Aug. 24, 1943. L. E. COUCH 2,327,340

PERFORATING GUN FOR OIL WELL CASINGS

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Fig. 1.

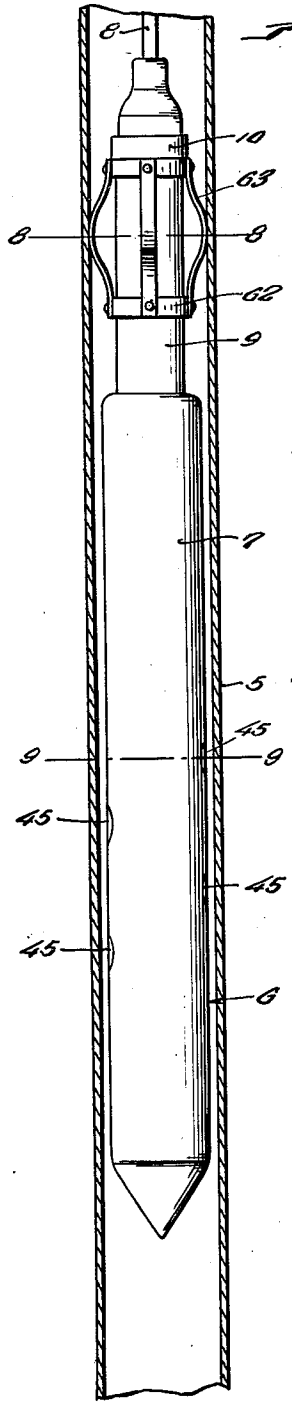


Fig. 8.

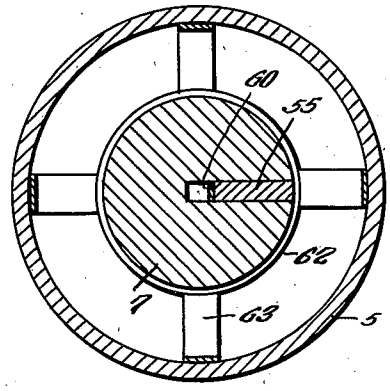
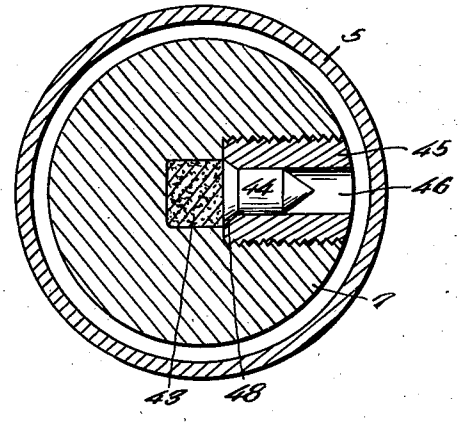


Fig. 9.



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Fig. 2.

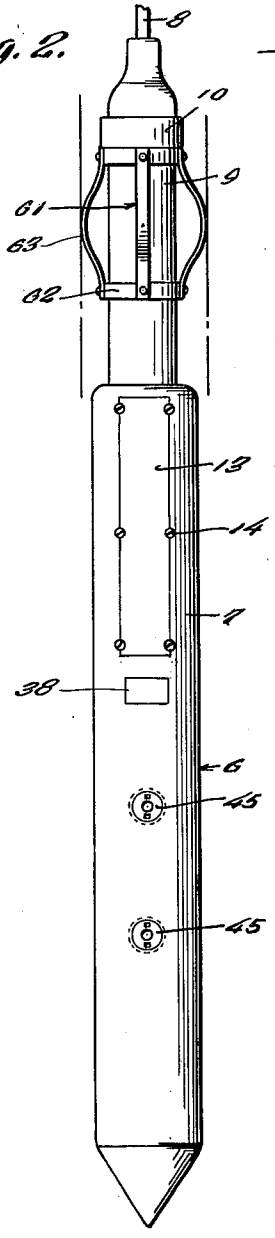


Fig. 3.

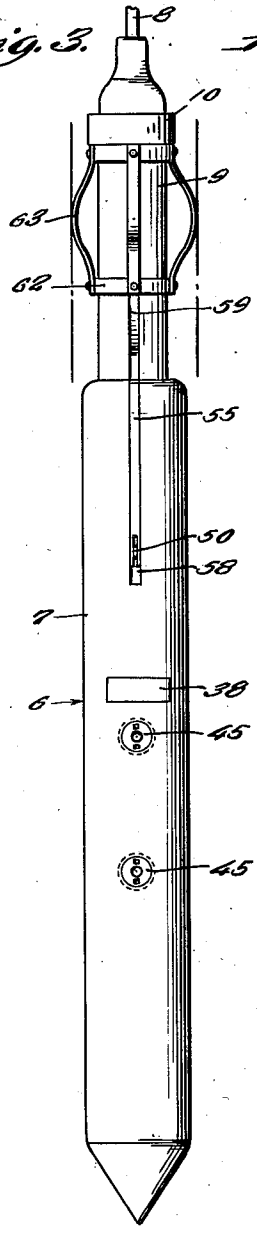


Fig. 4.

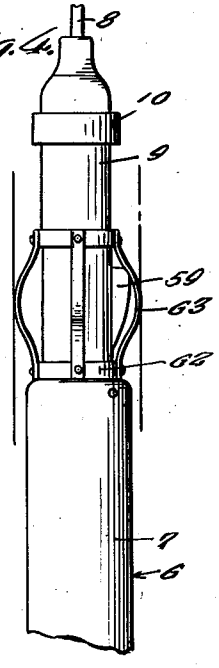
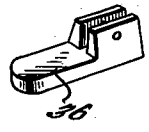


Fig. 15.



