July 8, 1947. J. V. HOWE 2,423,453

PROJECTILE

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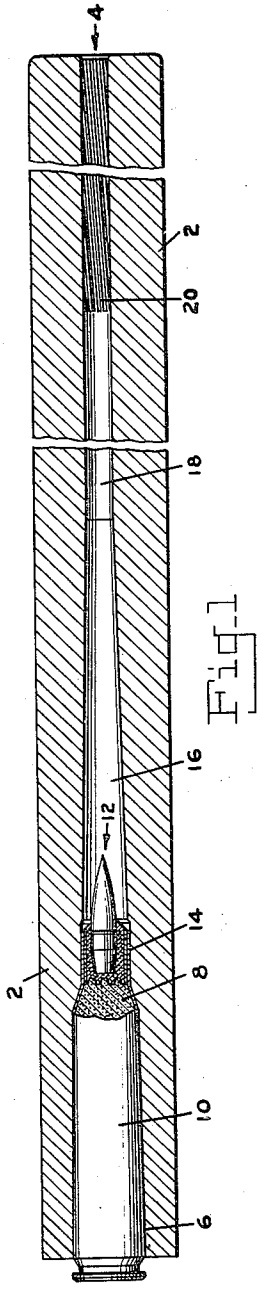

Fig. 1

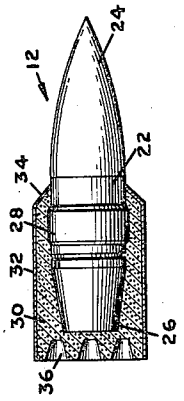

Fig. 3

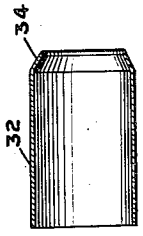

Fig. 5

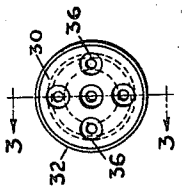

Fig. 2

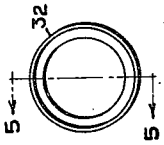

Fig. 4

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PROJECTILE

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5 Claims. (Cl. 102—92.5)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to firearms generally, and particularly to means for providing a large area of the projectile to be exposed to the propulsion gases, without however increasing that area of the projectile which resists its travel through the atmosphere.

Ballistics experts and gun designers have always been confronted with the problem of constructing a gun capable of imparting a high velocity to the projectile. The need for higher velocities in projectiles has increased with the advent of heavier armor for combat vehicles.

Solution of the problem is made more difficult by the fact that the projectile should have a large area exposed to the propulsion gases during its travel through the gun, so that the working pressure of the gases may exert a large force on the projectile, yet the area of the projectile should be as small as possible when the projectile moves through the atmosphere, so as to reduce air resistance to a minimum. Further complications and contradictions arise out of the fact that the projectile should be given a turning or rotating motion about the axis parallel to the direction of motion, but in order to impart to the projectile this rotary motion it is necessary to divert some of the energy of the propulsion gases which goes toward giving the projectile its forward velocity. Furthermore, the means used to impart a turning motion to the projectile serves as a mechanical retarding force, in that the raised lands of the rifling actually increase the friction between the projectile and the bore of the gun, serving to hinder acceleration of the projectile.

It is the object of this invention to provide a projectile and a gun in which the projectile exposes a large area to the pressure of the propulsion fluid and a small area to the atmosphere, and in which the desired turning motion is imparted to the projectile with a minimum of interference with the forward acceleration of the projectile. This object is achieved by the provision of a casing or shell of combustible material to increase the transverse dimension and therefore the cross sectional area of the incombustible member which comprises that portion of the projectile propelled through the atmosphere. The combustible casing or shell, known as a "sabot," is gradually burned away in a combustion chamber which converges forwardly. Rotary or turning motion is imparted to the projectile by rifling, but to reduce the retarding effect of the resultant friction to a minimum, the rifling extends throughout only a fraction of the bore, there being no rifling at all in the combustion chamber.

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The specific nature of the invention as well as other objects and advantages thereof will clearly appear from a description of a preferred embodiment as shown in the accompanying drawings in which:

Fig. 1 is a longitudinal view, with parts broken away and in section, showing a gun barrel complete with energy producing charge and projectile.

Fig. 2 is a rear end or face view of the complete projectile.

Fig. 3 is a view in section substantially on the line 3—3 of Fig. 2.

Fig. 4 is a rear end view of the envelope for the sabot.

Fig. 5 is a view in section substantially on line 5—5 of Fig. 4.

In the drawings is shown a gun comprising a barrel 2 having a longitudinal bore therethrough indicated generally by 4. At one end of the barrel the bore is enlarged as at 6 to receive a charge 8 of a suitable substance capable of producing energy when desired. The charge 8 will normally be a predetermined quantity of propellent powder of a desired composition, enclosed in a cartridge case 10. At the forward end of the case is secured a projectile indicated generally by 12, which will later be described in detail. Projectile 12 and that portion of case 10 containing it are housed in a chamber 14 formed in the gun bore. It will, of course, be understood that case 10 may sometimes be dispensed with, in which event projectile 12 will rest in chamber 14 in immediate contact with the walls thereof. Charge 8 may or may not then be enclosed in one or more combustible envelopes, as desired.

