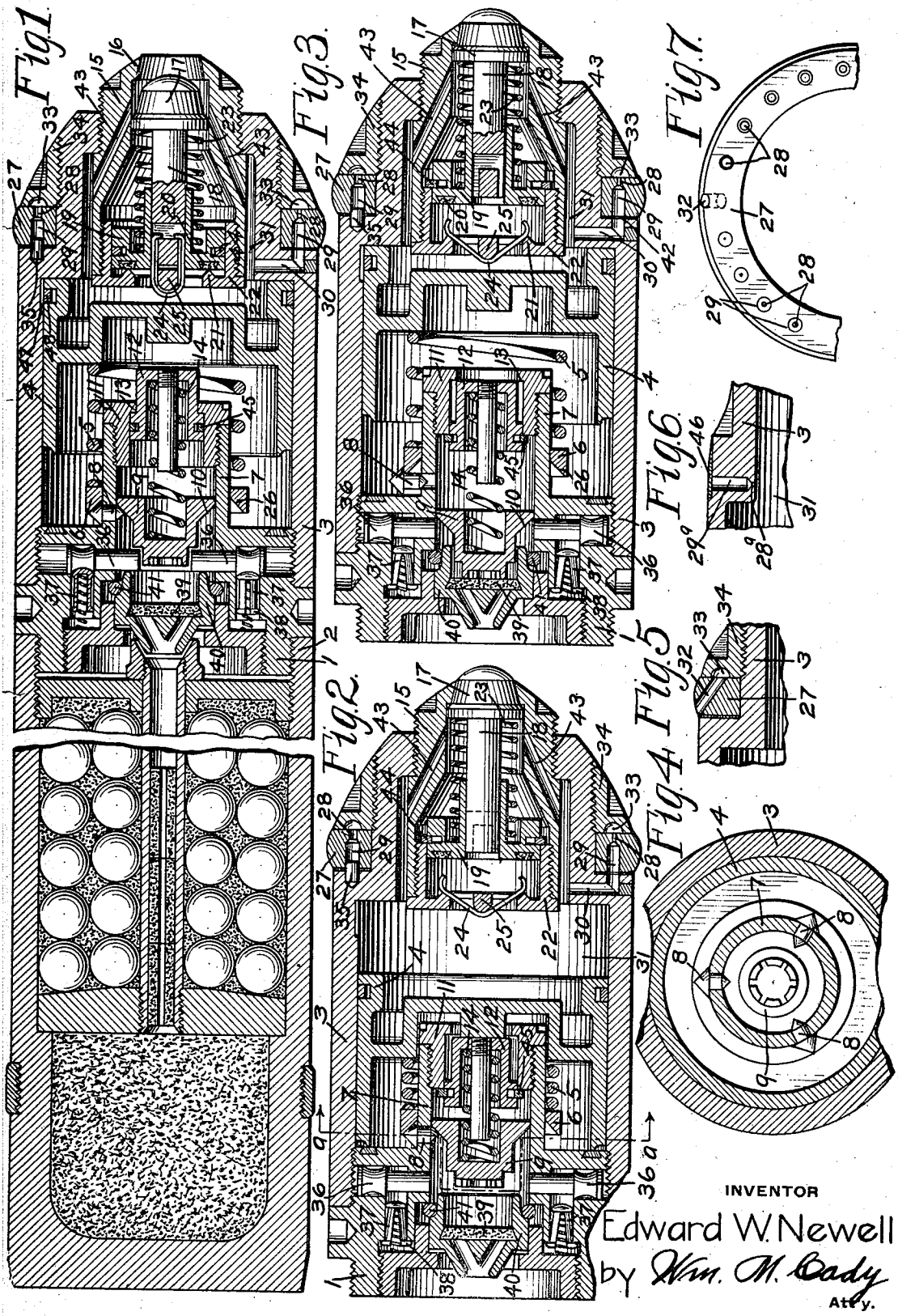
E. W. NEWELL.

TIME FUSE FOR PROJECTILES.

APPLICATION FILED JUNE 23, 1917.

1,309,770.

Patented July 15, 1919.



INVENTOR

Edward W. Newell

by Wm. M. Cady

Atty.

UNITED STATES PATENT OFFICE.

