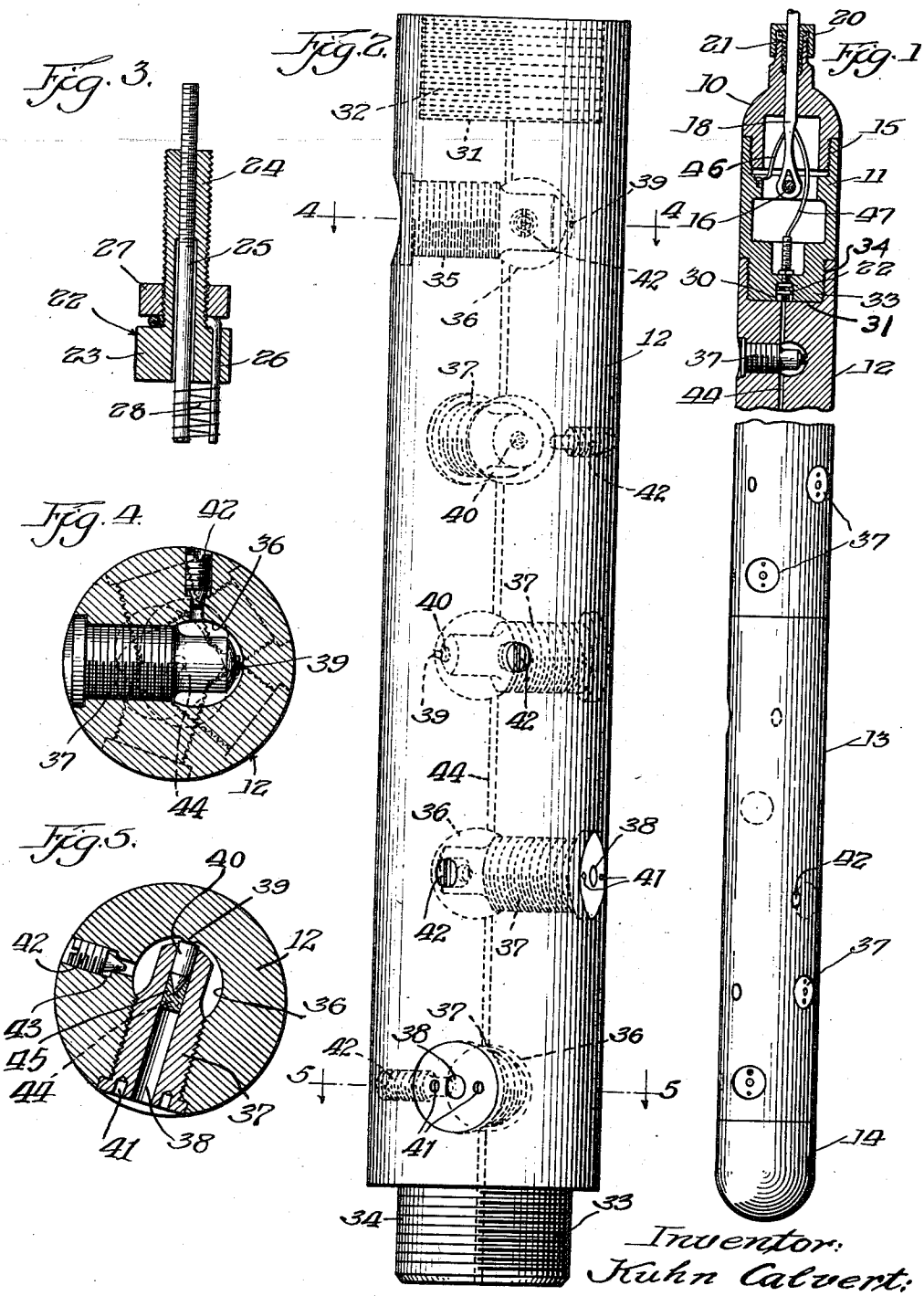
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BULLET TYPE CASING PERFORATOR

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BULLET TYPE CASING PERFORATOR

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12 Claims. (Cl. 164—0.5)

The invention relates to improvements in apparatus for perforating a well casing and has for an object to provide a portable gun unit which will fire a plurality of projectiles under control of an operator at some distance from the unit.

