

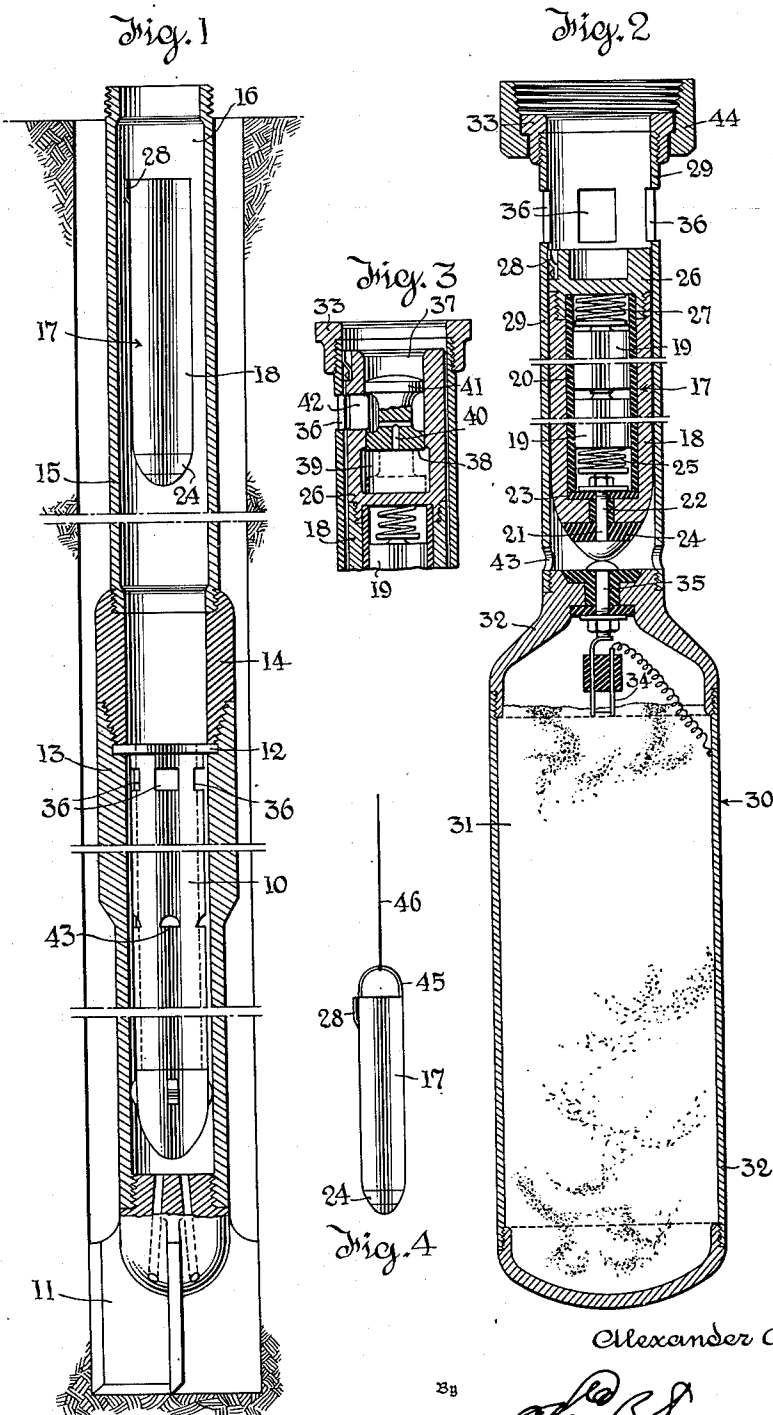
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BORE HOLE DEVICE AND METHOD OF ITS USE

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BORE HOLE DEVICE AND METHOD
OF ITS USE

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8 Claims. (Cl. 255—1)

This invention relates to an improved device and method for controlling the operation of bore hole apparatus, and is directed particularly to a device for electrically initiating the operation of apparatus of various kinds positioned at any point along the length of a bore hole.

This application is a continuation in part of my pending application Serial Number 525,286, filed March 25, 1931, and entitled Apparatus for surveying bore holes.

