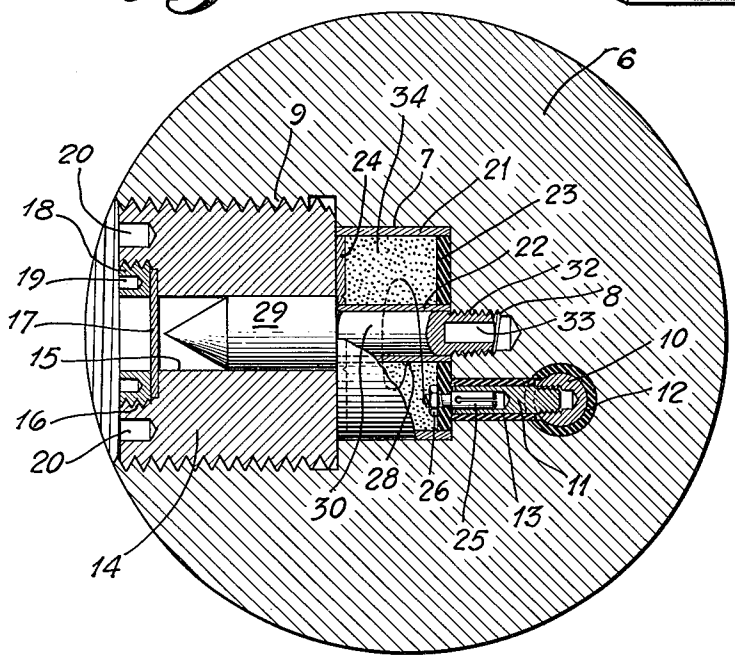
May 5, 1942. C. C. COLE 2,281,870

GUN PERFORATOR

Filed Aug. 12, 1940

Fig. 1



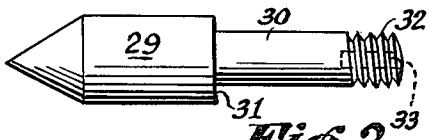


Fig. 2.

Fig. 3

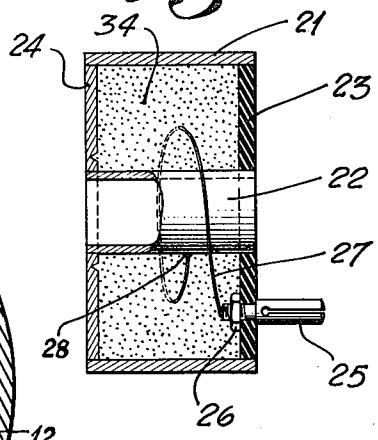
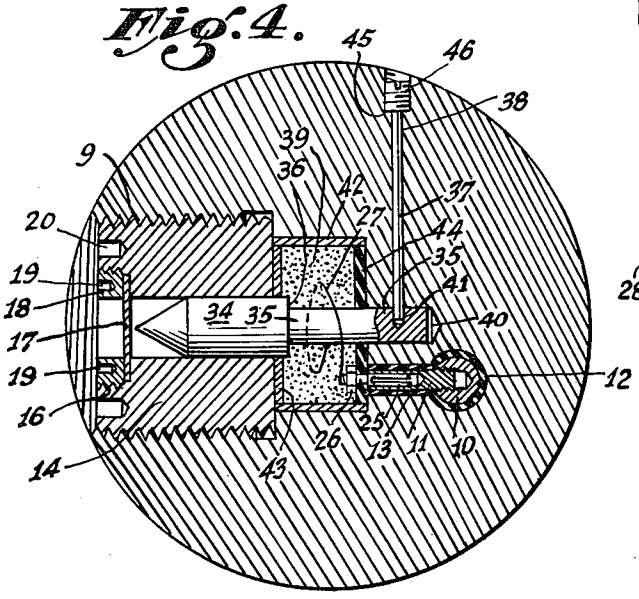


Fig. 4.



INVENTOR.

C. C. Cole

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UNITED STATES PATENT OFFICE

2,281,870

GUN PERFORATOR

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15 Claims. (Cl. 164—0.5)

This invention relates to well casing perforators of the gun type intended for operation in casing positioned in well bores.

In two co-pending applications, bearing serial numbers and filing dates, 288,853, August 7, 1939, and 344,115, July 5, 1940, respectively, I point out that the major problem to be solved in the construction and operation of gun perforators is the limitation imposed on projectile velocity by the necessarily short barrel of perforators intended for operation inside of casing. An important object of the invention herein disclosed is the provision of novel and improved projectiles and associated devices that compensate for the restricted barrel length of gun perforators.

