June 24, 1947. H. J. NICHOLS 2,422,920

ARMOR-PIERCING DROP BOMB

Filed Aug. 18, 1942

Fig. 1

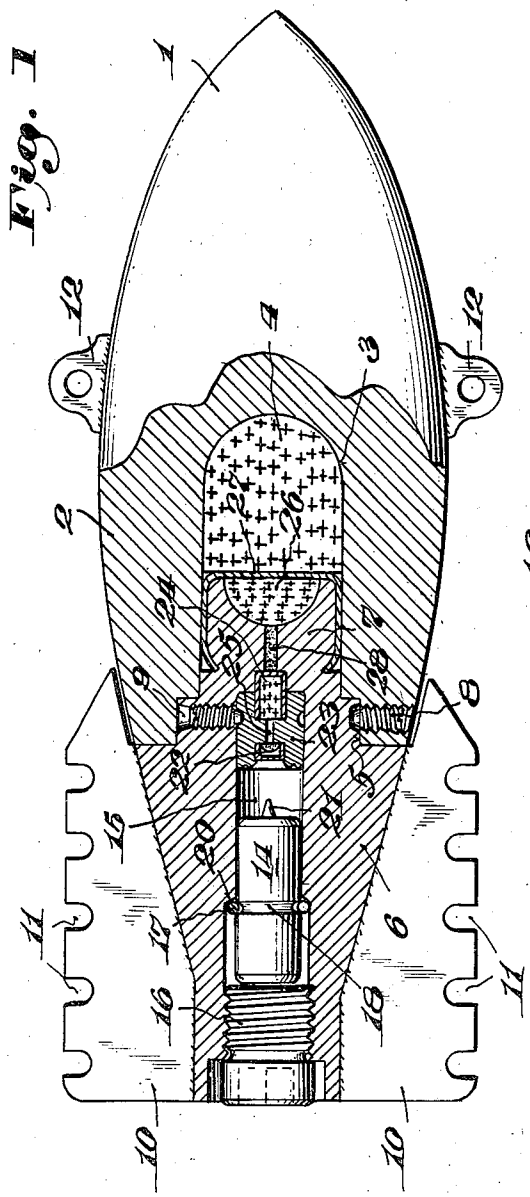
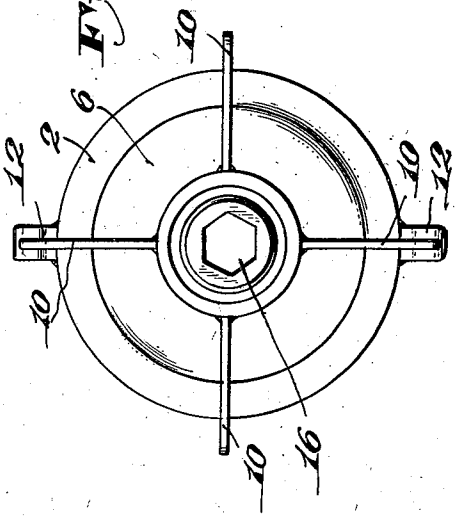


Fig. 2



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## ARMOR-PIERCING DROP BOMB

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9 Claims. (Cl. 102—2)

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This invention relates to aerial drop bombs, and particularly to target penetrating and armor piercing bombs.

Ordinary drop bombs are structurally too weak to be effective in penetrating armored and heavily re-enforced targets. Large drop bombs with unusually heavy cases can be made to penetrate protected targets such as the decks of ships, tops of tanks, armored barges and trains, concrete slabs, etc. only by dropping them from great heights. The use of such bombs is greatly limited in practice by the excessive weight of such bombs, and by the practical difficulty in hitting the target, which difficulty naturally increases as the dropping height increases. Furthermore, active targets such as ships, boats, and tanks almost invariably escape bombs launched from great heights by maneuvering to avoid them after they have been launched.