The use of surveying and recording instruments which may be lowered into a bore hole to any desired level and electrically operated to produce a record of inclination, direction, pressure, or the like is now well known. Likewise, the use of apparatus which may be positioned in a bore hole and electrically operated to fire a charge of explosive for the purpose of marking a core, perforating a casing, breaking drill pipe, blasting formations, or the like is also well known. Many of such instruments and devices are equipped with self-contained clock-operated switches and self-contained batteries for providing the electrical energy necessary for their operation and others are provided with insulated conductors extending to the surface. Apparatus of this character is, at times, unreliable either because of the risk of failure in utilizing an automatically operated circuit closer within the bore to initiate operation of the apparatus or from damage to the insulation or breakage of the insulated conductor. Apparatus of this character is also subject to failure due to the detrimental action of high temperatures and high fluid pressures, existing in some bore holes, on the self-contained battery or batteries and on the insulation of the electric conductors.

It is, therefore, the purpose of this invention to provide a device for initiating the operation of bore hole apparatus with greater certainty, and when desired.

It is the object of this invention to provide a device for initiating the operation of bore hole apparatus which has been positioned in the bore hole at any time before its operation is desired.

Another object of this invention is to provide a device for initiating the operation of electrical bore hole apparatus by means of a source of electrical energy which source is subject to temperature and pressure conditions existing in the bore hole for only a very brief interval of time, and during which the chances of damage to the source are greatly minimized if not entirely avoided.

It is a further object of this invention to provide for electrical control of the operation of

bore hole apparatus without the use of expensive insulated electric wires or cables extending from the apparatus to the surface.

One of the advantages of the present invention is that electrical bore hole apparatus may be lowered or dropped into the well entirely inert and thus it can not be accidentally operated. It is necessary to bring a source of electric energy into direct contact with the apparatus in order to energize the initiating element.

When a self-contained time-controlled initiating device is incorporated in the apparatus, the device will be automatically operated at the expiration of a certain pre-arranged time. If the device comprises a charge of explosives which becomes stuck in the bore and fails to reach the desired location in the well, then an accident might occur through ignition of the explosive charge by automatic operation of a self-contained time-control initiating feature. In the present invention, such a possibility of accident is entirely eliminated because the apparatus is first lowered in an inert condition to the desired location in the well, and the separate source of electric energy is thereafter independently dropped or lowered into contact with the apparatus properly located in the well. Thus, the present invention incorporates a valuable safety feature.

Other objects and advantages of the invention will be apparent from the following detailed description of the embodiments of the invention shown in the accompanying drawing, wherein:

Figure 1 is a sectional view, in elevation, showing an earth boring containing a boring tool supported by a drill pipe and bore hole apparatus supported within the shank of the drill bit.

Figure 2 is a sectional view of bore hole apparatus and a preferred form of initiating device.

Figure 3 is a sectional view of the upper portion of a modified form of the initiating device.

Figure 4 is an elevation view of the initiating device provided with a bail, for lowering the device into a bore hole.

Referring to Fig. 1 of the drawing, for the purpose of illustration, electrically controlled bore hole survey apparatus is indicated generally by the numeral 10. The survey instrument 10 may be of the type shown in my copending application above-referred to, or may be of any known construction, which depends upon electrical energy to initiate operation of the instrument. The instrument 10 may be supported within the elongated drill collar 13 by means of a flange or collar 12, extending from the instrument casing and secured between the threaded collar 13 and

the sub 14, or the instrument may be lowered or dropped through the drill pipe to a position of support resting on the drill bit 11. The drill bit assembly is supported and may be rotated by the conventional drill pipe 15 extending to operating apparatus at the surface of the earth.

The drill pipe 15 is provided with a bore 16 through which drill fluids may be circulated during the drilling operation. A cartridge-like device 17 is shown within the drill pipe 15 through which it is adapted to descend into contact with the survey instrument 10, shown positioned in the drill collar 13. The device 17, described hereinafter, is utilized to initiate operation of the electrically controlled instrument 10.

The cartridge-like device 17, shown in detail in Figure 2, comprises a cylindrical casing 18, preferably of metal, housing one or more batteries 19, insulated from the casing 18 by a sleeve or wrapping 20 of paper or other appropriate insulating material. The rounded nose of the casing 18 is provided with a contact stud 21 passing through the nose of the casing, and insulated therefrom by the sleeve 22 and washers 23 and 24 of insulating material. The washer 24 is preferably of a dense, rigid, insulating material, such as bakelite, vulcanized rubber, or the like. The outer end of the stud 21, and also the edge of the insulating disc 24 are shaped to provide a smooth rounded surface at this end of the cartridge to facilitate its movement downwardly through the drill mud or other drill fluid within the bore of the drill pipe 15.