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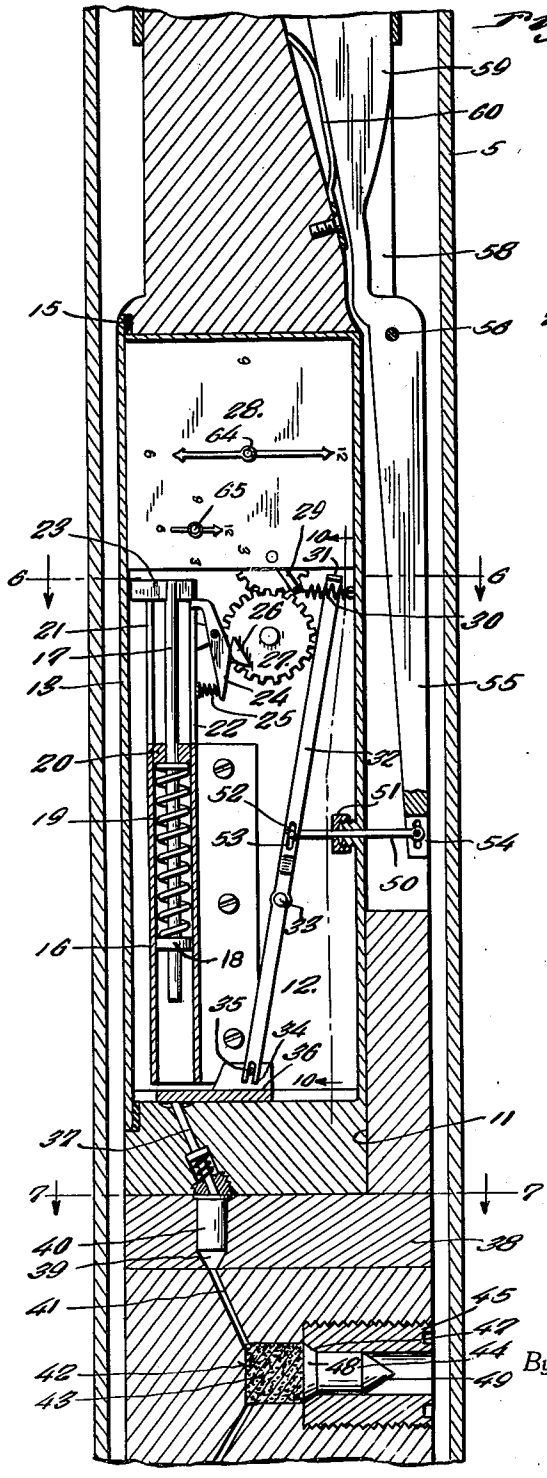
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PERFORATING GUN FOR OIL WELL CASINGS

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Fig. 5.



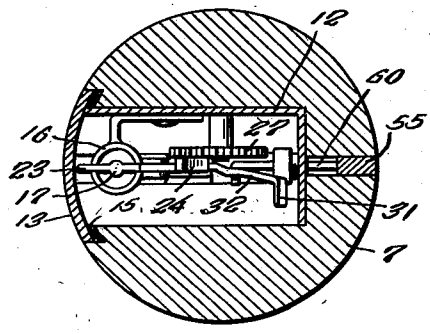


Fig. 6.

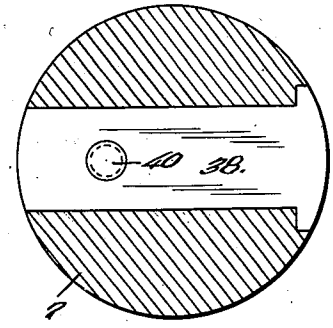


Fig. 7.

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PERFORATING GUN FOR OIL WELL CASINGS

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Fig. 10.

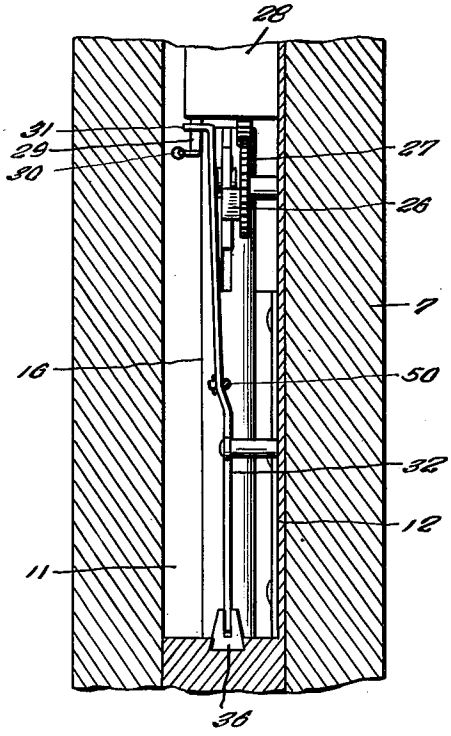


Fig. 11.

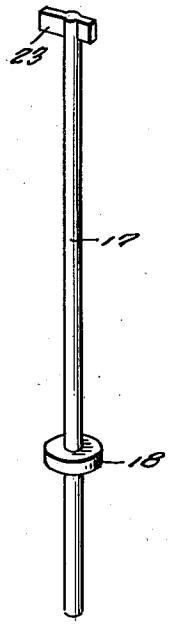
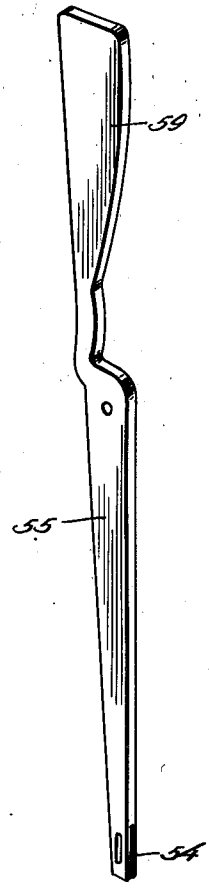


Fig. 12.



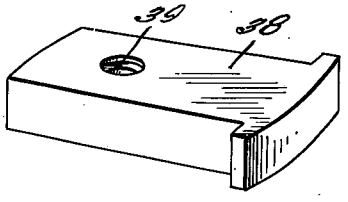


Fig. 13.

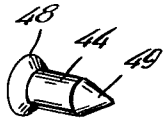


Fig. 14.

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PERFORATING GUN FOR OIL WELL CASINGS

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Fig. 18.