This invention provides a novel but practical solution of the manifold problems of effectively bombing small protected targets by providing a relatively small but strong and efficient bomb capable of augmenting its own striikng velocity upon impact with the target. Such bombs can be dropped effectively with respect to penetration from low altitudes, with correspondingly good accuracy, and in salvos. Consequently, the number of effective direct hits on small protected targets can thereby be greatly increased over the number attained by the practices heretofore employed. A direct hit with even a small bomb of this improved type is immeasurably superior to near hits with much larger bombs of the ordinary type.

It is accordingly a general object of this invention to provide means in the bomb itself to improve its target penetrating properties, thereby to accomplish greater penetration of resistant targets when the bomb is dropped from low altitudes.

A further general object is to incorporate in bomb construction a new principle, termed the reaction principle, for augmenting the striking velocity of the bomb upon impact with the target.

A particular object is to provide a relatively small but highly efficient armor-piercing bomb for use by relatively light planes such as interceptor planes, fighter planes, and fighter-bomber planes for attacking protected, moving targets such as tanks, ships, boats, barges, trains, etc. where penetration alone is sufficient to put the target out of action.

A further particular object is to provide a small armor-piercing bomb of the maximum simplicity and effectiveness.

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Another particular object is to provide a construction for relatively small bombs which will flight with the accuracy of an artillery projectile and which incorporates explosive means for augmenting the velocity upon striking a target, together with safe but effective means for actuating the explosive means at the proper instant.

Another object is to provide a construction for armor-piercing bombs in which the head and body function as an inverted gun to discharge its after-body and fins rearwardly, and in which the recoil from said discharge effectively augments the striking velocity of the head.

A further object is to provide a relatively small bomb which dispenses with spinners or propellers which retard the bomb in flight and which is unencumbered by safety devices attached to the plane, such as pull wires, which cause inconvenience and danger in actual practice.

A further particular object is to provide a construction of small armor-piercing bombs which can be readily launched in salvo; and which is particularly adapted for launching in tandem salvo by means of the catapult bomb rack described in my copending patent application Serial No. 301,675, filed October 27, 1939, which issued May 1, 1945, as Patent No. 2,374,885.

Other objects will be in part obvious from the annexed drawing and in part hereinafter indicated in connection with the following analysis of the invention.

This invention accordingly consists in the features of construction, combination of parts and in the unique relation of the members and in the relative proportioning and disposition thereof, all as more completely outlined herein.

To enable others skilled in the art to fully comprehend the underlying features of this invention, that they may embody the same in various structures, forms, and designs contemplated by the invention, a drawing depicting a preferred form of the invention has been annexed as part of this disclosure.

The principles and main construction features of the invention are illustrated in the accompanying drawing, in which Fig. 1 is a longitudinal sectional view of the bomb and Fig. 2 is a rear end view thereof, but it is to be understood that the distinctive and characteristic principles and features of the invention can be embodied in a variety of designs, forms and structures.

Referring now to the drawing in detail, the bomb as a whole is of streamline form and of

massive proportions designed for maximum strength to resist the disruptive forces occurring upon impact and during self-discharge. The head 1 and body 2 are preferably integral, and should be made of high-quality alloy steel, suitably heat-treated to impart maximum hardness and shock resistance to the head, while the body portion is preferably tempered to provide maximum toughness and elasticity. The general purpose is to specially adapt the head portion to retain its form on impact with armor, while the body portion is specially adapted to function as a gun barrel of maximum elastic strength.

The body is provided with a chamber 3 bored from the rear and adapted to contain an explosive propulsive charge 4, hereinafter termed the ejection charge, and a counter bore 5 at the rearward end of the body. The after body or tail portion 6, of exterior conical form blending with the streamlining of body 2, is preferably made of tough steel and is provided at the forward end with a piston 7, termed the reaction piston. This piston extends into the chamber 5 and is secured in the body 2 by any suitable means, as for example by set screws 8 engaging a circumferential groove 9 cut in the piston at the neck.

