

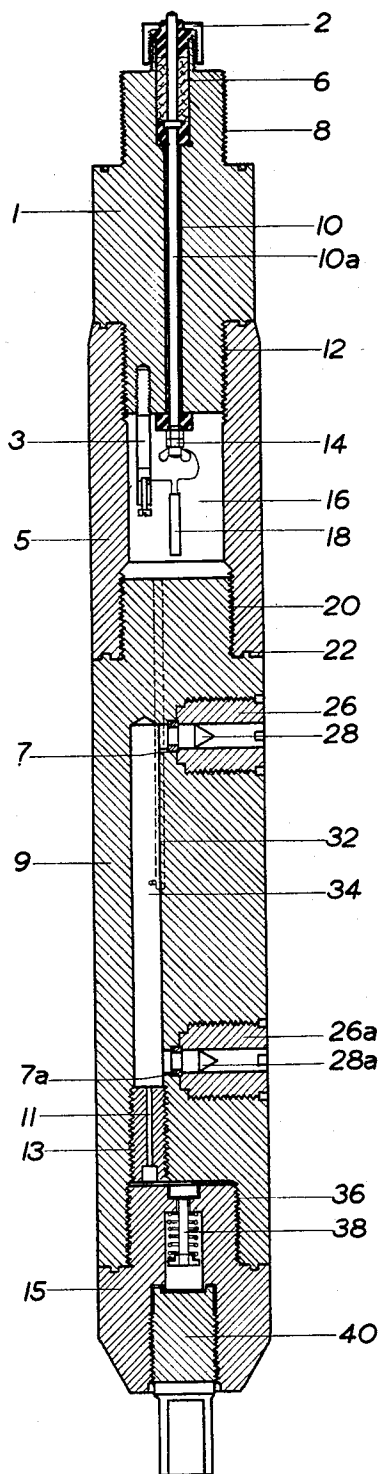
Jan. 31, 1939.

E. ALZNER

2,145,231

WELL CASING PERFORATOR

Filed Sept. 17, 1937



Inventor: Egon Alzner

By his Attorney:

[Signature]

UNITED STATES PATENT OFFICE

2,145,231

WELL CASING PERFORATOR

Egon Alzner, Campina, Rumania, assignor to
Shell Development Company, San Francisco,
Calif., a corporation of Delaware

Application September 17, 1937, Serial No. 164,351
In Rumania September 24, 1936

7 Claims. (Cl. 164—0.5)

The present invention relates to methods of firing explosive charges in boreholes, and pertains more specifically to a method and apparatus for exploding the charges of gun-type casing perforators by means of a gaseous igniting mixture.

Gun-type perforators are commonly used whenever, in the drilling or production of oil wells, it becomes necessary to perforate a casing along a certain portion of its length, for example, along a portion extending through an oil sand which had been passed and shut off by accident or mistake.

Perforators of this type comprise a single or a plurality of interconnected body members, each of the latter being usually provided with a plurality of chambers containing cartridges or explosive charges by means of which perforating projectiles are fired through the casing.

These explosive charges are usually ignited by electrical means, a priming composition or detonating cap being used for each separate charge.

The disadvantage of this method consists chiefly in the use of a plurality of priming compositions, and in the necessity of using a relatively large number of insulated electrical conductors in connection therewith. The numerous openings and passages for these conductors in the body of the perforator must be carefully made tight against fluid pressures in the borehole, so that the charging and preparation of these devices for actual use as well as the careful handling required in operation consumes a relatively long time.

It is, therefore, the object of this invention to provide a gun-type casing perforator in which explosive charges or cartridges are exploded by means of a single igniting or priming gaseous charge.

The construction of such casing perforators, and the method of firing the same according to the method of this invention will be clear from the following description taken with reference to the attached drawing, which gives a cross-section elevation view of a preferred embodiment of the present device.

Referring to the drawing, the perforator comprises a contact head 1, a connecting member 5, a body member 9, and a cap member 15, all cast and/or machined of any suitable metal.

The contact head 1 is provided with external screw-threads 8, by means of which the perforator may be attached to suitable suspending means, or to another perforator when it is de-

sired to operate several of these devices in series, as will be explained below.

The contact head 1 is provided with a central bore 10, having an upper portion of a somewhat enlarged diameter. This portion is filled with packing 6, and is closed at the top by a cap 2. An insulated conductor 10a passes through the cap, packing 6 and bore 10, and is terminated by an electrode 14, provided with an incandescent igniter or spark plug 18. The circuit of the igniter 18 is completed through the connecting pin 3 to the metallic mass of the perforator.

The contact head 1 is attached, by means of screw threads 12 to the connecting member 5, which is in turn attached to the body member 9 by means of screw threads 20. A fluid and gas-tight fit is insured, for example, by means of projections 22, provided, if desired, with suitable gaskets.

The connecting member 5 is made in the form of a hollow cylinder having an internal bore of relatively large diameter, a gas-tight priming chamber 16, serving as a housing for the igniter 18, being thereby formed between the contact head 1 and the body member 9.

The body member 9 is provided with a chamber 34 for the explosive charge, said chamber being in communication with any desired number of screw-threaded cylindrical openings preferably arranged at right angles to the axis of the perforator. The firing barrels 26 and 26a are screwed into these openings and hold the projectiles 28 and 28a. Obturation rings 7 and 7a, made of copper or any other suitable plastic material, are used to tighten the barrels in their nests and to support the projectiles, whereby a gas-tight seal is secured when said projectiles are in place.