Other objects and advantages of the invention will become apparent hereinafter and in the accompanying illustrative drawing, in which:

Fig. 1 is a transverse sectional view through a cylindric gun body showing the explosion chamber and a threaded breech bore, a barrel in longitudinal section, and the projectile and cartridge each partly in elevation and partly in section.

Fig. 2 shows one form of the projectile of my invention in elevation.

Fig. 3 is a view partly in elevation and partly in section of the explosive cartridge of the invention.

Fig. 4 is a transverse sectional view of a gun of the same type illustrated in Fig. 1 and shows another form of my invention.

Referring to Figs. 1, 2 and 3 by means of reference numerals, 6 designates a gun body of the elongated cylindric type providing the explosion chamber 7, the internally threaded breech bore 8 and counterbore 9. Electrical conducting and contact members comprise the longitudinaly extending rod 10 and the laterally directed socket 11 threadably engaging the same. Insulation is provided by sleeves 12 and 13.

The threaded barrel member 14 provides the bore 15 and internally threaded counterbore 16 is adapted to receive sealing plate 17 and retaining nut 18, sockets 19 and 20 being adapted to receive a suitable wrench.

The explosive cartridge comprises an outer shell 21, coaxial tube 22 and apertured ends 24 and 23, the latter being of insulating material; the fit of the ends in the shell and on the tube being sufficiently tight to permit handling of the assemblage. Shouldered and split plug 25 is secured to end 23 by nut 26 and further makes a connection with detonating wire 27, the other end of which is grounded as indicated by 28.

The projectile of my invention as illustrated in Figs. 1 and 2 takes the form of the penetrating end 29 having a rearwardly extending member 30 of reduced diameter, whereby rearwardly facing surface 31 is provided. Member 30 provides the threaded portion 32 and the recess 33.

In the form of my invention illustrated in Fig. 4 the projectile has the penetrating end 34, the rearwardly extending member 35 of reduced diameter whereby, as in the first described projectile, rearwardly facing surface 36 is provided. In Fig. 1, I show the projectile secured in breech bore 8 by threaded element 32. In the form of the invention illustrated in Fig. 4, I show a pin 37, securing the projectile in breech bore 40 and serving the same function. Pin 37, as will be seen, is located in bore 38 and extends into recess 41 formed in projectile member 35. Threaded plug 46 in counterbore 45 seals the outer opening of bore 38 and prevents the accidental loss of pin 37.

As shown in Fig. 4 the explosive cartridge comprises outer shell 42 and apertured ends 44 and 43 mounted upon projectile member 35 and penetrating end 34 respectively.

In the practice of the form of my invention illustrated in Fig. 1 threaded element 32 resists the force of initial explosion pressure against surface 31. At maximum pressure element 32 breaks or ruptures and explosion pressure then becomes effective against the equivalent of the entire area of the projectile base to propel the projectile out of the gun with great force. For a given area of surface 31 the size of recess 33 determines the pressure at which break will occur. It will be apparent that reliance could be placed upon stripping or shearing of the threads to release the projectile at maximum pressure.

In the operation of gun type perforators under some conditions it is required that the projectile penetrate three strings of casing, that is, the equivalent of more than an inch of steel. Obviously, to accomplish such penetration, explosion pressures must be extremely high. It will further be apparent that if pressure is initially applied to the greater part of the entire area of the base of the projectile then the means employed to hold the projectile in the barrel until maximum required pressure has been built up would have to provide a resistance to projectile movement comparable to that of an inch of steel.

In my invention, as illustrated in Fig. 1, maximum pressure is initially effective against surface 31. Member 30 is preferably constructed of such a diameter relative to 29 that the area of 31 is small with respect to the total area of projec-

tile base thereby permitting the employment of projectile retarding means of moderate magnitude and resistivity.

The operation of the form of the invention shown in Fig. 4 is equivalent to that of the form illustrated in Fig. 1. Maximum explosion pressure acting against projectile surface 36 shears pin 37. The projectile moves forward until member 35 leaves bore 40 at which time maximum pressure becomes instantly effective against an area equivalent to the entire area of projectile base.

In view of this disclosure, it will be apparent that projectile retarding pin 37 could be located in barrel member 14 and arranged to enter a recess former in projectile end 34. Other forms of projectile retarding means could also be employed without departing from the scope of my invention. For example sealing plate 17 could be made to serve this function.

Thus it will be seen that my invention contemplates a gun perforator in which explosive pressure acts against a relatively restricted area of projectile base in the course of building up to a maximum value at which time the projectile retarding means breaks or ruptures, thereby permitting maximum explosive force to be suddenly applied to the entire area of projectile base or the equivalent thereof.

