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DESCRIPTION AND INSTRUCTIONS

For the Use of Aeroplane Flare, Mark I

AND

Release Mechanism, Mark I For Aeroplane Flare.

THREE PLATES

WAR PLANS DIVISION

AUGUST, 1918.

42245

WAR DEPARTMENT

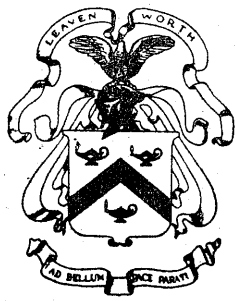
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Office of the Adjutant General.

WAR DEPARTMENT,

WASHINGTON, *August* 20, 1918.

The following pamphlet, entitled "Description and Instructions for the use of Aeroplane Flare, Mark I and Release Mechanism, Mark I for Aeroplane Flare," is published for the information of all concerned.

(062.1 A. G. O.)

BY ORDER OF THE SECRETARY OF WAR:

PEYTON C. MARCH,
General, Chief of Staff.

OFFICIAL:

H. P. McCAIN,
The Adjutant General.

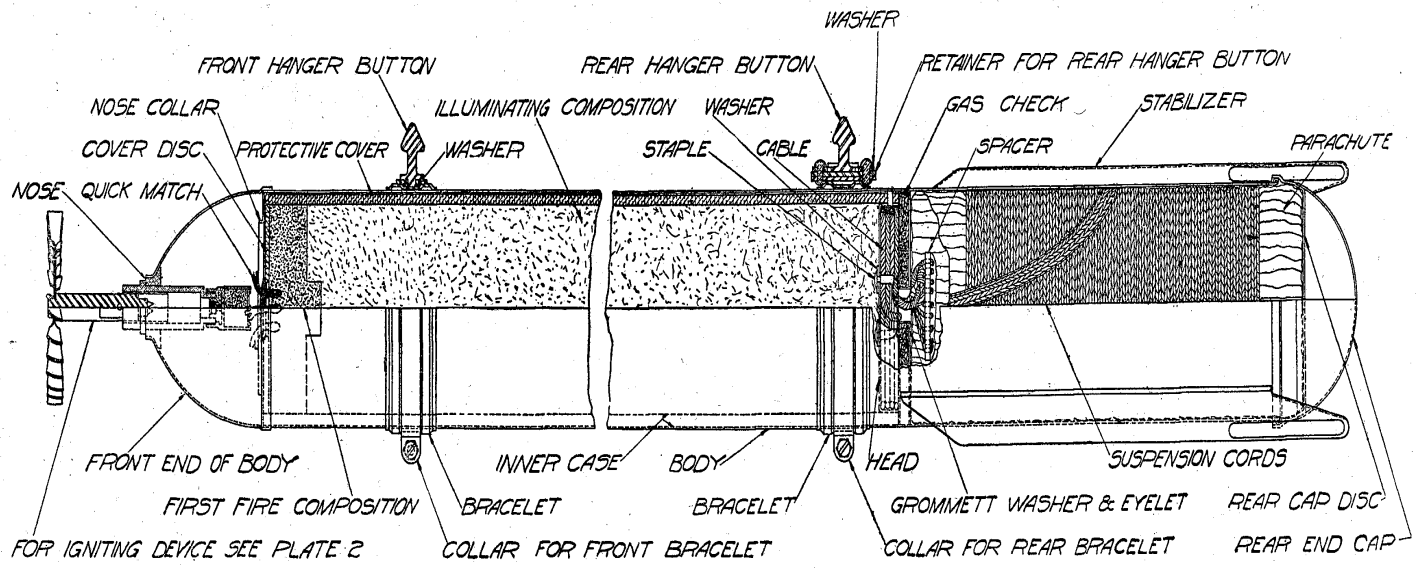


Plate I.
Assembly Drawing of Aeroplane Flare,
Mark I.

