

L. J. McNAIR.

PROJECTILE.

APPLICATION FILED JUNE 26, 1909.

1,007,223.

Patented Oct. 31, 1911.

2 SHEETS—SHEET 1.

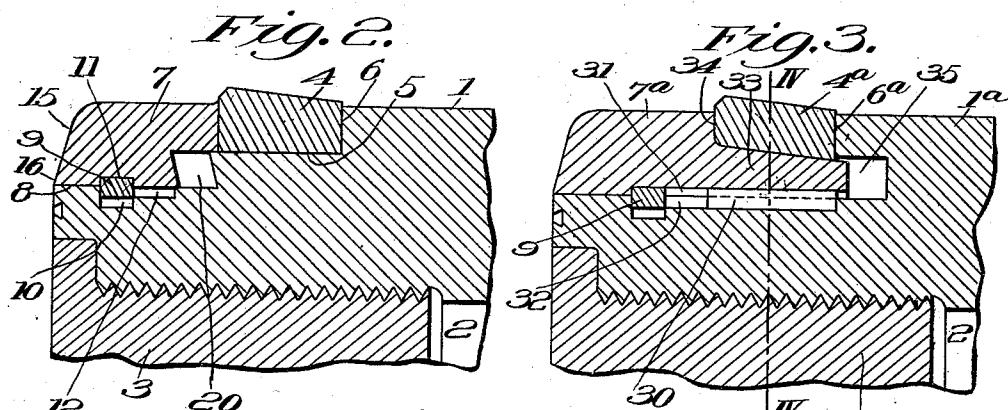
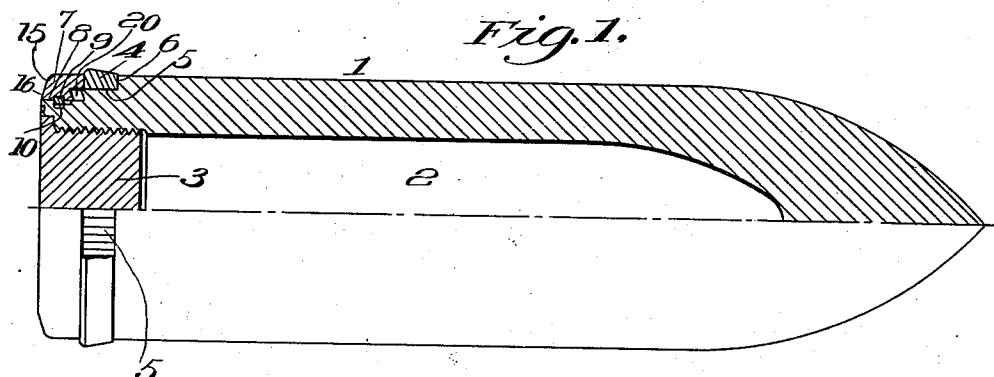
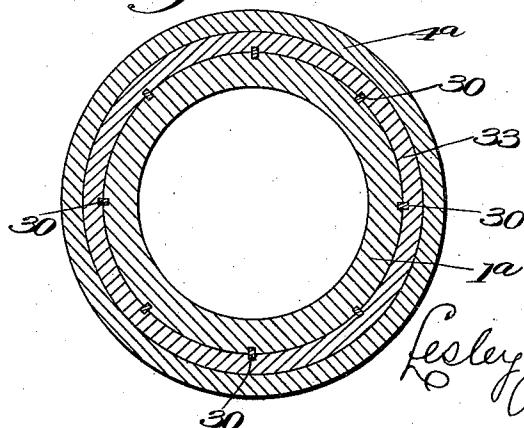


Fig. 4.