Having thus described my invention, I claim:

1. In a gun perforator, a body providing a bore and rearwardly therefrom an explosion chamber having a recess in the rearward wall thereof; a projectile positioned in said bore making a gas tight fit therewith, projectable entirely therefrom and having a member extending across said explosion chamber and into said recess; and breakable projectile retarding means.

2. In a gun perforator, a body; a barrel formed therein; an explosion chamber formed rearwardly from said barrel and having a breech bore in the rearward wall thereof; a projectile in said barrel making gas tight fit therewith, projectable entirely therefrom and having a member of reduced diameter extending across said explosion chamber and into said breech bore; and breakable projectile retarding means.

3. In a gun perforator, a body; a restricted muzzle bore formed therein; an explosion chamber of relatively large area formed rearwardly from said muzzle bore and having a breech bore restricted relative to said muzzle bore in the rearward wall thereof; a projectile in said muzzle bore making a gas tight fit therewith, projectable entirely therefrom and having a member of reduced section extending across said chamber and into said breech bore; and breakable projectile retarding means.

4. In a gun perforator, a body, a muzzle bore formed therein, an explosion chamber formed rearwardly from and opening into said muzzle bore and having a breech bore in its rearward wall, a projectile in said muzzle bore, making a gas tight fit therewith, projectable entirely therefrom and having a member of relatively restricted section extending across said explosion chamber and positioned in said breech bore and breakable means securing said member in said bore.

5. In a gun perforator, a body, a muzzle bore formed therein, an explosion chamber formed rearwardly from said bore and in communication therewith, a projectile in said bore making a gas tight fit therewith, projectable entirely therefrom having a rearward member of moderately restricted section extending across said explosion chamber, sealing means resistant to explosive pressure adjacent the rearward end of said member, sealing the same, and breakable projectile retarding means.

6. A cartridge for gun perforators comprising an outer shell, apertured ends in said shell and a coaxial tube through said aperaures, electrical contact and detonating means and a charge of explosive in said cartridge.

7. In a gun perforator, a body, a barrel formed therein, an explosion chamber formed in said body rearwardly from said barrel and having a threaded breech bore in its rearward wall, a projectile in said barrel making a gas tight fit therewith and completely ejectable out of the same providing a member of relatively reduced diameter extending across said explosion chamber, having a breakable threaded portion at its outer end engaging said threaded breech bore, and an explosive receiving cartridge mounted upon said projectile member and positioned in said explosion chamber.

8. In a gun perforator the combination of a projectile comprising a penetrating end having a rearwardly extending member of moderately restricted diameter, a breakable threaded portion at the outer end thereof and an explosive receiving cartridge mounted on said member.

9. In a gun perforator, a body having a barrel formed therein, an explosion chamber rearwardly therefrom, a breech bore in the rearward wall of said chamber and a lateral bore opening into said breech bore, a projectile in said barrel having a member of restricted diameter extending across said chamber and into said breech bore, a recess formed adjacent the outer end of said member in alignment with said lateral bore and a breakable pin in said lateral bore and said recess.

10. A combination, as in claim 9, and including sealing and pin retaining means in the outer end of said lateral bore and sealing means in the muzzle end of said barrel.

11. In a gun perforator, a body adapted to removably receive a barrel having a restricted bore, said body providing an explosion chamber of relatively large area in communication with said barrel bore, a breech bore in the rearward wall of said chamber and a lateral bore opening thereinto, a projectile positioned in said barrel bore having a member of moderately restricted diameter extending rearwardly across said chamber and into said breech bore and providing a socket adjacent its outer end in alignment with said lateral bore, a breakable pin in said lateral bore and extending into said socket, an explosive receiving cartridge in said explosion chamber mounted on said projectile and pin retaining and sealing means at the outer end of said lateral bore and sealing means at the muzzle end of said barrel bore.

12. A combination, as in claim 11 and including a charge of explosive in said cartridge and electrical conducting and firing means for the same.

13. In a gun perforator, a body providing a bore and rearwardly therefrom an explosion chamber having a recess in the rearward wall thereof; a projectile positioned in said bore making a substantially gas tight fit therewith and having a member providing a longitudinal recess in its rearward end extending across said explo-

sion chamber and into said explosion chamber recess; and means securing said member in said recess.

14. In a gun perforator, a body providing a bore, rearwardly therefrom an explosion chamber and a threaded bore in the chamber breech; a projectile positioned in said first bore making a substantially gas tight fit therewith and having a member providing a longitudinal recess in its rearward end extending across said explosion chamber, said member further providing a threaded portion engaging said threaded breech bore.

15. In a gun perforator, a body providing a muzzle bore, an explosion chamber rearwardly therefrom; a projectile in said muzzle bore making a substantially gas tight fit therewith and having a member providing a longitudinal bore in its rearward end extending across said chamber and means securing said member to the breech of said chamber.

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