of the shell is pale blue (almost a light grey) and the head (i.e., from nose to just above the shoulder) is red. When a cap is fitted to the shell the cap is red. The 100/17 hollow charge shell is an exception in that the cap is orange. Whether this is by design or is due to a variation in the shade of colour is not yet clear. These basic colours are normally applied by a process similar to sherardizing instead of by painting. The result is a flat finish and the absence of an obvious coating.

### Bands

A green band immediately above the driving band is found on shell both of the piercing type and normal nose fuzed H.E. type when filled T.N.T. or amatol.

A brown band immediately above the driving band is found on shrapnel shell.

A white band appears to be the distinguishing marking of shell designed for the attack of armour. With armour piercing shell the band is at the approximate centre between the shoulder and the driving band. With hollow charge shell the band is immediately above the driving band.

### Stencilling

The following particulars regarding the shell are normally stencilled in black between the shoulder and the driving band:—

- (a) Weight of filled shell in kilograms.
- (b) Nature of bursting charge. Shell filled with cast T.N.T. either by the pouring process or in the form of blocks are stencilled "TRITOLO." Those filled cyclonite/T.N.T. are stencilled "TRITOLITE." Shell filled amatol are stencilled "Amatolo."
- (c) Letters indicating the filling factory followed by the last three figures of the year of filling.
- (d) The calibre of the equipment in millimetres followed by an oblique stroke and the length of the piece expressed in terms of calibres.

The marking "Migl" indicates a modified design.

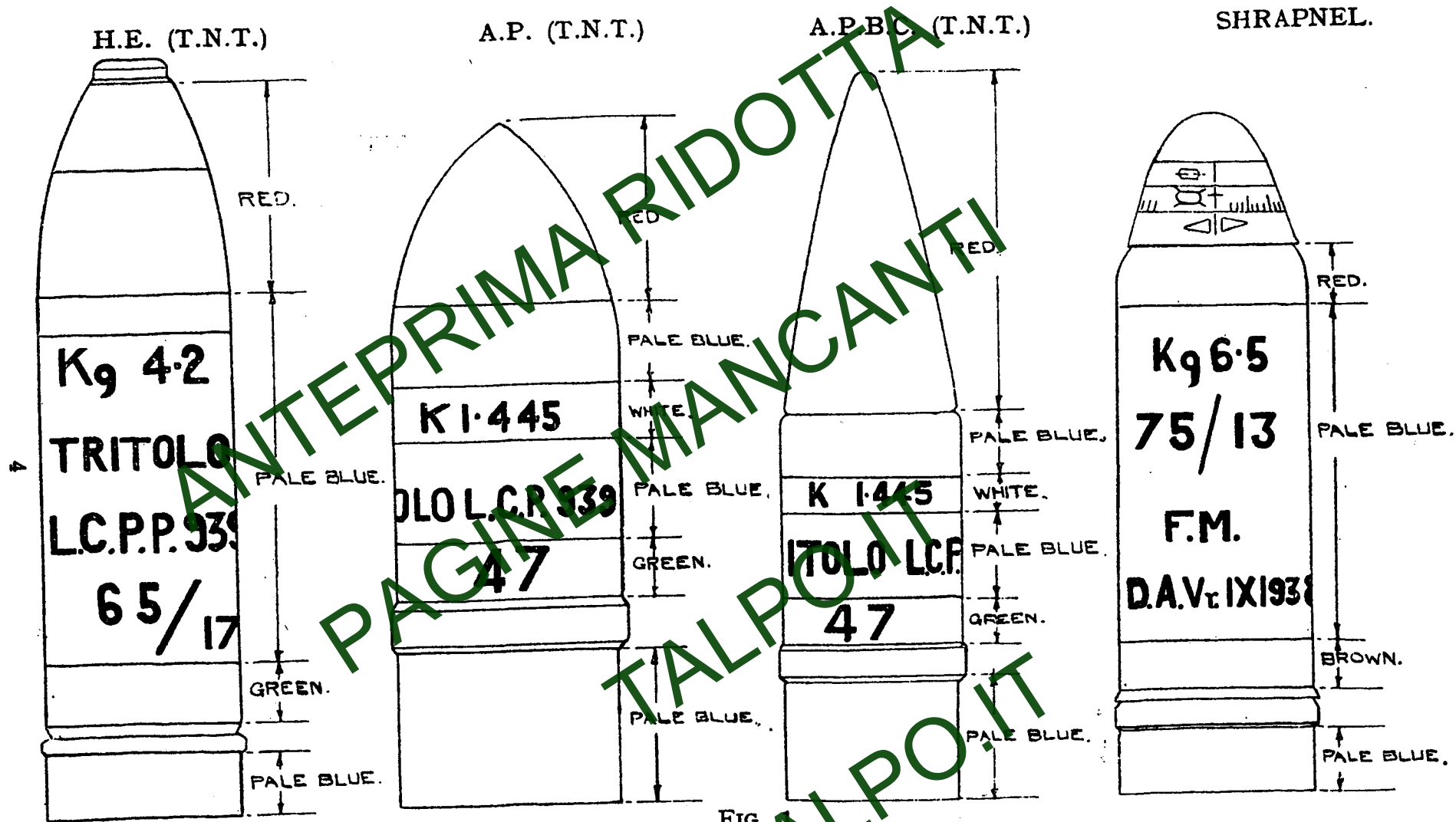


FIG.  
 Italian Shell, Typical Markings  
 (For 100/17 Hollow Charge Shell, see Fig. 19)

