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HANDBOOK OF THE BARLOW HEAVY DROP BOMB AND RELEASE MECHANISM

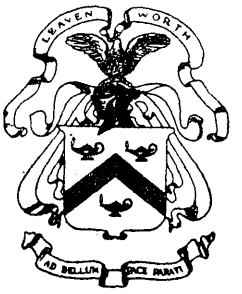
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General.

WAR DEPARTMENT,
WASHINGTON, *January 28, 1918.*

The following pamphlet entitled "Handbook of the Barlow Heavy Drop Bomb and Release Mechanism" is published for the information of all concerned.

[A. G. O. 062.1.]

BY ORDER OF THE SECRETARY OF WAR:

JOHN BIDDLE,
Major General, Acting Chief of Staff.

OFFICIAL:

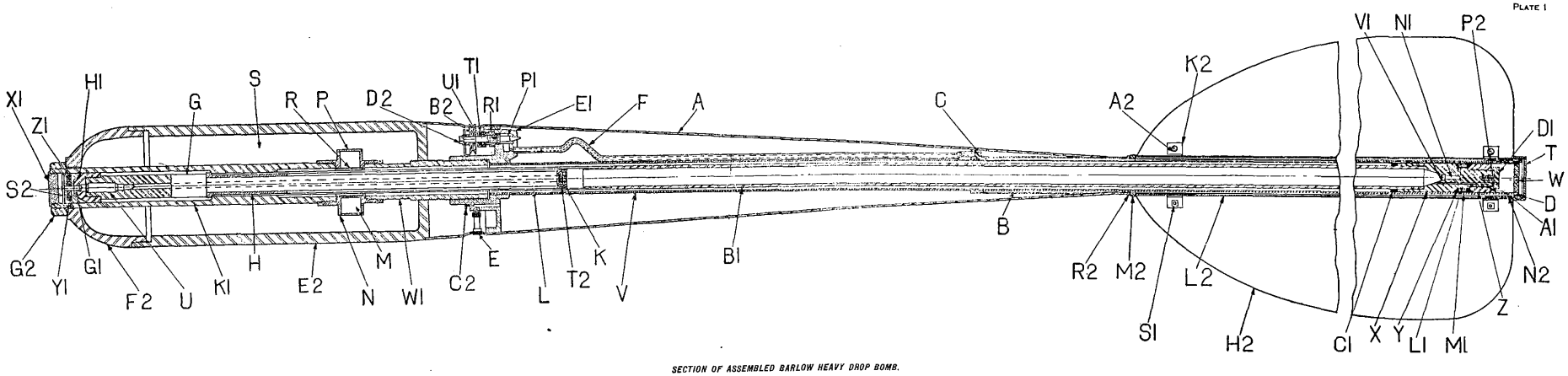
H. P. McCAIN,
The Adjutant General.

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PLATE I



SECTION OF ASSEMBLED BARLOW HEAVY DROP BOMB.

NOMENCLATURE.

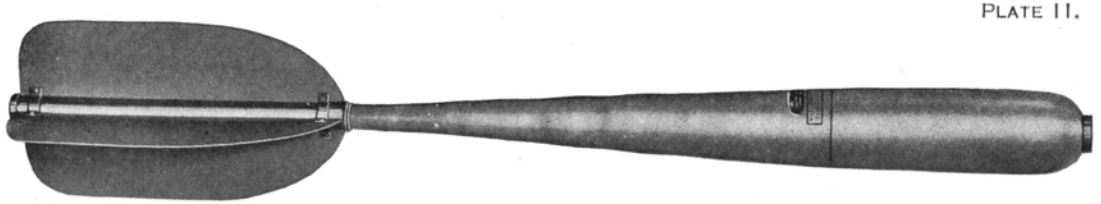
Symbol.	Quantity.	Name.	Material.	Location and purpose.
A	1	Air chamber	Steel	Fastened to rear end of shell (E2). Contains compressed air.
B	1	Air chamber tube	Brass	Fits over rear end of central tube (V). Supports stabilizer tube (L2).
C	1	Air chamber tube base	Cast brass	Soldered to front end of air chamber tube (B). Connects it to air tube (F).
D	1	Air chamber tube closing piece	Brass	Fits over rear end of central tube (W) and inside air chamber tube (B).
E	1	Air tank valve	Steel	Screws into diaphragm (E1). Admits air to chamber (A).
F	1	Air tube	Copper	Conducts compressed air from diaphragm (E1) to air chamber tube base (C).
G	1	Barrel	Rifle steel	Fits inside front stem (K1) and barrel tube (L). Carries firing mechanism.
H	1	Barrel bushing and stop	Brass	Screws into front end of barrel tube (L). Supports barrel (G).
K	1	Barrel nut	Steel	Screws into rear end of barrel (G). Carries packing (T2) and guides forward movement of barrel (G).
L	1	Barrel tube	Brass	Front extension of denotator tube (B1). Carries barrel bushing (H) at its front end.
M	1	Booster charge	T. N. T	Fills booster cup (N). Detonates bursting charge (S).
N	1	Booster cup	Brass	Between front (K1) and rear (W1) stems. Carries booster charge (M).
P	1	Booster cup sleeve	Steel	Fits over booster cup (N), holding booster charge (M) in place.
R	1	Booster cup tube	Brass	Fits inside booster cup (N), holding booster charge (M) in place.
S	1	Bursting charge	High explosive	Fills shell (E2). Bursts it upon exploding.
T	1	Cap	Brass	Fits over rear end of stabilizer tube (L2).
U	1	Cartridge .30 caliber		Fits into chamber in front end of barrel (G). Is discharged on contact, the bullet igniting priming cap (V1).
V	1	Central tube	Brass	Stationary tube, running from diaphragm (E1) to rear of bomb. Acts as interior wall of air chamber (A).
W	1	Central tube plug	do	Screws into rear end of central tube (W). Prevents too rapid movement of detonator (X).
X	1	Detonator	Cold-rolled steel	Screws onto rear end of detonator tube (B1). Carries detonator parts.
Y	2	Detonator chamfered washers	Hard rubber	Fit around detonator (X) on each side of fulminate casing (M1).
Z	1	Detonator nut	Cold-rolled steel	Screws onto end of detonator (X) holding fulminate casing (M) in place.
A1	1	Detonator stud washer	Leather	Fitted between detonator washer stud (D1) and detonator nut (Z).
B1	1	Detonator tube	Steel	Slides inside of central tube (V). Carries detonator (X) into booster cup (N).
C1	1	Detonator tube washer	Rubber	Fits around detonator tube (B1) against front end of detonator (X).
D1	1	Detonator washer stud	Cold-rolled steel	Screws over end of detonator (X).
E1	1	Diaphragm	Cast brass	Screws over rear stem (W1). Acts as front wall of air chamber (A) and carries the valves.
F1	1	Dummy detonator	Wood	Fits into space for detonator while bomb is being transported. Protects threads.
G1	1	Firing pin	Steel	Fits into firing-pin holder (H1). Fires cartridge (U).
H1	1	Firing-pin holder	do	Screws onto front end of barrel (G).
K1	1	Front stem	do	Fits through shell cap (F2) screwing into booster cup (N). Supports barrel (G).
L1	1	Fulminate charge	Fulminate of mercury	Contained in fulminate casing (M1). Detonates booster charge (M).
M1	1	Fulminate casing	Copper	Fits around detonator (X). Contains fulminate (L1).
N1	1	Guncotton train	Dry guncotton	Contained in detonator (X). Explodes fulminate (L1).
P1	1	Needle	Brass	Fits into diaphragm (E1). Part of release valve mechanism.
R1	1	Needle guide	do	Fits into diaphragm (E1) and around needle (P1). Part of release-valve mechanism.
S1	8	Nuts	Steel	Fasten screws (A2) in place on stabilizers.
T1		Packing	Packing	Inside packing nut (U1) around needle (P1) prevents air from escaping.
U1	1	Packing nut	Brass	Screws over end of needle guide (R1).
V1	1	Priming cap	Fulminate of mercury	Contained in detonator (X). Lights guncotton train (N1).
W1	1	Rear stem	Steel	Screws into rear end of booster cup (N) and diaphragm (E1). Connects shell (E) to air chamber (A).
X1	1	Safety cap	Brass	Screws into front end of front stem (K1). Prevents forward movement of extrusion mechanism.
Y1	2	Safety plugs	Steel	Fits between striking plug (S2) and firing pin holder (H1). Prevents premature explosion of cartridge (U).
Z1	2	Safety plug springs	Music wire	Fastened to safety plugs (Y1). Being compressed against firing pin (G1), force plugs off when moved out of front stem (K1).
A2	8	Screws	Steel	Fasten stabilizers (H2) to the stabilizer supports (K2).
B2	1	Sheave	do	Fits on sheave guide (C2). Operates needle (P1).
C2	1	Sheave guide	do	Fits around shoulder of diaphragm (E1) and supports sheave (B2).
D2	1	Sheave nut	Iron	Screws over end of needle (P1) fastening it to sheave (B2).
E2	1	Shell	Cast steel	Attached to front end of air chamber (A), containing bursting charge (S) and entire booster assembly.
F2	1	Shell cap	Brass	Screws into front end of shell (E2). Is front wall of it.
G2	1	Shell cap nut	Steel	Screws against front of shell cap, over front stem (K1) supporting latter in place.
H2	4	Stabilizers	Aluminum	Fastened to stabilizer supports (K2). Steady flight of bomb.
K2	8	Stabilizer supports	Brass	Fasten stabilizers (H2) to stabilizer tube (L2).
L2	1	Stabilizer tube	do	Fits over rear end of central tube (V). Carries stabilizers.
M2	1	Stabilizer tube bushing	do	Screws into front end of stabilizer tube (L2) and fits over air chamber tube (B).
N2	1	Stabilizer tube stop	do	Fits over rear end of air chamber tube (B). Limits rearward movement of stabilizer tube (L2).
P2	1	Stabilizer tube washer	Rubber	Fits over air chamber tube (B) and against front end of stop (N2).
R2	1	Stop ring	Brass	Fits over air chamber tube (B) against rear end of air chamber (A). Limits forward movement of stabilizer tube (L2).
S2	1	Striking plug	Steel	Attached to end of firing pin (G1). On contact, actuates firing pin.
T2	1	Packing	Packing	Held in groove of barrel nut (K). Prevents escape of air through barrel tube (G).

NOMENCLATURE OF THE TRAP.

