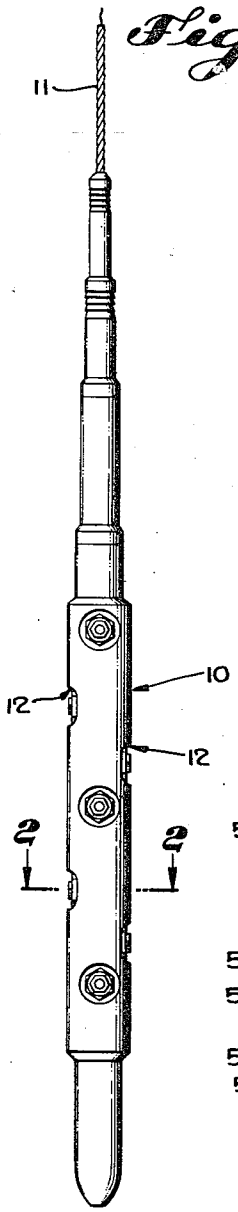
Aug. 25, 1953 R. A. PHILLIPS 2,649,736

CONTACT PIN IGNITER

Filed March 21, 1949

Fig. 1.



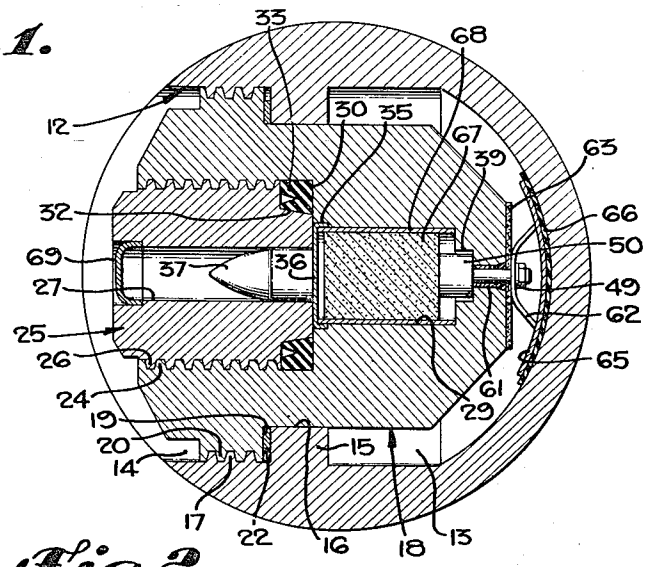


Fig. 2.

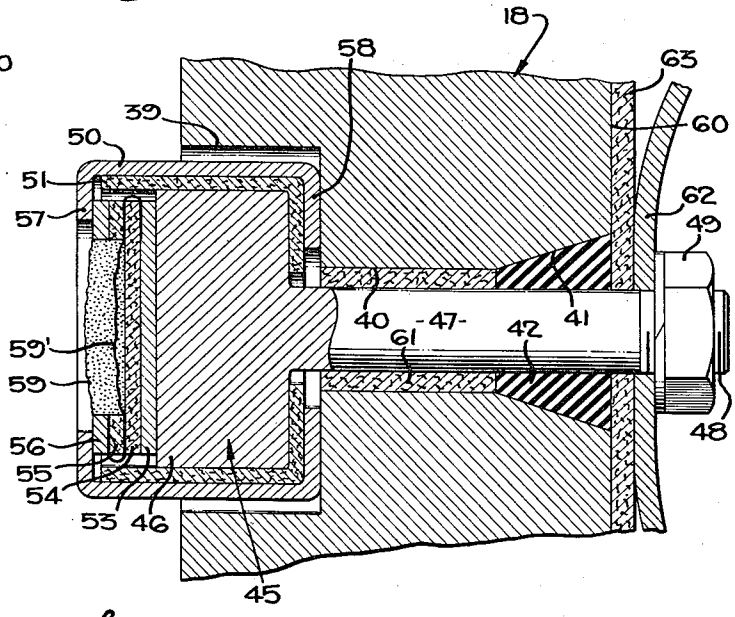


Fig. 3.

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CONTACT PIN IGNITER

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2 Claims. (Cl. 102—70.2)

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This invention relates in general to gun type, well casing perforators and more particularly to improvements in the propellant cartridge and ignition means for such gun perforators.