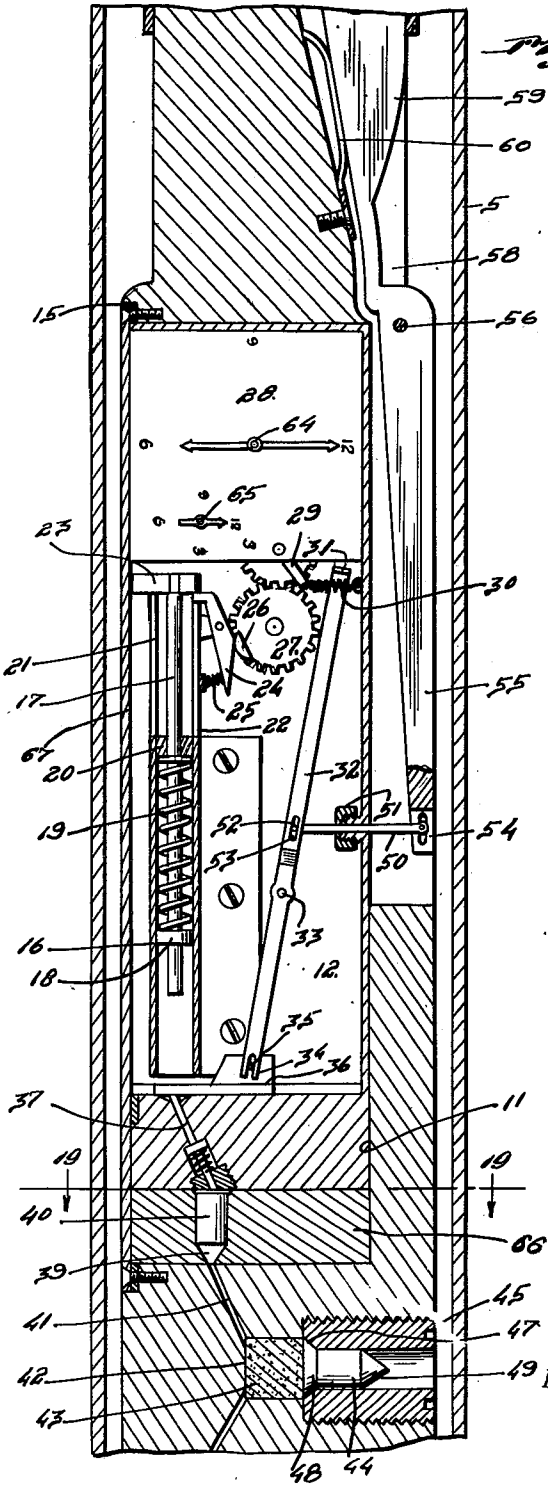


Fig. 16.

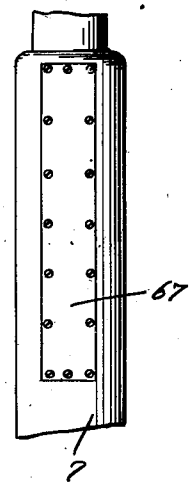
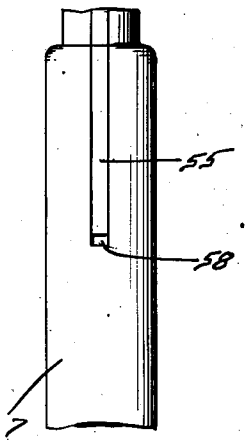


Fig. 17.



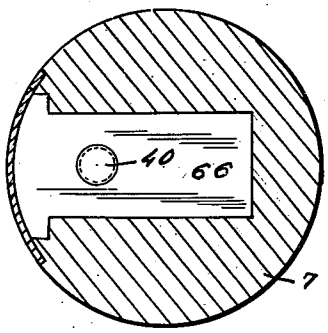


Fig. 19.

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UNITED STATES PATENT OFFICE

2,327,340

PERFORATING GUN FOR OIL WELL CASINGS

Lonnie E. Couch, Houston, Tex., assignor to Well Tool Development Corporation, a corporation of Texas

Application December 9, 1940, Serial No. 369,363

68 Claims. (Cl. 164—0.5)

This is a continuation-in-part application of my copending application Serial Number 310,045, filed December 19, 1939.

The present invention relates to a perforating gun for oil well casings and has for its primary object to provide a gun stock adapted to be lowered in the casing and embodying a time controlled mechanism for controlling the firing of a plurality of projectiles through the walls of the casing.

An important object of the present invention is to provide a safety slide for the firing pin for the projectile and adapted to be controlled by the raising and lowering movement of the gun stock in the casing.

A further object is to provide an apparatus of this character of simple and practical construction, which is efficient and reliable in performance, relatively inexpensive to manufacture and otherwise well adapted for the purposes for which the same is intended.

Other objects and advantages reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming part hereof, wherein like numerals refer to like parts throughout, and in which:

Figure 1 is a vertical sectional view through the well casing showing the gun in position therein.

Figure 2 is a side elevational view of the gun in position while being lowered in the casing and showing the cover plate for the firing mechanism.

Figure 3 is a similar view of the opposite side of the gun and showing the external control lever.

Figure 4 is a fragmentary side elevational view of the upper end of the gun showing the position of the control cage for releasing the external control lever.

Figure 5 is a fragmentary vertical sectional view through the gun.

Figures 6 and 7 are transverse sectional views taken respectively on the lines 6—6 and 7—7 of Figure 5.

Figures 8 and 9 are transverse sectional views taken respectively on the lines 8—8 and 9—9 of Figure 1.

Figure 10 is a fragmentary vertical sectional view taken substantially on a line 10—10 of Figure 5.

Figure 11 is a perspective view of the hammer for the gun.

Figure 12 is a similar view of the external control lever.

Figure 13 is a similar view of the removable cartridge block.

Figure 14 is a similar view of one of the projectiles.

Figure 15 is a similar view of the safety slide for the firing pin.

Figures 16 and 17 are views similar to Figures 1 and 2 respectively and illustrating a modified stock and cartridge block construction.

Figure 18 is a fragmentary vertical sectional view through the gun embodying the modification and

Figure 19 is a transverse sectional view taken substantially on a line 19—19 of Figure 18.

Referring now to the drawings in detail, wherein for the purpose of illustration I have disclosed a preferred embodiment of the invention, the numeral 5 designates the casing of the well and the numeral 6 designates the casing perforating gun generally which includes a cylindrical stock 7 having a cable 8 attached at its upper end for raising and lowering the same in the casing. The upper portion of the stock is reduced as shown at 9, the upper end of the reduced portion being defined by a flange 10.

A chamber 11 is formed in the stock within which is removably positioned a water-tight casing 12 having a cover plate 13 secured in position by screws or the like 14 and provided with a gasket 15 to seal the edges of the casing and chamber.

Secured within the casing is a tubular member 16 within which is slidably mounted a hammer 17 shown in detail in Figure 11 of the drawings. The hammer includes an annular flange 18 for guiding the hammer centrally in the tubular member 16 and to provide an abutment for one end of an expansible coil spring 19 positioned in the tubular member and held against a stationary abutment 20 formed in the upper portion of said tubular member and through which the hammer is slidably inserted. The upper portion of the tubular member above the abutment 20 is provided with longitudinally extending slotted openings 21 and 22 at diametrically opposite sides of the tubular member and within which is slidably positioned a crosshead 23 on the upper end of the hammer 17.

The hammer is adapted to be projected downwardly by the spring and the spring is held under tension with the hammer in a cocked position by means of a pivoted trip 24 having one

end yieldably held under the cross-head 23 by means of a spring 25.

The trip is adapted to be actuated for releasing the hammer by means of a cam 26 formed on a gear 27 journaled in the casing 12 and which is operatively engaged by a clockwork mechanism shown generally at 28. The clock mechanism includes a control arm 29 for starting and stopping the mechanism, as need be, and is yieldably held in a stopped position by means of a coil spring 30. The control arm 29 is positioned in the path of the angular end 31 of an inner control lever 32 which is pivoted as at 33 within the casing 12.

The control lever 32 is positioned somewhat vertically in the casing and has its lower end bifurcated as at 34 for engaging a pin 35 formed on a safety slide 36 movable into and out of position under the lower end of the tubular member 16 to prevent the outward movement of the hammer 17 when the parts are in position as shown in Figure 5 of the drawings.