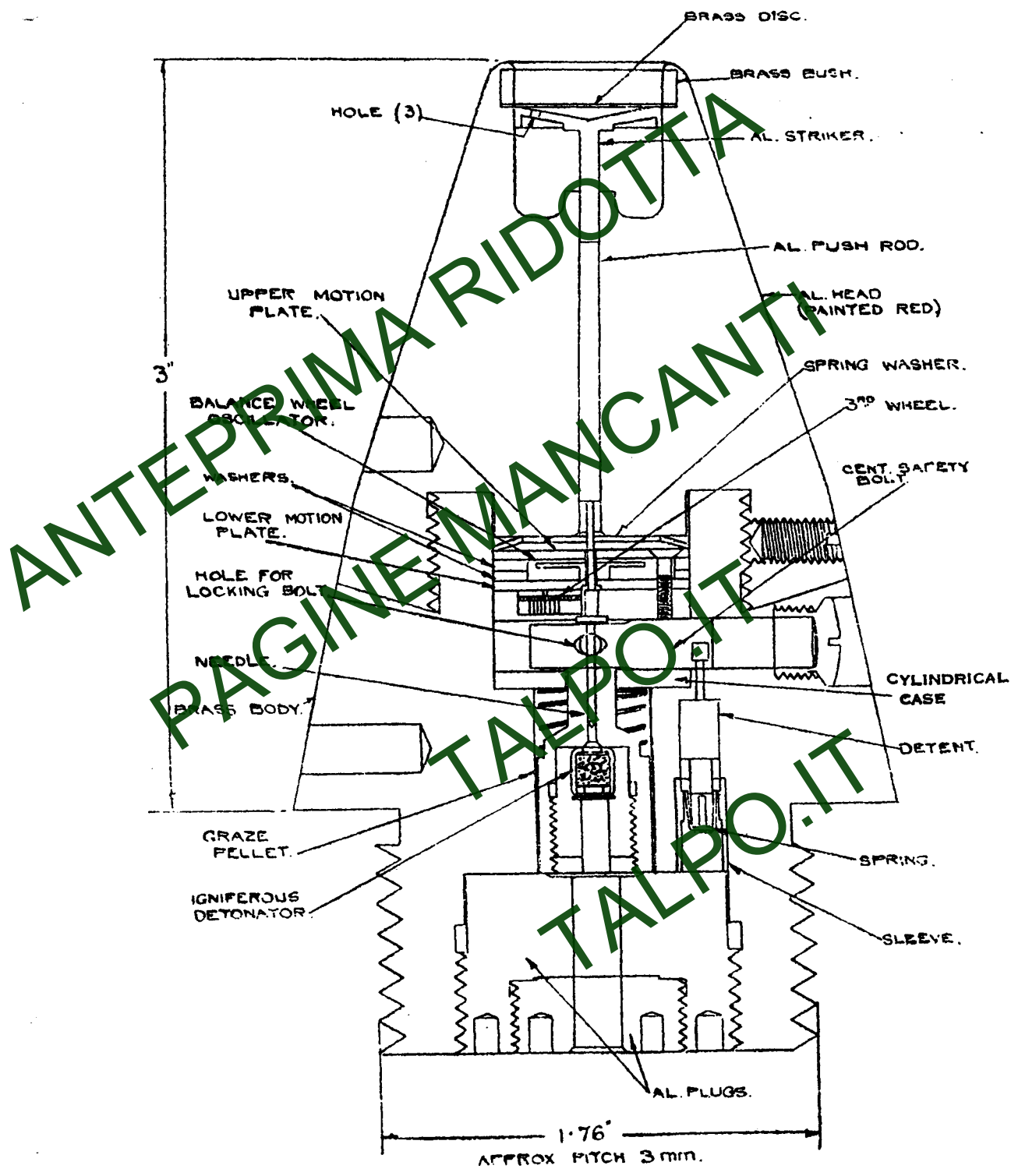


FIG. 2  
 Italian D.A./Graze Fuze with Clockwork Safety Device

# ITALIAN D.A./GRAZE FUZE WITH CLOCKWORK SAFETY

## DEVICE (Figs. 2 and 3)

The fuze is of the floating needle type with a graze pellet carrying the detonator. The needle and detonator are held apart by a centrifugal safety bolt, the outward movement of which is controlled by a clockwork escapement. The design is similar in principle to the Model 16 described in Pamphlet No. 4, but differs in details.

The overall length of the fuze is 4 inches. When assembled in the shell the 3 inches which protrude consist of a brass tapering body with a red painted aluminium head. The head is tapered near its base to correspond with the shape of the body, but the taper is markedly increased further forward. The nose is flat and is fitted with a brass sealing disc.

The screw-threaded portion of the body for insertion in the shell is 1.76 inches in diameter and has a pitch of approximately 3 mm. The body is bored to accommodate the clockwork and graze mechanisms and is closed at the base by two aluminium screwed plugs which are drilled to provide a flash channel. The front end of the body is reduced in diameter and threaded for the assembly of the head. A lateral channel is formed for the safety bolt, and a recess, displaced from the centre, contains a detent and sleeve. A radial channel at right angles to the lateral channel is formed for the locking bolt.

The brass graze pellet carries a 2.2 grain igniferous detonator secured by a perforated brass plug and is designed with a necked portion which acts as a guide for the needle. A steel creep spring is held in compression between a shoulder on the pellet and the base of the brass cylinder containing the clockwork mechanism. The base of the cylinder is bored to fit over the neck of the graze pellet. The detonator filling consists of mercury fulminate 45.7 per cent., potassium chlorate 28.9 per cent. and antimony sulphide 25.9 per cent.