When the production of an oil well has become exhausted the procedure resorted to in an effort to secure additional oil from the well consists in perforating the casing at different levels where oil bearing sands have been drilled through. The invention provides an improved casing perforator for the purposes described having a plurality of explosive charges for firing perforating means in the form of bullets and which may be fired electrically after the unit has been lowered in the well casing to the desired depth.

Another object of the invention is to provide a bullet type perforator which can be loaded in a manner whereby the operator will be absolutely safe from premature explosions of the charges.

Another object of the invention is to provide a bullet type perforator wherein the powder chambers for the gun units can be filled with powder as the last operation in preparing the gun for firing.

Another object is to provide a perforator consisting of sections of identical construction and which can be varied in number so that the present perforator may have a length for firing the desired number of charges for any particular perforating operation.

Another object is to provide a well casing perforator having a powder chamber for each gun unit which will be accessible from the exterior of the perforator after the gun unit is in place so that the same may be filled with powder and wherein all the powder chambers are connected with a central firing bore.

Another object of the invention is to provide a well casing perforator of relatively simple construction which will operate with high efficiency and fulfill all requirements of service.

With these and various other objects in view, the invention may consist of certain novel features of construction and operation as will be more fully described and particularly pointed out in the specification, drawing and claims appended hereto.

In the drawing, which illustrates an embodiment of the invention, and wherein like reference characters are used to designate like parts—

Figure 1 is an elevational view of the bullet type casing perforator of the invention showing a portion of the head end thereof in section;

Figure 2 is an elevational view of one of the intermediate sections of the perforator showing the spiral orientation of the gun units and their association each with a powder chamber;

Figure 3 is a vertical sectional view showing the improved firing plug employed in the present perforator;

Figure 4 is a sectional view taken substantially along line 4—4 of Figure 2 and showing the arrangement of the gun units with respect to the central firing bore; and

Figure 5 is another transverse sectional view taken along line 5—5 of Figure 2 showing the removable loading plug for the powder chambers.

Referring to the drawing, the perforating unit consists of a head piece 10, a part 11 providing an ignition chamber, an intermediate section 12, a lower intermediate section 13 of identical construction, and a bottom or nose member 14, all of said parts being formed of metal such as steel or a steel alloy. As shown in Figure 1, the parts 10 and 11 are suitably threaded at 15. Part 11 provides a cable pin 16 to which is suitably fastened the cable 18 extending through the head piece 10. By means of the cable the casing perforator is suspended and lowered into a well casing. The end of head piece 10 is threaded for receiving the cap 20 which forces member 21 into the recess provided in the end of said head piece and which thus applies pressure to packing confined within said recess forming a stuffing box for the cable 18, thereby sealing the interior of the chamber formed by parts 10 and 11 from external hydrostatic pressure.

Part 11 of the casing perforator is provided with a firing plug indicated in its entirety by numeral 22 and which is shown in detail in Figure 3. Said plug comprises a body portion 23 having a vertical extending part 24 externally threaded, whereby the firing plug may be secured in place within the recess therefor formed in part 11. The central electrode 25 extends through the body portion and depends some distance beyond the same. The ground electrode 26 also depends a like distance from the body portion and said electrode is suitably secured thereto by the nut 27 having threaded engagement with part 24. The fuse wire 28 connects the central electrode and the ground electrode and when energized said fuse wire will ignite the explosive powder in chamber 30 within which the electrodes are located.