Slidably mounted in a lower portion of the casing 12 is a spring retracted firing pin 37 having its upper end disposed in the path of the lower end of the hammer 17 for impact by said hammer when the latter is released. A cartridge block 38 is slidably mounted transversely of the stock 7 beneath the casing 12 and in the bottom portion of chamber 11, said block 38 being provided with a vertically extending chamber 39 within which is positioned a blank cartridge 40, the cartridge being positioned for discharge by the firing pin 37.

Communicating with the chamber 39 is a duct 41 extending longitudinally in the stock 7 and communicating with a plurality of chambers 42, one of which is shown in detail in Figure 5 of the drawings. Each of the chambers 42 is adapted to contain a charge of powder 43 behind a projectile 44 mounted in a barrel 45 threaded in the outer surface of the stock 7. The bore 46 of the barrel, at its inner end is flared as shown at 47 for conformably receiving the flared inner end 48 of the projectile. The projectile 44 is constructed of steel with a pointed nose 49 for penetrating the casing 5 when the same is fired and the flared inner end 48 of the projectile is constructed of soft lead adapted to be fused or compressed into the reduced size of the bore 46 by the heat and pressure of the explosive charge behind the projectile and is thus displaceable with the projectile. The flared end 48 further retards the discharge of the projectile whereby to insure the building up of sufficient pressure behind the projectile to cause the same to penetrate the casing. The flared construction further insures a liquid-tight seal which prevents moisture from penetrating into the chamber 42 to destroy effectiveness of the explosive.

Slidably inserted in the wall of the casing 12 is a link 50 provided with a packing gland 51, the inner end of the link being provided with a pin 52 mounted in a slotted opening 53 in the upper portion of the control lever 32. The outer end of the link 50 is provided with a pin and slot connection 54 with the lower end of an external control lever 55 which is pivoted intermediate its ends as at 56 to one side of the stock 7. The lever 55 is mounted within a vertically extending recess 58 formed in the side wall of the stock and the upper end of the lever is provided with a control head 59 behind which is positioned a leaf spring 60 for yieldably urging the head outwardly beyond the surface of the reduced portion 9 of the stock.

Slidably mounted on the reduced portion 9 of the stock is a cage designated generally at 61 which includes a pair of vertically spaced rings 62 connected by a plurality of leaf springs 63 which are curved outwardly at their intermediate portions for frictional engagement with the inner surface of the casing 5.

The clock is provided with the usual hour and minute hands 64 and the usual alarm setting hand 65, so that the clock may be set to actuate the trip 24 at a predetermined lapse of time following the lowering of the gun in the casing.

In the operation of the device the hammer 17 is set in the position as shown in Figure 5, the load placed in position, including the blank cartridge 40, and the cage 61 moved into its uppermost position so that the head 59 of the external control lever 55 is held inwardly against the pressure of the spring 60. The gun is then lowered in the casing to the desired predetermined depth, and the frictional engagement of the cage with the wall of the casing will keep the cage in its uppermost position as shown in Figures 2 and 3. When the desired depth is reached a slight upward movement of the cable 8 will raise the gun while the cage remains stationary and the head 59 is released by the cage as shown in Figure 4, thus permitting the spring 60 to move the lower end of the external control lever inwardly and actuating the internal control lever 32 which moves the clock control arm 29 to its starting or operative position and also removes the safety slide 36 away from the firing pin 37.

The trip 24 is subsequently actuated by the cam 26 to release the hammer and fire the blank cartridge, which in turn is effective to cause the explosion of the charge 43 of the several projectiles.

If desired, the spring 30 attached to the clock control arm 29 may be omitted, so that the control arm may be set in the position as shown in Figure 5, with the clock inoperative to cause release of hammer 17 before the device is lowered in the well, and will be moved into its operative position by the lever 32 upon a slight upward movement of the gun in the casing, after the gun has been lowered to the desired depth, as heretofore explained. Should it be desired to withdraw the gun from the well without firing the charge, after the clock has been operative, a subsequent lowering movement of the gun will cause the cage 63 to let the lower end of the arm 55 move outwardly and thus move the slide 36 into safety position, and prevent striking of the firing pin 37 by the hammer 17, the safety slide receiving the blow of the hammer. After the hammer has been released and completed its firing action, the subsequent upward withdrawing movement of the gun from the well will move the safety slide from under the hammer, the firing force of the spring 19 then having been spent so that there will be no danger of the charge being fired.

In Figures 16 to 19 inclusive I have illustrated a modified form of the invention involving a cartridge block 66, which terminates at its inner edge at the vertical plane of the inner edge of the casing 12, the block not extending entirely transversely of the stock and the cover plate 67 for the chamber 11 and casing 12 extending downwardly to also cover the block. This construction aids in excluding moisture from the blank cartridge in the block.

It is believed the details of construction and

manner of use of the device will be readily understood without further detailed explanation.

What I claim as new is:

1. A casing perforating gun comprising a stock adapted for lowering in the casing, a plurality of gun barrels transversely in the stock, having firing communication with each other, a projectile mounted in each barrel having a firing charge adapted to propel the projectile through the wall of the casing, mechanical firing means for the charge, a movable safety member for the firing means and means actuated by a predetermined sliding movement of the stock in the casing to control actuation of the firing means on the down movement of the stock and to move said safety member into and out of safety position as required.

2. A casing perforating gun comprising a stock adapted for lowering in the casing, a gun barrel transversely of the stock, a chamber behind the barrel adapted for receiving an explosive charge, the inner end of the bore of the barrel being flared, a projectile fitted in the barrel and having a flared inner end of soft metal seated in the flared end of the bore in direct engagement with the charge and adapted to be displaceable through the bore for discharge with the projectile when the charge is fired and means for firing the charge.

3. A casing perforating gun comprising a stock adapted for lowering in the casing, a lateral chamber in the stock adapted to receive an explosive charge, a gun barrel removably fittted in the outer end of the chamber, a projectile for the bore of the barrel and a soft metal flange on the inner end of the projectile for directly engaging the charge and adapted to restrain immediate ejection of the projectile upon firing of the charge, said flange being displaceable through the bore for discharge with the projectile.

4. A casing perforating gun comprising a stock adapted for lowering in the casing, a lateral chamber in the stock adapted to receive an explosive charge, a gun barrel removably fitted in the outer end of the chamber, a projectile for the bore of the barrel and a soft metal flange on the inner end of the projectile having a liquid tight fit with the inner end of the barrel in direct engagement with the charge and adapted to restrain immediate ejection of the projectile upon firing of the charge, said flange being displaceable through the bore for discharge with the projectile.

5. A casing perforating gun comprising a stock adapted for lowering in the casing, a lateral chamber in the stock adapted to receive an explosive charge, a gun barrel threaded in the chamber, a projectile fitted in the bore of the barrel and displaceable means sealing the projectile with the inner end of the barrel to restrain immediate ejection of the projectile upon firing of the charge, said displaceable means being in direct engagement with the charge for firing from the barrel with the projectile.