A set of fins 10 are attached to the after body 6, preferably by welding, to assure true flight of the bomb in well known manner. These fins may be provided with notches 11 adapted to cooperate with link chains (not shown) forming part of the catapult bomb rack described in my above mentioned patent. The bomb body 2 is also preferably fitted with a pair of welded-on supporting lugs 12. These lugs are also adapted to cooperate with the aforesaid link chains.

The reaction piston 7 is adapted to house a percussion detonating device disposed in axial bores drilled therein. This detonating device comprises percussion plunger 14, slidable in a bore 15 of piston 7, but normally held immovable therein by abutting against a screw plug 16 at the rear and by a split expansion-ring 17, assembled in a groove 18 of plunger 14 and resting against a sloping shoulder 20 cut in the walls of bore 15. The expansion ring is so designed that plunger 14 is held from forward displacement by any shock incidental to handling and transportation, but is capable of forward movement due to the shock of impact with the target. Plunger 14 is also provided with a firing pin 21 adapted to coact with primer 22 mounted in a plug 23 suitably secured in bore 15. Plug 23 also carries detonator 24, and a connecting duct 25 is provided to transmit the flame of primer 22 to detonator 24. At the forward end of piston 7 is located a cavity containing booster charge 26, of high explosive such as tetryl, and closed by suitable means such as cover 27. An explosive train 28, preferably of tetryl and adapted to transmit a detonating wave from detonator 24 to booster 26, is located in a small bore drilled in the axis of piston 7.

The ejection charge 4 preferably comprises a detonable explosive, such as cordite or others of the high power propellants containing nitroglycerine. However, a high explosive of the low brisant or semi-propellant type, rather than the shattering brisant type, is preferable, the object being to impart the maximum ejection velocity to piston 7 and the after body without or before rupturing body 2. Other suitable explosives comprising mixtures of explosive organic compounds, such as the ammonals and amatols, and the so-called grenade explosives containing nitro-starch and the like, may be employed to advantage.



The ejection charge 4 may be combined with the booster charge 26, the cover 27 being enlarged to contain both charges. This variation has practical advantages over the construction shown, which latter, however, makes the functions of the two charges clearly evident.

The operation of the bomb is as follows: The bomb may be supported individually in a conventional bomb rack by means of one of the supporting lugs 12, or it may be suspended in tandem grouping between conveyor link-chains in a catapult as described in my copending application Serial No. 301,675, filed October 27, 1939. In either case, there is no preliminary arming procedure, and the bomb can be launched merely by dropping.

When the bomb encounters the target or any hard surface after dropping, the retardation of the bomb causes the percussion plunger 14 to overcome the resistance of the expansion ring 17, and to be projected forcibly forward into impact with primer 22, exploding the same. The flash from primer 22 ignites detonator 24 which thereupon detonates train 28 which in turn detonates booster charge 26 and ejection charge 4 virtually simultaneously.

The arrangement described provides a slight delay in the explosion to enable the head of the bomb to enter the target, but it is to be understood that virtually instantaneous action can be obtained by eliminating the primer, and by placing the detonator in the position of the primer.

The combined explosive gases of the booster and ejection charges produce a powerful pressure on the walls of the chamber and on the head of piston 7, driving head 1 forwardly and piston 7 and the after body 6 rearwardly with great force. Following well known physical laws, the reaction from piston 7 and after body 6 produces a powerful forward thrust on the head and body, augmenting their momentum due to forward flight, and thereby greatly increases the penetrating ability of the bomb. This constitutes the novel reaction principle.

It will be perceived that the invention provides a simple and effective means for augmenting the penetrating ability of bombs, and attains in highly satisfactory manner the manifold objects recited in the preamble hereof.

Without further analysis the foregoing will so fully reveal the gist of this invention that others can, by applying current knowledge, readily adapt it for various applications without omitting certain features that, from the standpoint of the prior art, fairly constitute essential characteristics of the generic or specific aspects of the invention, and therefore such adaptations should and are intended to be comprehended within the meaning and range of equivalency of the following claims.