The intermediate sections of the perforator each have a recess 31, Figure 2, formed in one end thereof, which is internally threaded as at 32. The other end of the section is formed with

a depending portion 33 externally threaded at 34. The part 11 is likewise formed with a depending portion 33, externally threaded, and which is adapted to fit within the recess 31 of section 12, whereby the parts are securely held in connected relation. In a like manner a number of sections may be joined to form a perforator of the desired length. Each section is formed with a plurality of transverse sockets or recesses which are threaded for a portion of their length as at 35 and have formed at their inner end a powder chamber 36. The recesses in each section are spirally arranged as will be clear by reference to Figures 1 and 4 and each recess receives a gun unit including a barrel 37 having the bore 38 for receiving a bullet 40. The exterior of the gun barrel 37 is threaded so that the same is held within its recess in this manner, each barrel being provided with pin openings 41, whereby a tool may be applied to the barrel for facilitating the operation of threading the same within its recess. It will be observed that the rear of the barrel extends well within its respective powder chamber, in fact each barrel extends almost to the rear wall of its powder chamber. This is desirable since it increases the length of the bore and accordingly the bullet will issue with greater force and can be more accurately directed. As shown in the drawing, the end of each bullet 40 is in direct contact with the projection 39 extending inwardly from the rear of its respective powder chamber. The projection spaces the bullet from the rear wall of its chamber and upon firing of the powder the gases generated as a result are better able to act against the rear of the bullet to discharge the same from its barrel with the greatest velocity.

In accordance with the invention this operation takes place immediately preceding the firing of the perforator and therefore up to this time it has been absolutely impossible to discharge any of the bullets. Even the filling of the chambers with powder, as contemplated by the invention, is a safe procedure since it is not necessary to screw the barrels down onto a charge of explosive powder. Each powder chamber is provided with a removable plug 42 adapted to be threaded in an opening 43 formed in the perforator in alignment with a powder chamber. When the plug 42 is removed the chamber can be filled with powder through said opening. Each intermediate section is formed with a central bore 44 extending longitudinally of the section from end to end and which is of relatively small diameter. The bore connects each of the powder chambers which are radially arranged with respect thereto, and the upper end of the bore in section 12 will communicate with chamber 30 containing the firing plug. As a result of the operation of filling the chambers with powder the bore 44 will likewise be filled with explosive powder which when ignited through the instrumentality of the firing plug will cause firing of the gun units successively.

For reloading the perforator following firing of the same the parts 10 and 11 are removed as a unit from the top intermediate section 12. This removes the firing plug from its association with the firing bore 44 and thus prevents inadvertent explosion of the powder while the chambers are being filled therewith. The bores 38 in the respective barrels may be cleaned and for this purpose it is a relatively simple procedure to screw the barrel in a direction to remove the same from its transverse recess. When the bores have been cleaned and the barrels replaced or in the event this is found not to be necessary the next procedure is to deposit a bullet 40 in each bore, forcing the same into the lower part of the bore by a rubber plug 45 which is allowed to remain within the bore in order to prevent water, oil or other liquid coming into contact with and spoiling the explosive powder. The powder chambers 36 are then filled through the openings 43, it being first necessary, of course, to remove each of the plugs 42. In this operation some of the powder entering the chambers will of course find its way into and will fill the firing bore 44. The plug 42 for each powder chamber is screwed into place following the filling operation but before the sections of the perforator are joined to the part 11 it is necessary to insert a capsule containing explosive powder in chamber 30. The part 11 and the top intermediate section is then united and the perforator is ready for firing, provided the electric wires from the cable 18, namely, 46 and 47, are connected with the ground connection and firing plug, respectively.