6. A casing perforating gun comprising a stock adapted for lowering in the casing, a plurality of gun barrels transversely in the stock, a projectile mounted in each barrel having a firing charge adapted to propel the projectile through the wall of the casing and firing control means for the firing charge of the projectile and comprising a firing pin, a spring actuated hammer for the pin, time controlled means for releasing the hammer and means actuated by a predetermined movement of the stock in the casing to control actuation of the time controlled means.

7. A casing perforating gun comprising a stock adapted for lowering in the casing, a plurality of gun barrels transversely in the stock, a projectile mounted in each barrel having a firing charge adapted to propel the projectile through the wall of the casing and firing control means for the firing charge of the projectile and comprising a firing pin, a spring actuated hammer for the pin, a safety slide movable into and out of position between the pin and hammer to prevent contact therebetween, time controlled means for releasing the hammer and means controlled by the movement of the stock in the casing to actuate the slide and to control the actuation of the time controlled means.

8. A casing perforating gun comprising a stock adapted for lowering in the casing, a plurality of gun barrels transversely in the stock, a projectile mounted in each barrel having a firing charge adapted to propel the projectile through the wall of the casing and firing control means for the firing charge of the projectile and comprising a firing pin, a spring actuated hammer for the pin, a safety slide movable into and out of position between the pin and hammer to prevent contact therebetween, time controlled means for releasing the hammer, a spring actuated external control lever carried by the stock, means operatively connecting the lever with the slide and with the time controlled means, and a member slidably carried by the stock having frictional engagement with the casing and normally retaining the lever in a position with the time controlled means inactive, said stock being movable independently of the member upon the initial upward movement of the stock to release the lever and to uncover the firing pin.

9. A casing perforating gun comprising a stock adapted for lowering in a casing, a gun barrel transversely in the stock, a projectile in the gun, a firing charge arranged in the stock to eject the projectile when fired, firing means for the projectile and including a firing pin, safety means for the pin, and means actuated by a predetermined sliding movement of the stock in the casing for controlling effective actuation of the firing means on the down movement of the stock and for moving the safety means into and out of safety position.

10. A casing perforating gun comprising a stock adapted for lowering in a casing, a gun barrel transversely of the stock, a projectile and a firing charge arranged in the gun, mechanical firing means for the projectile including means under compression to cause firing, when released, safety means normally preventing firing of the gun by the means under compression, and means actuated by a predetermined sliding movement of the stock in the casing for controlling actuation of the firing means on the down movement of the stock and for moving the safety means both into or out of safety position.

11. A casing perforating gun comprising a stock adapted for lowering in a casing, a gun barrel transversely in the stock, a projectile including a firing charge in the barrel, firing means for the projectile and including a time controlled device, a stop for said device normally holding the same inactive or ineffective to cause ignition of the firing charge and means actuated by a predetermined movement of the stock in the casing for releasing said stop.

12. A casing perforating gun comprising a

stock adapted for lowering in a casing, a gun barrel transversely in the stock, a projectile and a firing charge in the gun, firing means for the projectile and including a time controlled device, a stop for said device normally holding the same inactive, a spring actuated member for releasing the stop and means normally holding the member against stop releasing movement, said holding means being controlled by a predetermined movement of the stock in the casing.

13. A casing perforating gun comprising a stock adapted for lowering in a casing, a gun barrel transversely in the stock, a projectile and a firing charge in the gun, mechanical firing means for the projectile and including a time controlled device, a stop for said device normally holding the same inactive, a safety means for the firing pin, a mechanism for releasing the stop and for moving the safety means into and out of safety position and means normally restraining actuation of the mechanism, said last named means being controlled by a predetermined movement of the stock in the casing.

14. A casing perforating gun comprising a stock adapted for lowering in a casing, a gun barrel transversely in the stock, a projectile and a firing charge in the gun, mechanical firing means for the projectile and including a time controlled device, a stop for said device normally holding the same inactive, a safety member normally covering the firing pin, a spring actuated mechanism for releasing the stop and for moving the safety member to uncover the pin and means normally restraining actuation of the mechanism, said last named means being controlled by a predetermined movement of the stock in the casing.

15. A casing perforating gun comprising a stock adapted for lowering in a casing, a gun barrel transversely in the stock, a projectile including a firing charge mounted in the stock and carried by the stock and arranged to be ejected out of gun barrel, mechanical firing means for the projectile and including a firing pin and a spring actuated hammer for the pin, a trip normally holding the hammer in cocked position, time controlled means for releasing the trip, a stop for the time controlled mechanism, a safety slide obstructing contact of the hammer with the pin, a spring actuated mechanism for releasing the stop and for moving the slide to uncover the pin and means normally restraining actuation of the mechanism, said last named means being controlled by a predetermined movement of the stock in the casing.

16. A casing perforating gun comprising a stock adapted for lowering in a casing, said stock having a recess therein, a barrel transversely in the stock having a projectile mounted therein for firing therefrom, a firing pin for the projectile, mechanism for actuating the firing pin and including a spring actuated hammer, and a time controlled trip for the hammer, a closed housing for the mechanism removably secured in the recess and means carried by the stock outwardly of the housing and operatively connected to said mechanism for controlling actuation thereof.

17. A casing perforating gun comprising a stock adapted to be lowered into a well casing, a gun barrel transversely in the stock, a projectile mounted to be ejected through the barrel, a firing charge for ejecting the projectile, when fired, mechanical firing means for firing the charge, means including a time controlled mechanism for temporarily maintaining the firing means in operative position, and means actuated by way of predetermined movement of the stock in the casing and effective to cause release of the maintaining means to allow the firing means to operate to fire the charge.

18. A casing perforating gun comprising a stock adapted to be inserted into a casing, a gun barrel transversely in the stock, a projectile mounted in the stock to be projected through the barrel, a firing charge arranged, when fired, to eject said projectile, mechanical firing means including a firing pin, means for temporarily maintaining the firing means in cocked position, which when released will cause the cocked firing means to act, safety means normally in safety position to prevent firing of the charge and means arranged to be actuated by way of predetermined movement of the stock in the casing and effective to move the safety means out of safety position to allow firing of said charge upon actuation of the firing means.

19. A casing perforating gun comprising a stock adapted for lowering in the casing, a gun barrel transversely of the stock, a chamber behind the barrel adapted for receiving an explosive charge, the inner end of the bore in the barrel being flared, a projectile fitted in the barrel and having at the inner end soft metal fitted in the flared end of the bore and directly confronting the charge and adapted to be displaceable through the bore for discharge with the projectile when the charge is fired, and means for firing the charge.

20. A casing perforating gun comprising a stock adapted to be lowered into a well casing, a gun barrel transversely in the stock, a projectile mounted to be ejected through the barrel, a firing charge for ejecting the projectile when fired, mechanical firing means for firing the charge including means under compression, which when released will cause firing, means for maintaining the firing means inoperative to fire the firing charge, and means arranged to be actuated by way of predetermined movement of the stock in the casing and effective to render the firing means operative to fire the charge.