In gun perforators of the type hereinbefore commonly employed, such as disclosed in Lane 2,062,975 and 2,092,317, the gun propellant charge or cartridge has been constructed in the form of a closed, cylindrical cell of relatively thin insulating material such as fiber, filled with a relatively loosely packed, fast burning powder. Means for igniting the powder in the cell has been provided in the form of a fusible wire which extends from end to end of the cartridge substantially along its axis. The ends of the fusible wire terminate in contact buttons which extend through the center of the end discs of the cartridge and suitable means has been provided in the gun body for making electrical contact with these contact pins.

This construction has had a number of disadvantages, among them being a limitation in the tightness or density with which the powder charge could be packed into a cartridge of such construction and at the same time avoid a resultant retardation in the rate of burning.

It has been recognized that an increase in the quantity of the propellant charge and thus an increase in power and penetrating ability of the gun perforator bullet would be attained if relatively high density, pelletized powder charges could be employed in the cartridge chamber. The pelletizing of the powder charges, however, was found not to lend itself readily to the incorporation of a fusible ignition wire in the body thereof and, furthermore, as beforementioned the rate of burning of such dense charges when ignited by such means is found to be prohibitively low.

It has been discovered, however, that dense, pelletized, powder propellant suitable for gun perforator uses may be satisfactorily ignited and rapid burning induced by means of a small, separate booster charge of deflagrable material placed closely adjacent to and within the cartridge or propellant chamber. Ignition of the small booster charge may then be successfully accomplished electrically by means of a fusible wire which may be connected electrically to a separate firing circuit, thereby obviating the necessity for incorporating a fuse wire within the main body of the pelletized propellant.

It is accordingly an object of this invention to provide an improved ignition means for gun perforator propellant charges.

It is another object of this invention to provide an electrically ignited booster charge or ignition means for a gun perforator cartridge.

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It is still another object of this invention to provide a compact contact pin igniter device which incorporates as a unitary structure, an ignition filament wire and a combustible fuse compound capable of efficient ignition of a separate, densely pelletized propellant powder charge within a gun perforator cartridge chamber.

It is a still further object of this invention to provide a perforationg gun, propellant charge ignition means which is simple, positive, self-contained, independent of the propellant powder charge and which provides a gas pressure seal at its point of entry into the combustion chamber.

Other objects, advantages and features of novelty of this invention will be evident hereinafter.

In the drawings which illustrate a preferred embodiment of the invention,

Figure 1 is an elevational view of a typical gun perforator assembly adapted to employ the ignition means of this invention.

Figure 2 is a cross-sectional view taken on line 2—2 of Figure 1.

Figure 3 is an enlarged, fragmentary cross-sectional view of a portion of the apparatus shown in Figure 2.

Referring first, primarily to Figures 1 and 2, a gun perforator with which the device of this invention is adapted to be used, by way of example, comprises an elongated cylindrical gun body 10, attached at its upper end to a supporting conductor cable 11 and having formed it in a plurality of laterally directed sockets 12. Each socket is divided into an inner cylindrical part 13 and an outer cylindrical opening 14 separated by means of an intermediately positioned, internal annular flange 15 forming on one side thereof an outwardly facing, annular shoulder 16. The cylindrical opening 14 adjacent and extending outwardly from the said annular shoulder 16 of the flange 15 is provided with internal screw threads 17.

Each socket in the gun body as hereinbefore described is adapted to receive and hold a laterally directed gun chamber block as shown at 18. Each gun chamber block is cylindrical in general form varying stepwise in diameter from end to end and provided on the outer end portion of the chamber block with a section of slightly increased outside diameter, forming an annular, inwardly facing shoulder at 19 and carrying on the outside periphery thereof, threads 20 engaging the beforementioned internal threads 17 of the socket.

The inner face of shoulder 19 is thus brought

up into sealing engagement with the outer face of shoulder 16 through an annular sealing gasket 22, by means of the before mentioned threads 17 and 23, when the gun chamber block is installed in the gun body socket as shown in Figure 2.

The outwardly directed end of the gun chamber block is formed with a counterbored portion of relatively large internal diameter, provided with internal threads as shown at 24. A cylindrical gun barrel 25 is formed with external threads 26 which engage threads 24 and by means of which it is threaded into and retained in place in the forward end of the gun chamber block. The gun barrel 25 is formed with a coaxially directed, gun bore 27 extending through it from end to end.

A cylindrical powder or cartridge receiving chamber is formed within the inner end portion of the gun chamber block as shown at 29. The said chamber 29 extends coaxially inward from and is of slightly reduced internal diameter relative to the beforementioned outer threaded gun barrel receiving portion, forming at the juncture therebetween an outwardly facing, annular shoulder 30.