During operations of preparing the perforator for firing it is of course understood that the switch for the electric circuit energizing the firing plug remains open. It is preferred practice to lock the switch in open position while the perforator is not in use so that the danger of premature ignition is reduced to a minimum. After the device has been inserted within a well casing and lowered by cable 18 to the required depth the switch is closed to cause energization of the fuse wire 28 having electrical contact with both electrodes. An explosion first of all will take place within chamber 30, which results in igniting the powder in the firing bore and accordingly the bullets will be fired in succession. The bullets will puncture the well casing in a plurality of places and due to the spiral arrangement of the gun units the said openings will be properly oriented. After firing the perforator is hauled to the surface and may be recharged for another firing operation.

The invention is not to be limited to or by details of construction of the particular embodiment thereof illustrated by the drawing, as various other forms of the device will of course be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

What is claimed is:

1. In a gun type casing perforator, a body portion, a cable attached to one end thereof for suspending the said body portion and by which the same may be lowered into a well casing, a plurality of explosive charges carried by said body portion, a gun unit associated with each charge, each of said explosive charges being accessible from the exterior of the body portion independently of the gun units whereby the same may be loaded after said gun units are in place, and a longitudinal central firing bore extending axially of the body portion for detonating said explosive charges successively.

2. A gun type casing perforator, a body member, a cable attached to one end thereof for suspending the member and by which the same may be lowered into a well casing, a plurality of laterally directed sockets formed in said body member and each terminating in a powder chamber, a gun unit located within each socket, each of said powder chambers having an open-

ing through which the same may be filled with an explosive charge, a removable plug closing each of said openings, and a longitudinal central firing bore extending axially of the body member for detonating said explosive charges successively.

3. A gun type well casing perforator, comprising a plurality of sections forming an elongated member having a head end portion, a nose end portion, a cable attached to the head end portion for suspending the member and by which the same may be lowered into a well casing, explosive charges carried by each intermediate section of the member, a gun unit associated with each explosive charge, each of said charges being accessible from the exterior of the member independently of the gun units whereby the same may be loaded after said gun units are in place, a longitudinal central firing bore extending axially of each intermediate section for detonating the explosive charges successively, and a firing plug in the head end portion adapted to be controlled by an operator at a point remote from the perforator.

4. A gun type casing perforator comprising a plurality of sections forming an elongated member, said sections including a head end portion, a nose end portion and at least one intermediate section, a cable attached to the head end portion for suspending the member and by which the same may be lowered into a well casing, a plurality of laterally directed sockets formed in said intermediate section, said sockets being spirally arranged longitudinally of the intermediate section and each socket being interiorly threaded for a portion of its length and terminating at its inner end in a powder chamber, a gun unit releasably threaded within each socket, each of said powder chambers being accessible from the exterior of the section independently of the gun units whereby the same may be filled with an explosive charge after said gun units are in place, and a longitudinal central firing bore extending axially of said intermediate section from end to end thereof for detonating said explosive charges successively.

5. A gun type casing perforator, comprising a plurality of sections forming an elongated member, said sections including a head end portion, a nose end portion and at least one intermediate section, a cable attached to the head end portion for suspending the member and by which the same may be lowered into a well casing, a plurality of laterally directed sockets formed in said intermediate section, said sockets being spirally arranged longitudinally of the intermediate section and each socket being interiorly threaded for a portion of its length and terminating at its inner end in a powder chamber, a gun unit releasably threaded within each socket, each of said powder chambers being accessible from the exterior of the section independently of the gun units whereby the same may be filled with an explosive charge after said gun units are in place, and a longitudinal central firing bore extending axially of said intermediate section and intersecting each powder chamber whereby said explosive charges are fired successively.

6. A gun type casing perforator, comprising a plurality of sections forming an elongated member, said sections including a head end portion, a nose end portion and at least one intermediate section, a cable attached to the head end portion for suspending the member and by which the same may be lowered into a well casing, a plurality of laterally directed sockets formed in said intermediate section, said sockets being spirally arranged longitudinally of the intermediate section and each socket being interiorly threaded for a portion of its length and terminating at its inner end in a powder chamber, a gun unit releasably threaded within each socket, each of said powder chambers being accessible from the exterior of the section independently of the gun units whereby the same may be filled with an explosive charge after said gun units are in place, a firing bore extending axially of said intermediate section for firing the explosive charges successively, said head end portion having a chamber formed therein communicating with the upper terminal end of said firing bore, and a firing plug within said chamber adapted to be controlled by an operator at a point remote from the member.