21. A casing perforating gun comprising a stock adapted to be used in a well casing, a gun barrel transversely in the stock, a projectile mounted to be ejected through the barrel, a firing charge for ejecting the projectile when fired, self-carried mechanical firing means for firing the charge including means under compression, which when released will cause firing, means for maintaining the firing means inoperative, other means under compression, which when released by way of predetermined movement of the stock in the casing will be effective to render the firing means operative to fire the charge and means for releasing said other means.

22. A casing perforating gun comprising a stock adapted to be lowered into a well casing, a gun barrel transversely in the stock, a projectile mounted to be ejected through the barrel, a firing charge for ejecting the projectile when fired, mechanical firing means for firing the charge including means under compression, which when released will cause the firing, means for maintaining the firing means inoperative and means operable by predetermined movement of the stock in the casing to selectively render the firing means operative or inoperative to fire the charge.

23. A perforating gun comprising a stock adapted for use in a well, said stock having a

recess therein, a barrel transversely in the stock, a projectile and explosive charge mounted in the stock for firing therefrom, a closed housing removably secured in the recess of the stock, said housing remaining permanently closed during firing, self-carried firing means in the housing for firing the projectile, and means including spring-actuated leverage mechanism carried by the stock outwardly of the housing and operatively connected to said firing means for controlling actuation thereof.

24. A casing perforating gun comprising a stock adapted for lowering in a well, said stock having a recess therein, a projectile mounted in the stock for firing therefrom, explosive means to propel the projectile, a closed housing removably secured in the recess of the stock, firing means in the housing for the projectile, including means under compression, which when released causes firing and means carried by the stock outwardly of the housing and operatively connected thereto for controlling actuation thereof.

25. A casing perforating gun comprising a stock adapted for lowering in a well, said stock having a recess therein, a projectile mounted in the stock for firing therefrom, explosive means to propel the projectile, a closed housing removably secured in the recess of the stock, firing means in the housing for the projectile, including means under compression, which when released causes firing and means carried by the stock outwardly of the housing and operatively connected thereto for the controlling actuation thereof by predetermined movement of the stock in the well.

26. A perforating gun for well casings comprising a stock having a chamber, an explosive charge in the chamber, a projectile mounted in the stock to be projected therefrom by the explosion of the charge, an ignition charge in the stock, said stock having a passageway providing for communication of the flame from the ignition charge to the explosive charge, and means for firing the ignition charge arranged to be rendered operative by movement of the stock in the casing.

27. A perforating gun for well casings comprising a body shaped to enter the casing and having a chamber therein, an explosive charge in the chamber, a projectile in the body arranged to be ejected therefrom upon explosion of the charge, a firing charge carried by said gun, said body having a passageway from the firing charge to the chamber for the ignition means from the firing charge, means for firing the firing charge, means for preventing effective operation of the firing means, means for locking the last-named means in active position whereby the firing means is ineffective to ignite an explosive charge during a normal process of locating the gun to desired location in the well casing, and means under the control of an operator for releasing the locking means so that effective operation of the firing means may take place to fire an explosive charge.

28. A casing perforating gun comprising a stock adapted for use in a well casing, means for locating the gun in the casing, a plurality of gun barrels transversely carried by the stock, a projectile carried for each barrel and an explosive charge for each projectile, both carried by the stock, said charges having ignition communication for one another adapted to propel the projectiles through the wall of the casing, firing means for the charges, controllable safety means for the firing means, and means actuated through predetermined movement for the gun in the casing of the locating means to control effective actuation of the firing means and to control said safety means.

29. A casing perforating gun comprising a stock adapted for use in a well casing, a plurality of gun barrels transversely carried by the stock, a projectile carried for each barrel and having a firing charge or charges adapted to propel the projectile through a wall of the casing, said firing charges having ignition communication for one another, firing means for the charges, a movable safety means for the projectile, and means actuated by predetermined movement of the stock in the casing to control effective actuation of the firing means and to move said safety means into or out of safety position as required.

30. A casing perforating gun comprising a stock adapted for use in a casing, a gun barrel transversely in the stock, a projectile and a firing charge in the stock arranged to allow for ejection of the projectile through the gun barrel, firing means for the projectile and including a time control device, means engaging said device normally holding the same ineffective to cause ignition of the firing charge, and means effected by movement of the stock in the casing for rendering the second-named means ineffective.

31. A casing perforating gun comprising a stock adapted for use in a casing, a gun barrel transversely in the stock, a projectile and firing charge carried by the stock arranged to eject the projectile through the barrel, firing means for the projectile and including a time control device, stop means for said device normally preventing the same from causing the ignition of the firing charge, and means for rendering the stop means ineffective.

32. A casing perforating gun adapted for use in a casing, comprising a body for use in a casing, said body having a recess therein, a barrel bore carried by said body, a projectile carried by said body for ejection therefrom, a detonation charge for the projectile, a firing pin for the charge, a closed housing removably secured in the recess of the body, firing means in the housing for the pin and including a time controlled means, and means carried by the body outwardly of the housing and operable for controlling the firing of the charge.

33. A casing perforating gun comprising a stock adapted to be used in a well casing, a gun barrel transversely in the stock, a projectile mounted to be ejected through the barrel, a firing charge for ejecting the projectile when fired, firing means for firing the charge and including a time controlled means, means for maintaining the firing means in operative position, and means arranged whereby predetermined movement of the stock in the casing will be effective to release the maintaining means to allow the firing means to operate to fire the charge.

34. A perforating gun comprising a stock adapted for use in a well, said stock having a recess therein, a gun barrel transversely in the stock having a projectile, and a firing charge for the projectile mounted therein for firing therefrom, a closed housing removably secured in the recess of the stock, firing means in said housing for the projectile, a closed flame passageway for allowing ignition means to activate the charge, and means carried by the stock outwardly of the housing and operatively associated to said firing means for controlling activation thereof.

35. A perforating gun for well casings comprising a stock having a chamber, means for placing said gun in a well casing, an explosive charge in the chamber, a projectile mounted in the stock to be ejected therefrom by the explosion of the charge, a primer charge in the stock arranged to ignite the explosive charge, means for firing the primer charge arranged to be rendered ineffective through manipulation of the placement means.

36. A casing, perforating gun comprising a stock adapted for use in a well casing, a plurality of gun barrels transversely in the stock, a projectile mounted in each of said barrels, firing charges arranged in said stock and adapted to propel the projectiles through the well casing, said firing charges having ignition communication for each other, firing means for the charges including a primer charge means, movable safety means for the firing means, and means arranged to control through movement of the stock in the casing effective actuation of the firing means and to move said safety member into and out of safety position.