EDWARD W. NEWELL, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO THE WESTINGHOUSE AIR BRAKE COMPANY, OF WILMERDING, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

TIME-FUSE FOR PROJECTILES.

1,309,770. Specification of Letters Patent. Patented July 15, 1919.

Application filed June 23, 1917. Serial No. 176,603.

To all whom it may concern:

Be it known that I, EDWARD W. NEWELL, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented new and useful Improvements in Time-Fuses for Projectiles, of which the following is a specification.

This invention relates to explosive projectiles, and more particularly to a time fuse mechanism therefor.

The ordinary time fuse for projectiles employs a powder train, the length of which is intended to be adjusted so as to burn in a predetermined length of time.

In practice, it has been found difficult to make a powder train which can be depended upon to always burn in a predetermined length of time, as slight variations in composition and the pressure at which the train is compressed and varying atmospheric conditions will cause changes in the time of burning. Furthermore, accurate machining and careful construction of the fuse mechanism is necessary to insure proper adjustment of the length of the train, and in addition, carelessness in fitting may permit leakage, so that the burning train may prematurely explode the charge.

The principal object of my invention is to provide a time fuse mechanism in which the above difficulties are avoided and for this purpose, the powder train is dispensed with and the timing function is accomplished by the use of fluid under pressure.

In the accompanying drawing; Figure 1 is a central sectional view of a projectile embodying my invention, showing the fuse mechanism in normal position; Fig. 2 a central sectional view of the fuse mechanism, showing the position of parts after the projectile is fired from the gun; Fig. 3 a similar view, showing the positions of parts after the timing fuse operates; Fig. 4 a fragmentary section on the line *a*—*a* of Fig. 2; Fig. 5 a sectional view of a portion of the projectile nose, showing the atmospheric vent in the vent ring; Fig. 6 a sectional view of a portion of the projectile nose, showing a modified construction for regulating the size of the vent port; and Fig. 7 a rear face view of a portion of the vent port adjusting ring.

As shown in the drawing, the construction may comprise a central member 1 adapted to be screwed into the main body portion 2 of the projectile and secured by screw threads to said central member 1 is a cylindrical fuse casing 3.

Within the fuse casing 3 is a piston chamber containing a piston 4 adapted to act on a coil spring 5 engaging a ring 6 mounted on a cylindrical extension 7 of the central member 1.

The ring 6 is provided with an annular inclined face 26 adapted to normally engage conical heads of holding pins 8 and within the cylindrical extension 7 is mounted a slidable firing plunger 9 having an annular inclined face 10 adapted to normally engage conical points of the pins 8.

Screwed into the end of the cylindrical extension 7 is a sleeve 11, within which is mounted a spring cap 12, normally held in engagement with an annular shoulder 13 of the sleeve 11 by a coil spring 14 interposed between the cap and the firing plunger 9.

A plug 15 having a central conical valve seat 16 is screwed into the nose end of the casing 3 and a valve 17 having a stem 18 is adapted to engage said seat when operated.

The stem 18 is mounted in a piston 19 having a seat 20 adapted to engage an annular seat ring 21 of a cap 22 which is screwed into the rear end of the plug 15 and interposed between the valve 17 and piston 19 is a coil spring 23 preferably under initial compression.

The valve 17 is normally locked in its open position by means of a spring clip 24 which is looped over a cross-bar 25 of the cap 22 and has its ends bent inwardly so as to engage an interior face formed by slotting the stem 18, the clip 24 being normally prevented from expanding by engagement with the walls of the bore containing the stem 18.

Mounted on the forward portion of the casing 3 is a rotatable ring 27 having a series of spaced ports 28 of varying size opening into holes 29 of uniform size, the latter holes being adapted to register with a passage 30 leading to the chamber 31 at the front of piston 4 as the ring is rotated. At one point in the circumference of the ring there is provided a vent port 32 which is adapted to continually register with a groove 33 formed in a nut 34 which is em-

ployed to clamp the ring 27 in position, and the ports 28 also register with said groove. A lock pin 35 secured in the casing 3 is adapted to engage in one of the holes 29, according to the position of the ring 27.

Radially movable locking pins 36 are mounted in the central member 1, so as to engage in recesses formed in the firing plunger 9 and said pins are yieldingly held in position by spring pressed clips 37, said clips being split and having rear flange portions 38 adapted to spring out and engage a rear wall of member 1 when forced back by the movement of pins 36.

