Jan. 28, 1947. J. B. SCHIAVON 2,414,900

PERFORATOR WITH PROJECTILES

Filed June 8, 1945 2 Sheets-Sheet 1

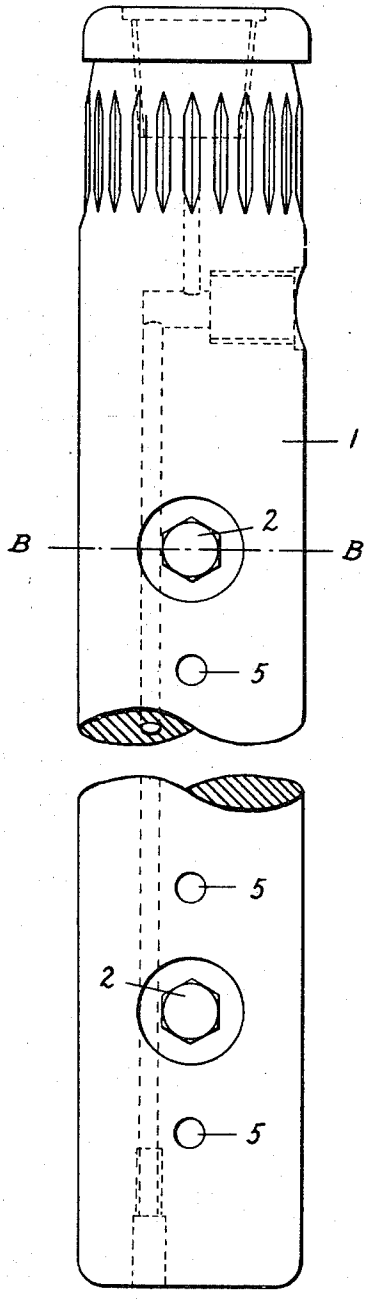


Fig. 1.

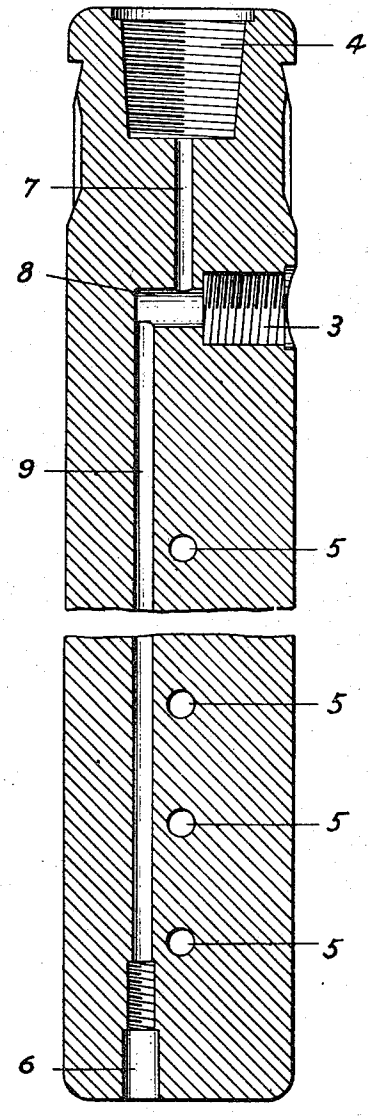


Fig. 2.

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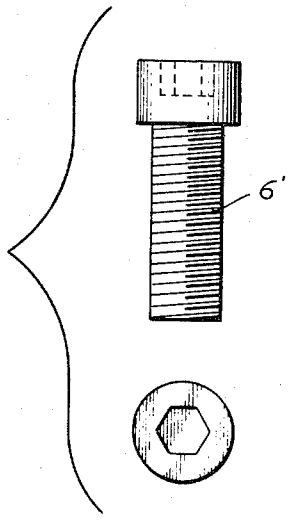


Fig. 5.

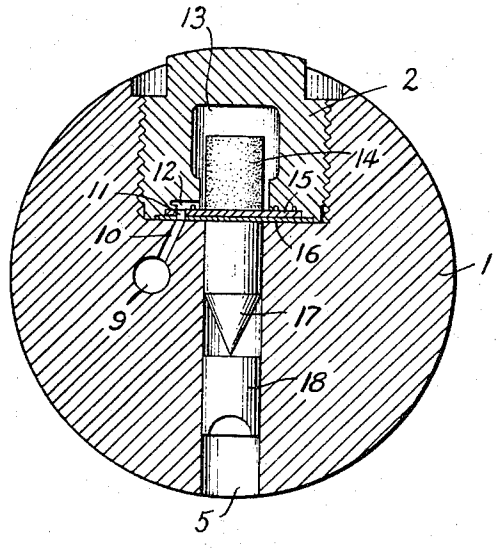


Fig. 3.