37. A perforating gun comprising a stock adapted for use in a casing, means for locating the gun in the casing, a plurality of gun barrels transversely in the stock, a projectile mounted in each barrel adapted to be ejected therefrom, firing charges for the projectiles arranged in the gun to eject the projectiles, said charges being arranged for ignition communication for one another and adapted to propel the projectiles through the wall of the casing when firing charges therein are activated, firing means for the charges including a primer charge, and means for activating the primer charge by way of manipulation of the locating means.

38. A casing perforating gun comprising a stock adapted for lowering in the casing, gun barrels transversely mounted in said stock, a chamber arranged for each barrel adapted for receiving an explosive charge therein, the inner end of the bore in the barrels being fired, a projectile in each barrel having at the inner end relatively soft material conformably fitted in the flared end of the bore and directly confronting a charge and adapted to be ejected through the bore of the barrel for discharge with the projectile when the charge is fired, a communication system for allowing ignition means to travel from one explosive charge to another for causing ignition of explosive charges which in turn eject the projectiles carried by said stock, and means for firing a charge.

39. A casing perforating gun comprising a stock adapted for lowering in the casing, gun barrels transversely mounted in said stock, a chamber arranged for each barrel adapted for receiving an explosive charge therein, the inner end of the bore in the barrels being flared, a projectile in each barrel having at the inner end relatively soft material comformably fitted in the flared end of the bore and directly confronting a charge and adapted to be ejected through the bore of the barrel for substantial destruction upon the ejection of the projectile when the charge is fired, a communication system for allowing ignition means to travel from one explosive charge to another thereby causing ignition of explosive charges which in turn eject the projectiles carried by said stock, and means for firing the charges.

40. A casing perforating gun comprising a stock adapted for locating in a well casing, gun barrels transversely mounted in said stock, each barrel having a chamber at the rear adapted for receiving an explosive charge in the gun, the inner end of the bore in each barrel being flared, a projectile for each barrel having at the inner end relatively soft material conformably fitted in the flared end of the bore and confronting a charge in the gun and adapted to be ejected through the bore of the barrel for discharge with the projectile when the charge is fired, a communication system for allowing ignition means to travel from one explosive charge to another thereby causing ignition of explosive charges which in turn eject the projectiles carried by said stock, and locating means carried by the gun for utilization in controlling firing of the charges.

41. A perforating gun for a well casing shaped to be manipulated in a casing and comprising a body having a chamber, a projectile and a firing charge to eject the projectile arranged therein, an ignition charge for the firing charge effectively arranged in the body, firing means for activating the ignition charge, and means operable upon predetermined movement of the body in the casing to cause effective operation of the firing means to activate the ignition charge.

42. A perforating gun for a wall casing comprising a stock having a chamber, means for placing said gun in a well casing, an explosive charge in the chamber, a projectile mounted in the stock to be ejected therefrom by explosion of the charge, a primer charge in the stock arranged to ignite the explosive charge, and means for firing the primer charge and arranged to be rendered effective to activate the primer charge through reciprocation of the placement means.

43. A perforating gun comprising a stock adapted for use in a well, said stock having a recess therein, a barrel transversely in the stock having a projectile for ejection therefrom, a closed housing secured in the recess of the stock, firing means in said housing for the projectile, including means under compression, which when released will cause firing, a closed flame passageway providing igniting communication to effectively ignite a firing charge for the projectile therein, and means carried by the stock outwardly of the housing and operatively connected to said firing means for controlling firing of the firing charge.

44. A casing perforating gun comprising a stock adapted for use in a well casing, means for locating the gun in the casing, a plurality of gun barrels transversely carried by the stock, a projectile carried for each barrel and an explosive charge for each projectile, both carried by the stock, said charges having ignition communication for one another adapted to propel the projectiles through the wall of the casing, firing means for the charges, controllable safety means for the firing means, and means actuated by way of predetermined utilization for the gun in the casing by way of the locating means to control effective actuation of the firing means and to control said safety means.

45. A casing perforating gun comprising a stock to be used in the casing, a gun barrel transversely of the stock, having a bore, a projectile in the barrel, a chamber behind the barrel adapted to guide the explosive force of an explosive charge therein substantially against the rear end of said projectile mounted in said barrel for final ejection through the bore of the gun barrel, and relatively soft material at the rear end of the projectile which is substantially the same

size as far as exposed surfaces are concerned, one to the other as the explosive charge, and means for igniting the explosive charge.

46. A perforating gun adapted to be used in well casing, means for positioning the gun inside said casing; projectiles and explosive charges for the projectiles arranged in the gun for propelling the projectiles upon ignition of the explosive charges, firing means for igniting the explosive charges including means held under compression for causing the firing means to fire, and means for releasing means held under compression.

47. A perforating gun adapted to be used in well casing, means for positioning the gun inside said casing, projectiles and explosive charges for the projectiles arranged in the gun for propelling the projectiles upon ignition of the explosive charges, firing means for igniting the explosive charges including means held under compression to cause the firing means to fire, and means for releasing means held under compression.

48. A casing perforating gun comprising a stock adapted to be used in casing, a gun barrel transversely of the stock, a projectile into the barrel, a chamber behind the barrel adapted to propel the explosive force of an explosive charge therein substantially against the inner end of a projectile mounted in said gun for final ejection through the bore of the gun barrel and said projectile being substantially exposed to the explosive charge, relatively soft material at the rear of the projectile which is substantially the same size as the charge in as far as exposed surfaces are concerned one to the other, and means for igniting the explosion charge.

49. A casing perforating gun comprising a stock adapted to be used in casing, a gun barrel transversely of the stock, a substantially closed chamber and bottleneck arrangement created by assembling the gun barrel with said stock, a projectile arranged in the barrel to be propelled outwardly through the outward end of the bore in the gun barrel, said outward end of the bore being of less diameter than the diameter of the explosive chamber, an explosive charge in said chamber the substantial force of which will act directly and substantially against an inward part of the projectile means, at said inward part of substantially the same diameter as the corresponding diameter of the explosion chamber and displaceable with the projectile to thereby utilize the substantial force of the explosion of an explosive charge so that the lines of explosive force substantially emerge behind said bullet through said bottleneck, which will be utilized as the projectile is being propelled, and means for igniting the explosive charge.

50. A casing perforating gun comprising a stock adapted to be used in casing, a projectile and an explosive charge arranged in the gun so as to propel the projectile outwardly therefrom upon explosion of the charge, said explosive charges being substantially behind the inner end of the projectile, a bottleneck arrangement therein for converging the lines of force substantially behind the inner end of the projectile so that the lines of force can act direct, and means for igniting the charge.

51. A casing perforating gun comprising a stock adapted to be used in casing, projectiles and explosive charges arranged therein so as to propel the projectiles outwardly therefrom upon explosion of the charges, firing means for the explosion charges, slidable safety means to control effective actuation of the firing means, while the gun is being lowered into the casing, and adjustable means for said slidable safety means both to lose control of effective actuation for firing or to control effective actuation of the firing means for withdrawal of the gun from the casing without firing.