Symbol.	Quantity.	Name.	Material.	Location and purpose.
A3	1	Chain	Steel	Fastens cotter pin (B3) to the frame (D3).
B3	1	Cotter pin	do	Fits across front of frame (D3). Prevents forward movement of front extrusion mechanism during flight.
C3	1	do	do	Fits through end of safety pin (A4), securing it to frame (D3).
D3	1	Frame	do	Main part of trap.
E3	1	Frame rivet	do	Fastens spacer between front walls of frame (D3).
F3	1	Frame spacer	do	Holds front walls of frame (D3) rigid.
G3	1	Frame stiffener	Wood	Fits inside central portion of frame (D3), reinforcing it.
H3	8	Frame-stiffener rivets	Steel	Fasten frame stiffener (G3), front yoke truss (P3), and rear yoke truss (V3) to frame (D3).
K3	2	Front trap suspensions	do	Riveted to frame (D3). Aid in securing trap to the airplane.
L3	2	Front trap-suspension rivets	do	Fasten front trap suspensions (K3) to frame (D3).
M3	2	Front yokes	do	Fastened to front yoke truss (P3). Hold bomb rigid.
N3	6	Front yoke rivets	do	Fasten front yokes (M3) to front yoke truss (P3).
P3	1	Front yoke truss	do	Riveted to frame (D3). Supports front yokes (M3).
R3	2	Rear trap suspensions	do	Riveted to frame (D3). Aid in securing trap to airplane.
S3	2	Rear trap-suspension rivets	do	Fasten rear trap suspensions (R3) to frame (D3).
T3	2	Rear yokes	do	Riveted to rear yoke truss (V3). Hold bomb rigid.
U3	6	Rear yoke rivets	do	Fasten rear yokes (T3) to rear yoke truss (V3).
V3	1	Rear yoke truss	do	Riveted to frame (D3). Supports rear yokes (T3).
W3	1	Release wire guide	Brass	Fastened to bracket (X3). Supports release wire.
X3	1	Release wire-guide bracket	Steel	Riveted to frame (D3). Supports release wire guide (W3).
Y3	2	Release wire-guide bracket rivets	do	Fasten release cord guide (W3) to release wire-guide bracket (X3).
Z3	2	Rings	do	Fasten ends of chain (A3) to cotter pin (B3) and frame.
A4	1	Saddle	Wood	Fits into strap hanger (G4). Supports bomb and distributes strain of strap hangers.
B4	1	Safety pin	Cold-rolled steel	Fits through safety-pin bracket (C4). Carries ring (E4).
C4	1	Safety-pin bracket	Steel	Riveted to frame (D3). Holds safety pin (A4) in place.
D4	4	Safety-pin bracket rivets	do	Fasten bracket (C4) to frame (D3).
E4	1	Safety-pin ring	do	Fastened to safety pin (B4). Attaches cord from sheave (B2) to trap.
F4	4	Stay eyelets	Cold-rolled steel	Fastened to trusses (P3 and V3). Aid in securing trap to airplane.
G4	1	Strap hanger	Leather	Fastened to bolts (H4 and M4). Supports saddle (A4) and bomb.
H4	1	Strap-hanger adjusting bolt	Steel	Fastens strap hanger (G4) to bracket (K4).
K4	1	Strap-hanger bracket	do	Riveted to frame (D3). Supports bolts (H4 and M4).
L4	6	Strap-hanger rivets	Copper	Fasten strap-hanger adjusting bolt (H4) and strap-hanger slip bolt (M4) to strap hanger (G4).
M4	1	Strap-hanger slip bolt	Steel	Fastens strap hanger (G4) to bracket (K4).
N4	1	Tail rod	do	Riveted to rear end of frame (D3). Prevents rearward movement of stabilizer tube (L2) during flight.
P4	2	Tail-rod rivets	do	Fasten tail rod (N4) to frame (D3).
R4	6	Washers	Copper	Fit over rivets (L4) against strap hanger (G4).
S4	1	Adjusting nut	Steel	Screws onto strap-hanger adjusting bolt (H4).
T4	1	Split pin	do	Fits through end of strap-hanger slip bolt (M4).
U4	1	Lock nut	do	Screws onto strap-hanger adjusting bolt (H4), locking nut (S4) in place.

GROUPINGS.

- Barlow heavy drop bomb
  - (a) The body
    - Safety cap (X1).
    - Shell cap nut (G2).
    - Shell cap (F2).
    - Shell (E2).
    - Front stem (K1).
    - Booster cup (N).
    - Booster cup tube (R).
    - Booster cup sleeve (P).
    - Rear stem (W1).
    - Diaphragm (E1).
    - Air chamber (A).
    - Air chamber tube base (C).
    - Air chamber tube (B).
    - Air chamber closing piece (D).
    - Air tube (F).
    - Central tube (V).
    - Central tube plug (W).
    - Stop ring (R2).
  - (b) The extrusion mechanisms
    - (1) The forward extrusion mechanism
      - Barrel (G).
      - Barrel bushing and stop (H).
      - Barrel tube (L).
      - Barrel nut (K).
      - Packing (T1).
      - Detonator tube (B1).
      - Detonator tube washer (C1).
    - (2) The rear extrusion mechanism
      - Stabilizer tube (L2).
      - Stabilizer tube bushing (M2).
      - Stabilizer tube stop (N2).
      - Stabilizer tube washer (P2).
      - Cap (T).
      - Stabilizer supports (K2).
      - Nuts (S1).
      - Screws (A2).
      - Stabilizer (H2).
    - (3) The operating or compressed-air mechanism
      - Air tank valve (E). (Intake.)
      - Release valve.
        - Needle (P1)
        - Needle guide (R1)
        - Packing (T1)
        - Packing nut (U1)
      - Sheave (B2).
      - Sheave guide (C2).
      - Sheave nut (D2).
  - (c) The firing mechanism and explosive features.
    - Striking plug (S2).
    - Firing pin (G1).
    - Firing pin holder (H1).
    - Safety plugs (Y1).
    - Safety plug springs (Z1).
    - Detonator (X).
    - Detonator chamfered washers (Y).
    - Fulminate casing (M1).
    - Detonator nut (Z).
    - Detonator washer stud (D1).
    - Detonator stud washer (A1).
    - Cartridge (U).
    - Priming cap (V1).
    - Guncotton (N1).
    - Fulminate charge (L1).
    - Booster charge (M).
    - Bursting charge (S).



Barlow heavy drop bomb, in "safe" position.

BARLOW HEAVY DROP BOMB.

DESCRIPTION OF THE BOMB.

The Barlow heavy drop bomb is a fragmentation bomb, to be used against personnel, and is not to be confused with the demolition or incendiary types.

This bomb is designed primarily for use against troops in the field or on the march, particularly when they are in massed formation; against railroad depots or trains; against personnel located in encampments, cantonments, or rest billets, where the protection afforded is of the frailest sort; and, as the bomb will explode above water as well as above the ground, against landing parties or small boats.

The high efficiency of the bomb is secured by mechanically causing explosion when the explosive head is between 4 and 5 feet from the ground. Thus, none of the energy of the detonation is lost or muffled by being buried in the earth; on the contrary, the entire force of the explosion is expended in the dispersion of fragments.

The bomb has a diameter of 6 inches; its length is 80 inches when in the normal or safe position, with a length of approximately 15 feet when in the extended or firing position. The approximate weight of the bomb is 95 pounds, of which 12 pounds represents the weight of the explosive materials and 83 pounds the weight of the container.

The major parts of the bombs are:

(*a*) The body.
(*b*) The extrusion mechanisms.
(*c*) The firing mechanism and explosive features.

(a) THE BODY.

The body consists of the safety cap (X1), the shell cap nut (G2), the shell cap (F2), the shell (E2), the front stem (K1), the booster cup (N), the booster cup tube (R), the booster cup

sleeve (P), the rear stem (W1), the diaphragm (E1), the air chamber (A), the air chamber tube base (C), the air chamber tube (B), the air chamber closing piece (D), the air tube (F), the central tube (V), the central tube plug (W), the stop ring (R2).

The safety cap (X1), designed to prevent the front extrusion mechanism from operating, is a brass cylinder $\frac{3}{8}$ of an inch high, with a maximum diameter of $1\frac{1}{4}$ inches. The outer surface is threaded to a diameter of 1.58 inches for a distance of $\frac{3}{16}$ of an inch from one end to screw into the front stem (K1). A slot $\frac{3}{32}$ of an inch wide and $\frac{5}{32}$ of an inch deep is cut in the other end to provide a grip for a key or screw driver.

The shell cap nut (G2) is a hollow steel cylinder $\frac{3}{4}$ of an inch long, with an outside diameter of $2\frac{5}{8}$ inches and an inside diameter of 1.91 inches. The inner surface is threaded to screw over the front stem (K1). Four quarter-inch holes are drilled in the outer surface to a depth of $\frac{1}{4}$ of an inch to provide a grip for a wrench.

The shell cap (F2), designed to cover the front end of the shell (E2), is a cup-shaped piece of steel with a height of $3\frac{7}{8}$ inches and a base with a diameter of 6 inches. The walls vary in thickness from $\frac{1}{2}$ of an inch at the base to $\frac{3}{4}$ of an inch at the top. The outer surface is threaded for a distance of $\frac{3}{4}$ of an inch from the base to a diameter of 5.629 inches to screw into the shell (E2). The top is traversed by a hole $1\frac{15}{16}$ inches in diameter to receive the front stem (K1). A quarter-inch hole is drilled in the outer surface to a depth of $\frac{5}{16}$ of an inch to provide a grip for a wrench.

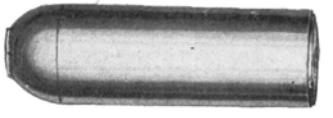
The shell (E2), which contains the bursting charge (S), is a hollow steel cup, open at one end, $14\frac{3}{8}$ inches long, with an outside diameter of 6 inches and walls $\frac{1}{2}$ inch thick. The open end is threaded to a diameter of 5.633 inches for a depth of 1 inch to receive the shell cap (F2). The base is drilled and tapped to a diameter of 1.91 inches to receive the rear stem (W1).

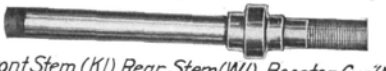
The front stem (K1), which fits inside the shell (E2), is a hollow steel cylinder 14.2 inches long, with walls 0.2 of an inch thick and an inside diameter of $1\frac{1}{2}$ inches, except at a distance of 8 inches from the front end, where, for a distance of 3.32 inches, the inside diameter is 1.13 inches, leaving a shoulder for the barrel bushing (H). The outer surface is threaded for a distance of 1 inch from the front end to receive the shell



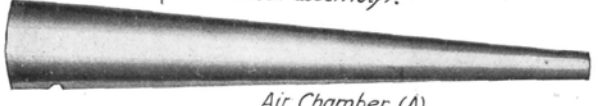
Barlow heavy drop bomb, extended in firing position.