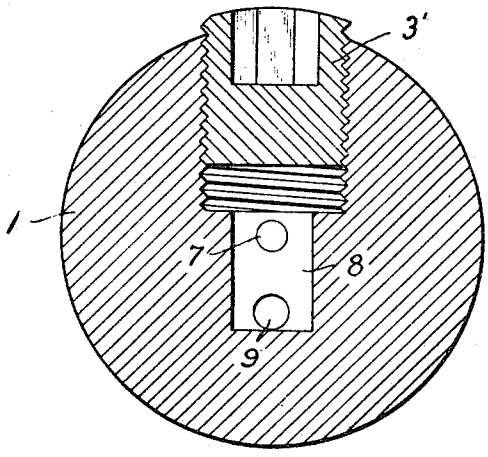


Fig. 4.

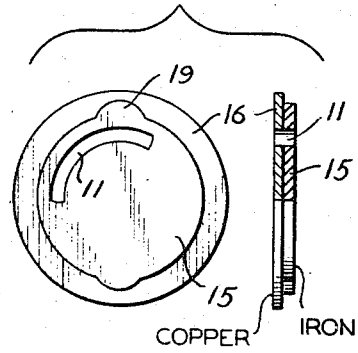


Fig. 6.

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UNITED STATES PATENT OFFICE

2,414,900

PERFORATOR WITH PROJECTILES

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3 Claims. (Cl. 164—0.5)

1

It is frequently the case in oil fields to find the oil containing strata at varying depths, and as a result the depth of one well may, and frequently does, vary substantially from that of another; often-times the oil strata are found intercalated between gas or water strata. In the first instance, it is often difficult, if not impossible, to ascertain at what depth the drilling of a well should be stopped, and in the second instance, determine which strata will produce oil and which water or gas.

In both cases drilling is performed through all the oil containing strata, which it is presumed are forming the oil deposit, and subsequently the wells are conditioned so that a profitable selective working of the actual oil containing strata is performed by eliminating the water and gas fluids which if allowed to flow into the well would hamper the normal oil production of the field.

One way of performing this selective process is as follows: after all the strata of the oil formation have been drilled and the contents of each has been carefully ascertained, a casing is positioned in the well down to the bottom thereof, and the entire thickness of the oil stratum is cemented off; in other words, the annular space, comprised between the external wall of the pipe and the wall of the well, is filled with cement grout which, when it sets or hardens, forms an hermetic seal stopping the flow of fluids from the drilled strata into the well; subsequently the tubing is perforated at predetermined depths corresponding to the strata which it is desired to work, that is to say, the oil strata.

In the modern art the method most generally applied to perform these perforations is to fire laterally, at the desired depth, projectiles into the strata by means of a device commonly known as a "perforating gun."

The present invention deals with a device of this nature, and the novel constructive details of which will become apparent from a reading of this description with the assistance of the drawings, in which identical parts bear the same reference numerals.

Fig. 1 is an elevation of the device; Fig. 2 is a longitudinal section; Fig. 3 is a transverse section on the line A—B of Fig. 1; Fig. 4 is a transverse section near the upper end of Fig. 1; and Figs. 5 and 6 are detail views.

Figure 1 shows a view of the device which comprises a steel cylindrical body 1 of variable diameter, depending on the diameter of the tubing within which it is required to operate; the full length of which varying according to the number

2

of projectiles that are fired simultaneously. Alternately located within said cylindrical body 1 are conduits which perforate the cylindrical body in its entire diameter, one end of each being closed by means of a threaded plug 2 and opposing the same are apertures forming the bore for each projectile.

Figure 2 shows a longitudinal sectional view of the device in which it is apparent that the device is perforated, at a certain distance from its geometrical axis, by a conduit 9 of circular cross-section, extending from the lower end of the device to near the upper end of the same. The lower end of the conduit 9 has a cavity 6 wherein the head of a closure screw 6' is located (Figure 5) while the upper end of the conduit 9 terminates in the transversal cylindrical chamber 8 the outer enlarged end 3 of which is closed with a threaded plug 3', (Figure 4). Chamber 8 communicates by means of circular conduit 7 extending along the axis of the cylindrical body of the perforator, with the cavity 4 located in the upper end of the device, said cavity 4 being threaded in order to affix the body of the perforator to the percussion mechanism, the purpose of the latter being explained hereinafter.

Along two generatrices of the body 1, diametrically opposed and alternately located, are conduits 5 which constitute the chamber and bore of the projectiles 17 (Figure 3) and the cavities corresponding to the plugs 2 which communicate with the conduits.

