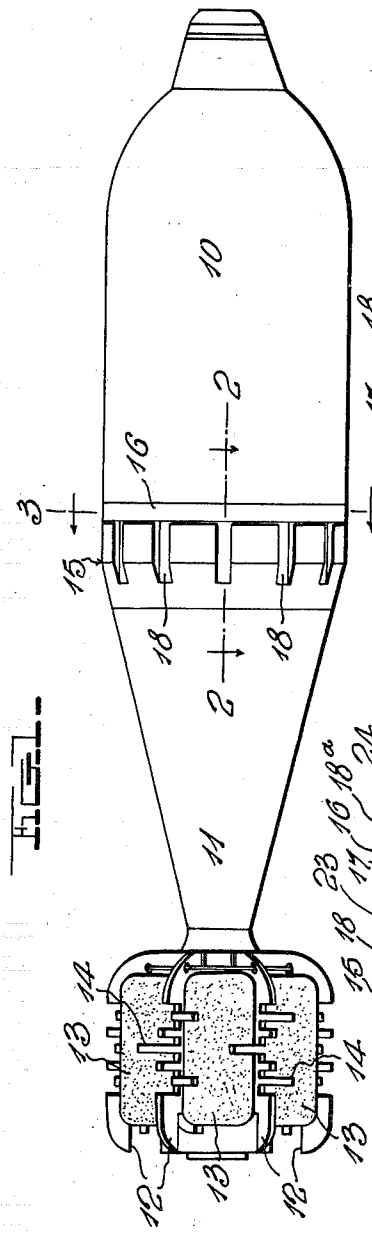
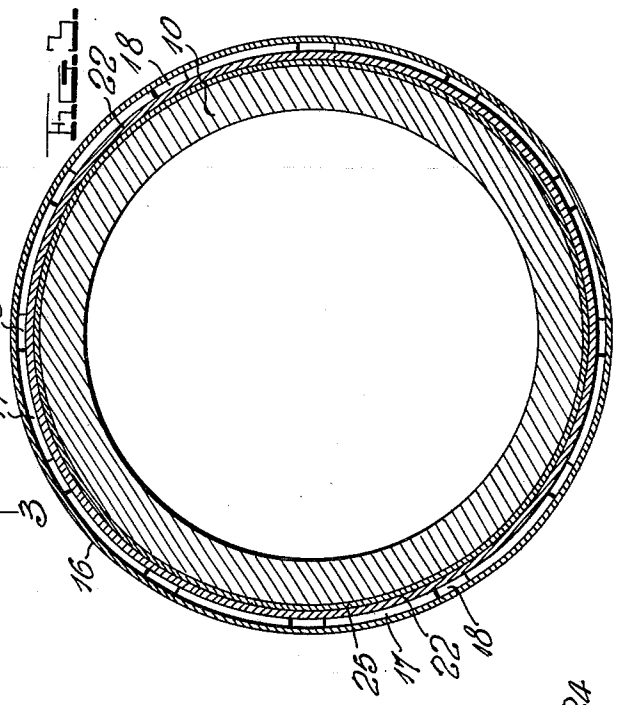
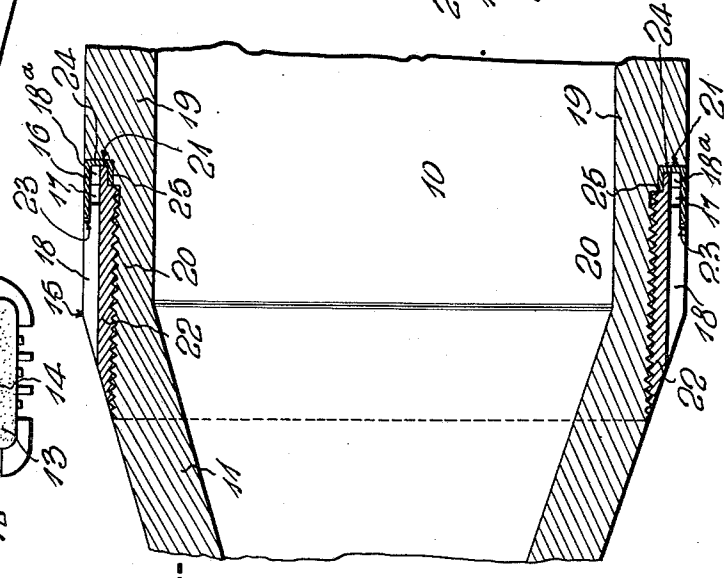
Oct. 20, 1936. B. P. JOYCE 2,057,953