Shell (E2) and Shell Cap (F2).





Front Stem (K1), Rear Stem (W1), Booster Cup (N), Sleeve (P). (Comprises booster assembly).



Air Chamber (A).



Central Tube (V), removed from air chamber (A), showing Air Tube (E), connecting Diaphragm (E1), at left to Air Chamber Tube (B), at right.

cap nut (G2), and for a distance of 1 inch from the rear end to screw into the booster cup (N). The inner surface is threaded for a distance of $\frac{3}{8}$ of an inch to receive the safety cap (X1).

The booster cup (N), which contains the booster charge (M), is a hollow brass cylinder $3\frac{1}{4}$ inches long, cast to three different outside diameters. The front end is 2.18 inches in diameter, the rear end 2.025 inches, and the middle 3.275 inches. The inner surface is threaded to a diameter of 1.91 inches for a distance of 0.925 inch from the front end to receive the front stem (K1) and to a diameter of 1.91 inches for a distance of 0.925 inch from the rear end to receive the rear stem (W1). The remainder of the inner surface is bored 1.485 inches in diameter to receive the booster cup tube (R). The outer surface of the middle portion of the cup is machined to a diameter of 3.15 inches for a distance of $1\frac{1}{8}$ inches from the front end to receive the booster cup sleeve (P). Four recesses are cast in this portion to receive the booster charge (M).

The booster cup tube (R), of brass, is 1.4 inches long with an outside diameter of 1.48 inches and an inside diameter of 1.42 inches. It is designed to fit inside the booster cup and aid in retaining the booster charge (M) in position.

The booster cup sleeve (P) is a piece of steel tubing $1\frac{1}{8}$ inches long, with an outside diameter of 3.281 inches and an inside diameter of 3.15 inches, and is designed to fit over the middle portion of the booster cup (N) and aid in retaining the booster charge (M) in position.

The rear stem (W1), which acts as a guide for the front extrusion mechanism, is a hollow steel cylinder $6\frac{1}{8}$ inches long with an inside diameter of 1.42 inches and a maximum outside diameter of 1.91 inches. For a distance of 0.15 of an inch from one end the outer surface is turned down to a diameter of 1.9 inches. This part of the stem is traversed by two slots $\frac{1}{8}$ of an inch wide to provide a grip for a tool. The outer surface of the stem is threaded for a distance of $3\frac{5}{8}$ inches from the rear end to screw through the rear end of the shell (E2) and into the diaphragm (E1). In like manner the front end is threaded to a diameter of $1\frac{7}{8}$ inches for a distance of 1 inch to screw into the booster cup (N).

The diaphragm (E1), which closes the front end of the air chamber (A) and contains the air valves, is an irregular-shaped brass casting in the form of a hollow cylinder with a cup around

it. Its maximum dimensions are a length of 3.4 inches and diameter 5.329 inches. The cylindrical portion is cast hollow to permit the passage of the barrel tube (L). This portion is threaded to a diameter of 1.91 inches to a depth of 1.85 inches from the front end to receive the rear stem (W1). A hole is pipe tapped in the outer surface of this portion to receive the air-tank valve (E). An 0.152-inch hole is drilled from the rear surface to meet the pipe-tapped hole, thus forming a passage to the air chamber. The cup portion is recessed to receive the needle guide (R1), the needle (P1), and the air tube (F).

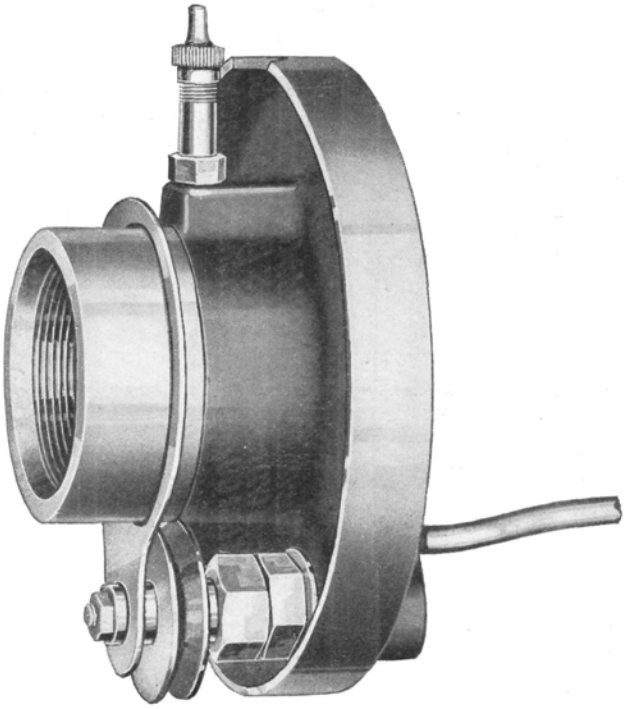
The air chamber (A), designed to act as a compressed air container, is a piece of sheet steel in the shape of a hollow truncated cone 35 inches high, with a base 5.8 inches in diameter, which tapers to a diameter of 1.755 inches at the top. The walls of the chamber are $\frac{1}{16}$ of an inch thick. The top of the chamber is soldered to the air chamber tube (B). The diaphragm (E1) is inserted in the bottom of the cone and, at a distance of 3 inches from the base, is soldered to the inner wall of the air chamber (A), thus acting as the base of the compressed air container. At a distance of $2\frac{7}{16}$ inches from the lower edge an oval recess 3 inches long and $1\frac{1}{8}$ inches wide traverses one wall to provide for the sheave (B2) and operating cord. Opposite this recess, at a distance of 2.55 inches from the base, is a hole $1\frac{1}{2}$ inches in diameter to provide a space for the air tank valve (E).

The air chamber tube base (C), which directs the passage of air to the rear, is a hollow brass cylinder $\frac{3}{4}$ of an inch long with an inside diameter of 1.505 inches and an outside diameter of 1.8 inches. It is machined to a diameter of 1.655 inches for a distance of 0.25 of an inch from one end to fit into the air chamber tube (B) to which it is soldered. A lug projects 0.32 of an inch from one side; a hole is drilled into the lug to receive the air tube (F).

The air chamber tube (B) which conducts the air from the base (C) to the rear of the bomb, is a hollow brass cylinder $33\frac{1}{4}$ inches long with an outside diameter of $1\frac{3}{4}$ inches and an inside diameter of 1.66 inches. One end is soldered to the air chamber tube base (C) and the other fits into the stabilizer tube stop (N2).

The air chamber tube closing piece (D), designed to maintain the tube (B) in its proper relative position, is a split brass ring $\frac{1}{4}$ of an inch wide with an outside diameter of 1.658 inches and an

PLATE V.



*Diaphragm (**E1**) showing air tank valve (**E**) above, and release valve parts and sheave (**B2**) below.*



Firing Pin Holder (H1) removed from barrel tube, with Safety Plugs (Y1) in position around Firing Pin (G1).







Barrel Tube (G) with Firing Pin Holder (H1) attached and Safety Plugs (Y1) removed. Barrel Bushing and Stop (H) and Barrel Nut (K) are shown on the opposite end of the tube.



Detonator Tube (B1) with loaded detonator attached.

inside diameter of 1½ inches. The piece fits over the end of the central tube (V) and inside the air chamber tube (B).

The air tube (F), designed to conduct the air from the diaphragm (E1) to the air chamber tube case (C), is a piece of copper tubing 23 inches long with an outside diameter of ¼ of an inch and walls $\frac{1}{32}$ of an inch thick. One end of the tube fits into a recess in the diaphragm (E1) and in the air chamber tube case (C).

The central tube (V), designed to aid in guiding the front extrusion mechanism, is of brass, 57½ inches long with an outside diameter of 1½ inches and an inside diameter of 1.42 inches. The rear end is tapped to a diameter of 1.445 inches for a distance of ⅜ of an inch to receive the central tube plug (W). The front end of the tube fits into the diaphragm (E1).

The central tube plug (W), which prevents too rapid operation of the front extrusion mechanism, is a brass cylinder 1.445 inches in diameter and ¼ of an inch thick. The outer surface is threaded to screw into the rear end of the central tube (V). A $\frac{1}{16}$-inch hole is drilled through the center to provide a passage for the compressed air. Two holes $\frac{5}{32}$ of an inch in diameter are drilled in one end of the plug to a depth of ¼ of an inch to provide a grip for a wrench.

The stop ring (R2), designed to prevent leakage from the air chamber (A), is of brass ⅛ of an inch thick, with an outside diameter of 2 inches and an inside diameter of 1¾ inches. It fits over the air chamber tube (B) against the small end of the air chamber (A) and is soldered in place.

(b) THE EXTRUSION MECHANISMS.

The extrusion mechanisms may be subdivided into:

(1) The forward extrusion mechanism.
(2) The rear extrusion mechanism.
(3) The operating or compressed air mechanism.

The last supplies the motive power for the first two.

(1) The forward extrusion mechanism consists of part of the firing mechanism (described on page 15), the barrel (G), the barrel bushing and stop (H), the barrel tube (L), the barrel nut (K), the packing (T1), the detonator tube (B1), and the detonator tube washer (C1).

The barrel, designed to carry the firing mechanism, is a cylinder of barrel steel, 24 inches long and 1.14 at its largest diameter.

The forward end is turned to a diameter of 1.062 and threaded (16 threads per inch special form) for a distance of 0.6 of an inch to receive the firing pin holder. A shoulder 0.1 of an inch wide just above the threaded portion is turned to a diameter of 0.984 inch; a recess 0.05 of an inch wide of the same diameter is cut just below the threaded portion. The bore at the forward end is enlarged to receive a standard .30 caliber service cartridge, so that the base of the cartridge case is held flush with the base of the chamber.