The primer 39 is mounted in a longitudinally movable holder 40 which is normally held in position by a split spring ring 41.

In operation, the parts are normally in the positions shown in Fig. 1 of the drawing, with the primer holder 40 held by the spring ring 41, the firing plunger 9 by the pins 8, the valve 17 being held open by the clip 24.

The firing plunger 9 is also positively held in position by the pins 36, so that the projectile cannot be accidentally exploded during handling and transportation.

When it is desired to use a projectile, the nut 34 is unscrewed and the ring 27 is slipped back out of engagement with pin 35, so that the ring may be rotated.

The ports 28 are calculated to vent fluid at such a rate that the fuse will be operated when the time in seconds has elapsed according to the marked graduation in seconds (not shown) for the particular port, and consequently the ring 27 is turned to bring the desired port 28 into registry with passage 30 and then the ring is slipped back against its gasket 42 and the pin 35 engages in one of the holes 29, so as to prevent rotation of the ring 27. The nut 34 is then screwed down against the ring 27 and the projectile is ready for firing.

Upon firing the projectile, the piston 4 is thrown relatively rearwardly by inertia against a rear seat, and air from the atmosphere enters at the opening formed by the valve 17 and passes through passages 43 to chamber 31.

The pressure of air in chamber 31 necessary to operate the parts is made low enough to come within the range of air pressure which may be attained under the slowest projectile speed and the highest altitude.

When the predetermined pressure as above determined is reached in chamber 31, the same is sufficient to lift piston 19 off its seat 21 against the resistance of the spring 23, and the full area of the piston being now exposed, the piston promptly moves forward so as to uncover the arms of the spring clip 24, which immediately fly out to the position shown in Fig. 2 of the drawing. The spring 23 then under compression acts on the valve 17 to force the same against its seat 16 and thus cut off the further inflow of air to chamber 31. When the piston 19 has moved out a certain distance, an expandible spring ring 44 flies out and engages the front end wall of cap 22, thus preventing the return movement of the piston, so that the pressure of spring 23 is maintained to hold the valve 17 seated.

In the meantime, the rotary movement of the projectile on its axis throws the pins 36 outwardly, causing the spring clips 37 to be forced rearwardly, so that the flanges 38 can move out and lock, as shown in Fig. 2 of the drawing.

The pins 36 having moved out, the firing plunger 9 is free to strike the primer when released.

As the piston 4 moves rearwardly, it engages the spring cap 12 and shifts same rearwardly so as to compress the spring 14 and when the cap has moved a sufficient distance, a split spring ring 45 therein flies out and engages back of the member 11 so as to hold the cap in position with the spring compressed against the firing plunger 9.

When the pressure in chamber 31 has been reduced to a predetermined degree by escape through the particular port 28 which registers with passage 30, the piston 4 is moved forward by the spring 5, so that the pressure on the ring 6 and the pins 8 is relieved and when the piston 4 is near the end of its stroke, the spring pressure on the ring 6 is reduced to a point such that the pressure of the compressed spring 14 is sufficient to force the firing plunger 9 rearwardly, the pins 8 being thrown out radially, and the ring 6 being pressed forward against the weakened resistance of spring 5.

The firing plunger 9 having been released, strikes the primer 39 and explodes the projectile in the usual manner.

In order to insure the prompt and positive outward movement of piston 4 through its full stroke, a groove 47 is provided in the cylinder bore of casing 3 near the end of the stroke of the piston, so that when the piston is near the end of its stroke fluid under pressure in chamber 31 can leak through said groove around the piston ring 48 to the opposite side of the piston and thus tend to equalize the opposing fluid pressures on the piston, so that the movement of the piston by the spring 5 is facilitated and then the pressure of spring 14 acting through the firing plunger 9 is sufficient to force the pins 8 outwardly and permit the firing plunger 9 to strike the primer 39 and thereby explode the projectile.

If the projectile should graze an object during flight or should the timing mechanism fail to act so as to permit the projectile to strike, the projectile will be exploded by the shock, since the shock of contact with an object causes the relative forward move-

ment of the primer holder 40 by inertia, so that the spring ring 41 is forced outwardly and the primer 39, through the movement of the holder 40, is brought into engagement with the firing plunger 9.