MORTAR PROJECTILE

Filed April 12, 1935 2 Sheets-Sheet 1







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MORTAR PROJECTILE

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FIG. 4

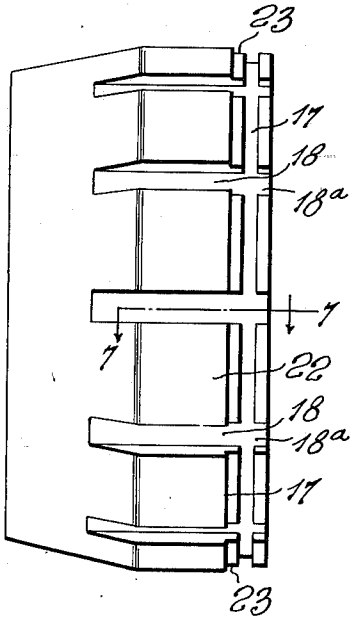


FIG. 5

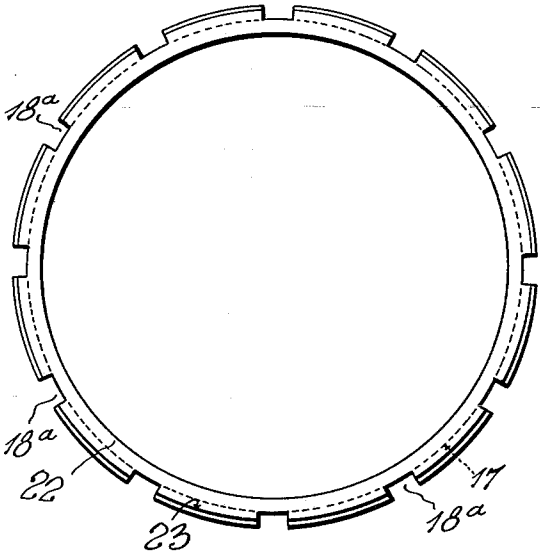


FIG. 7

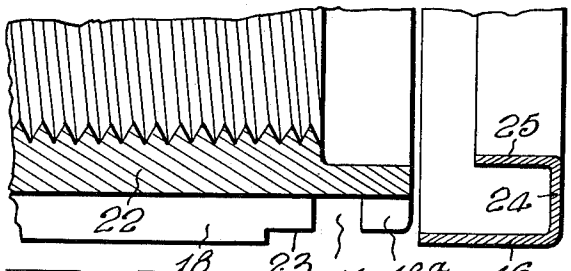


FIG. 6

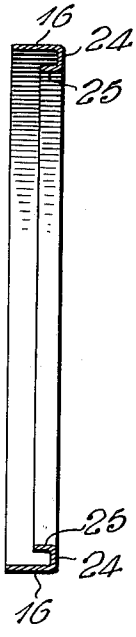
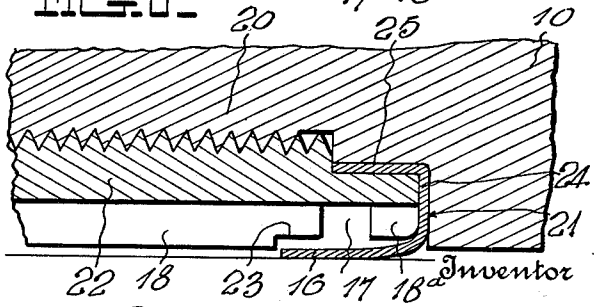