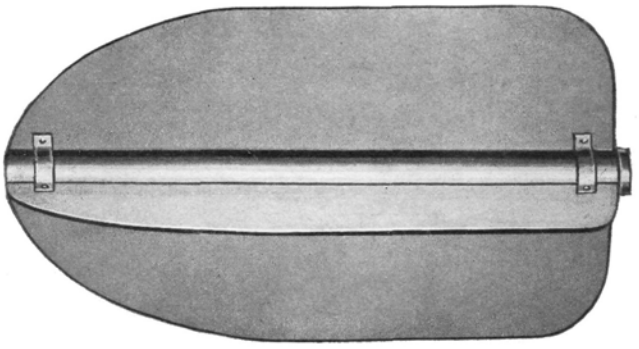
The barrel bushing and stop (H), which maintains the barrel (G) in its proper relative position, is a hollow brass cylinder 4 inches long, with an inside diameter of $\frac{7}{8}$ of an inch and a maximum outside diameter of 1.2 inches. At a distance of $\frac{1}{4}$ of an inch from the front end the outer surface is threaded to a diameter of 1.035 inches for a distance of $\frac{1}{2}$ of an inch to screw into the barrel tube (L). For a distance of $3\frac{1}{4}$ inches from the rear end the outer surface is machined to a diameter of 1 inch to fit inside the barrel tube. A 0.101-inch hole is drilled in the outer surface at a distance of $\frac{1}{8}$ of an inch from the front end to provide a grip for a wrench.

The barrel tube (L), which connects the barrel (G) and the detonator tube (B1), is of brass, 20 inches long, with an inside diameter of 1 inch and an outside diameter of $1\frac{1}{8}$ inches. It is counterbored to a diameter of 1.035 inches for a distance of 1.56 inches from the rear end to receive the detonator tube (B1). The front end is tapped to a diameter of 1.035 inches for a distance of 0.6 of an inch to receive the barrel bushing (H).

The barrel nut (K), designed to maintain the rear end of the barrel (G) in position, is a hollow steel cylinder $\frac{1}{2}$ of an inch long with an outside diameter of 0.96 of an inch and an inside diameter of $\frac{5}{8}$ of an inch. The inner surface is threaded to screw over the end of the barrel. A groove 0.3 of an inch wide and 0.06 of an inch deep is cut around the outer surface to provide space for the packing (T1). Two 0.101-inch holes are drilled in one end to a depth of 0.06 of an inch to provide a grip for a wrench.

The detonator tube (B1), which connects the detonator (X) to the barrel tube (L), is of steel, 48.15 inches long with an inside diameter of $\frac{15}{16}$ of an inch and an outside diameter of $1\frac{1}{8}$ inches. The outer surface is turned down to a diameter of 1.035 inches for a distance of $1\frac{1}{2}$ inches from one end to fit into the barrel tube (L), and is threaded for a distance of 0.6 of an inch from the other end to screw into the detonator (X).

PLATE VII.



Stabilizer tube (L2) with stabilizers (H2) attached. (Comprises stabilizer assembly.)

The detonator tube washer (C1) is a rubber ring designed to cushion the stopping of the detonator (X) against the front stem (K1), which is fitted over the detonator tube (B1) and bears against the front end of the detonator (X).

(2) The rear extrusion mechanism consists of the stabilizer tube (L2), the stabilizer tube bushing (M2), the stabilizer tube stop (N2), the stabilizer tube washer (P1), the cap (T), the stabilizer supports (K2), the nuts (S1), the screws (A2), and the stabilizers (H2).

The stabilizer tube (L2), which carries the stabilizers (H2), is of brass, 25.6 inches long with an inside diameter of 1.92 inches and an outside diameter of 2 inches. It is tapped to a diameter of 1.95 inches for a distance of 0.6 of an inch from one end to receive the stabilizer tube bushing (M2).

The stabilizer tube bushing (M2), designed to prevent air from escaping from the front end of the stabilizer tube (L2), is a hollow brass cylinder $\frac{3}{4}$ of an inch long, with an inside diameter of 1.755 inches and a maximum outside diameter of 2.1 inches. It is threaded to a diameter of 1.95 inches for a distance of $\frac{1}{2}$ of an inch from one end to screw into the stabilizer tube (L2). A hole 0.101 of an inch in diameter is drilled to a depth of 0.1 of an inch at a distance of $\frac{1}{8}$ of an inch from the other end to provide a grip for a wrench.

The stabilizer tube stop (N2), designed to stop the rear extrusion mechanism when it has reached the extended position, is a hollow brass cylinder $1\frac{1}{2}$ inches long with an inside diameter of 1.755 inches and an outside diameter of 1.915 inches. It fits over the rear end of the air chamber tube (B) and is soldered to it. The rubber stabilizer tube washer (P2) is fitted over the end of the air chamber tube against the stabilizer tube stop (N2).

The cap (T) is a brass cap $\frac{9}{16}$ of an inch high with an outside diameter of $2\frac{1}{8}$ inches and walls and base $\frac{1}{12}$ of an inch thick. It closes the rear end of the stabilizer tube (L2) and is soldered to it.

The stabilizer supports (K2), which are part of the device which fasten the stabilizers (H2) to the stabilizer tube (L2), are strips of brass $2\frac{5}{8}$ inches long, $\frac{3}{4}$ of an inch wide, and 0.04 of an inch thick. There are two sets made up of four in each set. They are suitably bent at the center to fit one-quarter of the way around the stabilizer tube, and at the same time allow each end to project outward to a distance of 0.6 of an inch. These projections are traversed by a hole 0.19 of an inch in

diameter to receive the screws (A2), which, with the nuts (S1), secure the stabilizers (H2) to the supports.

The stabilizers (H2), designed to steady the flight of the bomb, are irregular-shaped pieces of sheet aluminum 25 inches long, with a maximum width of 6 inches and a thickness of 0.05 of an inch. The edge which fits next to the stabilizer tube (L2) is straight and the outer edge curved. Two holes are drilled through each stabilizer at a distance of 0.35 of an inch from the straight edge, to receive the screws (A2) which secure the stabilizers to the supports (K2).

(3) The compressed air mechanism consists of the air tank valve (E), the needle guide (R1), the needle (P1), the packing (T1), the packing nut (U1), the sheave (B2), the sheave guide (C2), the sheave nut (D2).

The air tank valve (E), through which air is pumped into the air chamber (A), is a Schrader standard air valve. It screws into the recess in the side of the diaphragm (E1).

The needle guide (R1) is a hollow brass cylinder 0.9 of an inch long, with a minimum inside diameter of 0.285 inch. A quarter of an inch from one end a hexagon is cut with a short diameter of $\frac{3}{4}$ of an inch and a width of 0.3 of an inch to provide a grip for a wrench. The outer surface is threaded for a diameter of 0.6 of an inch for a distance of 0.2 of an inch from this end to screw into the diaphragm (E1), and for a distance of 0.3 of an inch from the other end to receive the packing nut (U1). The inner surface is tapped to a diameter of $\frac{3}{8}$ of an inch for a distance of $\frac{3}{4}$ of an inch from the rear end to receive the needle (P1).

The needle (P1), which controls the flow of air from the air chamber (A) to the air chamber tube (B), is a brass cylinder 3 inches long with a maximum diameter of $\frac{3}{8}$ of an inch. One end is 0.2 of an inch in diameter and tapers to a diameter of 0.28 of an inch at a distance of 1.2 of an inch from this end to close the recess in the diaphragm (E1). The central portion of the needle is threaded to receive the needle guide. The other end is threaded for a distance of 0.2 of an inch to receive the sheave nut (D2). The needle is square for a distance of 0.6 of an inch from this threaded portion to fit into the sheave and thus rotate with it.

The packing nut (U1), which fastens the needle in position, is a hexagonal piece of steel 0.45 of an inch long, the short diameter of the hexagon being $\frac{3}{4}$ of an inch. It is drilled

and tapped to a diameter of 0.6 of an inch for a distance of 0.2 of an inch to screw over the needle guide (R1). It is drilled to a diameter of 0.535 of an inch for a distance of 0.2 of an inch from the threading to provide for the packing (T1). It is drilled to a diameter of 0.285 of an inch for the remainder of its length to permit the passage of the needle (P1).

The sheave (B2), which operates the needle (P1), is a steel cylinder $1\frac{1}{2}$ inches in diameter and 0.65 of an inch long. A lug $\frac{1}{2}$ of an inch in diameter projecting from one face to a distance of 0.35 of an inch fits into a hole in the sheave guide (C2). The center of the sheave is traversed by a square hole to receive the needle (P1). A V-shaped groove is cut in the surface of the cylinder to provide for the operating cord. In this groove six 0.063-inch holes, equally spaced around the sheave, are drilled radially to permit the insertion of the split pin attached to the release cord.

The sheave guide (C2), which maintains the sheave (B2) in position, is a hollow steel cylinder $\frac{1}{4}$ of an inch high, with an inside diameter of 2.405 inches and walls $\frac{1}{16}$ of an inch thick. The bottom is flared out to a diameter of 2.9 inches. A lug projects $1\frac{1}{4}$ inches from one side. It is traversed by a hole 0.51 of an inch in diameter to receive the lug on the sheave (B2).

(c) THE FIRING MECHANISM AND EXPLOSIVE FEATURES.

The firing mechanism consists of the striking plug (S2), the firing pin (G1), the firing pin holder (H1), the safety plugs (Y1), the safety plug springs (Z1), the detonator (X), the detonator chamfered washer (Y), the fulminate casing (M1), the detonator nut (Z), the detonator washer stud (D1), the detonator stud washer (A1), the cartridge (U), the priming cap (V1), the dry guncotton train (N1), the fulminate charge (L1), the booster charge (M), and the bursting charge (S).

The striking plug (S2), designed to insure the operation of the firing pin (G1), is a steel ring $\frac{3}{32}$ of an inch thick, with an outside diameter of 1.43 inches and an inside diameter of 0.2 of an inch. The plug fits over the end of the firing pin (G1) and is riveted to it.

The firing pin (G1), designed to fire the cartridge (U), is a small steel cylinder 1.2 inches long with a maximum diameter

of 0.35 of an inch. The end is pointed to strike the percussion cap of the cartridge (U). The other end is inserted through the firing pin holder (H1), the striking plug (S2), and riveted over the plug.