Immediately forward of chamber 14 is disposed a combustion chamber 16, which is preferably tapered or convergent forwardly as shown to snugly receive the transverse dimension of advancing projectile 12 which is being reduced by combustion of the combustible casing or sabot. Chamber 16 preferably has smooth walls, to provide a minimum of resistance to the passage therethrough of the projectile.

Chamber 16 converges or tapers down to a dimension which is substantially that of the projectile proper, or that portion of the projectile which is adapted to be propelled through the atmosphere. Immediately forward of chamber 16

is a preferably smooth bore chamber 18 having a substantially constant transverse dimension throughout its length. This dimension also is substantially the same as the transverse dimension of the projectile proper.

In order that the portion of the projectile leaving the gun have the desired turning or rotary motion, bore 4 is provided with rifling 20, as will be understood by those skilled in the art. Preferably, only a portion of the length of the bore will be rifled, in order to provide a minimum of resistance by the rifling to acceleration of the projectile, although it will, of course, be understood that the entire constant-diameter portion of the bore may be rifled.

Referring now to Figs. 2 to 5, it is seen that projectile 12 comprises an incombustible, usually metallic, member or bullet 22 which is preferably generally cylindrical, but pointed or tapered forwardly in ogival form as at 24. Member 22 is moreover preferably tapered, or made to converge, rearwardly into boat-tail form as shown at 26, to decrease the air resistance. Member 22 has a predetermined maximum transverse dimension, usually a diameter, which in this case is the diameter of rotating band 28. The maximum cross-sectional area presented by member 22 to the atmosphere through which it moves will then depend upon the transverse dimension, or diameter, of band 28.

In order that projectile 12 may present a greater cross-sectional area to the fluid pressure while it is exposed thereto or during a portion of that time, a casing or sabot 30 of a combustible material is provided along at least a portion of the length of member or bullet 22. Sabot 30 may be made up of either a single base or double base powder reduced to a soft plastic mass by the use of suitable solvents. The mass may then be formed about member 22 by any of a number of well known means, such as injection molding, or the plastic mass may be molded into pellets, each of which is then formed around a member 22 under hydraulic pressure. Sabot 30 will preferably itself be encased in an envelope 32, which may be of any suitable combustible substance, such as paper covered with shellac, paper or shellac alone, Cellophane, or the like. The envelope may even be made of metal. Sabot 30 and envelope 32 will preferably be made to converge forwardly, as shown at 34.

A single or double base powder, molded into such a body as shown, is very rigid. However, if it be found that the sabot tends to burn away too fast, leaving the projectile proper suspended in the center of the combustion chamber, a substance such as camphor can be used in the material of the sabot to slow down the burning time. The burning time can thus be adjusted so that combustion of the sabot is completed when the projectile leaves the combustion chamber.

To facilitate and expedite the combustion of sabot 30 during the passage of the projectile through chamber 16, the rear face or surface of the shell is formed with openings 36, which may be conical indentations, as shown. Indentations

36 serve to increase the surface area exposed to the burning gases.

I claim:

1. A projectile comprising a body portion, a sabot of propellent material enveloping the sides and rear of said body portion, said sabot having a generally cylindrical outline and a forward, frusto-conical shoulder meeting the body portion medially thereof, and an outer, metallic covering for the cylindrical and frusto-conical portions of said sabot.

2. In a projectile as in claim 1, cavities in the rear face of said sabot.

3. In a projectile for use in a gun having a bore section tapering forwardly from a first diameter to a second diameter, a bullet having a maximum diameter substantially equal to said second diameter, and a sabot enclosing the rear portion only of said bullet, said sabot comprising a rigid generally cylindrical body of explosive having a diameter substantially equal to said first diameter and means positively attaching said sabot to said bullet, said sabot acting as a guide for said projectile during its passage along said bore section.

4. In a high-velocity projectile for use in a gun having a smooth tapered bore section, said projectile comprising a bullet having an ogival nose and a circumferentially grooved body, the greatest diameter of said bullet being substantially equal to the diameter of the smaller end of said bore section, and a sabot completely surrounding the rear portion only of the body of said bullet, said sabot comprising a rigid body of propellant having a generally cylindrical exterior surface of the diameter of the larger end of said bore section and rigidly attached to said bullet by engagement with said grooves, whereby said sabot acts as a guide for said bullet during its passage along said bore section.

5. A projectile as in claim 4, said sabot including a metallic cylindrical envelope enclosing said body of propellant, said envelope having an open rear end and tapering at its forward end into contact with the body of said bullet.

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