The brass detent is supported by a three-pronged form of stirrup spring which is attached to its base and rests on the shoulder formed in the brass sleeve. The stem of the detent enters a recess in the underside of the safety bolt and retains the bolt in the safe position until "set back" occurs.

The aluminium centrifugal safety bolt is forked at the inner end to provide two arms which pass under a flange formed on the needle and so prevent the needle moving towards the detonator. A recess to engage the detent is formed in the underside of the bolt and a hole is formed in the centre at one side to engage the stem of a spring-loaded centrifugal locking bolt. The opposite side of the safety bolt is in the form of a toothed rack which is enmeshed with the first spur of the clockwork escapement mechanism.

The clockwork arrangement is carried in a brass cylinder which is bored to accommodate the safety bolt and locking bolt. The escapement mechanism consists of a train of four wheels, each consisting of a spur and pinion, and a balance wheel oscillator. The first spur is enmeshed with the rack on the safety bolt. The fourth pinion is an escapement wheel and engages a recess formed in the eccentric projection on the balance wheel oscillator. The balance wheel oscillator is contained between the upper and lower motion plates which are suitably

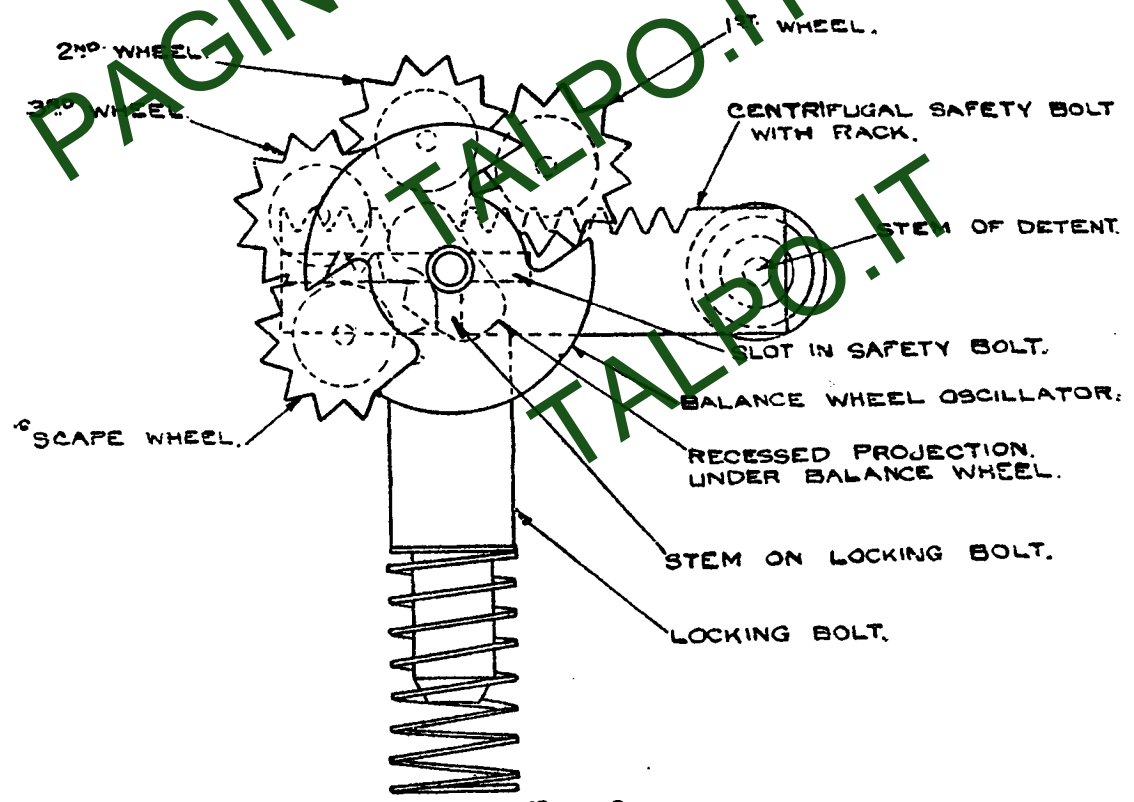
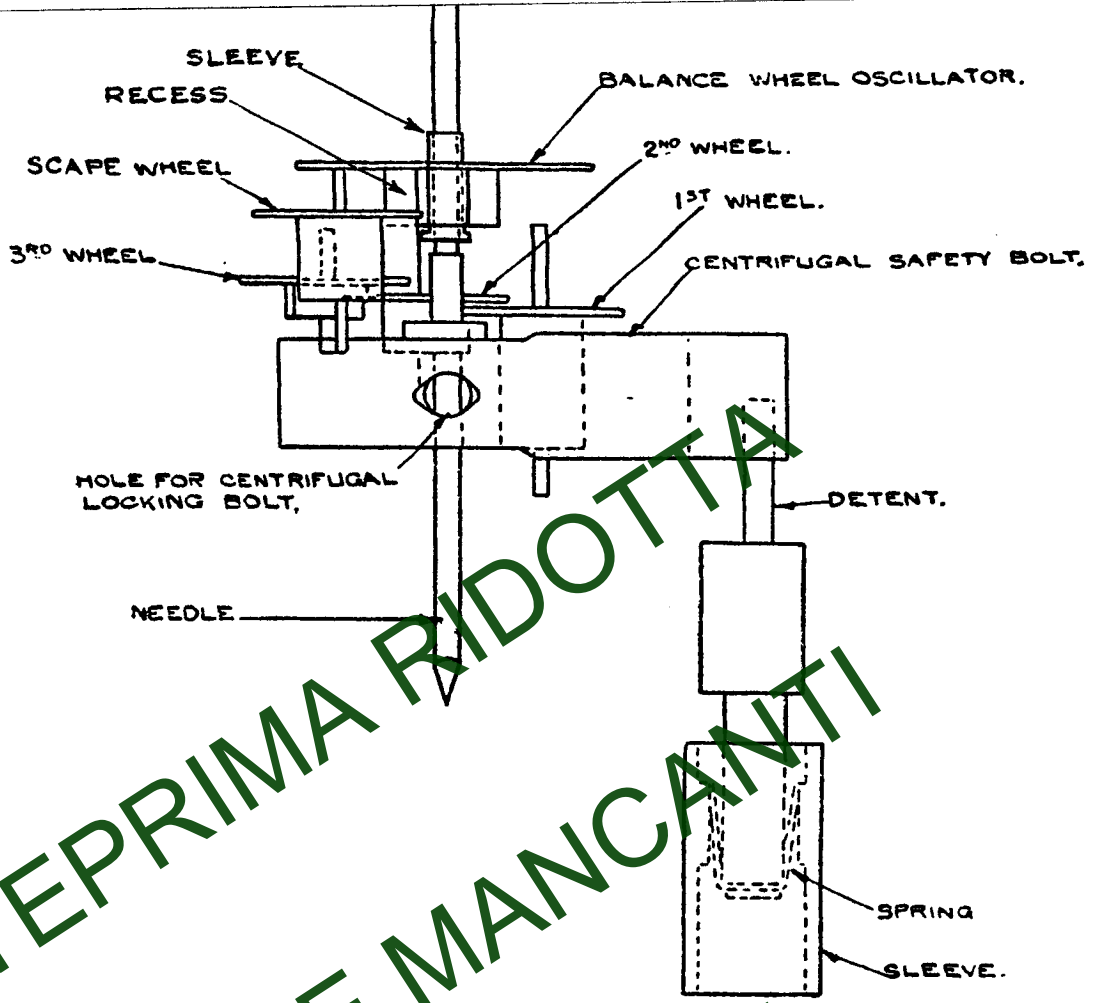