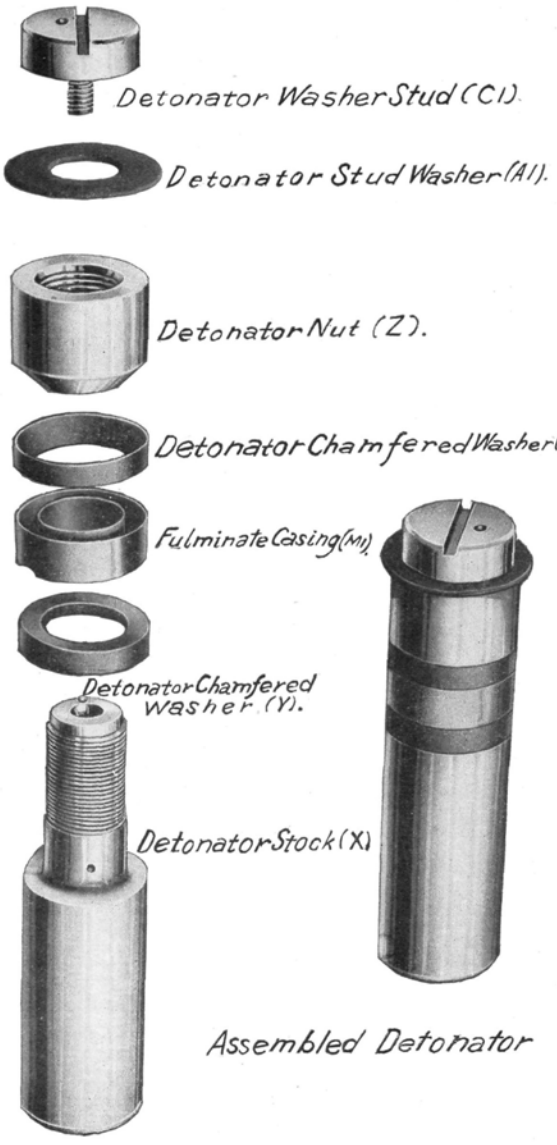
The firing-pin holder (H1) is a steel cylinder 0.85 of an inch long and 1.49 inches in diameter, surmounted by a truncated cone ½ of an inch long with a diameter at the top of ¾ of an inch. A hole 0.985 of an inch in diameter is drilled and tapped in the base of the cylindrical portion to a depth of 0.74 of an inch to screw over the end of the barrel (G). This recess is continued for a distance of 0.35 of an inch by a hole ⅝ of an inch in diameter and for an additional distance of 0.26 of an inch by a hole ¼ of an inch in diameter to receive the firing pin (G1). The top of the cone is traversed by two slots to provide a grip for a wrench.

The safety plugs (Y1), which prevent the firing pin (G1) from striking the cartridge (U) until the bomb is partially extended, are two halves of steel cylinder 0.9 of an inch high and 1.49 inches in diameter. Each is recessed to a depth of 0.4 of an inch from one end to fit over the firing-pin holder (H1). A hole 0.193 of an inch in diameter is drilled to a depth of ½ of an inch in each plug to provide for the two safety-plug springs (Z1).

The detonator (X), which carries the fulminate charge (L1), is a steel cylinder 4.925 inches long, with a maximum diameter of 1.415 inches. The outer surface is machined to a diameter of 0.915 inch for a distance of 1.98 inches from the rear end to receive the two chamfered washers (Y) and the copper fulminate casing (M1). This surface is threaded to a diameter of ⅞ of an inch for a distance of 1.293 inches from the rear end to receive the detonator nut (Z). This is drilled and tapped to a diameter of ¼ of an inch to receive the detonator washer stud (D1). A hole 0.128 of an inch in diameter is drilled at a distance of ¼ of an inch from the axis; through this hole the compressed air finds egress from the central tube (V) and is directed against the barrel nut (K), thus causing the forward movement of the barrel (G). The front end is drilled to a diameter of 1.125 inches for an additional distance of 0.45 of an inch to receive the end of the detonator tube (B1). It is also recessed for the priming cap (V1) and the guncotton train (N1).

The detonator nut (Z) is a hollow steel cylinder 1.12 inches long with an outside diameter of 1.415 inches and an inside

PLATE VIII.



Assembled Detonator

diameter of $\frac{7}{8}$ of an inch, which is threaded to screw on over the detonator (X). It is beveled at one end to receive the rear detonator chamfered washer (Y). Two $\frac{1}{8}$-inch holes are drilled in the rear surface to a depth of $\frac{1}{8}$ of an inch to provide a grip for a wrench. The detonator washer stud (D1) screws into the end of the detonator (X) after the leather detonator stud washer (A1) is fitted in place. A hole 0.128 of an inch in diameter is drilled through the stud to permit the flow of air from the central tube (V) into the air passage in the detonator.

The removal of the firing pin holder (H1) permits the insertion of a .30 caliber ball cartridge (U) in the breech of the barrel (G).

A priming cap (V1) is set in the recess in the forward end of the detonator (X); a train of guncotton (N1) leads from the primer cap through the detonator stock to the cylindrical fulminate casing (M1), which contains the fulminate charge (L1).

The booster charge (M) is held in the chamber in the booster cup (N), between the booster cup tube (R) and the booster cup sleeve (P). The bursting charge (S) completely surrounds the entire booster cup assembly and fills the chamber in the shell (E2).

In order to facilitate the handling of the bomb during the various cleaning and testing operations, the bomb depot will supply a kit containing the following tools:

1 special tool.
1 wrench for packing nut (U1).
1 wrench for stabilizer tube bushing (M2) and central tube plug (W).
1 wrench for shell cap nut (G2).
1 wrench for barrel nut (K) and barrel bushing (H).
1 monkey wrench.
4 testing detonators.
2 Schrader tire pressure gauges.
1 ramrod.

OPERATION OF THE BOMB.

As the bomb is dropped from the airplane, the sheave (B2) is rotated by the sheave operating cord, which is attached to the trap. This withdraws the needle (P1) from the recess in the diaphragm (E1), thus opening the valve and permitting the

compressed air in the chamber (A) to escape into the air tube (F). The air flows through the tube, through a hole in the air chamber tube base (C), and through the space between the air chamber tube (B) and the central tube (V) into the chamber between the cap (T) and the central tube plug (W).

The air acting on the cap (T) forces the rear extrusion mechanism to the rear until the stabilizer tube bushing (M2) comes in contact with the stabilizer tube washer (P2). At the same time the air acting on the detonator washer stud (D1) and on the detonator stud washer (A1) forces the front extrusion mechanism forward until the detonator tube washer (C1) comes in contact with the shoulder of the front stem (K1). The detonator (X) is now seated inside the booster cup (N) and registers with it.

By means of the air hole in the detonator washer stud (D1) and detonator (X) the continued pressure is now exerted against the barrel nut (K), whereupon the barrel (G) is forced forward until the barrel nut (K) strikes the barrel bushing and stop (H). In the forward movement of the barrel (G) the safety plugs (Y1) are carried out of the front stem (K1) and are thrown off by the action of the safety plug springs (Z1).

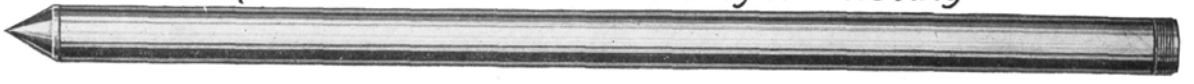
The bomb falls nose downward. Upon contact with any object, the striking plug (S2) causes the firing pin (G1) to strike the percussion cap of the cartridge (U), thus firing the cartridge. The bullet, passing up the barrel (G) and detonator tube (B1), strikes the priming cap (V1) set in the recess in the detonator (X). The flash from the primer detonates the guncotton (N1), which in turn explodes the fulminate charge (L1); this detonates successively the booster charge (M) and the bursting charge (S).

When it is desired to drop the bomb in the "safe" or unarmed condition (as when driven by hostile planes over the lines of friendly troops), the cotter pin (C3) is withdrawn, allowing the safety pin (B4) and the release cord to fall with the bomb. Thus the compressed air mechanism does not operate and the extrusion rods remain in their normal positions. The shock of the fall may cause the detonation of the fulminate charge (L1), but will not detonate the bursting charge (S).

RANGE OF EFFECTIVENESS.

To all personnel within 50 yards in the open the explosion may be considered as fatal. The *danger zone* of fragmentation

Special Tool used in loading and testing



Safety cap (X1)





Central Tube plug (W)

is within a radius of 200 yards. However, the width of dispersion is much greater, fragments at times being hurled over 500 yards from the point of contact.

SAFETY FEATURES.

It is impossible for the mechanical features of the bomb to function, and thus cause detonation of the bomb, while it is still attached to the plane.

The fulminate charge (L1), carried normally in a sliding tube in the rear end of the bomb, may be exploded, but this will not effect the bursting charge (S); no damage will result other than the rupture of the rear tubes of the bomb.

The firing pin (G1) is positively engaged by the safety plugs (Y1), which prevents the pin from striking the igniting cartridge until the tube has been extended. As the extrusion mechanism does not move forward until several seconds after the bomb has been released from the trap, neither the aviator nor his machine is endangered by any malfunction of the bomb itself.

MARKS AND CONTAINERS.

The exterior surface of the bomb is painted a dark olive drab, except for a 1-inch band, which is painted black, to indicate the location of the center of gravity of the loaded bomb. The parts of the shell which come in contact with the bursting charge and the parts of the booster cup, sleeve, and tube which come in contact with the booster charge are painted with a non-acid paint. All other interior metal parts are protected from rust by a suitable paint.

The bomb carries a brass name plate just below the shell and over the release valve, bearing the inscription:

Name of manufacturer.
Barlow heavy drop bomb.
Lot —— year. Insp't ——.

Each bomb is packed in a wooden shipping case, with the loaded detonator in a separate compartment. The detonator is wrapped in cheesecloth and carried in a sealed tin container. An envelope, which contains the required washers and the release cord and clip, will be found in each case.

Each bomb is supplied with a dummy detonator during transportation. This detonator is a wooden cylinder 4¼ inches long and 1.4 inches in diameter.

DIRECTIONS FOR CLEANING, TESTING, AND PREPARATIONS FOR USE.

Before preparing the bomb for use it must be thoroughly cleaned and oiled to insure the proper functioning of all parts. A suitable stand or bench rest to hold the bomb securely in a horizontal position should be prepared and so arranged that all parts removed during the cleaning may be kept entirely free from dirt and grit.

USE ONLY CHEESECLOTH AND LIGHT OIL to avoid any accumulation of lint or gummy deposit on the moving parts. Windy or dusty places should be avoided, as the entrance of sand and grit must be prevented. The oil should be used SPARINGLY, only just enough to insure smooth action. A heavy oil or too much oil will cause stiffness in the moving parts, inasmuch as oil freezes at high altitudes.

Threaded parts should be handled with great care, as the threads are very fine and liable to be stripped with rough handling. Special care must be exercised with the threads on the forward end of the barrel tube.

CLEANING.

1. Remove the safety cap (X1).
2. Remove the stabilizer assembly by unscrewing the stabilizer tube bushing (M2) and withdrawing the stabalizer tube (L2) from the air chamber tube (B).
3. Remove the central tube plug (W).
4. Using the special tool provided for the purpose, push against the rear end of the detonator tube assembly, forcing the forward end out until the barrel bushing (H) can be unscrewed, and remove the barrel (G).
5. Screw the special tool into the barrel (L) in place of the bushing just removed and force the detonator tube assembly entirely out of the rear of the bomb, thus removing the wooden dummy detonator. The detonator tube washer (C1) may have been put in place at the time of the original assembly. If so, see that it is removed with the detonator tube (B1).
6. Using a wooden rod, thoroughly clean the central tube with cheesecloth and light oil. Wipe off all the moving parts just taken from the bomb and cover them with a very light film of oil. BE SURE TO REMOVE ALL THE HEAVY GREASE FROM THE BARREL TUBE (L).

