

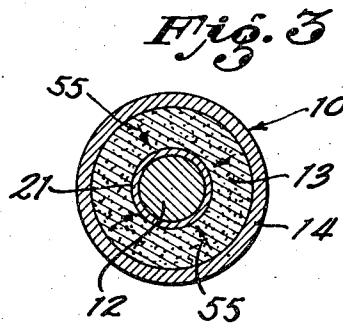
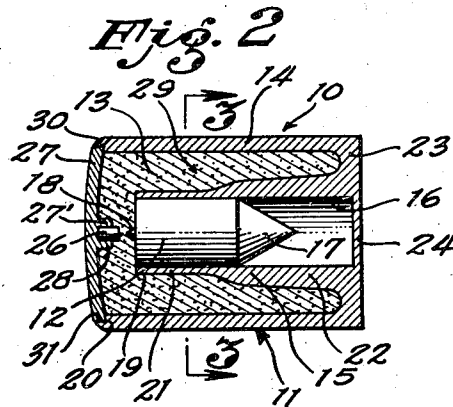
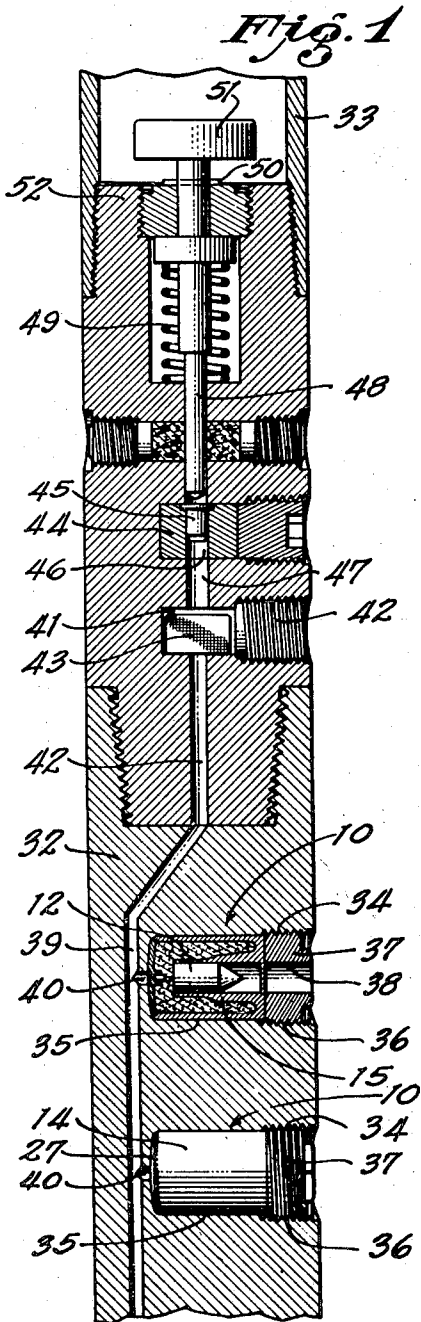
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WELL CASING PERFORATING GUN AND CARTRIDGE

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WELL CASING PERFORATING GUN
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4 Claims. (Cl. 89—1)

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My invention relates to a cartridge including a shell, bullet, and powder charge, having a wide range of usefulness, and which may be advantageously used in a gun for perforating casing within a well or for shooting projectiles into the formation surrounding the well bore.

It is an object of the invention to provide a cartridge of novel form having therein a self-contained gun barrel.

A further object of the invention is to provide a cartridge so formed that the force of the explosion of the powder charge acts to retard the outward movement of the projectile while a high pressure of products of combustion are built up in the powder chamber and against the rear end of the projectile so that when the projectile is finally released it will be propelled at maximum velocity.

A further object of the invention is to provide a cartridge having a tubular portion to receive the projectile and a powder chamber in the cartridge laterally disposed with relation to the portion occupied by the projectile, thereby producing a cartridge which is relatively short for the size of bullet and powder charge used therein.

A further object of the invention is to provide a cartridge having a shell with an outer wall and a projectile receiving tube or barrel disposed inside the space defined by the outer wall and in spaced relation thereto so as to provide a powder chamber, at least a part of which surrounds the projectile tube or barrel.

A further object of the invention is to provide means for preventing movement of the projectile as the result of external hydrostatic pressure exerted thereagainst in a deep well.

A further object of the invention is to provide a cartridge having a projectile and means for concealing and protecting the projectile from externally applied pressure, this means comprising a wall which is penetrated by the projectile when it is propelled outward as a result of the explosion of the powder charge.

A further object of the invention is to provide a cartridge having a detonator or cap so placed that it is protected against external contact and resulting accidental ignition of the powder charge.

A further object of the invention is to provide a cartridge having a detonator or cap so placed that it can be set off only by inward movement of an external wall portion of the shell of the cartridge.

A further object of the invention is to provide

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a novel method of firing the explosive charge of the cartridge.