FIG. 8



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Patented Oct. 20, 1936 2,057,953

UNITED STATES PATENT OFFICE

2,057,953

MORTAR PROJECTILE

Bryan P. Joyce, East Orange, N. J., assignor to American Armament Corporation, New York, N. Y., a corporation of New York

Application April 12, 1935, Serial No. 16,081

4 Claims. (Cl. 102—29)

My invention relates to projectiles for guns and particularly for smooth bore mortars.

The principal object is to provide a simple and efficient obturating device for projectiles used in mortars. Among the further objects of this invention are:—

To provide an obturating device which will permit the projectile upon which it is fitted to drop freely down the bore of the mortar in order that sufficient force may be provided by gravity to fire the primer which sets off the propelling charge;

To provide an obturating device which, when the propelling charge is fired, will close the space between the projectile and the mortar wall and so utilize the full effect of the exploding powder gases;

To provide means seating said obturating device in such manner that, when the projectile is inserted in the mouth of the mortar, the obturating device itself will not be injured in any way by bumping or contacting the mortar mouth;

To provide a device which not only closes the space between the projectile and the mortar tube, but also reduces the maximum powder pressure by resiliently expanding into contact with the mortar tube and so cushioning the hammer-blow of the exploding gases, thereby maintaining the maximum pressure at a minimum;

To provide a device which, by closing the space between the projectile and the mortar tube, causes the projectile to move under a minimum pressure, thereby enlarging the powder chamber with consequent reduction in maximum powder-pressure;

To provide a device which, by closing the space between the projectile and the mortar tube, utilizes to the full, the maximum effect of the exploding powder gases;

To provide an obturating device which will not interfere with the boat-tail effect produced by rearwardly tapering the projectile;

To provide for holding the flaming gases in the mortar for a longer time than usual, insuring that the capsules used for the increments of propelling powder shall be consumed by combustion;

To provide a construction which will produce little wear on the barrel of the mortar and one which will readily compensate for any wear which may exist; and

To provide a rather simple and inexpensive construction, yet one which will be advantageous from numerous standpoints.

With the foregoing in view, the invention resides in the novel subject matter hereinafter described and claimed, description being accomplished by reference to the accompanying drawings.

Fig. 1 is a side elevation showing a mortar projectile constructed in accordance with the invention.

Fig. 2 is a longitudinal sectional view on line 2—2 of Fig. 1.

Fig. 3 is a transverse sectional view on line 3—3 of Fig. 1.

Fig. 4 is a side elevation of the grooved sleeve which surrounds the main section of the projectile and is instrumental in mounting the obturating ring and effecting expansion thereof.

Fig. 5 is an end view of the sleeve shown in Fig. 4.

Fig. 6 is a diametrical sectional view of the obturating ring.

Fig. 7 is an enlarged detail sectional view on line 7—7 of Fig. 4 but showing the sleeve and the obturating ring in juxtaposition.

Fig. 8 is a detail sectional view showing the ring expanded for gas-tight contact with the bore of the mortar.

The projectile 10 selected for illustration, is of the type having the usual rearwardly tapered tail 11 which gives the so-called "boat tail effect" tending to increase the range. While the powder charge for propelling the projectile may be carried in any preferred way, radial fins 12 are shown on the rear extremity of the tail 11, the increments of powder being carried in capsules 13 held between said fins by fingers 14. The usual firing cartridge is within the fins and projects beyond their rear ends as shown in Fig. 1.