The inner end portion of the gun barrel 25 is chamfered or relieved as shown at 32 to form an annular recess bounded on the inner side by the beforementioned outwardly facing shoulder 30 to contain an annular sealing gasket 33.

The mouth of the cartridge chamber 29 at a point adjacent the inner end of the barrel 25 is counterbored at 35 to receive the inwardly facing circular flange portion of a shear disc 36 which may be attached to the rear end of a perforator bullet positioned in the breech end of the barrel as shown at 37.

The rear end of the chamber 29 is formed with a coaxial cylindrical recess or depression 39 and also with a relatively small drilled passage 40 extending coaxially from the bottom of said recess 39 through the inner end of the gun chamber block.

The innermost end portion of the drilled passage 40 is formed with an outwardly diverging conical section as shown at 41, adapted to receive in sealing engagement an annular gasket 42.

Referring now primarily to Figure 3, the contact pin igniter portion of this invention is there shown in enlarged detail. This contact pin igniter is comprised of a main pin shaped body portion 45 having a cylindrical head 46 and a stem or shank 47 extending coaxially therefrom. The extremity of the stem 47 carries threads 48, upon which a retaining nut 49 is threaded for fastening the contact pin igniter assembly in the gun chamber block as shown. The igniter pin head 46 is covered by a relatively thin, sheet metal contact cup 50, crimped in place at 57 over an intermediate insulating cup member 51. Retained on the top end of the contact pin 46 is a metal contact disc 53, an insulating disc 54 and concentric therewith an annular insulating washer 55 and an annular metal contact ring 56 superimposed thereon. The top and bottom inwardly directed flanges 57 and 58 respectively of the beforementioned metal contact cup serves to clamp the contact head assembly together.

The annular, insulating ring 55 and the annular, metal contact ring 56 form a cylindrical depression bottomed by the upper surface of the beforementioned insulating disc 54. A quantity of explosive or deflagrable material is molded into this depression and occupies the position shown at 59. A fusible ignition wire of small diameter passes diametrally across the head depression and through the explosive or deflagrable body 59 as shown at 59'. The lower end portion of the ignition wire 59' as viewed in Figure 3, is clamped between insulating disc 54 and the annular insulating washer 55 and folded back and clamped between the washer 55 and the annular metal contact ring 56, thereby being electrically connected at the lower end through the contact ring 56 to the metal contact cup 50. The upper end portion of the ignition wire 59' as viewed in Figure 3 is similarly clamped between the insulating washer 55 and the insulating disc 54 and folded back and clamped between insulating disc 54 and the metal contact disc 53 thereby being placed in electrical contact at its upper end through the said metal contact disc 53 with the head and body 45 of the contact pin. The ends of the ignition wire 59' are preferably also soldered to the contact ring 56 and the contact disc 53.

The contact pin body and assembly, as hereinbefore described, may be bolted into any suitably formed cartridge chamber such as that hereinbefore described by way of example in connection with Figures 1 and 2, by means of the threads 48 and retaining nut 49. In the construction herein illustrated, the contact pin 45 and associated assembly is positioned with the contact pin head 46 seated in and partially contained within the cylindrical recess 39 of the gun chamber block 18 as shown in Figures 2 and 3, with the contact pin stem 47 extending through the drilled passage 40 and the threaded end portion thereof carrying the nut 49 extending outward beyond the rear end surface 60 of the gun chamber block 18.

The contact pin igniter head 46 is centered within the recess 39 and the stem 47 centered within the passage 40 by means of an insulating spacing tube 61 which makes a snug fit concentrically within the passage 40 and in turn makes a snug concentric fit over the contact pin stem 47. In the inner, flared portion 41 of the drilled passage 40 is positioned a tapered gasket 42 composed of rubber or the like suitable material. The gasket 42 is pressed inward to form a seal between the stem 47 and the flared surface 41 by means of compressive force exerted by the nut 49 on the threads 48, such force being transmitted through the central body portion of a perforate contact spring element 62 and an insulating separator washer 63. A gas tight seal is thus formed between the contact pin igniter head 46 and stem 47 and the surrounding gun chamber block 18.

When the gun chamber block 18 is assembled within the gun body as shown in Figure 2, the contact spring element 62 engages a contact plate 65. The contact plate 65 is retained on the inner wall of the gun body but electrically insulated therefrom by means of a separating layer of insulation 66 and connected to suitable electrical wiring within the gun body which may lead to a selective switching mechanism if desired, and thence to the conductor cable 11 in such a manner as that more fully described in Lane 2,062,975.