The lower terminal of the battery 19 is electrically connected to the stud 21 by a spring 25 which also supports and cushions the battery within the cartridge casing. The upper end of the cartridge is closed by a threaded plug member 26, preferably of metal. A spring 27 may be inserted between the upper end of the battery 19 and the closure member 26, to maintain the battery or batteries properly positioned and to insure electrical connection between the upper battery terminal and the closure member 26. The plug 26 is provided with a laterally protruding spring finger 28, to assure good electrical contact between the member 26 and the bore hole apparatus supporting sleeve 29, in their relative positions illustrated in Fig. 2.

Referring to Figure 4, the initiating device 17 may be provided with a bail or loop 45 at its upper end. A line or wire 46 attached to the bail 45 can then be utilized for lowering the device into the drill pipe or well.

Bore hole apparatus in the form of a charge of explosive is indicated in Fig. 2 by the numeral 30. This apparatus comprises a quantity of explosive 31, contained in the metal receptacle 32, which may be supported by a sleeve 29, flange 33, and the collar 44, the latter being adapted to be secured to the sub 14 at the lower end of the drill pipe 15, shown in Figure 1. The explosive device is provided with an electric igniter 34, of conventional construction, electrically connected to the receptacle 32 and to an insulated central contact stud 35.

The operation of the cartridge or initiating device for initiating the operation of electrically controlled bore hole apparatus is as follows: Apparatus in the form of a survey instrument, explosive device, or the like, is positioned and supported by or in the drill pipe 15 at the desired level of operations. Survey or other apparatus may be so positioned at any time and may remain in the bore hole during drilling or any other oper-

ations preceding operation of the apparatus. When it is desired to initiate operation of the apparatus, the cartridge device 17 is introduced into the drill pipe at the surface of the earth and permitted to drop freely or is lowered by line 46 through the bore of the drill pipe. Drill fluid circulation may be maintained during descent of the cartridge, and such fluid as enters the sleeve 29, flows out through openings 36 and 43 as the cartridge enters the sleeve. When the cartridge reaches the positioned apparatus, the contact stud 21 engages a contact stud, such as 35, on the apparatus. This engagement completes an electrical circuit through the contacts 21 and 35, the cartridge casing 26, the spring finger 28, the supporting sleeve 29 and the apparatus casing 32 to supply electrical energy from the battery 19 carried in the cartridge to the electrically controlled bore hole apparatus. The electrical energy thus supplied, initiates operation of the survey instrument 10, the explosive device 31, or whatever other form of apparatus is to be operated.

The drop cartridge 17 may be assisted in its downward movement through the drill pipe by the circulation of drill mud downwardly through the drill pipe. Openings 36, are provided in the supporting sleeve 29 to permit this circulation of the drill fluid.

In order to provide a signal to the operator at the surface of the earth, to indicate that the initiating device 17 has reached the apparatus, the member 26 carried by the cartridge may be provided with an internal bore 37 fitted with a piston valve 38 (see Fig. 3). The lower end of the bore 37 may be filled with a viscous fluid 39, the discharge of which, under operating conditions is controlled by restricted passages 40, in the piston valve. The piston valve 38 is also provided with a head 41; and an opening 42 is provided in the wall of member 26 to permit passage of drill fluids through the drill pipe, the bore 37, opening 42, openings 36, and thence downwardly to the drill bit.

The operation of the signal means is as follows: As the drop cartridge enters and seats in the sleeve 29, as shown in Fig. 3, the head 41 of the piston 38 temporarily prevents free flow of drill fluids through the openings 42 and 36. The stoppage of flow of the drill fluids causes increased pressure in the bore of the drill pipe, which in turn produces knocking or laboring in the drill fluid circulating pump at the surface. The operator is thus notified by the sound of his engine that the battery equipped cartridge has reached the apparatus. Increased pressure in the bore of the drill pipe forces the piston 38 to move downwardly in the bore 37 of member 26, the movement being retarded and controlled by the escape of the viscous medium 39 through the passages 40. The increased pressure upon the cartridge 17, also insures good electrical contact between the contact studs 21 and 35. After the valve head 41 clears the opening 42, circulation of the drill fluid to the drill bit is resumed, and notice of the fact that the cartridge device 17 has reached a proper operative position in the boring, is registered at the surface by the resumption of normal operation of the circulating pump. The use of the valve mechanism in the cartridge head may be dispensed with in operating those forms of bore hole apparatus wherein the operator is adequately notified of actuation of the apparatus, by observing vibration due to explosions, or the like. On the other hand, the signal feature is

especially desirable in conjunction with the initiating of the operation of survey instruments, since it automatically notifies the operator when to stop the circulating pumps in order that the survey instrument may operate without being disturbed or otherwise adversely affected by pump vibration, etc.