Figure 3 illustrates a cross section of the device along the axis B—B; in this view it is apparent that the longitudinal conduit 9 communicates with a cavity 13 made in plug 2 through a conduit 10 which is perforated from the cavity of plug 2. It is obvious, in this figure, that the body of the perforator 1 is transversally pierced by a conduit 5 constituting the chamber and bore of the projectile 17 and furthermore by a threaded cavity receiving the plug 2 within which is located a concentric cavity or explosion chamber 13 wherein the charge of powder 14 is placed. The plugs 2 are provided with a recess of a special form, the purpose of which is to receive the locking disc 15—16. This locking disc 15—16 consists of one disc of iron 15 and one of copper 16, which have been joined together with a coating of tin or the like. The iron disc 15 is provided with two projections 19 (Figure 6) which lodge in corresponding notches located in the recesses of plug 2, the purpose of the projections being to permit the disc 15—16 to rotate with the plug

2 when the latter is screwed into position until it is set against the bottom of the cavity.

The screwing of the plug is made with the assistance of reference marks so as to place the conduits 10 in communication with a slot 11 made in the disc 15—16 (Figures 3 and 6) while at the same time said slot 11 communicates with the channel 12 located in the plug 2 and through same with the chamber 13. In like manner, the disc 15—16, on being firmly held between the plug 2 and the bottom of the cavity, separates the chamber 13 from the conduit 5 until the time of operating the device, in the manner as hereinafter explained.

Operation

The plugs 2 corresponding to the projectiles which it is desired to fire are unscrewed, and a charge of powder 14 is placed in each plug, together with the discs 15—16, the whole being hereafter screwed in place in operative position into the corresponding cavity and with the assistance of the reference marks, so as to maintain the communication between the main conduit 9 and the explosion chamber 13 by means of the conduits 10, slot 11 of parts 15—16 and channel 12 of plug 2. In like manner the primary charge of powder is renewed from chamber 8 by removing threaded plug 3' (Figure 4) which is again screwed into position once the charge of powder has been placed therein; previously the projectiles 17 have been placed in their respective chambers corresponding to the charges 14 and held temporarily in position by means of stoppers 18.

When the device is loaded in the aforementioned manner, and as illustrated in Figure 2, the percussion mechanism is screwed into position in cavity 4. This percussion mechanism consists of known mechanical elements, not described herein, which actuate on a fulminate and which provoke, through conduit 7, the ignition of the primary charge located in cavity 8; the ignition of said primary charge is propagated through the longitudinal conduit 9 and transversal conduits 10, 11 and 12 to the individual charges located in the plugs 2, the ignition of which causes the rupture of discs 15—16 thus imparting its energy to the projectile 17.

From the foregoing it will be apparent to those skilled in the art that, on carrying the present invention into practice, minor variations may be

introduced as regards the construction and appearance of the perforator with projectiles described, without departing from the spirit and scope of this invention as clearly defined in the appended claims.

I claim:

1. A device for perforating tubing by means of projectiles, consisting of a cylindrical body with alternate diametrical conduits traversing the cylindrical body through its entire diameter; one end of each of said conduits being provided with a recess within which is located a hollow plug; passages in the cylindrical body communicating the chamber of said plugs with a conduit located longitudinally within the cylindrical body, but offset from the geometrical axis of said cylindrical body to carry a train of flash from a primary charge; means for detaching the chambers in each of the plugs from said diametrical conduits, the latter serving for the purpose of loading projectiles; a closing member associated with each plug, and the provision of slots in said closing members adapted to be connected with said passages, thereby permitting communication of the longitudinal conduit in the cylindrical body with the chambers in said plugs.

2. A device for perforating tubing by means of projectiles, consisting of a cylindrical body in which is located a conduit following the length of said cylindrical body, but offset from the geometrical axis of same; to carry a train of flash from a primary charge the provision of secondary conduits located in said cylindrical body communicating said longitudinal conduit with the chambers in interchangeable hollow plugs located in conduits adapted to receive the projectiles to be fired, said conduits being positioned transversely in the cylindrical body of the device.

3. A device for perforating tubing by means of projectiles which comprises a cylindrical body with transversally and alternately positioned conduits traversing the cylindrical body in its entire diameter; projectiles in said conduits, interchangeable hollow plugs closing one end of said conduits, and individual charges of an explosive in the chambers of said hollow plugs; said plugs being provided with apertures communicating the chambers in said plugs with a principal conduit longitudinally positioned in the cylindrical body of the device for carrying a train of flash from a primary charge.

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