52. A casing perforating gun adapted to be used in casing, means for positioning the gun in casing, projectiles and explosive charges arranged therein so as to propel the projectiles outwardly therefrom upon explosion of the charges, and firing means for the charges, safety means normally in safety position for the firing means, and including means allowed to be actuated by way of predetermined utilization of the positioning means for allowing the firing means to fire the gun.

53. A casing perforating gun adapted to be used in casing, means for positioning the gun in casing, projectiles and explosive charges arranged therein so as to propel the projectiles outwardly therefrom upon explosion of the charges, and firing means for the charges, including means allowed to be actuated by way of predetermined utilization of the positioning means for rendering the firing means operable to fire the gun.

54. A casing perforating gun adapted to be used in casing, means for positioning the gun in casing, projectiles and explosive charges arranged therein so as to propel the projectiles outwardly therefrom upon explosion of the charges, firing means for the charges, safety means for the firing means, said firing means including means allowed to be actuated by way of predetermined utilization of the positioning means and means for actuating and controlling safety means used in conjunction with the gun.

55. A casing perforating gun comprising a stock adapted to be used in casing, means for positioning the gun to desired depth in the casing, projectiles and explosive charges arranged therein so as to propel the projectiles outwardly therefrom upon explosion of the charges, and firing means for the charges including a flame passageway for allowing ignition means to travel from the firing means to at least one explosive charge and including means for actuating the firing means to be rendered effective to do so by predetermined movement of the positioning means.

56. A casing perforating gun comprising a stock adapted to be used in casing, means for positioning the gun to desired depth in the casing, projectiles and explosive charges arranged therein so as to propel the projectiles outwardly therefrom upon explosion of the charges, firing means for the charges including a flame passageway for allowing ignition means to travel from the firing means to at least one explosive charge, and safety means for the explosive charges arranged to be selectively moved to both its operative and inoperative positions and thereby control the explosion of the explosive charges.

57. A casing perforating gun comprising a stock adapted to be used in casing, means for positioning the gun to desired location in the casing, projectiles and explosive charges arranged therein so as to propel the projectiles outwardly therefrom upon explosion of the charges, firing means for the charges including a flame passageway for allowing ignition means to travel from the firing means to at least one explosive charge, and safety means normally in

safety position and arranged to be moved to an inoperative position by way of predetermined utilization of the positioning means.

58. A perforating gun comprising a stock adapted for use in a well, said stock having a recess therein, a gun barrel transversely in the stock having a projectile to be propelled therefrom, a closed housing secured in the recess of the stock, means for positioning the gun in the well, firing mechanism in the housing for the projectile, and means carried by the stock outwardly of the housing and operatively associated to said firing mechanism for allowing the firing means to operate by way of predetermined utilization of the positioning means.

59. A perforating gun comprising a stock adapted for use in a well, said stock having a recess therein, a gun barrel transversely in the stock having a projectile to be propelled therefrom, a closed housing secured in the recess of the stock, means for positioning the gun in the well, firing means including firing mechanism in the housing for the projectile, slider means carried by the stock having a predetermined relationship to the firing means during downward movement of the gun in the well, and means for controlling the relationship by manipulation of the placement means thereafter.

60. A perforating gun comprising a stock adapted for use in a well, said stock having a recess therein, a gun barrel transversely in the stock having a projectile to be propelled therefrom, a closed housing secured in the recess of the stock, means for positioning the gun in the well, firing means, including firing mechanism in the recess for the projectile, slider means carried by the stock having a predetermined relationship for the firing means during downward movement of the gun in the well, and means for controlling the relationship by means of predetermined utilization of the placement means thereafter, and so the firing means can be ineffectively spent if desired without firing the projectile and thereafter the gun withdrawn from the well.

61. A perforating gun adapted to be used in well casing, means for positioning the gun inside said casing, projectiles and explosive charges for the projectiles arranged in the gun for propelling the projectiles upon ignition of the explosive charges, firing means for igniting the explosive charges including means under compression which when released allows the firing means to operate, and means for releasing means under compression.

62. A perforating gun for well casing having projectiles and explosive charges therein arranged for propelling the projectiles outwardly therefrom upon ignition of the explosive charges, means for positioning the gun in the casing, and firing means for igniting the explosive charges including means essentially controlled by way of predetermined movement of the positioning means to control both effective and ineffective operation of the firing means.

63. A perforating gun for well casing having projectiles and explosive charges therein arranged for propelling the projectiles outwardly therefrom upon ignition of the explosive charges, means for positioning the gun in the casing, and firing means for igniting the explosive charges including means essentially controlled by way of predetermined utilization of the positioning means to control both effective and ineffective operation of the firing means, safety means for the firing means for movement of the gun in any direction in the casing and adapted to cause the firing means to be ineffective for withdrawal of the gun from the casing without firing the charges, said safety means being essentially controlled by way of predetermined utilization of the positioning means.

64. A perforating gun for well casing having projectiles and explosive charges therein arranged for propelling the projectiles outwardly therefrom upon ignition of the explosive charges, means for positioning the gun in the casing, firing means for igniting the explosive charges, safety means for the firing means for movement of the gun in any direction in the casing and adapted to cause the firing means to be ineffective for withdrawal of the gun from the casing without firing the charges, said safety means being essentially controlled by way of predetermined movement of the positioning means.

65. A perforating gun adapted to be used in well casing, means for positioning the gun to desired depth inside said casing, projectiles and explosive charges for the projectiles arranged in the gun for propelling the projectiles upon ignition of the explosive charges, and firing means for igniting the explosive charges, including means normally under compression during the positioning of the gun and being releasable through predetermined utilization of the positioning means when it is desired to let the firing means operate for igniting the explosive charges.

66. A perforating gun adapted to be used in well casing, means for positioning the gun to desired depth inside said casing, projectiles and explosive charges for the projectiles arranged in the gun for propelling the projectiles upon ignition of the explosive charges, and firing means for igniting the explosive charges, including means normally under compression during the positioning of the gun and being releasable through predetermined utilization of the positioning means when it is desired to allow and cause the firing means to operate for igniting the explosive charges.

67. A perforating gun for well casings comprising a stock having a chamber, means for placing said gun in a well casing, an explosive charge in the chamber, a projectile mounted in the stock to be ejected therefrom by the explosion of the charge, a primer charge in the stock arranged to ignite the explosive charge, and means for firing the primer charge arranged to be rendered effective or ineffective, or both, through manipulation of the placement means.

68. A perforating gun for well casings comprising means for lowering the gun to desired depth therein, leverage mechanism for use in control of the operation of the gun, said leverage mechanism including a device on an outward side of the gun, and including means for controlling the mechanism, and means for utilizing said device by means of predetermined utilization of the lowering means.

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