Slightly in advance of the line 15 at which the tapered tail portion 11 joins the cylindrical forward portion of the projectile, is an expansible soft metal obturating ring 16 which is flush with the projectile periphery, the front edge of said ring being fluid-tightly secured to the projectile body in any suitable manner while its rear edge is free. Beneath this relatively thin sheet metal ring or band, I provide means for effectively supporting it against accidental deformation but permitting the powder gases to act freely upon its inner face so as to quickly expand the ring into gas-tight contact with the bore of the mortar or gun. This is preferably accomplished by forming a net-work of grooves or passages in the portion of the projectile immediately beneath the ring, at least some of the grooves extending beyond the rear edge of the ring. These grooves or passages form a net-work of supporting ribs or surfaces which contact with the inner face of the ring or band over sufficient area of said face to

effectively support it against accidental deformation. In the embodiment of the invention illustrated, the body of the projectile is formed with a circumferential groove 17 under the ring 16 and normally having its open side closed by this ring, said body being provided also with a plurality of longitudinal peripheral grooves 18 whose front ends open into the circumferential groove 17, the rear ends of said longitudinal grooves 18 being open through the peripheral surface of the tapered tail 11.

When the powder charge is fired in the mortar behind the projectile, the gas under pressure enters the groove 17 through the grooves 18, thereby expanding the ring 16 into gas-tight contact with the bore of the mortar, preventing idle escape of gas and insuring numerous advantages hereinafter mentioned.

In successful tests of structure shown in the drawings and in which the groove 17 is beneath the center of the ring, the markings left on the obturating rings by the mortar barrel show that the greatest pressure is exerted on said rings directly opposite the circumferential grooves of the projectiles.

The obturating ring 16 may be formed from copper, gilding metal, brass, or any other suitable metal. If desired, its exposed surface may be provided with relatively soft metal inserts in accordance with my reissued Patent No. 16,978 of May 29, 1928. When such a construction is provided, any particles of grit on the exterior of the projectile will imbed themselves in the soft metal surface of the obturating ring instead of scoring the bore of the mortar.

The specific construction disclosed in the drawings is preferably followed, although variations may of course be made. From a circumferential line somewhat in advance of the line 15 to another line in rear of said line 15, the main section 19 of the projectile body is reduced in diameter as shown at 20, providing a rearwardly facing shoulder 21 at the front end of this reduced portion. An auxiliary body section in the form of a sleeve 22 is secured upon the reduced portion 20, preferably by tightly threading it thereon as shown. The grooves 17 and 18 are formed in the peripheral surface of the sleeve 22, and to facilitate the formation of the grooves 18, they may well extend entirely to the front end of said sleeve 22, as shown at 18^a, instead of terminating at the circumferential groove 17. The front portion of the sleeve 22 is preferably reduced at 23 to receive the thickness of the obturating ring 16, which ring is provided with an integral annular portion 24 tightly clamped between the shoulder 21 and the front extremity of said sleeve 22, said ring being also provided with an integral cylindrical portion 25 tightly held between the periphery of the reduced portion 20 and the inner side of said sleeve 22.

The operation of the present device is as follows:—As made, the outside of the projectile has the same contour, insofar as maximum diameter is concerned, as the customary mortar projectiles which have a sufficient clearance between themselves and the bore of the mortar to permit them to fall with sufficient speed to fire the propelling charge. Upon the firing of the propelling charge, the grooves beneath the obturating ring admit the powder gases which expand the ring in contact with the mortar tube; as the obturator functions under very low pressure, the projectile is started on its way out of the mortar at the starting of the burning of the propelling charge and gradually enlarges the powder chamber with the burning of the charge, permitting the powder gases to exert a maximum of push to the projectile throughout the length of the mortar tube.

In the usual projectiles without obturating devices and which have a space between the diameter of the projectile and the mortar tube, the propelling charge has to build up a much higher pressure to start the projectile on its way out of the tube than with the projectiles equipped with the present device. This is owing to the leakage of powder gases by the projectiles; also, in expanding to contact the tube, the obturating device affords a certain resilience to the hammer-blow of the powder gases.