7. Reassemble the bomb by reversing the above operations, making certain that the central tube plug (W), the safety plugs (Y1), and the safety cap (X1) have been replaced.

TESTING.

PRESSURE TEST.

An air pressure test of eight hours' duration must first be made to determine the amount of leakage before the bomb can be put through the operating test. The pressure in the air chamber at the start of the test must be between 110 and 120 pounds per square inch, and in no case may the bomb be used without repair if the leakage is more than 10 pounds for the eight-hour period, unless the flight to be undertaken is to be of very short duration. Bear in mind the fact that the bomb must have at least 100 pounds pressure when it is released from the airplane in order to function properly.

OPERATING TEST.

Place the bomb in a horizontal position and remove the safety cap (X1), stabilizer assembly, and the central tube plug (W); using the tapered end of the special tool, push the detonator tube assembly far enough forward to permit the removal of the barrel bushing (H) and barrel (G).

Screw the special tool into the forward end of the barrel (L) and force this far enough out of the rear of the bomb to permit the insertion of a testing detonator, which should be securely screwed onto the detonator tube (B1). UNDER NO CIRCUMSTANCES IS A LOADED DETONATOR TO BE USED DURING TEST.

Move the detonator assembly far enough forward to permit the removal of the special tool and replace the barrel (G) and bushing (H). Remove the firing pin holder (H1) from the barrel (G) and insert an *empty* cartridge in the breech. Replace the firing pin holder (H1) and safety plugs (Y1) and push the detonator tube back into its normal position.

Examine the central tube plug (W) to make certain that the hole in its center is clear and allows the free passage of air and replace it in the rear of the central tube.

Replace the stablizer tube (L2), with the washer in its proper place.

Air should now be pumped into the air chamber until a pressure of between 110 and 120 pounds is reached.

Having provided for a clear space of 10 feet in front of the bomb for the extrusion rod, open the release valve by turning the sheave (B2).

If all moving parts function freely and are extended their *full length* by the air pressure, the test may be considered successful and the release cord and clip should now be attached, as follows:

ATTACHING RELEASE CORD TO SHEAVE.

1. Release the air pressure in the air chamber (A) by depressing the plunger in the air valve (E) and move the extrusion tubes back into their normal positions.

2. Close the release valve by turning the operating sheave pulley in the proper direction. Now carefully reopen the valve, making not less than one and one-quarter nor more than one and one-half revolutions of the sheave. Taking the release cord and clip from the shipping envelope, cover the cord with shellac, and insert the cotter pin in the hole in the sheave groove nearest the vertical.

3. Again close the valve securely by turning the sheave back to its original position, at the same time winding the cord tightly in the groove of the sheave. After noting that the cord lays well down in the groove and alongside the head of the cotter pin, a little more shellac should be used to fill up the visible portion of the sheave groove. The hook itself and the slack of the cord should be slipped into the operating valve slot in the shell to prevent accidental removal.

NOTE.—(1) In closing the valve care should be taken not to jam the valve shut; it should be closed securely, but in such a way that only a moderate pull on the release cord will open it. (2) A certain amount of slack in the cord must be provided for after it has been affixed to the ring on the trap; otherwise the jarring of the plane in motion would suffice to open the valve.

PREPARATION FOR USE (LOADING).

After the bomb has been cleaned and properly tested for pressure and operation the following steps must be taken to complete the preparation for immediate use:

1. Remove the safety cap (X1), stabilizer assembly, the central tube plug (W).

2. Using the special tool as above described, push the detonator tube assembly far enough forward to permit the removal of the barrel bushing (H) and barrel (G).

3. Insert the special tool into the forward end of the barrel tube (L) and push it far enough out of the rear of the bomb to make possible the removal of the testing detonator.

4. Gently remove the loaded detonator from its sealed container. It should here be noted that this detonator (X) is extremely sensitive and the greatest possible care must be exercised in handling it, as the least bit of jamming of these parts will cause a serious explosion. In order to avoid all pressure or friction on the fulminate, the detonator should be held by its front or socket end only. Never place the hands around the copper fulminate casing (M1) or rubber washers (Y).

5. Examine the detonator assembly to see that it is tight. If the detonator nut (Z) has worked loose it should be tightened with extreme caution; only just enough pressure should be exerted on it to hold the detonator parts securely in place. The leather detonator stud washer (A1) must be in good condition; if it is hard and stiff, it can be softened by applying a little oil to its edges.

6. Carefully place the loaded detonator on the detonator tube (B1) and screw it securely into position.

7. Gently *draw* the detonator tube (B1) into the central tube (V), carefully guiding the detonator into place by turning the special tool to the right during its forward movement. Do not stand at the rear of the bomb during this operation, nor force the detonator tube forward by pushing on the rear of the detonator (X).

8. REPLACE THE CENTRAL TUBE PLUG (W).

9. Reassemble the stabilizer assembly on the air chamber tube (B), making sure that the stabilizer tube washer (P2) is in place.

10. Carefully draw the detonator tube (B1) forward just far enough to permit the removal of the special tool and replace the barrel (G) and barrel bushing (H). Avoid turning and jarring the detonator tube during this operation.

11. Remove the firing pin holder (H1) and insert a .30 caliber Springfield ball cartridge in the breech. Examine the firing pin (G1) to see that it moves freely, and replace the firing pin holder on the barrel (G). Be sure that the *firing pin* is held *clear of the cartridge* while the firing pin holder is being screwed securely into place.

12. Place the safety plugs (Y1) in position around the firing pin and slowly push the detonator tube back into place.

13. REPLACE THE SAFETY CAP (X1).

14. Using the pressure gauge, see that the air pressure is between 110 and 120 pounds and place the bomb in the trap of the aeroplane. (See p. 29.)

15. IMMEDIATELY BEFORE STARTING OUT ON THE FLIGHT, HOOK THE RELEASE CORD CLIP INTO THE SAFETY PIN RING (E4) AND REMOVE THE SAFETY CAP (X1).

CAUTIONS.

This bomb contains a high explosive.

While under certain conditions the bomb may be spoken of as "safe," this is only a comparative term, and the entire apparatus should always be handled with the greatest care.

REMEMBER THAT THE DETONATOR ALONE HAS SUFFICIENT ENERGY TO BLOW OFF A MAN'S HAND. Avoid friction on the detonator parts and never place the hands on the copper disk or rubber rings, but only on the steel sections of the front end of the detonator (X).

Do not allow the detonator to fall, and avoid jarring it in any way.

Never ASSUME that the detonator has been removed from the detonator assembly. *Make sure* of this fact before handling the bomb.

In lifting or carrying the device, never hold by any movable part, such as the vanes or stabilizer tube. These parts are very easily bent and scored, thus putting the bomb permanently out of commission. Support the weight mainly by the shell or warhead section, as near as possible to the painted band, which marks the center of gravity.

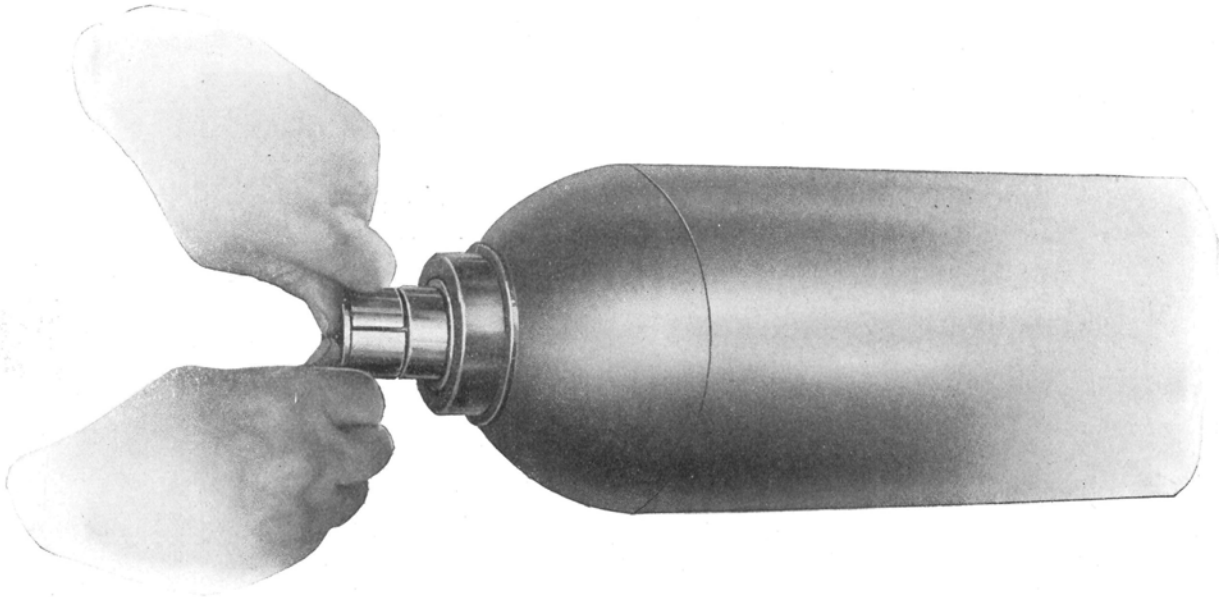
Do not substitute the parts of one bomb for those of another without very careful tests. Although every effort has been made to make all parts interchangeable, special fitting is often required to insure the proper functioning of all parts.

The safety cap (X1) must ALWAYS be in its proper position EXCEPT:

(1) When the bomb is being tested.

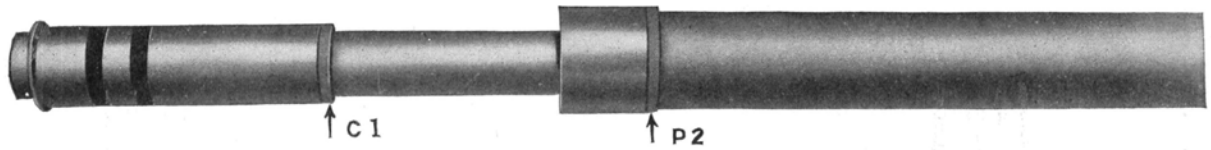
(2) After the bomb has been placed in the trap ready for immediate use.