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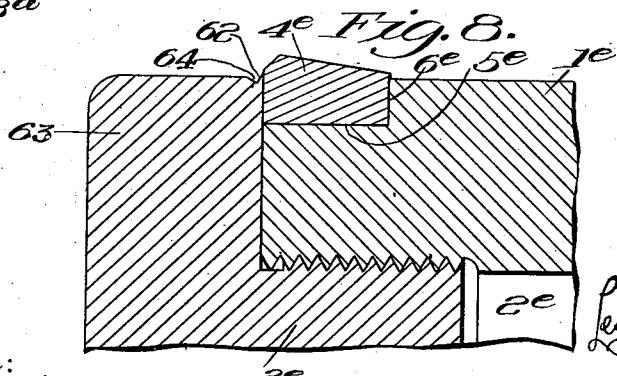
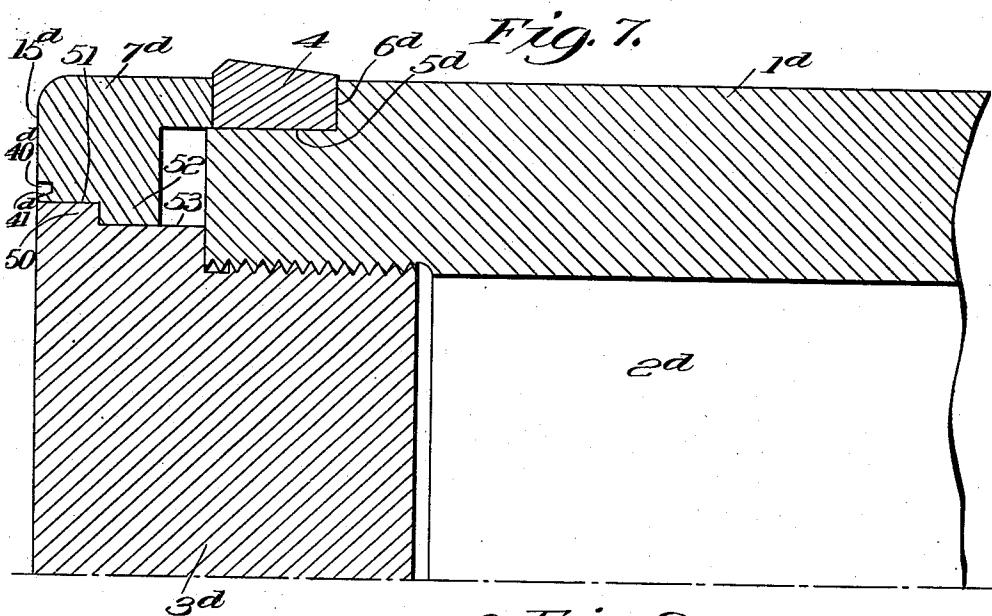
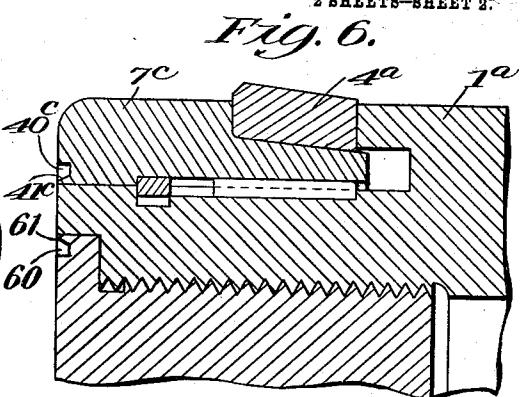
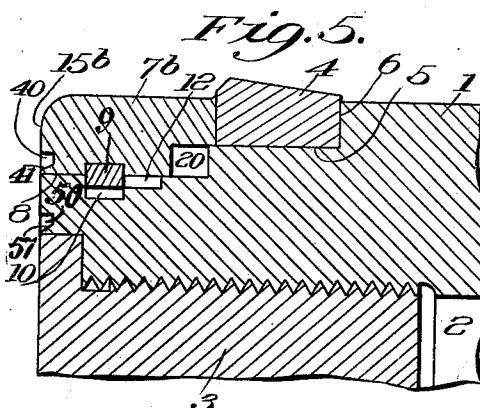
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2 SHEETS—SHEET 2



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UNITED STATES PATENT OFFICE.