In operation, current for ignition of the ignition booster charge 59 may thus be made to flow from a suitable source at the top of the well borehole (not shown) down through the insulated conductor in the conductor cable 11 to the contact plate 65, from there through contact springs 62, igniter pin stem 47, igniter head 45,

metal disc 53, through fusible wire 59', to annular metal ring 56 and from there through metal cup 50 to ground through the gun chamber block 18 and gun body 10 and thence in return through the ground comprising the sheath of conductor cable 11 and the surrounding formations to the beforementioned current source.

The cartridge chamber 29 in the gun chamber block 18 may be charged with a cylindrical pelletized powder charge as illustrated at 67 and which may be contained for convenience within a surrounding cylindrical, plastic sleeve as shown at 68.

Upon firing the ignition charge 59 as hereinbefore described, intense heat and pressure is quickly applied to the pelletized propellant 67 resulting in its accelerated combustion. After ignition and during the initial combustion of the propellant 67, the resultant gas pressure rises in the chamber 29 to a degree where the pressure is sufficient to rupture the shear disc 36 and propel the bullet 37 at high velocity out through the barrel 27, dislodging the barrel sealing cap 69 and continuing on to penetrate any surrounding casing or formation.

The fusible wire 59' may be composed of a suitable resistance material such as that, for example, known to the trade as No. 39 Nichrome filament wire. The contact pin body may be made of any metal of adequate strength and heat resistant properties such as, for example, copper, brass or steel. The contact pin head cup 50 and metal parts 53 and 56 are preferably made of copper or brass sheet .010 inch in thickness in order to have good electrical conductivity. The igniter or booster compound 59 may be that known to the industry as FFFG black powder, dry pressed into the depression formed at the top of the igniter pin head. The insulating cup 51 and disc 53 may be formed or cut from .010 inch thick, fibre insulating paper or cloth such as Empire Cloth. The annular insulating ring 55 may be cut from 3/64 inch thick commercial red fibre sheeting. The insulating tubing 61 may be of fibre, extruded Vinylite or the like plastic material.

The igniter pin assembly of the present invention is not limited to use in a specific type of gun chamber block or cartridge chamber as herein illustrated, but may be employed in connection with any similar chamber containing combustible material which it is desired to ignite. For example, the igniter pin may be employed in any separate ignition chamber containing a charge of explosive such as that illustrated in Turechek 2,297,038 or Zschokke 2,326,-114. In these latter examples, the ignition chamber serves to ignite a plurality of separate gun charges indirectly through a relatively long ignition passage.

It is to be understood that the foregoing is illustrative only and that the invention is not to be limited thereby but may include various modifications within the skill of the art without departing from the scope of the invention as defined in the appended claims.

The term "explosive charge" as used herein is intended to include both detonating and deflagrating types of charges.

What is claimed is:

1. A contact pin igniter comprising: a metal contact cup having inwardly directed top and bottom flanges forming top and bottom openings in said contact cup; a pin shaped metal body having a cylindrical head positioned within said contact cup and a shank which extends through the bottom opening of said contact cup; electrical insulating means insulating said contact cup from the head and shank of said metal body; an insulating disc on the top end surface of said head within said contact cup; an annular insulating ring on the top surface of said insulating disc within said contact cup; an annular metal ring concentrically positioned on the top surface of said annular insulating ring within said contact cup; said insulating disc, insulating ring and metal ring cooperating to form an upwardly facing cylindrical depression; said inwardly directed top flange extending over and making electrical contact between said annular metal ring and said contact cup and clamping said metal ring, said insulating ring and said insulating disc in the above described superimposed positions in said contact cup; a fusible wire on the upper surface of said insulating disc; both end portions of said fusible wire being clamped between said insulating disc and said annular insulating ring; one end of said fusible wire extending around the edge of said insulating disc into electrical connection with said head and the opposite end of said fusible wire extending around the edge of said insulating ring into electrical connection with said metal ring; and an explosive charge within said depression in physical contact with said fusible wire.

2. A contact pin igniter as described in claim 1 in which the electrical contact between said first mentioned end of said fusible wire and said head is made through a metal disc interposed between the top end surface of said head and the bottom surface of said insulating disc, said metal disc being in electrical contact with said head and said first mentioned end of said fusible wire being in electrical contact with said metal disc.

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