It will be obvious that the above-described initiating device is useful for starting the operation of all types of electrically controlled bore hole apparatus. It may be used for initiating the operation of bore hole survey instruments, core taking devices, explosive charges, casing perforators and many similar devices. It is adapted to operate apparatus which has been positioned at any desired level in the bore hole at any time before the operation is to be effected. The source of electrical energy being contained in the initiating device is not subjected to detrimental temperature or pressure conditions for periods long enough to destroy the effectiveness of the source before successful initiation of operations; and it furthermore obviates the use of wires or conductors with their attendant expense, difficulties and hazards.

A further valuable feature of the present invention, particularly when used to initiate the firing of an explosive charge, is that, should the battery equipped device 17 fail to make contact with the terminals of the explosive igniter 34, then after a few hours the batteries 19 will be rundown and inert due to electrical leakage through the drill fluid across the insulated washer 24. The result is that the operation of withdrawing the explosive charge from the well may then be carried out with safety and without fear of accidental explosion.

Obviously, various forms of external contacts and cartridge shapes may be designed by those skilled in the art without departing from the scope of this invention. This invention also contemplates the use of equivalent types of initiating devices used in or out of drill pipes and bore hole casings for controlling electrical apparatus positioned at any pointed along the length of a bore hole.

What I claim is:

1. A device for initiating the operation of electrically controlled bore hole apparatus located within a boring at any point along the length thereof, the said device comprising a casing adapted to be passed into and along the boring and into electrical contact with said bore hole apparatus, a source of electrical energy contained within the casing, and means for conducting the current from said source to separate parts of the casing which are electrically insulated from each other, and adapted to conduct current from said source to said apparatus.

2. A device for initiating the operation of electrically controlled bore hole apparatus located within a boring at any point along the length thereof, the said device comprising a casing adapted to be passed into and along said boring, a source of electrical energy contained within said casing, contacts on the exterior surface of said casing insulated from each other and adapted to make electrical contact with said bore hole apparatus for supplying electrical energy thereto, and means connecting said contacts to said source of energy.

3. A device for initiating the operation of elec-

trically controlled bore hole apparatus located within a boring at any point along the length thereof, the said device comprising a casing adapted to be passed into and along the boring, a source of electrical energy contained within the casing, an exterior contact stud in the nose of said casing and insulated from the side wall thereof, said contact stud and said casing being adapted to make electrical connection with said bore hole apparatus, and means electrically connecting said source of electrical energy to said contact stud and to said casing.

4. A device for initiating the operation of electrically controlled bore hole apparatus located within a boring at any point along the length thereof, the said device comprising a hollow casing adapted to be passed into and along the boring, said casing including two metal parts electrically separated by an insulating member, a battery source of electrical energy positioned within said hollow casing having one electrode in electrical contact with one of said metal parts and the other electrode in electrical contact with the other of said metal parts.

5. In bore hole apparatus of the character described, a device for initiating operation of apparatus that is located within the boring at any point along the length thereof, the said device comprising a casing adapted to be passed into and along the boring and into electrical contact with the apparatus in the boring and means comprising an element movable in the casing for controlling the flow of fluid in the boring when the device has made contact with the apparatus to evidence at the surface that such contact has been effected.

6. In bore hole apparatus of the character described, a device for initiating operation of apparatus that is located within the boring at any point along the length thereof, the said device comprising a casing adapted to be passed into and along the boring and into electrical contact with the said apparatus to furnish current thereto, a source of electrical energy contained within the casing and means for conducting the current from said source to the exterior surface of the device at spaced points thereof which are electrically insulated from each other, and means comprising an element movable within the casing for controlling the flow of fluid in the boring when the device has made contact with the said apparatus in the bore whereby it is evidenced at the surface that such contact has been effected.

7. The method of initiating the operation of electrically controlled bore hole apparatus at any point along the length of a bore hole, comprising the following steps; positioning the apparatus at a desired point within the bore hole and passing a source of electrical energy along the bore and into electrical circuit with said apparatus to supply thereto the electrical energy required to initiate the operation thereof.

8. The method of initiating the operation of electrically controlled bore hole apparatus at any point along the length of a bore hole, comprising the following steps; positioning the apparatus at a desired point within the bore hole and passing a source of electrical energy along the bore to a position adjacent to said apparatus to supply electrical energy to said apparatus to initiate the operation thereof.

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