LESLEY J. McNAIR, OF THE UNITED STATES ARMY.

PROJECTILE.

1,007,223.

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To all whom it may concern:

Be it known that I, LESLEY J. McNAIR, a citizen of the United States of America, lieutenant in the U. S. Army, have invented certain new and useful Improvements in Projectiles, of which the following is a specification.

My invention relates to projectiles and particularly to improvements in obturating and rotating bands therefor.

Among the objects of my invention are to provide a structure by which a rotating band or ring of greater cross section than that generally in use may be applied to a projectile, and to provide means for readily attaching such a ring.

It is also an object of my invention to provide means whereby this ring may be expanded or upset to effectually seal the space between the projectile and the bore of the gun, to prevent the escape of gases by the projectile upon the firing of the gun and the consequent erosion of the bore. The upsetting of the band will also cause it to properly grip the rifling, although the bore of the gun may be seriously worn.

It is also an object of my invention to provide means for sealing the joints between different parts of the projectile against leakage of gases.

In the accompanying drawings, which form a part of this specification, I have shown certain embodiments of my invention, which I have chosen for purposes of illustration, but I do not wish to be understood as limiting myself to the precise construction shown as my invention may be embodied in various other forms.

In these drawings, Figure 1 is a side view of a projectile, one-half in section and one-half in elevation, showing one form of my invention. Fig. 2 is a longitudinal sectional view upon an enlarged scale, of a portion of the projectile shown in Fig. 1. Fig. 3 is a view similar to Fig. 2, showing a modified form of my invention. Fig. 4 is a transverse section on a reduced scale of the projectile shown in Fig. 3, taken at the point indicated by the line IV—IV on the latter, the plug being omitted. Figs. 5, 6, 7 and 8, are views similar to Figs. 2 and 3, showing different modifications of my invention.

Referring to the drawings in detail, and particularly to Figs. 1 and 2; 1 is the projectile, preferably formed with a cavity 2 for the reception of an exploding charge. A

plug 3 is provided for closing the cavity. 4 is the obturating rotating band or ring, which is preferably formed of some more or less compressible material, such as copper. For the reception of this band a seat 5 is provided on the rear portion of the projectile, the forward face of the band abutting against the shoulder 6. To retain the band in place and to upset the same upon the firing of the gun, a pressure or abutment member 7 is used, which is slidably mounted upon a seat 8 on the projectile. In the form shown in Figs. 1 and 2, this pressure or abutment member is an endless ring, but it may be given other forms, such as that of a cup, inclosing the rear end of the projectile. In order to hold the parts in assembled relation while the projectile is being handled and loaded into the gun, and to take up the shock upon the band 4 when the projectile is seated in the bore, it is necessary to provide some means for holding the pressure or abutment member 7 upon the projectile. Locking devices of various types may be used for this purpose, but I prefer to use the split spring ring 9 fitting in the groove 10 in the projectile. The groove 10 is made of a sufficient depth to permit the ring 9 to be contracted into it until the outer face of the ring is flush with or below the seat 8 on the projectile, when the pressure or abutment member can be slipped into place. When the groove 11 in the pressure or abutment member moves over the spring locking ring, the latter will expand into the groove 11 and lock the pressure member in place. The groove 10 is made of greater breadth than the ring 9, the forward portion 12 being preferably cut to a less depth than the rear portion, a space being thus formed to receive the locking ring when the pressure or abutment member is driven forward on the projectile by the powder pressure. The seat 5 on the projectile may be knurled or otherwise roughened as shown in Fig. 1, where a portion of the band 4 is illustrated as broken away, for the purpose of preventing relative movement between the band and the projectile; the band thus transmits the rotation which it receives from the rifling of the gun to the projectile, and rotates the latter. The shoulder 6 may be similarly knurled or roughened, if desired. Where the pressure or abutment member is in the form of a ring as shown, to seal the joint between it and

its seat its rear face 15 is preferably inclined in order to permit the gas pressure to exert an inward component upon the ring, which will slightly compress it, or bend in the 5 tapered toe 16 thereof, and cause the same to grip the seat 8 on the projectile. The entrance of gases into the space 20 is thus prevented and the full effective pressure upon the rear face of the ring is maintained.