FIG. 3

Italian D.A./Graze Fuze. Arrangement of Mechanism

spaced by two brass washers. This assembly is secured by two screws to the brass cylinder containing the train of wheels and is surmounted by a spring washer compressed beneath the head of the fuze.

The aluminium head is drilled through the centre to take the stem of the hammer and the aluminium push rod and is recessed at the nose for the hammer head. The recess is closed against air pressure by a brass disc secured by a bush of the same material.

The hammer head has three holes for the escape of the air behind it when the hammer is driven in.

### Action

On acceleration the detent sets back, forcing its spring past the shoulder in the sleeve and withdrawing its stem from the recess in the safety bolt. The prongs of the spring then engage the underside of the shoulder and prevent the detent moving forward.

During flight the locking bolt is moved outwards against its spring by centrifugal force and releases the safety bolt. The safety bolt then commences to move outwards, also under the impetus of centrifugal force. The outward movement of the safety bolt is transmitted by the toothed rack on the bolt to the train of wheels, and is controlled by the action of the balance wheel oscillator. The throw on the projection formed beneath the balance wheel oscillator, under the influence of centrifugal force, performs the normal function of the hair spring in a clock mechanism and, with the recess acting as a pallet, controls the rotation of the escapement pinion. When the forked portion of the safety bolt has moved clear of the needle and graze pellet, the needle is held on the detonator by the "creep" resulting from deceleration, and the graze pellet is held by the creep spring.

On graze the needle is driven in by the hammer and push rod whilst the graze pellet overcomes the creep spring and carries the detonator on to the needle. The flash passes through the flash channel in the base of the fuze.

### ITALIAN TIME FUZE GRADUATED TO 13.2 (Fig. 4)

The fuze is used in the Q.F. 102 mm. 35 calibre anti-aircraft gun ammunition and is a tensioned fuze of the combustion type. The setting graduations extend from zero to 13.2. A fuze set to 13 gave a time of burning of 26.6 secs. at rest. The design includes a delay arrangement between the lower time ring and the magazine which ensures a minimum time of burning of .6 sec. and thus provides for safety against a "flash-over" in the bore or the results of a dangerously short setting. The screw-threaded portion of the fuze for insertion in the shell is 1.762 inches in diameter.

The exterior of the fuze, visible when assembled in the shell, is of aluminium or aluminium alloy. The tension cap and the upper ring are shaped to coincide and form an ogival head. The lower ring is cylindrical and the flange of the platform is tapered. The setting graduations may be marked on the lower ring or on the flange of the platform. A soldered alloy cover with tear-off wire and ring is sometimes fitted to the fuze. The cover is marked with a red arrow and the word "TIRARE," indicating the method of removal.