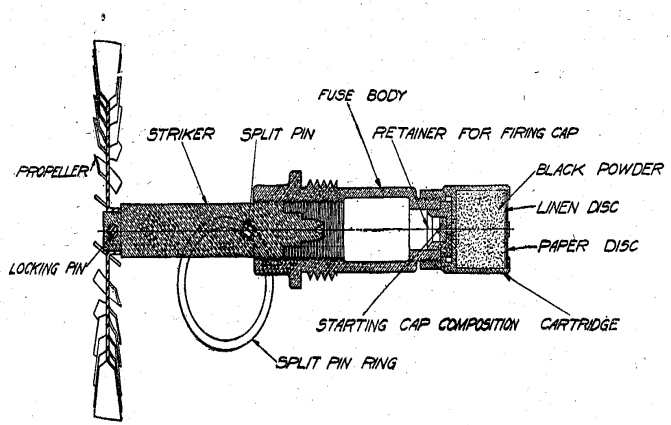


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AEROPLANE FLARE, MARK I.

The Aeroplane Flare, Mark I, is an illuminating device which is dropped from an aeroplane at night to obtain illumination of the ground. It is provided with a mechanism which ignites the illuminating composition at some distance below the plane; a parachute serves to suspend the burning flare in the air. The time of burning is not less than seven minutes, with an average candle power of 350,000.

The flare consists of three major parts: (*a*) the outer case, (*b*) the igniting device and (*c*) the inner case with illuminant and parachute.

(a) The Outer Case.

The outer case consists of the body, the front end of body, the nose, the nose collar, the bracelets, the front collar, the rear collar, the front hanger button, the rear hanger button, the retainer for rear hanger button, the rear end cap, the rear cap disc and the stabilizers.

The BODY is a cylinder of No. 29 gauge tin plate, 39 inches long and 4.375 inches in diameter (inside). The two ends of the plate are clinched together in a flat lapped joint .25 of an inch wide. The rear edge of the body is turned back for .125 of an inch to form a reinforcing fold on which the rear cap is fitted.

The FRONT END OF BODY is a hemispherical cap of No. 29 gauge tin plate, which is clinched onto the body. A hole is punched in the center, the flange of which is turned outward for a short distance to support the nose. The cap is 3.203 inches long and 4.375 inches in diameter, except for the portion which is peened over the body. This is 4.421 inches in diameter.

The NOSE is a brass bushing 1.578 inches in diameter and .390 of an inch long, tapering to a diameter of 1.109 inches to fit into the flanged hole in the front end, where it is soldered in place. It is tapped on the inside to receive the threaded portion of the fuse body.

A NOSE COLLAR of 20 gauge sheet steel, 4.421 inches in diameter, is soldered in the joint between the body and the front end. A hole 3.156 inches in diameter is punched in the center of the collar with the edges bent slightly forward. The collar serves to hold the inner case in its proper position in relation to the firing mechanism.

Two BRACELETS of 29 gauge tin plate, 1.395 inches wide, are soldered around the body, one 6.968 inches from the nose and the other 11.391 inches from the rear. Two annular corrugations, .171 of an inch from each edge and 4.687 inches in diameter, form a channel in the center of each bracelet, .515 inches wide and 4.531 inches in diameter which serve to locate the front and rear collars.

The FRONT COLLAR is made of .078 of an inch steel plate, .5 of an inch wide, except for a distance of .812 of an inch, midway between the ends, where the width is increased to .812 of an inch. In the center of this square surface is a hole, .281 inches in diameter, in which the front hanger button is riveted. The collar is bent into a circle with a diameter of 4.531 inches. The two ends, in each of which a ¼ inch hole is drilled, are bent outward to face each other; a 10x24 fillister head machine *SCREW*, .5 of an inch long, is inserted in the two holes and, with its hexagon *NUT*, serves as a means of clamping the collar on the bracelet.

The REAR COLLAR is similar to the front collar except that the widened surface, intended to support the rear hanger button, is 1.687 inches wide and .875 of an inch long, with rounded corners and has two .218 of an inch holes, drilled 1.187 inches apart, to receive the rivets which secure the retainer for the rear hanger button to the collar.

The FRONT HANGER BUTTON is a steel cylinder of irregular shape, measuring 1.187 inches long and .625 of an inch at the point of largest diameter. The base is turned down to a diameter of .25 of an inch for a distance of .187 of an inch, to form a stud whereby the button is riveted to the front collar. At a point .25 of an inch from the base, a recess with rounded corners is turned to a diameter of .25 of an inch, and .437 of an inch in width to fit into the jaws of the release mechanism. The remaining section is .5 of an inch long and conical in shape, tapering from a diameter of .593 of an inch to a rounded point at the top. The lower corners of the cone are also rounded off.