- 10 The operation of my construction is as follows: The parts having been assembled by first placing the obturating band or ring upon its seat, contracting the spring locking ring into the groove 10 and slipping the 15 pressure or abutment member 7 upon its seat 8 until the spring locking ring expands into the groove 11, the projectile is ready for charging into the gun. In this latter operation, as will be understood, the projectile 20 is pushed forward through the powder chamber until the band 4 seats firmly against the rear extremities of the lands in the rifled portion of the gun. This seating takes place with a considerable shock, which 25 is transmitted from the band 4 to the ring 7, and from the latter to its locking means, in this case, the locking ring 9. The powder charge is then placed in the gun, and, the breech being locked, the gun is ready for 30 firing. The enormous pressure produced by the explosion of the powder in the powder chamber acts upon the rear face of the projectile to drive the latter forward. It also acts upon the rear face 15 of the ring 35 7, and as the mass of the ring is much less than that of the projectile, its inertia will be first overcome and it will be caused to move forward upon the projectile, upsetting the ring 4 and causing the latter to 40 expand into the rifling. The band and projectile are thus given the desired rotary movement and the escape of gases from the powder chamber around the projectile absolutely prevented. This escape of gases is 45 the principal source of gun erosion, one of the most serious problems arising from the use of modern high-powered powders, and one which ordnance experts have long sought to overcome. The pressure upon the 50 rear face 15 of the pressure or abutment member continues throughout the length of the bore, and the band 4 thus continually tends to expand and compensate for the removal of its peripheral portions by friction 55 against the gun walls as it advances. The band is also caused to fill the bore of the gun, even though the latter through the use of projectiles of ordinary types, has become badly eroded.
- 60 Figs. 3 and 4 illustrate a modified form of my invention, in which the obturating band 4^a is mounted upon a tapered extension 33, formed upon the pressure or abutment member 7^a. The band is adapted to 65 be compressed between a shoulder 6^a on the

projectile, and a shoulder 34 on the pressure member, in the manner described with reference to the form of projectile shown in Figs. 1 and 2, the cone shaped surface of the extension 33 giving an increased expansive action. As the obturating rotating band is in this form practically carried by the pressure member, means must be provided for transmitting rotation from the latter to the projectile, for which purpose 70 I may use a series of keys 30 fitting in ways 31 and 32 in the pressure or abutment member and projectile respectively. The ways 31 are made longer than the keys, in order to permit forward movement of the pressure member. A split locking ring 9 is 75 preferably used for retaining the pressure member in place. An annular recess 35 is formed in the projectile for the reception of the end of projection 33 when the pressure member moves forward. The operation of this form of my invention is substantially the same as that of the form previously described, except that in addition to the expansion of the band due to upsetting, it is forced 80 outwardly by the wedging surface of the tapered extension 33.

In Fig. 5, I have shown a modification of my invention substantially similar to the form shown in Figs. 1 and 2, with the exception of the pressure or abutment member or ring 7^b. This ring, instead of having the inclined rear face 15, has its rear face 15^b provided with an annular groove 40, near its inner circumference. A comparatively thin wall 41, preferably tapered as shown, is thus left between the groove and the bore of the ring. This wall is sufficiently flexible to be forced into close contact with the seat 8 on the projectile under the influence of the powder pressure and effectually seals the joint between the ring 7^b and the projectile, against the entrance of the gases. The effective pressure upon the rear face 15^b of the ring is thus maintained and leakage of gases under the obturating band prevented. A similar groove 50 may be cut in the projectile near its joint with the plug, the thin wall 51 sealing the joint and preventing leakage of gases into the charge 100 cavity.