I claim:

1. An explosive armor-piercing drop bomb comprising, in combination, integral streamlined head and body portions comprising approximately two-thirds of the length of said bomb and an interfitting rearwardly slidable tail portion streamlined to blend with said body portion, said body portion having a cavity in the central part thereof, an explosive propulsive charge in said cavity, and detonating means contained within said tail portion and operatively associated with said propulsive charge, said detonating means comprising an explodable element and a percussion plunger normally held against movement but

able to slide forwardly on impact with the target to strike said explodable element.

2. A device as set forth in claim 1 in which said bomb is provided with flight stabilizing fins.

3. A device as set forth in claim 1 in which said tail portion is provided with a piston member and one or more axial bores in which said detonating means are positioned, and means for closing said bores.

4. A device as set forth in claim 1 in which the bomb is provided with combination fin and guide means at its rear end and supporting means near its central part to permit the same to be conveniently carried in a bomb rack.

5. Self-energized reaction propelling means for augmenting the striking velocity of streamlined aerial drop bombs having an integral armor-piercing head and chambered body comprising, in combination, a propulsive charge sealed in said chambered body, a tail structure including a piston member fitted into said chambered body, and means housed within said tail structure and said piston member for initiating the explosion of said propulsive charge upon impact of the head with a resistant target, including a primer mounted axially in said tail structure, a booster charge mounted axially in said piston, a slidable percussion plunger also mounted axially in said tail structure and provided with a firing pin adapted to explode said primer, and means for holding said percussion plunger in inactive position until impact comprising a shoulder in the tail structure, a groove in the plunger, and a split ring coacting with said shoulder and groove.

6. An explosive armor-piercing drop bomb comprising, in combination, a solid streamlined head and body portion having an explosion resistant chamber, and a separate rearwardly tapered tail portion having stabilizing fins and blending in contour with the streamlining of the head and body portion; a high explosive ejection charge contained within said chamber; means for detonating the said ejection charge in delayed relation to impact of the head of the bomb with a target; and rearwardly ejectable piston means solid with said tail portion and extending into said chamber for utilizing the detonation of said ejection charge to generate a forwardly directed reaction force, thereby to augment the forward momentum of said head and body portions.

7. An explosive armor-piercing drop bomb comprising, in combination, a massive monoblock head and chambered body, a high explosive ejection charge contained within said chambered body, a rearwardly tapered tail portion having piston means mounted in and slidable rearwardly in said chambered body, a detonating device carried by said tail portion for detonating said ejection charge with precise timing after impact of the head of the bomb with a resistant target, means including said piston for utilizing the reactive force of the detonation of said ejection charge to augment the forward momentum of said head and body; said head, body, and tail portion combined being of streamlined form and having fins attached to the tail portion of the bomb for aiding in true flight.



8. Self-energized reaction propelling means for augmenting the striking velocity of aerial drop bombs having a massive integral armor-piercing head and explosion resistant chambered body comprising, in combination, a high explosive reaction propulsive charge contained within said chambered body, a rearwardly tapering finned tail structure including a rearwardly slidable piston member fitted into said chambered body rearwardly of said charge, and percussion actuated means housed within said tail structure and said piston member for initiating the detonation of said propulsive charge in precisely timed relation to impact of the head with a resistant target, said means including a detonating charge and a percussion plunger forwardly slidable by such impact to cause explosion of said detonating charge.

9. In an explosive armor-piercing bomb, in combination, a massive monoblock head portion provided with an explosion resisting chambered axial bore, a rearwardly tapered tail portion of substantially less mass than said head portion having stabilizing fins and also having piston means mounted slidable rearwardly in said bore; and reaction means for augmenting the forward momentum of said head portion upon impacting a target comprising said tail portion, an explosive ejection charge of low brisance positioned in said bore ahead of said piston so as to exert rearwardly acting explosive pressure on said piston thereby to eject same from said bore, and self-timing means operable only after impact of said head portion with a target for exploding said ejection charge in effectively timed relation to such impact.

HARRY J. NICHOLS.


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