The explosive charge chamber 34 is in communication with the priming chamber 16 by means of a bore 32, which may be of a relatively small diameter.

The chamber 34 is closed by means of a plug 13, having a bore 11.

The cap member 15 is screwed onto the body member 9 by means of screw threads 36, and has a central bore holding a non-return check valve 38. This bore may be tightly closed from the outside by means of the screw plug 40.

The perforator is prepared for operation as follows: The firing barrels 26, holding the projectiles 28 are first screwed into the openings provided therefor in the body member 9. The cap member 15 is then unscrewed, and the plug 13 removed from the body member 9. An explosive charge, such as smokeless powder, pyroxylin,

etc., is then inserted into the chamber 34, whereafter the plug 13 and cap 15 are replaced, the plug 40 being removed from the latter. A compressor or a tank containing any suitable explosive gas mixture under pressure is then connected to the cap member 15. This mixture may comprise air and hydrogen, air and a suitable hydrocarbon gas, etc. The compressed gas passes through the non-return valve 38, the bore 11 in plug 13, and fills the explosive chamber 34, passing thereafter through bore 32 to fill the igniting chamber 16. Although, as stated above, the chamber 34 may already have been filled with a solid explosive, the gaseous mixture will pass without difficulty between the porous mass formed by the grains or flakes of said explosive. Likewise, if the perforator had been loaded with explosive sticks or an explosive cartridge, which is especially advantageous to secure quick operation, the gases will easily pass through the interstices between said sticks or cartridge and the walls of the chamber 34.

After the perforator has been filled with explosive gases to a desired pressure, the cap member is again closed by means of plug 40, any escape of gases from within the perforator being prevented by the packing 6, rings and projectiles 7 and 28, and the check valve 38. The insulated conductor 10a is then connected to a source of electric current through an open switch or a contact device, such, for example, as described in Patent No. 2,059,488 to Prikel, and the perforator is lowered by any suitable means to the place where it is desired to perforate the casing. The switch or contact device is then closed, and the igniter or spark plug 18 ignites the explosive gaseous mixture in chamber 16, the explosion being transmitted through bore 32 to the explosive in chamber 34, which is in turn exploded and drives the projectiles 28 through the casing.

It must be noted that in some cases the use of a solid explosive in chamber 34 may be entirely dispensed with, both chambers 16 and 34 being filled only with the explosive gas mixture, which operates in such cases both as an igniting and as a driving charge.

If it is desired to operate a plurality of perforators connected in series, the following procedure may be followed.

Assuming that a top perforator T is to be operated in series with a bottom perforator B, the cap member 15 is removed from the perforator T, while the cap 2, packing 6, conductor 10a and electrode 14 are removed from perforator B. The two perforators are then loaded with projectiles and solid explosive in the ordinary manner, after which they are screwed together on top of each other, the screw threads 8 of perforator B engaging the screw threads 36 of perforator T.

The perforators are then filled with an explosive gaseous mixture through the valve 38 of perforator B, said mixture passing to the perforator T through the unobstructed passage 10. The charges in both perforators are exploded by means of the igniter 18 of perforator T.

It is understood that the present invention is in no way limited to the embodiment described above, but broadly embraces a method of firing

a gun type casing perforator by igniting a gaseous mixture confined in said perforator, said gaseous mixture serving either as a priming charge for a separate explosive charge placed in a space permeated by said gaseous mixture, or as a driving charge capable of forcing projectiles through the desired target.

It is also understood that, should it be so desired, the gaseous mixture may be exploded by means other than electrical, for example, by means of a priming cap located in chamber 16 and fired by any suitable method, such, for example, as by dropping a go devil on top of the perforator.

I claim as my invention:

1. In the process of firing projectiles from a gun-type casing perforator, confining a solid explosive charge in an atmosphere formed by an explosive gas within the perforator, and igniting said gas to explode the solid explosive charge.

2. In a gun-type casing perforator, a housing, a gas-tight chamber within the housing, firing barrels held by the housing in communication with the chamber, projectiles adapted to form a gas-tight seal within the barrels, means for confining an explosive gas charge in the chamber, and means for igniting said gas charge.

3. In a gun-type casing perforator, a housing, a gas-tight chamber within the housing, firing barrels held by the housing in communication with the chamber, projectiles adapted to form a gas-tight seal within the barrels, means for placing and retaining a solid explosive charge within the chamber, means for confining a gaseous explosive charge within the chamber, said gaseous charge surrounding said solid charge, and means for igniting said explosive gas charge.

4. In a gun-type perforator, a housing, a first and a second gas-tight chamber within the housing, a communicating passage between the chambers, firing barrels held by the housing in communication with the second chamber, projectiles adapted to form a gas-tight seal within the barrels, means for placing and retaining a solid explosive charge within the second chamber, means for confining a gaseous explosive charge within the first and the second chambers, said gaseous charge surrounding said solid charge, and means within the first chamber for igniting said gaseous explosive charge.

5. In the process of perforating a well casing, igniting an originally gaseous charge for simultaneously discharging a plurality of projectiles against said casing.

6. In the process of perforating a well casing, using an originally gaseous igniting charge for simultaneously firing a plurality of explosive charges capable of driving a plurality of projectiles through said casing.

7. In a gun-type casing perforator, a housing forming a gas-tight chamber, cylindrical orifices communicating between said chamber and the outside through the walls of the housing, projectiles adapted to form a gas-tight seal within said orifices, means for confining an explosive gas charge in the chamber, and means for igniting said gas charge.

EGON ALZNER.