Fig. 6 shows a form of projectile similar to that shown in Fig. 3, with the exception of the pressure or abutment ring 7^c, which is provided with a groove 40^c similar to the groove 40 shown in Fig. 5, leaving a thin wall 41^c similar to the wall 41. In this figure I have shown a groove 60 cut in the plug leaving a thin wall 61 acting to seal the joint between the plug and projectile.

In Fig. 7, another modification of my invention is shown, in which the projectile 1^d is provided with a powder cavity 2^d adapted to be closed by the plug 3^d. The obturating rotating band 4 is seated upon a seat 5^d and 110

against a shoulder 6^a formed on the projectile. A pressure or abutment member in the form of a ring 7^a abuts against the rear wall of the obturating rotating band. This pressure member instead of being slidably mounted upon a seat formed on the rear of the projectile, is carried by a portion of the plug 3^a . The plug is provided with a flange 50 to limit the rearward movement of the pressure ring, the upper edge of the flange forming a seating surface 51 . An inwardly projecting flange 52 on the ring, engages with flange 50 , the inner surface of the former resting on the seat 53 formed on the plug. The rear face 15^a of the ring, upon which the powder pressure acts to force the ring forward and expand the obturating band, is preferably provided with a groove 40^a , leaving a thin wall 41^a similar to the wall 41 above described and operating in the same manner. The assembling of the parts of this projectile is accomplished by simply placing the obturating rotating band upon its seat on the projectile, slipping the ring 7^a over the plug and screwing the latter into place.

In Fig. 8 I have shown another modification of my invention, in which a rotating band 4^e is mounted upon a seat 5^e and against the shoulder 6^e formed on the projectile 1^e . No pressure member for upsetting the band is used in this form. The band is retained in place by the flange 63 formed on the plug 3^e used for closing the powder chamber 2^e . In order to prevent the leakage of gases beneath the rotating band, I form a thin lip 62 upon the edge of the flange 63 , preferably by cutting a groove 64 in the latter. The powder pressure acting upon this lip presses it against the rotating band and effectually seals the joint. An important advantage of this method of closing joints between portions of projectiles is that the tightness of the seal is proportional at all times to the powder pressure which the seal is required to withstand. This is a particularly desirable feature when there is relative movement between the parts, as in the form 5 of my invention shown in the first seven figures, as the closeness of the fit and resultant friction and resistance to movement is never in excess of what is actually necessary for the particular pressure present.

In the structure of Fig. 8 I do not obtain the advantages due to the upsetting of the rotating band as in the forms of my invention which I have previously described, but I have a projectile of very simple construction and few parts. The application of the rotating band is a very much simpler and cheaper operation than in the form of projectile commonly in use, in which it is necessary to hammer or force the rotating band into a groove cut in the projectile. It is

also possible to use a rotating band of much greater depth and heavier cross section than is feasible where the band is applied in the old way. The possibility of breakage of the band by centrifugal force after the projectile leaves the gun, an accident which frequently happens under present conditions, is thus eliminated.

Having thus described my invention, I claim:

1. In combination with a projectile for breech-loading rifled guns, an obturating, rotating band, an abutment-member mounted upon the projectile and abutting against said band, and means for positively locking the abutment-member to the projectile, said means limiting rearward movement of the abutment-member relatively to the projectile prior to and during loading and acting to retain said rotating band against rearward movement on the projectile when the band seats against the lands of the gun, but permitting forward movement of said abutment-member on the projectile.

2. In combination with a projectile for breech loading rifled guns, an obturating rotating band, an abutment member mounted upon the projectile and abutting against said band, and means comprising a hard metal locking ring engaging portions of the projectile and of the abutment for positively locking the abutment member to the projectile, said means limiting rearward movement of the abutment member relatively to the projectile prior to and during loading and acting to retain said rotating band against rearward movement on the projectile when the band seats against the lands of the gun, but permitting forward movement of said abutment member on the projectile.