The barrel bushing (H) should at all times be screwed securely into the barrel tube. If the bushing is loose, the force of



View showing method of inserting safety plugs (Y1) and returning the extended detonator tube to its proper position.

PLATE XI.



View of rear of bomb, showing correct position of the detonator tube washer (C1) and stabilizer tube washer (P2). Note the extended detonator tube to which the loaded detonator has just been attached.

the air pressure may blow the barrel (G) entirely clear of the bomb upon rotating the sheave (B2).

Before completing tests and preparation for use, examine the firing pin (G1) to see that it has not been bent or broken.

The detonator stud washer (A1) on the detonator tube just above the detonator and stabilizer tube washer (P2) must always be in place and in proper condition.

The edges of the safety plugs (Y1) are easily burred if dropped on a hard surface. These should be carefully examined, smoothed off when necessary, and *always replaced* before pushing the detonator tube back into its normal position.

The greatest care should be exercised when using the special tool. Its threads should be examined often to prevent any possible damage to the fine threads in the barrel tube, due to battered threads on the special tool plug. The cap should always be kept on the threads of this tool when it is not in use.

Always make certain that the central tube plug (W) has been securely placed in its proper position. The purpose of this plug and the small air vent through its center is to prevent a too rapid movement of the front extrusion mechanism. If this plug is omitted, the detonator tube (B1) will be driven forward with sufficient violence to detonate the bomb at the moment of its release from the plane.

INSTRUCTIONS ON FIELD REPAIR WORK.

If during the testing period the air pressure can not be maintained at the proper figure (110 to 120 pounds), a search should be made to locate the point of leakage. This may quickly be found by applying a small quantity of oil or water to the exposed soldered joints and then examining the suspected areas for bubbles.

On account of possible strains received during transit, the joint between the air chamber (A) and the air-chamber tube (B), located just under the stabilizer-tube bushing (M2), may have been weakened and jarred loose. This point should therefore be examined first. The welded seams on the air chamber should next be inspected.

If the cause of the leakage has not yet been located, remove the explosive head by unscrewing the shell (E2) from the air-chamber assembly. This will give free access to the diaphragm (E1) and the valves.

All leaks in the joints or porous spots in the diaphragm may be readily closed with solder. In making these repairs it should be remembered that the air pressure should first be released, and that all paint and oil must be removed from surfaces to be soldered.

RELEASE MECHANISM FOR THE BARLOW HEAVY DROP BOMB.

The release mechanism for the Barlow heavy drop bomb consists of a battery of four or more traps. Each trap carries one bomb.

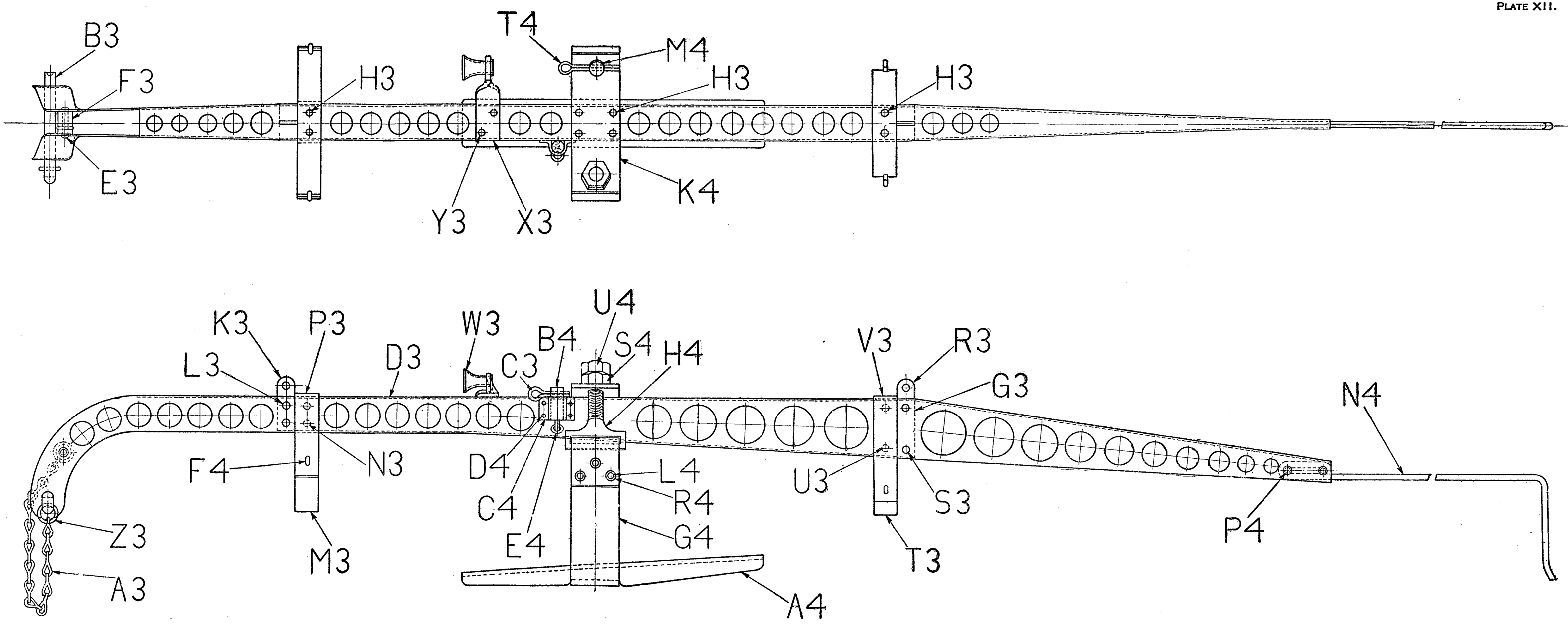
The trap consists of a frame (D3), a frame stiffener (G3), a tail rod (N4), a front-trap suspension (K3), a rear-trap suspension (R3), a chain (A3), two rings (Z3), a strap-hanger bracket (K4), a strap hanger (G4), a strap-hanger slip bolt (M4), a split pin (T4), a strap-hanger adjusting bolt (H4), an adjusting nut (S4), a lock nut (U4), a saddle (A4), a front-yoke truss (P3), two front yokes (M3), a rear yoke truss (V3), two rear yokes (T3), a release wire guide bracket (X3), a release wire guide (W3), a safety pin bracket (C4), a safety pin (B4), and a safety-pin ring (E4).

The frame (D3), which is the main part of the trap, is a piece of sheet steel in the shape of a long inverted trough. Its maximum dimensions are: Length, 54½ inches; width, 1¼ inches; and height, 2½ inches. The sides and top are traversed by several holes to decrease the weight of the trap.

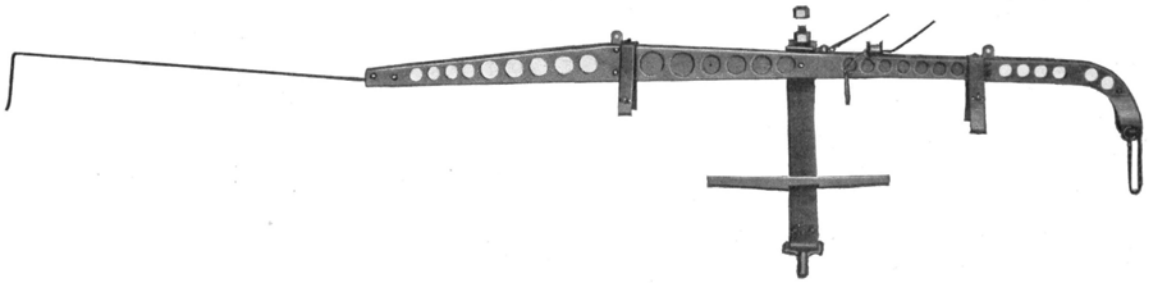
The frame stiffener (G3) is a piece of wood 26¾ inches long, 1⅛ inches wide, and tapers from a depth of $2\frac{3}{64}$ inches at the rear end to a depth of $1\frac{7}{16}$ inches at the front end. It is fastened inside the frame (D3) by the rivets (H3) and rivets (S3).

The tail rod (N4) is of cold-rolled steel 27½ inches long and ¼ of an inch in diameter. It is looped at one end to receive the rivets (P4), which fasten it to the rear end of the frame (D3). The other end is bent at right angles and projects downward 4¼ inches and bears against the cap, thus preventing the operating of the rear extrusion mechanism.

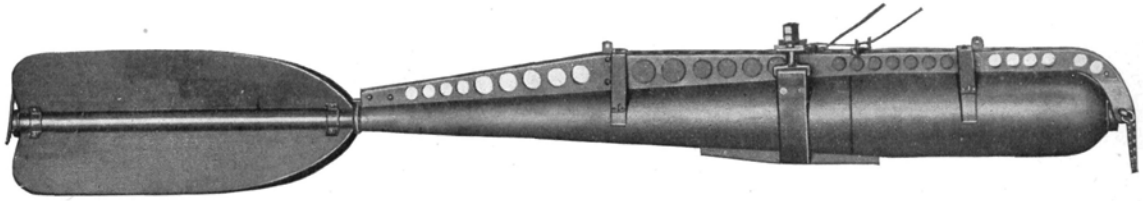
The front trap suspension (K3) is a piece of steel $2\frac{5}{16}$ inches long, ¾ of an inch wide, and ⅛ of an inch thick. The lower end, which projects through a slot in the top of the frame (D3), is traversed by two ¼-inch holes to receive the rivets (L3), which fasten the suspensions to the frame. The upper end is traversed



DRAWING OF THE TRAP.



Trap, ready to receive the bomb.



Trap, with bomb ready for release.

by a $\frac{5}{16}$-inch hole to receive the pins which fasten the front of the trap to the airplane.

The rear trap suspension (R3) is a steel strip $2\frac{5}{16}$ inches long, $\frac{3}{4}$ of an inch wide, and $\frac{1}{8}$ of an inch thick. The lower end, which projects through a slot in the top of the frame, is traversed by two $\frac{1}{4}$-inch holes to receive the rivets (S3), which fasten the suspension to the frame. The upper end is traversed by a $\frac{5}{16}$-inch hole to receive the pin which fastens the rear of the trap to the airplane.

The frame spacer (F3), designed to stiffen the front end of the frame, is a hollow steel cylinder $\frac{7}{8}$ of an inch long with an outside diameter of $\frac{1}{2}$ of an inch and an inside diameter of $\frac{7}{16}$ of an inch. It is held in place between the sides of the frame (D3) near its front end by the frame rivet (E3).