With projectiles which do not have an obturating device, the leakage between them and the bore of the mortar is so great that the average push on the projectile of these gases is limited to but a few inches of length of the mortar tube, the remainder of the tube merely serving to aim the projectile in its flight.

With the present device and in view of the fact that the gases are confined behind the projectile without any leakage, the average push of the powder gases on the projectile is increased, very materially, over a similar push given the powder gases by the same propelling charge to the non-obturated projectiles.

The fact that the present device permits the propelling charge to give a materially increased push to the projectile over similar projectiles, which do not have obturating devices, permits a very materially increased range to be obtained with the present projectile and by also reducing the maximum powder-pressure, it permits the mortar parts to be made materially lighter, resulting in a much lighter weapon, which has to be transported by man-power; also, a weapon which has a very materially increased range as the weight which can be transported by one man is limited. The present projectile permits either lighter man-loads or permits increase in range or capacity of the projectile, or both.

Not only does the present device permit a decrease in weight of the mortar parts and increase in the range of the projectile, but it also reduces to a minimum the dispersion by closing the space between the obturated projectile and the mortar wall and so obtains uniform action of the propelling charge. In actual practice, it is, of course, necessary to have tolerance on the mortar bore as well as tolerance on the projectiles with consequent variation in space between projectiles and the mortar wall. This has heretofore resulted in varying the leakage of the propelling charge between the projectiles and the mortar bore with consequent variation in the push of the propelling charge, resulting in a wide dispersion in range. With the present device, as the space between the projectile and mortar wall is closed, the variation in the space between the projectile, itself, and the mortar wall is of no consequence, with the result that every projectile fired gets an equal push from its propelling charge and so dispersion is reduced to a minimum. Any wear which may take place either with use of the present projectile or which may have occurred when using the mortar with conventional projectiles, will be compensated for by the obturating ring.

As excellent results are obtainable from the details disclosed, they may well be followed, but attention is again invited to the possibility of making variations within the scope of the inven-

tion as claimed. For example, the body of the projectile may be formed in two cup-shaped sections screwed together with the obturating ring clamped between them, the shoulder 21 being on one section and the grooves 17 and 18 on the other.

What is claimed is:

1. A projectile comprising a main body section having a rearwardly facing shoulder and a reduced portion behind said shoulder, an auxiliary body section in the form of a sleeve secured around said reduced portion, the periphery of said sleeve having an open-sided circumferential groove near its front end and being provided with longitudinal open-sided grooves extending rearwardly from and communicating with said circumferential groove, and an obturating ring surrounding said front end of said sleeve and spanning the open side of said circumferential groove and the front portions of the open sides of said longitudinal grooves, said ring having an annular portion clamped between said front end of said sleeve and said shoulder and an annular portion held between said sleeve and said reduced portion of said main body section.

2. A structure as specified in claim 1; the projectile body formed by said main and auxiliary sections being provided with a rearwardly tapered tail portion through the peripheral surface of which said longitudinal grooves open.

3. A projectile comprising a main body section having a rearwardly facing shoulder and a reduced portion behind said shoulder, an auxiliary section in the form of a sleeve secured around said reduced portion of said main body section, and an obturating ring surrounding the front end of said sleeve, said ring having an annular portion clamped between said front end of said sleeve and said shoulder, and another annular portion integral with the aforesaid annular portion and held between said sleeve and said reduced portion of said main body section, said sleeve having means for conducting powder-gases under said ring to expand the same.

4. A projectile comprising a main body section having a rearwardly facing shoulder and a reduced portion behind said shoulder, an auxiliary section in the form of a sleeve secured around said reduced portion of said main body section, and an obturating ring surrounding the front end of said sleeve, said ring having an annular portion clamped between said front end of said sleeve and said shoulder, said sleeve having means for conducting powder-gases under said ring to expand the same.

BRYAN P. JOYCE.