3. In combination with a projectile, a band, an abutment member, and a split locking ring for locking the abutment member to the projectile.

4. In combination with a projectile, a band, and means including a split spring locking ring for retaining said band on said projectile.

5. In combination with a projectile, an obturating band, an abutment member movable relatively to the projectile for expanding said band, a locking ring for securing the abutment member to the projectile, a groove in the abutment member for the reception of a portion of the locking ring, and a groove in the projectile for another portion of said locking ring, said last mentioned groove being of greater width than the locking ring, said ring normally occupying a position partly in one groove and partly in the other.

6. In combination with a projectile, a band, an abutment member for retaining said band upon said projectile, a locking ring for locking said abutment member to

said projectile, grooves in said projectile and abutment member for the reception of said locking ring, the depth of one of said grooves at least equaling the thickness of 5 said locking ring, said ring normally occupying a position partly in one groove and partly in the other.

7. In combination with a projectile, an obturating, rotating band, an abutment- 10 member mounted upon a rearwardly projecting portion of said projectile of reduced diameter, and slidable thereon, and means for directly and positively preventing relative rotation between said abutment-member 15 and projectile.

8. In combination with a projectile, a member carried by the projectile, movable relatively thereto and adapted to be operated by the powder pressure and having 20 a forwardly and inwardly inclined wedging surface, and an obturating band mounted on and carried by said wedging surface.

9. In combination with a projectile having a cylindrical seat of reduced diameter, 25 an abutment member slidably mounted on said seat and adapted to be operated by the powder pressure, said abutment member having a forwardly projecting extension provided with a conical outer surface, an 30 obturating band mounted on said surface, and an abutment on said projectile against which the forward face of said band abuts.

10. In combination with a projectile, an abutment member movable longitudinally, 35 with reference to said projectile, an obturating band carried thereby, means for preventing separation of said abutment member and said projectile, and means for preventing relative rotation of said member 40 and said projectile.

11. In combination with a projectile, an obturating rotating band, an abutment member movable relatively to said projectile, said member being provided with a 45 cone shaped surface for expanding said band and with an abutment engaging with the rear face of said band, and means for preventing relative rotation between said abutment member and said projectile.

50 12. In combination with a projectile, an obturating rotating band, an abutment member for expanding said band, a longitudinally disposed key for preventing rela-

tive rotation between said abutment member and the projectile, one of said members being provided with a key-way for the reception of said key, of greater length than the latter, whereby relative longitudinal movement between said members is permitted.

13. In combination with a projectile, a 60 rotating band, an abutment ring for retaining said band upon said projectile, said ring seating upon a portion of said projectile, and a groove cut in the rear face of said abutment ring, near the seating surface of 65 the ring upon the projectile.

14. In combination with a projectile, an obturating band, an abutment ring for expanding the same, slidably mounted upon a portion of the projectile, and a comparatively thin sealing lip formed upon 70 said ring for sealing the joint between the same and said projectile.

15. In combination with a projectile, an obturating band, an abutment ring movable 75 longitudinally with relation to said projectile for expanding said band, said ring seating upon a portion of said projectile, and a groove in one of said last mentioned parts, near the seating surface of said ring upon 80 said projectile, forming a sealing lip for sealing the joint between said ring and said projectile.

16. In a projectile, a member having a cavity for the reception of a charge, and a 85 plug member for closing the opening to said cavity, one of said members having a thin sealing lip integral therewith and formed upon a surface thereof exposed to gas pressure, and along its line of contact with the 90 other of said members, said sealing lip lying in contact with the surface of said other member and adapted to be forced into sealing engagement therewith by the 95 gas pressure.

17. In a projectile, a member having a cavity for the reception of a charge, and a plug for closing the opening to said cavity, said plug having a groove formed in an exposed face near its line of contact with said 100 member to form a sealing lip for sealing the joint between said parts.

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Witnesses:

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