A $\frac{1}{2}$-inch cotter pin (B3), attached to the trap by means of a chain (A3) and two rings (Z3), is inserted through two holes in the front end of the frame. Its purpose is to prevent the forward movement of the front extrusion mechanism while the bomb is still in the trap.

The strap hanger bracket (K4), designed to support the bolts (H4 and M4), is a steel strip $5\frac{1}{2}$ inches long, 2 inches wide, and $\frac{3}{16}$ of an inch thick. Four $\frac{5}{16}$-inch holes are drilled near the center to receive the rivets (H3) which fasten it to the frame (D3). A hole $\frac{3}{32}$ of an inch in diameter is drilled at a distance of $\frac{5}{8}$ of an inch from each end to receive the bolts (H4 and M4).

The strap hanger (G4), which fastens the bomb to the trap, is a strip of leather $19\frac{5}{8}$ inches long, 2 inches wide, and $\frac{3}{16}$ of an inch thick. One end is slipped through the strap hanger adjusting bolt (H4) and the other through the strap hanger slip bolt (M4). Each is overlapped a distance of 2 inches and held in place by three copper rivets (L4) and washers (R4).

The strap hanger slip bolt (M4), which supports one end of the strap hanger (G4), is a T-shaped piece of steel with a length of $2\frac{1}{2}$ inches. The arm is $\frac{5}{8}$ of an inch in diameter. A $\frac{1}{4}$-inch hole is drilled near the end of the arm to receive the cotter pin (T4) which holds the bolt in place. It is traversed by the slot $2\frac{1}{8}$ inches long and $\frac{1}{4}$ of an inch wide to receive the strap hanger (G4).

The strap hanger adjusting bolt (H4), which supports one end of the strap hanger (G4), is a T-shaped piece of steel $3\frac{1}{2}$ inches long. The arm of the T is $\frac{5}{8}$ of an inch long and is threaded for a distance of $2\frac{1}{4}$ inches to receive the nut (S4). The head

is traversed by a slot 2⅛ inches long and ¼ of an inch wide to receive the strap hanger (G4).

The saddle (A4), which aids in supporting the bomb, is a piece of wood 12¾ inches long, 2 inches wide, with a maximum thickness of 1 inch. A slot 2 inches wide and 3/16 of an inch deep traverses the under side to receive the strap hanger (G4). The upper surface is curved to fit the bomb.

The front yoke truss (P3), which supports the yokes (M3), is a steel strip 8½ inches long, 1 inch wide, and ⅛ of an inch thick, bent in the shape of an inverted U, with a base 1½ inches wide and arms 3½ inches long. The base is traversed by two holes designed to receive the rivets (H3) which fasten the yoke to the frame (D3). Three holes are drilled at a distance of ¼ of an inch from each end to receive the rivets (N3) which fasten the yokes (M3) to the truss.

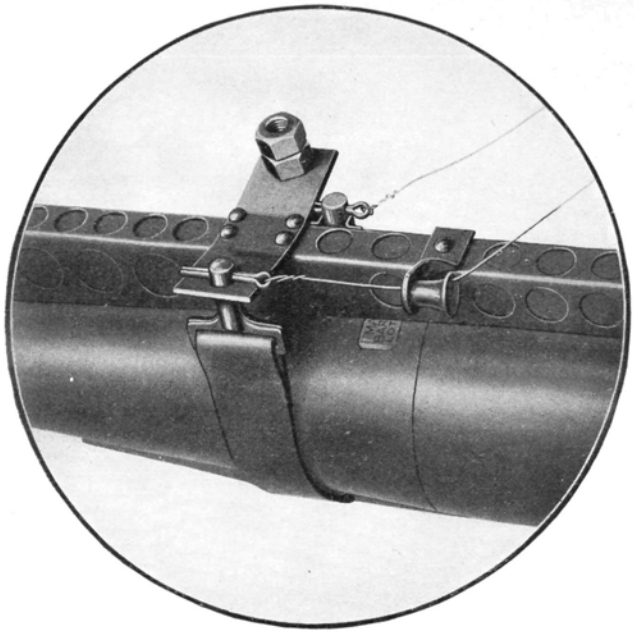
The front yokes (M3), designed to hold the bomb steady in the trap, are steel strips 6 inches long, 1 inch wide, and ⅛ of an inch thick. They are curved for a distance of 4¾ inches from the lower end to fit the surface of the bomb. Three holes are drilled near this end to receive the rivets (N3). The upper ends are traversed by two holes for the rivets which fasten the yokes to the frame.

The rear yoke truss (V3), which supports the yokes (T3), is a steel strip 9¾ inches long, 1 inch wide, and ⅛ of an inch thick, bent in the shape of an inverted U, with a base 1½ inches wide and arms 4¼ inches long. The base is traversed by two holes designed to receive the rivets (H3) which fasten the truss to the frame. Three holes are drilled at a distance of ¼ of an inch from each end to receive the rivets (U3) which fasten the yokes (T3) to the truss.

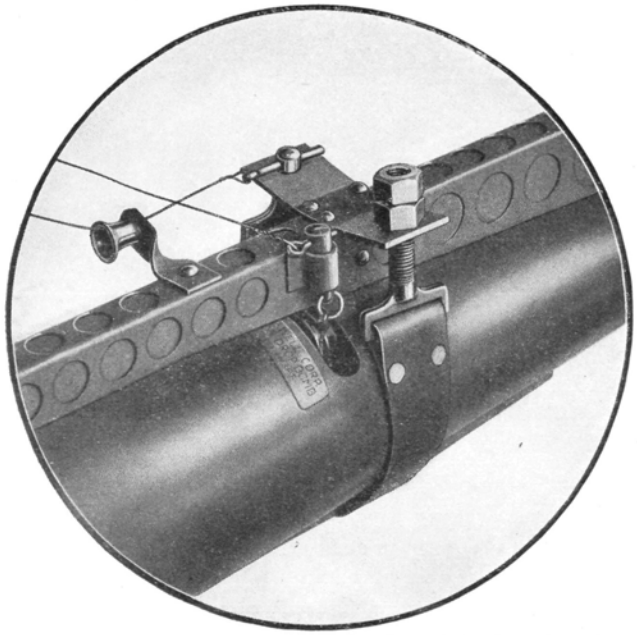
The rear yokes (T3), designed to hold the bomb steady in the trap, are steel strips 5¼ inches long, 1 inch wide, and ⅛ of an inch thick. They are curved for a distance of 2¾ inches from the lower end to fit the surface of the bomb. Three holes are drilled near this end to receive the rivets (U3). The upper ends are traversed by two holes for the rivets which fasten the yokes to the frame.

One stay eyelet (F4) is fastened to each yoke to provide an additional means of securing the trap to the airplane.

The release wire guide bracket (X3), which secures the release wire guide (W3) to the trap, is a twisted steel strip 3⅛ inches long, 1 inch wide, and ⅛ of an inch thick. One end is



Details of release mechanism of trap, with release cord and cotter pin shown in the center. (*See other view.*)



Details of release mechanism of trap, showing safety pin and method of attaching the valve-operating cord to the safety-pin ring. (*See other view.*)

traversed by two holes designed to receive the rivets (Y3) which fasten it to the frame (D3). A ½-inch hole is drilled in the other end to receive the release wire guide (W3).

The release wire guide (W3), designed to carry the release wire, is a hollow conical-shaped piece of brass 1⅛ inches long. One end is slipped through the hole in the release wire guide bracket (X3) and lipped over, thus fastening the guide (W3) to the bracket (X3).

The safety pin bracket (C4), which fastens the safety pin (B4) to the trap, is a sheet steel strip 2½ inches long, 1 inch wide, and $\frac{1}{16}$ of an inch thick. It is curved in the middle to fit around the safety pin (B4). Two holes are drilled near each end to receive the safety pin bracket rivets (D4), which fasten the bracket to the frame (D3).

The safety pin (B4), which controls the operation of the sheave (B2), is a cold-rolled steel cylinder 1$\frac{11}{16}$ inches long and $\frac{5}{8}$ of an inch in diameter. The sides are cut away for a distance of $\frac{9}{16}$ of an inch from one end, leaving a lug $\frac{5}{32}$ of an inch wide. A $\frac{5}{16}$-inch hole is drilled in this lug to receive the safety pin ring (E4), to which is attached the cord which operates the sheave (B2). A ¼-inch hole is drilled in the other end of the pin to receive the split pin (T4) which holds the safety pin in place.

OPERATION OF THE TRAP.

PLACING BOMB IN THE TRAP.

Remove the lock nut (U4) from the strap hanger adjusting bolt (H4), then ease off on the adjusting nut (S4). Raise the bomb into position, making sure that the stabilizers (H2) are clear and that the tail rod (N4) sits properly over the cap (T). Put the saddle (A4) in position underneath the bomb, slip the bolt (M4) through the hole in the strap hanger bracket (K4), and put the split pin (T4) back into the hole in the slip bolt. Tighten up on the adjusting bolt (H4) until the bomb is seated securely in the trap and then tighten the lock nut (U4). Do not make the strap hanger (G4) unnecessarily tight, as this will cause the pin (T4) to bind and prevent proper release.

Hook the snap of the valve release cord into the safety pin ring (E4), being very careful not to open the valve.

OPERATION OF THE TRAP.

When it is desired to release the bomb, the pin (T4) is withdrawn from the strap hanger slip bolt (M4) by means of the

release wire. The bolt slips through the hole in the strap hanger bracket (K4), thus freeing the bomb from the strap hanger (G4) and allowing it to fall. The valve release cord, being attached to the safety pin (B4) on the trap, rotates the sheave as the bomb leaves the trap, until the small split pin on the end of the release cord is pulled out of the hole in the sheave (B2). The bomb is now entirely clear of the trap, with the air release valve open; the extrusion mechanisms should begin to function immediately.

If it is desired to drop the bomb in a "safe" or unarmed condition, pull the "safe" wire, which removes the cotter pin (C3) from the end of the safety pin (B4) and allows the latter to fall with the bomb, thus preventing the opening of the air release valve.

NOTE.—It is essential that provision be made to exert *a straight pull* on the safety cotter pin (C3) *in a direct line with the hole traversing the safety pin (B4)*. Since there is no guide on the trap for this purpose, some means must be provided to hold the safety wire in the proper position; otherwise the pulling of the safety wire may result in the upward movement of the safety pin (B4), thereby causing the opening of the release valve.

NOTE II.—The packing (T1) on the barrel nut (K) has been replaced by a cupped leather washer, for greater facility in operation. The forward end of the detonator (X) has been tapered down to provide a smaller bearing surface in the central tube (V).

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