The REAR HANGER BUTTON is similar to the front hanger button except that the stud on the base, which serves to secure the button to the collar, has been omitted, the overall length of the rear button is therefore but 1 inch. The base, which is .062 of an inch high, is intended to fit into the slots in the retainer.

The RETAINER FOR REAR HANGER BUTTON is a steel plate, 1.687 inches long, .843 of an inch wide and .078 of an inch thick. Two .25 of an inch holes, 1.187 inches apart, are provided for the .187x.312 of an inch rivets and washers by means of which it is secured to the rear collar. The two sides of the plate have been bent over in such a manner as to leave a slot, .687 of an inch wide at the bottom, .375 of an inch wide at the top and .781 of an inch long, in which the base of the rear hanger button moves. The heads of the rivets, securing the retainer to the collar, limit the movement of the button and prevent it from falling out of the slot.

The REAR END CAP is a convex shape of 29 gauge tin plate, 4.343 inches in diameter and 1.562 inches long, which is soldered over the closed end of the rear cap disc.

The REAR CAP DISC is a stepped, truncated cone of 29 gauge tin plate. The section of largest diameter is .218 of an inch wide and 4.562 inches in diameter (inside) and is intended to fit over the rear end of the body, where it is lightly crimped in place. The section of smallest diameter (4.132 inches, outside measurement), is intended to fit into the rear end cap. Upon explosion of the expelling charge, the disc, with the rear end cap, is forced off by the pressure exerted against the parachute and inner case.

The four STABILIZERS are trapezoids of .031 of an inch sheet steel, with an overall length of 9.765 inches and a width of 1.109 inches. The inner edge of each is bent at right angles to the stabilizer surface, forming a lug .087 of an inch high, by means of which the stabilizer is soldered to the rear of the body.

(b) The Igniting Device.

The igniting device consists of a sheet steel plate, .031 of an inch thick and 3.546 inches in diameter. The edge of the plate is slotted to form 28 vanes, which are twisted to a 15 degree angle, left hand helix, to cause rotation of the plate in the air. A .359 of an inch hole is punched in the center of the propeller, with the inside edge flanged to form a collar .187 of an inch long. The end of the striker is pressed into this hole; a steel pin, .078x.359 of an inch, is then inserted in the hole through the collar and striker, to secure them in place.

The STRIKER is a solid brass rod, measuring 2.916 inches in length and .562 of an inch at the point of largest diameter, where it is threaded for a distance of .39 of an inch to fit into the fuse body. The front end is turned down to a diameter of .359 of an inch for a distance of .234 of an inch, to fit into the propeller; a hole, .116 of an inch in diameter, is drilled through this section, .125 of an inch from the end, to receive the steel locking pin.

The remaining portion above the threaded section is 1.734 inches long and .484 of an inch in diameter. Here two surfaces, diametrically opposite each other, are flatted to a diameter of .312 of an inch, for a distance of .593 of an inch above the threads, to fit into the prongs of the spring guide on the release mechanism. A .116 of an inch hole is drilled through these surfaces to receive the split pin.

Below the threaded section the diameter is reduced to .312 of an inch, for a distance of .234 of an inch, to pass through the lower recess in the fuse body. From this point the striker is turned to a diameter of .203 of an inch for a distance of .156 of an inch and then tapers to a diameter of .125 of an inch at the end. Two V notches, perpendicular to each other, are cut in the end of the striker, to form four sharp points for the firing pin.

The FUSE BODY is a brass cylinder of irregular shape, measuring 2.453 inches in length and 1.093 inches at the point of largest diameter, where it is flatted in two places to provide a grip for a wrench. It is threaded on the outside to screw into the nose and, on the end, to receive the cartridge. It is suitably tapped and recessed on the inside to receive the striker and the firing cap retainer.

The CARTRIDGE is a brass cylinder 1.140 inches long and .812 of an inch in diameter, which is intended to hold the expelling and igniting charge. It is bored and threaded to a diameter of .597 of an inch, for a distance of .328 of an inch, to fit the bottom of the fuse body. The opposite end is bored out to a diameter of .734 of an inch to receive the powder charge. Thus a disc .062 of an inch thick is left between the front and rear recesses; a .187 of an inch hole is drilled through this, to provide a means whereby the flash from the firing cap may reach the powder. Four tapered lugs, .093 of an inch long, equally spaced about the circumference, are bent inward at the time of assembly to secure the wad in place.