A further object of the invention is to provide a cartridge which is not only suitable for submarine use, but also in guns of various types, and especially guns with short barrels.

Further objects and advantages of the invention will be brought out in the following part of the specification.

Referring to the drawings which are for illustrative purposes only:

Fig. 1 is a vertically sectioned view showing a portion of the gun with a preferred embodiment of the cartridge therein.

Fig. 2 is an enlarged longitudinal section of the cartridge.

Fig. 3 is a cross-section taken on the plane represented by the line 3—3 of Fig. 2.

The cartridge 10 shown as a preferred embodiment of my invention comprises a shell or casing 11, a projectile or bullet 12 and a powder charge 13. In this specification and in the claims, the term "powder" is intended to designate all of the explosives usable for the purpose of propelling the projectile.

The casing 11 includes an outer wall 14 which is of tubular form and preferably cylindrical, although it may be slightly tapered. Within the outer wall 14 there is a tube 15 which may be referred to as a barrel. This tube 15 is spaced from the outer wall 14 and is preferably coaxial therewith. It provides a bore 16 to receive a projectile 12 which comprises a cylindrical body of hard metal such as steel alloy, having a point 17 on its front end and having a small point 18 projecting centrally from its rear end face.

The rear end of the bullet and the rear end 19 of the tube 15 are spaced from the plane defined by a shoulder 20 formed in the rear end of the outer wall 14. The tube 15 comprises a rear section 21 having a length nearly as great as the length of the body of the projectile 12, and a front section 22. The rear section 21 of the tube 15 comprises a relatively thin wall, for a purpose which will be hereinafter described, and the front section 22 comprises a thicker wall which is joined by an annular front wall 23 with the front end of the outer wall 14. The front end of the bore 16 of the tube or barrel 15 is closed by a wall 24, this wall isolating the bore from the exterior of the cartridge and guarding the front end of the projectile against externally applied hydraulic pressures such as encountered in deep wells, thereby assuring that the bullet will not be forced rearward or leftward from the position in which it is shown

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in Fig. 2, to prematurely fire the cartridge as the result of the engagement of the point 18 with a firing device 26 supported in a rear wall 27 in axial alignment with the point or firing pin 18. The rear wall comprises a metal disc, slightly dished and having on the inner face a projecting annular wall 27' forming a recess to receive the firing device 26 which may be a cap or a fulminate of mercury detonator such as used in shot gun, revolver and rifle cartridges. The peripheral portion of the wall 27 rests against the shoulder 20 at the rear end of the outer wall 14 and is adapted to be placed in the position shown after the projectile 12 has been placed in the barrel 15 and the powder charge has been placed in the powder chamber 29, comprising the annular space between the outer wall 14 and the tube 15 and the space between the rear end of the projectile 12 and the rear wall 27. When the rear wall 27 is finally placed against the shoulder 20, an annular lip 30 which surrounds the shoulder 20 is rolled in so as to engage the slightly chamfered edge wall 31 of the rear end wall or disc 27.

In Fig. 1 I have shown a gun body 32 forming part of a gun adapted to be lowered into a well by use of suitable suspension means, such as, for example, a string of tubing, a portion of which is shown at 33. The gun body 32 has one or more bores 34 extending in from the side wall to form cartridge chambers 35 and adjacent internally threaded sections 36 to receive cartridge securing means 37, comprising externally threaded plugs with axial openings 38 of substantially the same diameter as the bore 16 of the cartridge 10, these openings 38 comprising barrels or barrel extensions for the barrels 15 of the cartridges.

A vertical passage 39 extends within the gun body 32 in spaced relation to the rear end of each cartridge chamber 35, and this vertical passage 39 is connected with the rear ends of the chambers 35 by ports 40. The upper end of the vertical passage 39 communicates with a firing charge chamber 41 through passage means 42, this firing charge chamber 41 being closed by removable plug 42', enabling access to the chamber 41, whereby a firing charge 43 of powder may be placed in the chamber 41.

Above the firing charge chamber 41 there is a removable block 44 adapted to carry a priming device 45 in a vertical opening 46, the lower end of which is connected through a passage 47 with the upper portion of the firing charge chamber 41. A firing pin 48 is arranged above the priming device 45 and is normally held in raised position by a spring 49 and a shear pin 50 disposed below a head 51 supported on the upper end of the firing pin 48 above the upper end 52 of the gun body, where it may be engaged by suitable actuating means such as a weight or go-devil adapted to strike the head 51 to drive the firing pin 48 downward so that the point at the lower end thereof will engage the priming device 45 and fire the same.

The blast or flame issuing downward from the priming device 45, which ordinarily may consist of a small blank cartridge, passes into the firing charge chamber 41 and ignites the firing charge 43, which is of sufficient size to produce a heavy pressure or explosive force in the passage 39 which will be transmitted through the ports 40 into the rear ends of the cartridge chambers 35 and against the rear faces of the walls 27 of the cartridges 10, forcing these walls 27 rightward or forward from the position in which they normally occupy, thereby bringing the firing devices 26

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into engagement with the pins 18 to explode the firing device 26 and thereby ignite the powder charges 13 in the cartridges 10.