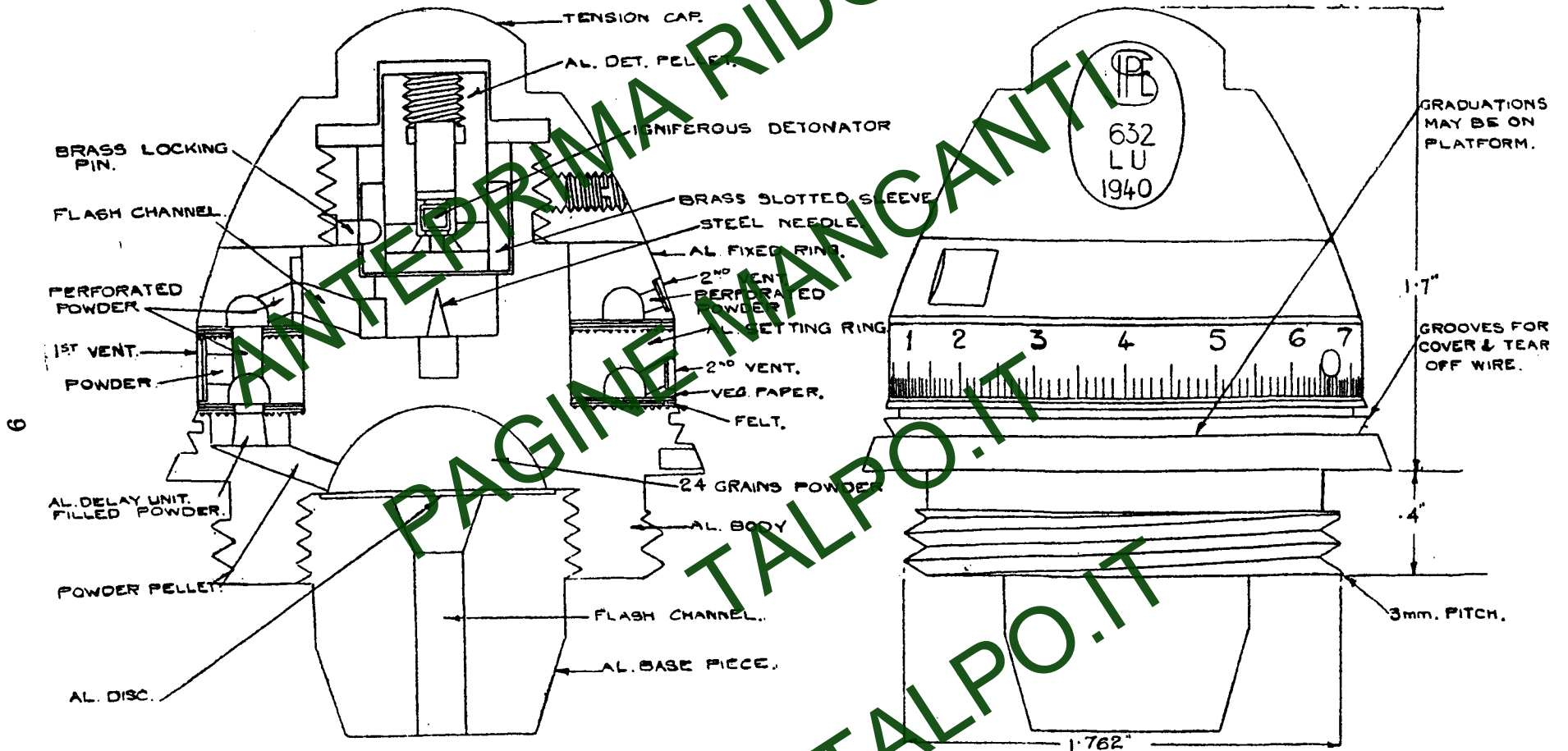


FIG. 4

Italian Time Fuze Graduated to 13.2

The aluminium body of the fuze is screw-threaded to a depth of .4 inch for insertion in the shell and is shaped to form a platform to support the lower time ring. The tapered flange of the platform may be grooved to receive the soldered alloy cover and the tear-off wire, or may be graduated for the setting of the lower time ring. The numbered graduations extend from 0 to 13. These are subdivided in tenths except between 0 and 1, where the subdivision commences at .8. The space between 0 and this graduation is barred out by two crossed diagonal lines. The subdivision continues beyond the 13 graduation to 13.2. A circular recess in the platform communicates with an inclined flash channel leading to the magazine. The recess contains an aluminium disc, with a central hole tapering towards the top, which contains a pressed filling of powder and introduces a .3 sec. delay. A felt washer, with a hole to correspond with the position of the delay unit, is attached to the platform by an adhesive. The inclined flash channel contains a solid pellet of powder, which gives a further delay of .3 sec. The magazine contains a 24-grain filling of granular gunpowder and is closed by an aluminium base piece which screws into the body with a left-hand thread and protrudes at the base. The base piece has a central flash channel, which is lightly closed at its inner end by a thin disc of aluminium. The body is cylindrical above the platform for the assembly of the two time rings, and is screw-threaded to receive the tensioning cap. Two semi-circular recesses are formed in the cylindrical part of the body which coincide with similar recesses in the upper time ring to receive the two aluminium locking pins which hold the upper time ring in a fixed position. A recess formed in the front end of the body contains the detonator assembly. A steel needle is fixed in the base of the recess, and a flash channel is drilled through the wall to coincide with a similar channel in the upper time ring.

The detonator assembly consists of an igniferous detonator carried in a cylindrical aluminium pellet which is held off the needle by a slotted brass sleeve. The detonator is retained in the pellet by a brass screwed plug. The slotted brass sleeve supporting the pellet is a tight fit round the base of the pellet, and is itself supported by a shoulder formed in the recess. Movement of the sleeve is prevented by a brass locking pin which is inserted through the wall of the recess and engages in the slot.