The WAD is a paper disc .75 of an inch in diameter, with a .25 of an inch hole in the center; it is reinforced by a linen disc of the same size and is placed over the powder charge in the cartridge. The four lugs on the end of the cartridge are bent in over the wad, which is thus secured in place.

The RETAINER FOR FIRING CAP is a brass cylinder .312 of an inch long and .515 of an inch in diameter. The front end is turned down to a diameter of .359 of an inch for a distance of .171 of an inch to fit into the end of the fuse body. A recess is bored in this section .234 of an inch in diameter and .25 of an inch deep, with the shoulder countersunk for .062 of an inch. This is intended to hold the firing cap composition. A hole .078 of an inch in diameter leads from this recess to the opposite face of the retainer. The retainer is placed in position with the smaller end inserted in the bottom of the fuse body and the cartridge is then screwed down over it and onto the fuse body.

The SPLIT PIN is a steel pin .093 of an inch in diameter and 1 inch long; it is provided with a steel *RING* of 10 gauge wire, .125 of an inch in diameter, to facilitate its removal. It is inserted in the hole through the flatted portion of the striker and serves to prevent the firing pin from coming in contact with the firing cap. When the flare is to be used, the split pin is removed and some means on the release mechanism is employed to prevent the rotation of the propeller until the flare is dropped from the plane.

(c) The Inner Case, with Illuminant and Parachute Assembly.

The INNER CASE, with illuminant and parachute assembly, consists of the inner case, the cover disc, the head, the staple and washers, the Grommett washer and eyelet, the gas check, the parachute, the spacer and the cable.

The inner case is a cylinder of Bird's board, machine rolled and cut, with a protecting casing of taggers tin, No. 35 gauge;

it is 29.125 inches long, with an outside diameter of 4.312 inches and an inside diameter of 3.921 inches. The front or ignition end is filled with the starting composition in the manner described below and covered with a cardboard *COVER DISC*, .125 of an inch thick, which has a 1-inch hole in its center to provide for the strands of quick match. The disc is fitted snugly in the end of the case and is then drumheaded with a 2-inch linen band, which extends one inch over the end of the case.

The HEAD is a sheet steel disc, .043 of an inch thick, 3.921 inches in diameter, with the outer edge turned up for a distance of .5 of an inch to fit snugly in the case. A steel staple, made of $\frac{3}{16}$ of an inch round stock and bent in a U shape, .5 of an inch high and 1 inch wide, is riveted in the center with two steel washers and serves as a means of attaching the cable to the case. The head is inserted in the end of the inner case and riveted in place by means of eight .125x.375 of an inch copper rivets, with steel washers, .437 of an inch in diameter, driven through the upturned edge to the outer circumference of the case.

The GAS CHECK is a reinforced felt disc, .312 of an inch thick and 4.5 inches in diameter, with a .625 of an inch hole in the center. A sheet steel disc .031 of an inch thick and 4.125 inches in diameter is placed on each side of the felt disc; four rivets, .187x.5 of an inch, are driven through the two plates and the felt to fasten them together. The discs are provided with central holes .875 of an inch in diameter, to receive the Grommett eyelet and washer, through which the cable slides.

The PARACHUTE is made of 16 or 20 gores and one circular center piece of pongee silk, with a developed diameter of 18 feet 8 inches. A cord 60 feet long is fastened securely around the periphery of the parachute to provide a means of attaching the suspension cords. The sixteen suspension cords are 25 feet, 3 inches long; the center cord is 25 feet long and is attached to the four center suspension cords, which are 40 inches long. All the cords, except the four just mentioned, are passed through the holes provided in the spacer (for method of folding parachute, see "Method of Assembly," page 12).

The SPACER is a fibre disc 2.375 inches in diameter and .125 of an inch thick. The center hole is .156 of an inch in diameter, while the sixteen holes, equally spaced about the circumference and .094 of an inch from the edge, are .109 of an inch in diameter.

The CABLE is a length of .125 of an inch twisted wire cable, measuring 35.25 inches, including the loops at each end. The joints of the .875 of an inch loops are twisted and wrapped for a distance of 1 inch and then securely soldered.

The Igniting and Illuminating Elements.