A modified construction for controlling the venting of air from chamber 31 is shown in Fig. 5 of the drawing, in which the ports 28^a open directly into the chamber 31 and the connecting holes 29^a are normally sealed from the atmosphere by a thin metal band 46 which forms an air tight joint.

When the projectile is to be fired, the band is punched through at the particular hole 29^a corresponding with the port 28^a which it is desired to open, so that air in chamber 31 can escape through the punched hole during the flight of the projectile.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a projectile, the combination with a fuse mechanism, of a chamber having an air inlet and a vent port, means for closing said inlet port upon charging the chamber with air to a predetermined pressure during the flight of the projectile, and means operated upon a predetermined reduction in pressure in said chamber through said vent port for effecting the operation of said fuse mechanism.

2. In a projectile, the combination with a fuse mechanism, of a chamber having an air inlet port and a vent port, means operated upon a reduction in pressure in said chamber for effecting the operation of said fuse mechanism, and means for closing said inlet port upon the pressure in said chamber attaining a predetermined degree.

3. In a projectile, the combination with a firing plunger, of a piston device subject to the pressure in a chamber adapted to be charged with fluid under pressure during the flight of the projectile and actuated upon a predetermined reduction in pressure in said chamber for effecting the operation of said firing plunger and means for venting fluid from said chamber at a predetermined rate.

4. In a projectile, the combination with a firing plunger, of a chamber having a port through which fluid is compressed into said chamber from the atmosphere during the flight of the projectile and a piston device subject to the pressure in said chamber and actuated upon a predetermined reduction in pressure in said chamber for effecting the operation of said firing plunger, and means for varying the rate at which fluid is vented from said chamber.

5. In a projectile, the combination with a firing plunger, of a chamber having a port through which fluid is compressed into said chamber from the atmosphere during the flight of the projectile and a piston device subject to the pressure in a chamber adapted to be charged with fluid under pressure and actuated upon a predetermined reduction in pressure in said chamber for effecting the operation of said firing plunger, and means adapted to be adjusted for connecting one of a plurality of ports varying in size with said chamber for venting fluid from said chamber at a predetermined rate.

6. In a projectile, the combination with a firing plunger, of a piston device subject to the pressure of a chamber and operated upon a predetermined reduction in pressure in said chamber for effecting the operation of said firing plunger, a valve device for controlling communication through which air from the atmosphere is supplied to said chamber during the flight of the projectile and adapted to close said communication at a predetermined pressure in the chamber, and means for venting fluid from the chamber at a predetermined rate.

7. In a fuse mechanism, the combination with a firing plunger, of a piston operated by fluid under pressure in a chamber for impressing a propulsive force on said plunger, and a locking device controlled by said piston for preventing movement of the plunger and adapted to release said plunger upon movement of said piston under a predetermined reduction in pressure in said chamber.

8. In a fuse mechanism, the combination with a firing plunger, of a spring, a piston operated upon an increase in fluid pressure in a chamber for compressing said spring against the firing plunger, and a device operated by the movement of the piston for locking the firing plunger against movement and adapted to be released by the movement of said piston upon a predetermined reduction in pressure in said chamber to thereby permit the operation of said plunger by said spring.

9. In a fuse mechanism, the combination with a firing plunger, of a piston controlled by the fluid pressure in a chamber for effecting the operation of said plunger and a rotatable ring having a plurality of ports of varying size and adapted to be adjusted to connect said chamber through one of the ports with an exhaust port.

10. In a fuse mechanism, the combination with a firing plunger having an inclined face, of pins adapted to engage said face, a ring having an inclined face for also engaging said pins, a piston, and a spring interposed between said ring and said piston.

11. In a fuse mechanism, the combination with a firing plunger having an inclined face, of pins adapted to engage said face, a ring having an inclined face for also engaging said pins, a piston, a spring interposed between said ring and said piston, and a spring acting on said plunger and adapted to be compressed by the movement of said piston.

12. In a fuse mechanism, the combination with a firing plunger having an inclined face, of pins adapted to engage said face, a ring having an inclined face for also engaging said pins, a piston, a spring interposed between said ring and said piston, a spring acting on said plunger and adapted to be compressed by the movement of said piston, and means for locking said spring in its compressed position.

In testimony whereof I have hereunto set my hand.

EDWARD W. NEWELL.