The lower time ring is of aluminium and is the setting ring. The groove containing the fuze powder in its underside extends through 310 degrees and has two circular vents for the escape of pressure and a flash-hole leading to the upper surface of the ring. The first vent and the flash-hole are connected with the commencement of the powder groove. The second vent is smaller and is located at 150 degrees from the commencement of the powder groove. The first vent contains a pressing of powder, and both vents are closed by tin discs, which are secured by stabbing and sealed with varnish. The flash-hole connecting the commencement of the powder groove with the upper surface of the ring contains a filling of pressed powder. A hole is drilled through this pressing and the powder in the groove beneath it to assist ignition. A washer of vegetable paper, with a hole to correspond with the commencement of the groove, is fixed to the underside of the ring to cover the powder groove, and a felt washer, perforated to correspond

with the flash-hole, is fixed to the upper surface. A recess is formed in the cylindrical exterior wall of the ring for the setting key.

The fixed upper time ring is also of aluminium with a powder groove in its underside, which also extends through 310 degrees. Two vents are provided for the escape of pressure. The first is of the elongated type, and is formed in the bridge, or solid portion of the ring between the ends of the powder groove, and is connected to the commencement of the groove by a circular hole. This vent contains no filling, and is closed by a tin disc. The second vent is circular and smaller, and is located at 150 degrees from the commencement of the powder groove. A small hole through the powder filling is continued slightly into the fuze powder in the groove. The vent is closed by two tin discs. In both vents the closing discs are secured by stabbing and sealed with varnish. An inclined flash-hole is formed in the inner wall of the ring at the commencement of the powder groove. The powder filling in the flash-hole has a central perforation, which corresponds with a similar vertical perforation in the fuze powder at .1 inch from the commencement of the groove. The flash-hole in the ring is held coincident with the flash-hole in the body by the two locking pins. A washer of vegetable paper is fixed to the underside of the ring to cover the powder groove. A hole in the washer corresponds with the commencement of the groove.

The aluminium tension cap is screwed over the forward end of the body to obtain the required resistance to the turning of the lower ring, and is secured by a brass grub screw.

Analysis of the powders gave the following results:—

	Fuze Powder	Magazine Powder.
Sulphur ... ..	8.4 per cent.	9.5 per cent.
Potassium nitrate ... ..	32.2 ..	75.5 ..
Charcoal ... ..	11.7 ..	14.6 ..
Tarry matter ... ..	3.7 ..	0.4 ..

### Action

On acceleration the detonator pellet sets back through the slotted sleeve and the detonator is impinged on the needle. The flash produced passes through the flash channel in the recess and ignites the powder in the flash channel in the upper ring, thus igniting the fuze powder, which commences to burn along the groove in the underside of the ring. The pressure set up by the burning fuze powder dislodges the closing disc of the first vent, and thus prevents variation in the rate of burning as the result of heat and pressure. The distance between the commencement of the powder groove in the upper ring and the powder-filled flash-hole in the surface of the lower ring depends upon the angle through which the lower ring is turned in setting. When the fuze powder in the upper ring has burned round to this surface flash-hole the fuze powder in the lower ring is ignited through the powder in the flash-hole. The closing disc of the vent is blown out and the fuze powder burns round the groove to the delay unit in the platform. From the delay unit the flash is passed to the solid powder pellet in the flash channel, and thence to the magazine.

The second vent in each of the rings is blown open when the fuze powder has burned round to the position of the vent.

With the lower ring set to the zero graduation the flash-hole in its surface is aligned with commencement of the powder groove in the upper ring and the delay unit in the platform. Thus the flash from the detonator is transmitted directly to the delay unit.

With the lower ring set to the cross which indicates the safe position, the surface flash-hole in the lower ring is masked by the solid portion between the ends of the groove in the upper ring. Also, the delay unit in the platform is masked by the corresponding portion of the lower ring.

### ITALIAN TIME FUZE GRADUATED TO 160 (Figs. 5 and 6)

The fuze is used in Q.F. 102 mm .35 calibre anti-aircraft gun ammunition and is a tensioned fuze of the combustion type. The screw-threaded portion of the body, for insertion in the shell, is longer than that of the smaller fuze graduated to 13.2. The setting graduations extend from zero to 160. A fuze set to 160 gave a time of burning of 35.9 secs. at rest. The design includes a delay arrangement between the lower time ring and the magazine, which ensures a minimum time of burning of .1 sec. as in the smaller fuze. The body is screw-threaded to a 1.766 inch diameter, with a pitch of approximately 3 mm.

With the exception of the graduated brass platform, the exposed part of the fuze when fitted in the shell is of aluminium. The nose plug has a flat head, and is shaped to correspond with the tapering contour of the tension nut and upper time ring. The lower time ring is cylindrical and is milled. The platform is tapered. A brass cover with slight fluting near the nose is attached by a soldered tear-off strip to the lower edge of the platform.

