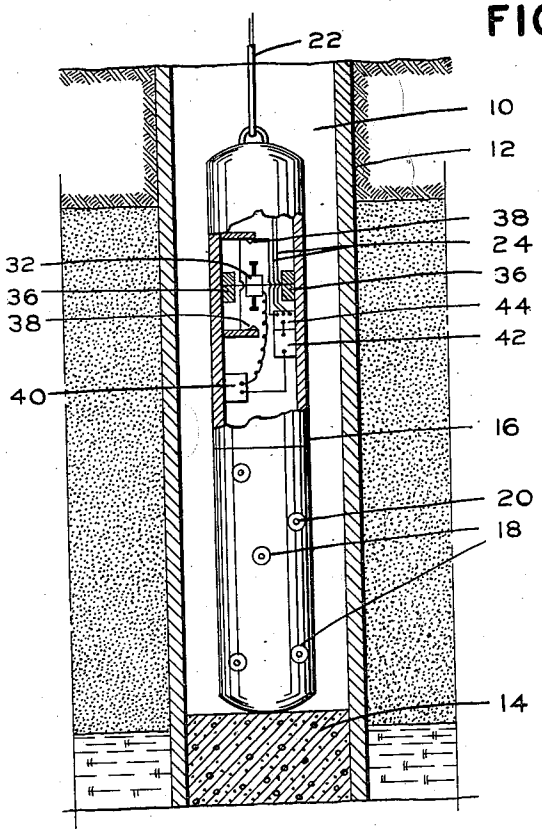
May 16, 1944. D. G. C. HARE 2,349,041

SIGNALING DEVICE FOR GUN PERFORATORS

Filed Aug. 29, 1941

FIG. 1.



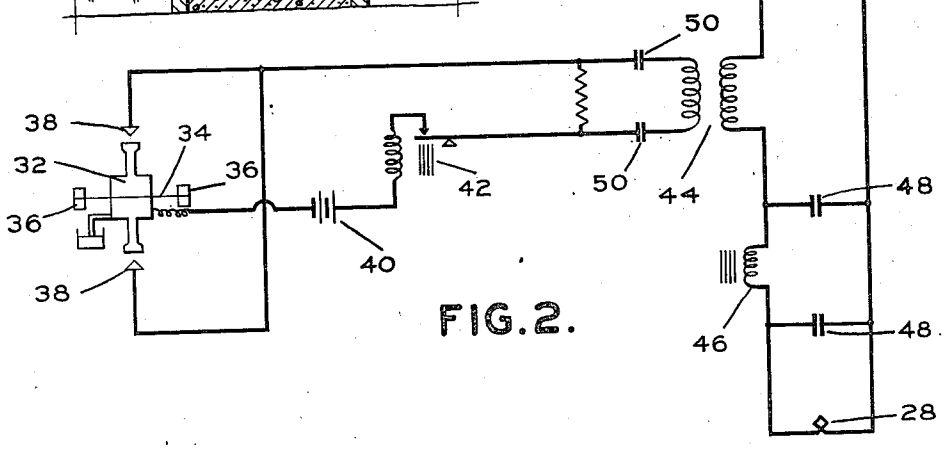
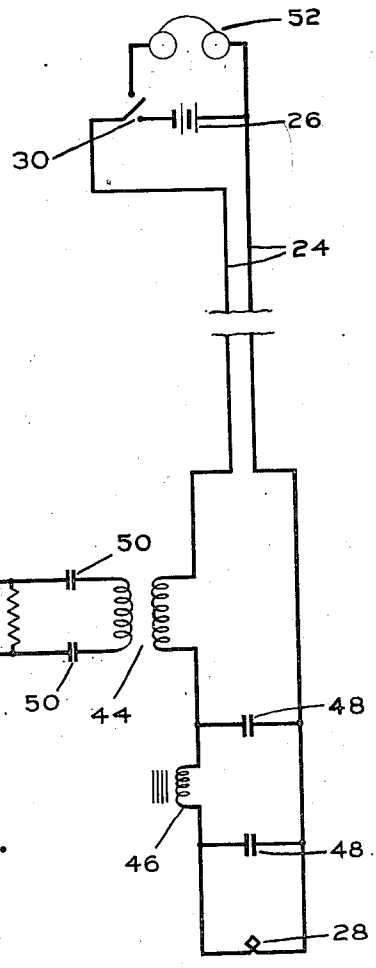


FIG. 2.



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SIGNALING DEVICE FOR GUN PERFORATORS

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Application August 29, 1941, Serial No. 408,836

3 Claims. (Cl. 177—311)

This invention relates to signaling systems and devices and more particularly to a device for providing an indication at the surface when a tool such as gun perforator is raised or lowered in a bore hole. The principal object of the invention is the provision of a simple device of this kind which will furnish a positive indication that a device such as a gun perforator is moved upwardly or downwardly from a previous position in a bore hole.

In the perforating of a well casing or of the formations around a bore hole by means of a gun perforator, it is frequently difficult to determine the exact position of the perforating device in the hole. These devices are comparatively heavy and as they are usually run into and out of the hole by means of a wire cable, the weight of the device often causes considerable elongation of the cable. It is quite common in gun perforating practice to lower the perforating tool to the bottom of the hole or to a cement plug which may have been placed at an elevation above the bottom of the hole, and then to raise the tool to the point at which it is intended to perforate. Because of the stretch of the cable the operator is not always certain that the tool has been raised off the bottom, even though he may have pulled up some distance on the suspending cable.