As previously set forth herein, the rear section 21 of the tube or barrel 15 comprises a relatively thin wall. The diameter of the bullet 12 is greater than the diameter of the bore 16 so that the bullet must be pressed into place, placing the wall of the rear section 21 under tension so that it will tightly grip the body of the projectile 12. As the burning of the powder charge 13 proceeds, the pressure of a gas will be built up in the powder charge chamber 29 of the cartridge 10, and, since the pressure of this gas acts in all directions, radial inward force will be applied externally to the section 21 of the tube 15 as indicated by arrows 55 in Fig. 3, causing the wall section 21 to grip the projectile 12 with greater force, so as to retard outward movement of the projectile in the bore 16 while a heavy pressure is being built up in the chamber 29 of the cartridge 10, the result being that when the projectile 12 is propelled outwardly, the pressure behind the same will be close to the maximum of which the powder charge 13 is capable, and accordingly the projectile 12 will be moved outwardly at high velocity, rupturing or shearing the guard wall 24 and then passing through the barrel extension 38, Fig. 1, to the exterior.

It will be noted that the cross-sectional area of the powder charge chamber 29 is quite large as compared to the cross-sectional area of the projectile 12, and that therefore the cartridge 10, although it is relatively short, will carry a much heavier charge of powder than the common style of cartridge for the same size of bullet having the shell or casing extended rearward from the projectile. For a half-inch diameter bullet, it is possible to make a cartridge in accordance with my invention having a length of one and three-quarters to two and one-eighth inches, which will carry a powder charge of two hundred grains, determined in actual practice of well perforating to be the maximum amount of powder required for any of the uses or penetration required of a half-inch bullet, such as shown approximately to scale in Fig. 2.

I claim as my invention:

1. In a well casing perforating gun of the character described: a gun body having a chamber for a primary firing charge, means to ignite the firing charge, a duct leading away from said firing charge chamber, and a cartridge chamber connected to said duct so as to receive fluid pressure resulting from the burning of said firing charge; a removable wall closing the front end of said cartridge chamber and having a bore therein for passage of a projectile to the exterior; and a cartridge in said cartridge chamber, said cartridge comprising a shell having a wall movable relatively to the remaining walls of the cartridge by externally applied fluid pressure, an opening with a projectile therein aligned with said bore, a powder chamber with a propelling powder charge therein and means acting in response to movement of said movable wall by said fluid pressure to ignite said powder charge.

2. In a well casing perforating gun of the character described: a gun body having a chamber for a primary firing charge, means to ignite the firing charge, a duct leading away from said firing charge chamber, and a cartridge chamber connected to said duct so that its rear end will receive fluid pressure resulting from the burning of said firing charge; a removable wall closing

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the front end of said cartridge chamber and having a bore therein for passage of a projectile to the exterior; and a cartridge in said cartridge chamber, said cartridge comprising a shell having at its rear end a wall which is movably relatively to the opposite wall of the cartridge by said fluid pressure in the rear end of said cartridge chamber, a tubular barrel aligned with said bore and extending into said shell from the front end thereof and forming in said shell an annular powder chamber, a projectile in the inner end of said barrel, a propelling powder charge in said powder charge chamber, and means acting in response to movement of said movable wall by said fluid pressure to ignite said powder charge.

3. In a well casing perforating gun of the character described: a gun body having a chamber for a primary firing charge, means to ignite the firing charge, a duct leading away from said firing charge chamber, and a cartridge chamber connected to said duct so as to receive fluid pressure resulting from the burning of said firing charge; a removable wall closing the front end of said cartridge chamber and having a bore therein for passage of a projectile to the exterior; and a cartridge in said cartridge chamber, said cartridge comprising a shell having a wall movable relatively to the opposite wall of the cartridge by externally applied fluid pressure, a tubular barrel aligned with said bore and extending into said shell from the front end thereof and forming in said shell an annular powder chamber, a projectile in the inner end of said barrel, a propelling powder charge in said powder charge chamber, and pressure responsive igniting means disposed between said rear end wall and the rear end of said projectile so as to be compressed as the result of the movement of said rear end wall of said shell.

4. In a well casing perforating gun of the character described: a gun body having a chamber for a primary firing charge, means to ignite the firing charge, a duct leading away from said firing charge chamber, a bore having a projectile at the inner end thereof, a transverse wall in said bore in a position spaced from the outer end of said bore, the periphery of said transverse wall

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being secured so that rupture is required for the removal thereof, a powder charge chamber communicating with the rear end of said bore, a powder charge therein, a wall separating said powder charge chamber from said duct, said wall being so formed that it will be flexed toward said powder charge chamber by fluid pressure transmitted through said duct as the result of the burning of said firing charge, and means acting in response to the flexing of said wall by said fluid pressure to ignite said powder charge.

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