The brass body has a magazine, containing 51 grains of gunpowder, formed in its underside. The magazine is closed by a screwed brass plug which protrudes from the base of the fuze. The plug has a central flash channel closed by a thin brass disc. Six equi-spaced recesses, surrounding the flash channel, are drilled from the base of the plug. The plug is secured by means of a set screw. A central channel is formed leading from the magazine to the top of the body. The flash channel between the magazine and the platform is formed by a radial channel, closed at its outer end by a brass plug, and a vertical channel connecting the radial channel to the surface of the platform. The radial channel contains a solid pellet of powder, which causes a delay of .3 sec., and the vertical channel contains a brass ring with a hole tapering towards the head, which is filled with pressed powder, and also provides a delay of .3 sec. The central channel and the radial channel are closed in the magazine by discs of tinfoil. The numbered setting graduations on the flange of the platform extend from zero to 160 and are subdivided in tenths from .8 onwards. The .5 setting is also graduated. A radial locking pin of brass is fitted in the body to engage a recess in the fixed upper time ring. The body is screw-threaded near the forward end to receive the tensioning nut, and is reduced in diameter at the head to form a spigot which is threaded to receive the cover plate and two locking nuts. The step formed by the reduction in diameter at the head has formed in it a part-circular groove.

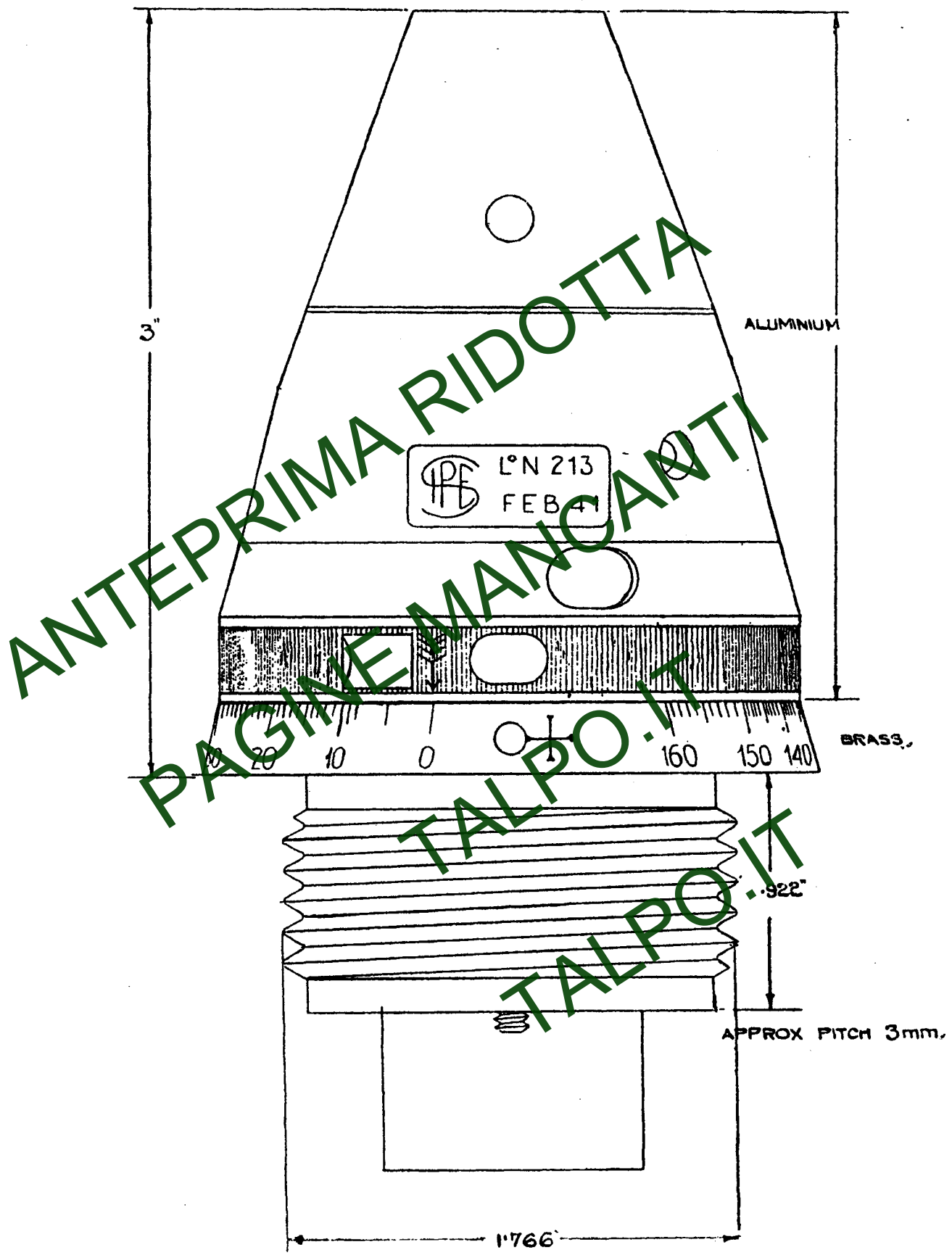


FIG. 5

Italian Time Fuze Graduated to 160

the ends of which are connected by inclined grooves with vertical grooves in the recess containing the detonator assembly. This recess is displaced from the centre of the body, and has a steel needle fitted in its base. Two inclined flats are formed at the front end of the recess, on which the arms of the stirrup spring are supported, and a flash channel for the ignition of the upper time ring is formed in the wall of the recess.

The detonator assembly consists of an igniferous detonator carried in a cylindrical brass pellet, which is held away from the needle by a brass stirrup spring.

The lower time ring is the setting ring, and has a powder groove in the underside extending through 320 degrees, with three vents. The first vent corresponds with the commencement of the groove, the second is at 115 degrees from this point, and the third at 225 degrees. An arrow is inscribed on the milled exterior of the ring for setting, and a recess is formed for the setting key.

The upper ring is locked by a radial brass pin in the body. The powder groove in its underside extends through the same angle as that in the lower ring, and has vents similarly placed except that the first vent is in the solid part of the ring and is connected to the groove by a short channel.