In accordance with this invention, a device is provided either within or attached to the perforating tool for closing an electric circuit to provide a signal at the surface when the tool is raised from its bottom position. A signal will also be given in case the perforating tool should become stuck during the lowering operation. For a better understanding of the invention reference may be had to the accompanying drawing in which,

Fig. 1 is a vertical elevation, partly in section, of a gun perforating tool at rest on a cement plug in a bore hole, while

Fig. 2 is a diagram of the electrical connections.

Referring to the drawing, a bore hole 10 provided with a casing 12 has been plugged as by means of the cement plug 14, and it may be assumed that it is desired to perforate the casing 12 at a point somewhat above the plug 14. A gun perforating tool 16 which, as is generally known, usually comprises a plurality of barrels 18 and charges of explosive adapted when fired to project bullets 20 through the casing and into the formation, is lowered into the hole by means of a cable 22, which usually includes a pair of wires shown at 24 in Fig. 2, for connecting a source of electricity 26 at the surface to one or more firing caps 28 in the tool. When a switch 30 is closed, the cap 28 will be fired to cause the explosive, not shown, to discharge the bullets through the casing.

An inertia member 32 is resiliently supported within the housing of the tool 16 as by means of a spring disc 34 secured to the housing by lugs 36. A pair of contact members 38 are rigidly secured to the perforating tool housing in vertical alignment with the inertia member 32 and separated from the inertia element by a distance such that on a predetermined raising or lowering acceleration of the perforating tool the inertia member will strike one of the contacts 38 to complete an electric signal circuit which will be described. As shown in Fig. 2, the inertia member 32 is connected electrically with a source of current 40 which in turn is connected to a signal generator 42 which may be a high frequency buzzer having a frequency of about 1,000 cycles. The buzzer 42 is connected through one coil of a transformer 44 to the two contacts 38. The firing circuit, which has already been partially described, also includes the other coil of the transformer 44 and preferably a choke coil 46 and a pair of condensers 48 connected across the line.

In operation, acceleration of the perforating tool in either an upward or downward direction causes the inertia member 32 to engage the lower or upper contact 38 respectively to close the signal circuit, thus energizing the signal generator or buzzer 42. High frequency current from the buzzer circuit is coupled into the firing circuit by means of transformer 44 and the choke coil 46 and condensers 48 tend to prevent current from the buzzer circuit from flowing through the firing cap 28. As a further safe-guard condensers 50 may be placed in the signal or buzzer circuit to prevent any direct current from entering the firing circuit. The signal current coupled into the firing circuit will pass through the signal receiver 52 which may comprise a pair of head phones, when the switch 30 is in its upper position. Thus, assuming the perforating tool to be in the position shown in Fig. 1, the operator pulls upwardly on the cable 22 until he hears the signal in the receiver 52 caused by the upward motion of the tool closing the signal circuit through the inertia contactor 32, and he then has a positive indication that the perforating tool has been raised above the cement plug 14. The operator then moves the switch 30 to

its lower position, thus connecting the source of current 26 into the firing circuit 24 and the firing of the cap 28 will discharge the explosive to cause the bullets to be projected through the casing 12.

If the perforator should become stuck during the lowering operation and then dislodged so as to move downwardly again, the downward acceleration will cause the inertia member 32 to strike the upper contact 38 to close the signal circuit and provide a signal at the receivers 52, as before described.

It will thus be seen that a simple arrangement has been provided to furnish a positive indication of movement of the perforating tool and that no additional electric circuit is needed from the tool to the surface, the signal current being impressed on the already existing firing circuit to energize the signal receiver.

Obviously many modifications and variations of the invention, as hereinbefore set forth, may be made without departing from the spirit and scope thereof and, therefore, only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. In combination with a gun perforator adapted to be lowered to the bottom of a bore hole on a wire cable, a signaling device, a source of electrical current and a vertically movable inertia contactor in said perforator, a signal circuit in which said signaling device, current source and inertia contactor are connected electrically in series, a firing circuit for said perforator and a transformer connecting said signal circuit with said firing circuit, the arrangement being such that on upward or downward accelerating movement of said perforator said inertia contactor will close said signal circuit through said transformer to couple a signal current into said firing circuit, and a signal receiver connected in said firing circuit.

2. In combination with a gun perforator adapted to be lowered to the bottom of a bore hole on a wire cable, a signaling device, a source of electrical current and an inertia contactor connected in a series signal circuit in said perforator, said contactor comprising a pair of vertically separated fixed contacts and a vertically movable inertia member disposed between said contacts so that upward or downward accelerating movement of said perforator will cause said inertia members to engage one of said contacts to close said signal circuit, a firing circuit for said perforator including a second source of electrical current, a firing cap, a normally open switch, a signal receiving device and said cable connected electrically in series, and a transformer connecting said signal circuit with said firing circuit, the arrangement being such that when said signal circuit is closed a signal will be impressed on said firing circuit and indicated by said receiving device.

3. In combination with a gun perforator suspended in a well from a cable and connected in a firing circuit including said cable to a source of electricity at the surface, means for indicating when said perforator is moved vertically from a stationary position comprising a signaling device, a source of electricity and an inertia contactor connected in a signal circuit in said perforator, means for inductively coupling said signal circuit to said firing circuit, and a signal receiver at the surface connected in said firing circuit.

DONALD G. C. HARE.