The igniting and illuminating elements consist of the *ILLUMINATING COMPOSITION*, the *FIRST FIRE COMPOSITION*, the *QUICK MATCH* and *PRIMING*, the *EXPELLING CHARGE* and the *FIRING CAP*.

The ILLUMINATING COMPOSITION is made of the following ingredients:

Nitrate of barium	76 parts
Aluminum (100 mesh or finer)	12 parts
Butters' Bronze Aluminum	6 parts
Sulphur	4 parts
Castor oil	2 parts

It is charged into the case under hydraulic pressure to within .5 of an inch of the end of the paper case. To increase the exposed surface, in contact with the first fire composition, several holes .75 of an inch in diameter are drilled in the illuminating composition to a depth of .375 of an inch. The illuminant burns, for not less than seven minutes, with an average candle power of 350,000.

The FIRST FIRE COMPOSITION is placed over the illuminating composition and after being packed closely into the holes described above is charged into the case under a like pressure, to within .1875 of an inch of the edge of the case. It consists of the following mixture, dampened with methylated spirits:

Barium nitrate	4 parts
Saltpetre	3 parts
Sulphur	1 part
Orange shellac	1 part

Three pieces of *QUICK MATCH* in the form of a star are nailed on the first fire composition in the center of the 1-inch hole in the cardboard disc and gunpowder priming is then placed over and around the quick match.

The EXPELLING CHARGE is contained in the cartridge, which is filled with F.F.F.G. grain black rifle powder.

The FIRING CAP consists of a friction composition, which is placed in the retainer to a depth of .078 of an inch.

Method of Assembly.

The wire cable is looped through the staple in the head of the inner case. The free end is inserted through the hole in the gas check; to this loop are tied the strings of the parachute in a single knot, with the free ends projecting about two inches below the knot. These free ends are folded back along the strings and bound to them by a wrapping of strong cord, for a distance of 1.5 inches. The inner case is then inserted in the outside metal case and the wire cable is coiled in place at the head of the inner case. The gas check is placed against the end of the inner