The other details of the rings are the same as those given in the description of the smaller fuze.

The brass cover plate consists of a disc with a screw-threaded hole in the centre, and is screwed on the spigot projection on the body to cover the detonator recess and the curved groove in the body.

The cover plate is held by a brass locking nut screwed to the spigot above it.

The tensioning nut is formed with a diaphragm perforated to fit over the spigot on the body, and is screwed over the body to bear on the time rings to produce the required resistance to the turning of the lower ring. After adjustment the tensioning nut is secured by a brass locking nut, which is screwed to the spigot and bears on the diaphragm, and by a fixing screw. The nut has an internal screw-thread and a fixing screw for the attachment of the nose plug.

The aluminium nose plug is tapered with a flat top and is screwed into the tensioning nut, with a lead washer sealing the joint.

Analysis of the powders gave the following results:

	Fuze Powder.	Magazine Powder.
Sulphur ... ..	9.2 per cent.	9.6 per cent.
Potassium nitrate ... ..	75.0 "	75.5 "
Charcoal ... ..	15.3 "	14.5 "
Tarry matter ... ..	0.5 "	0.4 "

### Action

On acceleration the detonator pellet overcomes the support of the stirrup spring and sets back, carrying the detonator on to the needle. The flash produced is transmitted to the filling in the upper time ring, and the subsequent action is similar to that of the smaller fuze. The groove in the detonator recess and in the front end of the body appear to be designed for the dispersion of the pressure set up by the action of the detonator, and thus avoids disintegration of the powder.

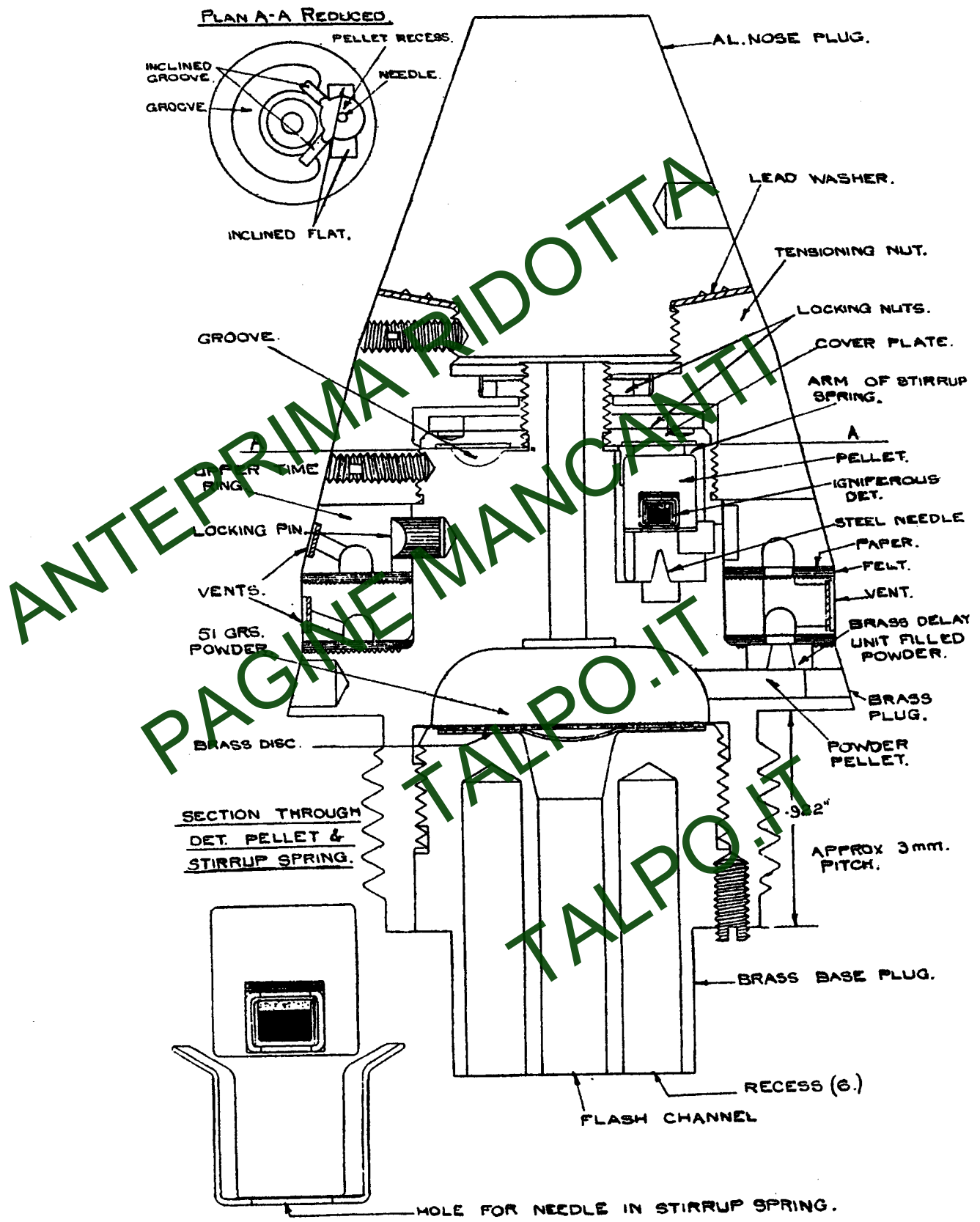


FIG. 6  
 Italian Time Fuze Graduated to 160