7. A gun type casing perforator comprising a plurality of sections forming an elongated member, said sections including a head end portion, a nose end portion and at least one intermediate section, a cable attached to the head end portion for suspending the member by which the same may be lowered into a well casing, a plurality of laterally directed sockets formed in said intermediate section, a gun unit located within each socket and forming with the rear thereof a powder chamber, said intermediate section having openings formed therein leading to a powder chamber respectively through which the same may be filled with an explosive charge, a removable plug closing each of said openings, and a longitudinal central firing bore extending axially of said intermediate section from end to end thereof and intersecting said powder chambers whereby the explosive charges are fired successively.

8. A gun type casing perforator comprising a plurality of sections forming an elongated member, said sections including a head end portion, a nose end portion and at least one intermediate section, a cable attached to the head end portion for suspending the member by which the same may be lowered into a well casing, a plurality of laterally directed sockets formed in said intermediate section, a gun unit located within each socket and forming with the rear thereof a powder chamber, said intermediate section having openings formed therein leading to a powder chamber respectively through which the same may be filled with an explosive charge, a removable plug closing each of said openings, a firing bore extending axially of said intermediate section for firing the explosive charges successively, said head end portion having a chamber communicating with the upper terminal end of said firing bore, and a firing plug in said chamber adapted to be controlled by an operator at a point remote from the member.

9. A gun type casing perforator comprising a plurality of sections forming an elongated member, said sections including a head end portion, a nose end portion and at least one intermediate section, a plurality of sockets in said intermediate section, each terminating at its inner end in a powder chamber, a gun unit releasably mounted within each socket, each of said powder chambers having an opening through which the same may be filled with an explosive charge after said gun units are in place, and a longitudinally extending firing bore located substan-

tially centrally of said intermediate section for detonating said explosive charges successively, said firing bore joining the powder chambers of each gun unit which are radially arranged with respect to said firing bore.

10. A gun type casing perforator comprising a plurality of sections forming an elongated member, said sections including a head end portion, a nose end portion and at least one intermediate section, a plurality of sockets in said intermediate section, each terminating at its inner end in a powder chamber, a gun unit releasably mounted within each socket including a barrel extending approximately to the rear of its powder chamber, and an axial bore in said barrel for receiving a bullet to be fired, each of said powder chambers having an opening through which the same may be filled with an explosive charge after said gun units are in place, and a substantially central firing bore extending longitudinally of said intermediate section from end to end thereof for detonating the explosive charges successively.

11. A gun type casing perforator comprising a plurality of sections forming an elongated member, said sections including a head end portion, a nose end portion and at least one intermediate section, a plurality of sockets in said intermediate section each terminating at its inner end in a powder chamber, a gun unit located within each socket and including a barrel having a bore for accommodating a bullet, the rear end of each barrel extending within its respective powder chamber whereby to provide a bore of maximum length, each of said powder chambers having an opening through which the same may be filled with an explosive charge after said gun units are in place, and a central firing bore of relatively small diameter extending the length of said intermediate section for detonating the explosive charges successively.

12. A gun type casing perforator comprising a plurality of sections forming an elongated member, said sections including a head end portion, a nose end portion and at least one intermediate section, a plurality of sockets in said intermediate section each terminating at its inner end in a powder chamber, a gun unit located within each socket and including a barrel having an axial bore for receiving a bullet, the rear of each barrel extending within its respective powder chamber whereby to provide a bore of maximum length, and a projection extending inwardly from the rear wall of each powder chamber adapted to contact its respective bullet to thereby space the same from the wall of the powder chamber.

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