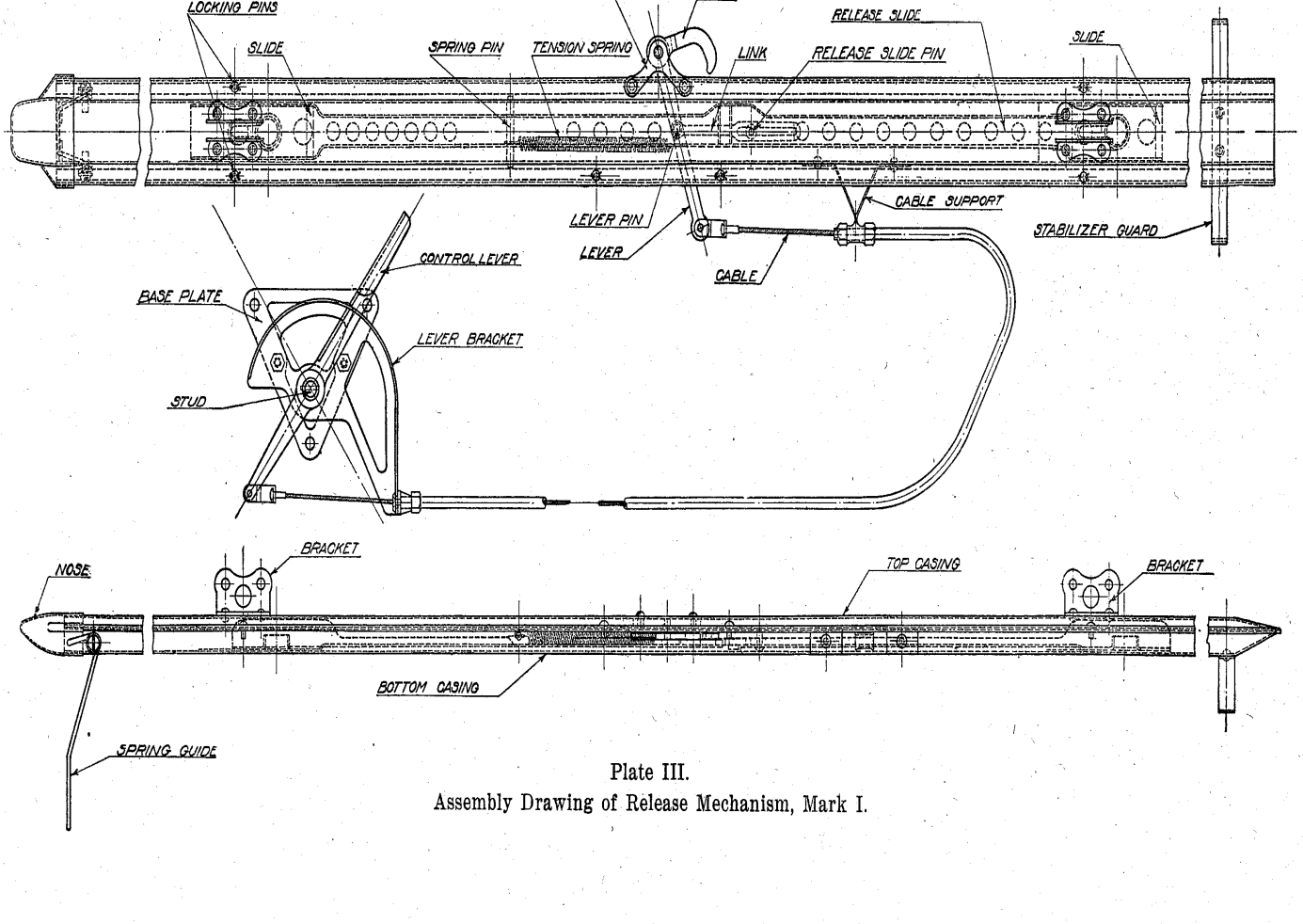


Plate III.
Assembly Drawing of Release Mechanism, Mark I.

case and the folded parachute is inserted in the metal case. In putting on the cap, it is crimped in four places, each crimp being .5 of an inch long and equally spaced about the circumference of the cap.

The method of folding the parachute is as follows:

Method of Folding Parachute for Airplane Flare.

1. Spread out the parachute to its fullest extent, with the cords and spacer on top, on any smooth, flat surface.

2. Holding the parachute firmly at two opposite points on the outer edge, draw all the cords down to one side, until one-half the parachute is superimposed over the other. The parachute is now in the shape of a half circle, with a single fold across its diameter and all the cords extending beyond the circumference.

3. Draw the center cord down until the center of the parachute is turned approximately one-third inside itself.

4. In order to fold smoothly, the parachute must be stretched and all the cords must be held fairly taut to avoid twisting. The parachute should be held manually or secured with clips at five points, viz.: at both points on the outer circumference at the ends of the diametric fold, at the two points along this fold where the center is drawn down and at the spacer or ends of the suspension cords.

5. Begin with the left hand gore and fold over from the right in a bellows fold, making each fold 9 inches wide. Extreme care must be taken that these folds extend up the entire distance from the edge to the center of the parachute and that they form a straight edge at the lower end. This operation should produce a layer of folds just 9 inches wide.

6. While folding, the cords should be carefully watched. If held taut no difficulty will be encountered through their twisting. They should be equally spaced across the width of the folds.

7. Now roll up the parachute, beginning at the top end. Roll very tightly in a cylindrical form, care being exercised that the sides of the folds do not extend beyond the 9-inch length.

8. Gather the strings together about a foot from the edge of the parachute and roll them smoothly around the rolled parachute, from one side to the other. Be sure to keep all the cords straight and untwisted. When about only one foot of the cords remains this length should be secured in some manner to prevent unwinding, until the parachute is placed in the outer case of the flare.

9. The completely folded and rolled parachute should be in the form of a smooth, compact cylinder about 4 inches in diameter and 9 inches in length.

Marking and Packing.

The exterior surface of the flare is painted a bright red and is stenciled in white paint to designate the type of flare, the lot number, the name of the manufacturer and the inspector's initials. Two flares are hermetically sealed in a tin-lined, wooden shipping box, which is similarly marked.

Operation of the Flare.

The split pin and ring are removed from the striker when the flare is placed in the release mechanism. If the release mechanism, Mark I, is used, the prongs of the spring guide are fitted over the flatted portion of the striker. If some other type of mechanism is employed, some means must be provided whereby the propeller may be prevented from turning until the time of release.

After the flare has been released, the turning of the propeller during its fall through the air causes the striker to revolve until the pointed end is driven into the firing cap. At a distance of approximately two hundred feet below the plane the friction composition is thus ignited, which sets off the expelling and igniting charge in the cartridge. The inner case is thereupon expelled from the outer case, driving the parachute ahead of it. The parachute should open up at once and support the illuminant throughout the entire time of burning.

RELEASE MECHANISM, MARK I.

For Aeroplane Flare.

The Release Mechanism, Mark I, has been designed to carry the Aeroplane Flare, Mark I. It consists of the following principal parts: The top and bottom casings, the release slide, the slides, a link, two release lever pins, a spring pin, a release lever fulcrum, a lever, a nose, a bracket, six locking pins and cotters, a tension spring, a cable support, a spring guide and a control lever mechanism. The apparatus is 44.937 inches long and 2.125 inches wide.

The TOP and BOTTOM CASINGS are strips of sheet steel, so shaped as to form a channel for the release slide and operating parts, when they are locked together with their six locking pins and cotters. The top casing is provided with two brackets and bolts, riveted in place, by means of which the release mechanism is secured to the plane. The nose is a shaped cap of sheet steel which is welded over the front end of the bottom casing.

The CABLE SUPPORT is a strip of sheet steel, properly bent and bolted to the bottom case, to act as a guide and support for the cable.

The FULCRUM is a triangular shape of sheet steel, two corners of which are bolted to the top and bottom casing near the center. One end of the lever swings from the third or outer angle of the fulcrum, the other end being connected to the control lever by means of a cable.

The RELEASE SLIDE is a length of sheet steel, so shaped as to fit in the channel of the bottom casing. It is attached to the lever by means of a slotted link, which in turn swings from the center of the lever. A pin, set in the slide, fits the slot in the link in such a manner that the release slide is moved in one direction for release, but is not returned to its original position when the lever is pulled back by the tension spring.

At each end of the release slide a .625 of an inch hole is punched to receive the hanger buttons of the flare. The edges of these holes are flanged to a height of .281 of an inch to bear against the hanger buttons. The upturned edges of the slide are cut away at one place for a distance of 1.625 inches. A pin, inserted through the sides of the cotton casings, impinges on the two shoulders of this groove and thus serves to limit the movement of the release slide. One end of the tension spring is fastened to the pin, while the other is attached to the lever.

The bottom casing has two holes, .75 of an inch in diameter in its surface, properly spaced for the insertion of the hanger buttons. A groove ⅜ of an inch wide is cut from each of these

holes, extending for a distance of .937 of an inch toward the nose. The slides are thin pieces of metal, similarly drilled and slotted, which are welded to the bottom casing, to reinforce it at these points and also to act as bearing surfaces for the release slide. The hanger buttons are inserted in the holes in the bottom casing and the release slide and the flare is pushed forward about 1 inch, carrying the release slide with it. The buttons are now at the narrow end of the slots in the loaded position and the flare remains suspended with the shoulder of each button hanging on its respective slide.

The LEVER is provided with a rounded hook at one end, when the flare is in the trap and the release slide is in the loaded position, the end of this hook engages a projection on the release slide in such a manner that the latter cannot be moved until the lever is pulled.

The STABILIZER GUARD is a flat piece of sheet metal, so shaped that its two ends fit between the stabilizers when the flare is in the trap. It is bolted to the bottom casing and acts as a rear support for the flare.

The SPRING GUIDE is a fork of steel wire, the ends of which are bent and fastened to the casings by means of two screws, The wire is bent in the center to form two prongs which fit over the flatted surfaces of the striker and thus prevent it from revolving before release from the plane.

A CONTROL MECHANISM is provided which consists of a base plate, lever bracket and lever, with the necessary washers, studs, etc. The base plate is fastened in a convenient position in the fuselage, a length of cable is attached to the lever and passed through the cable support to the end of the lever on the release mechanism.

To Load.

Pull the operating lever to full firing position and return to its normal position. Place the flare in the trap by inserting the hanger button in their respective holes, at the same time making certain that the prongs of the spring guide are fitted over the flatted portion of the striker. Now slide the flare forward into loaded position until the hanger buttons are at the bottom of the narrow grooves in the bottom casing. This may be tested by attempting to slide the flare back, if in the correct position it cannot be moved without pulling the release lever.

Remove the cotter pin from the striker of the flare.