June 19, 1923.

1,458,925

J. BARAB

DETONATOR

Filed May 18, 1921

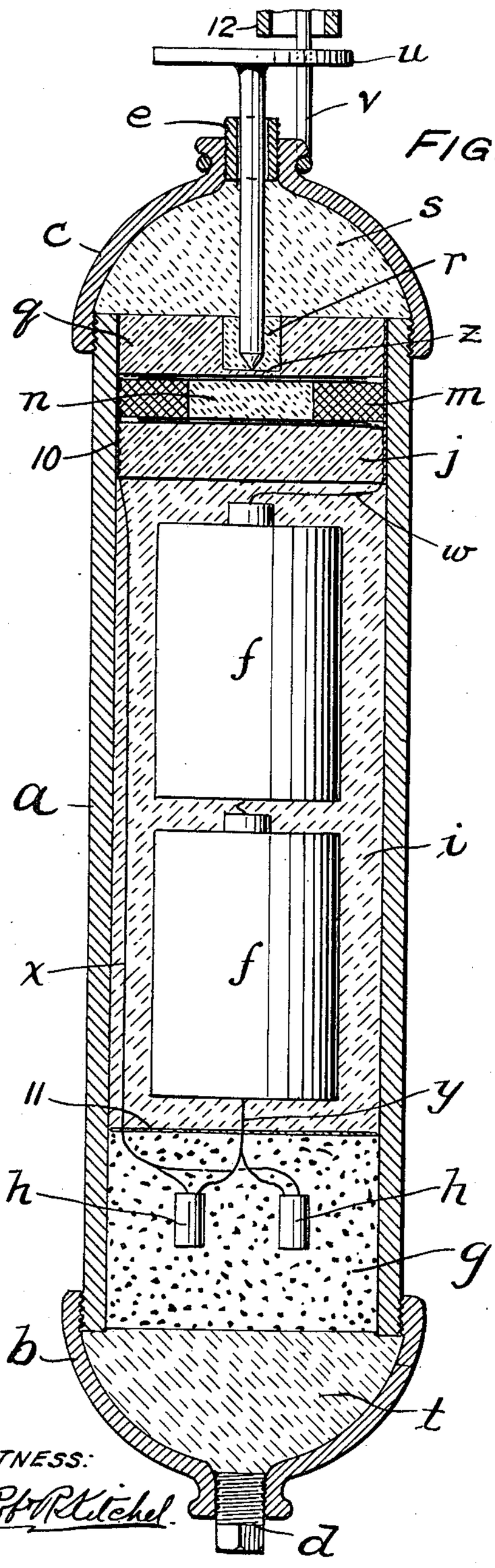

FIG. 1.

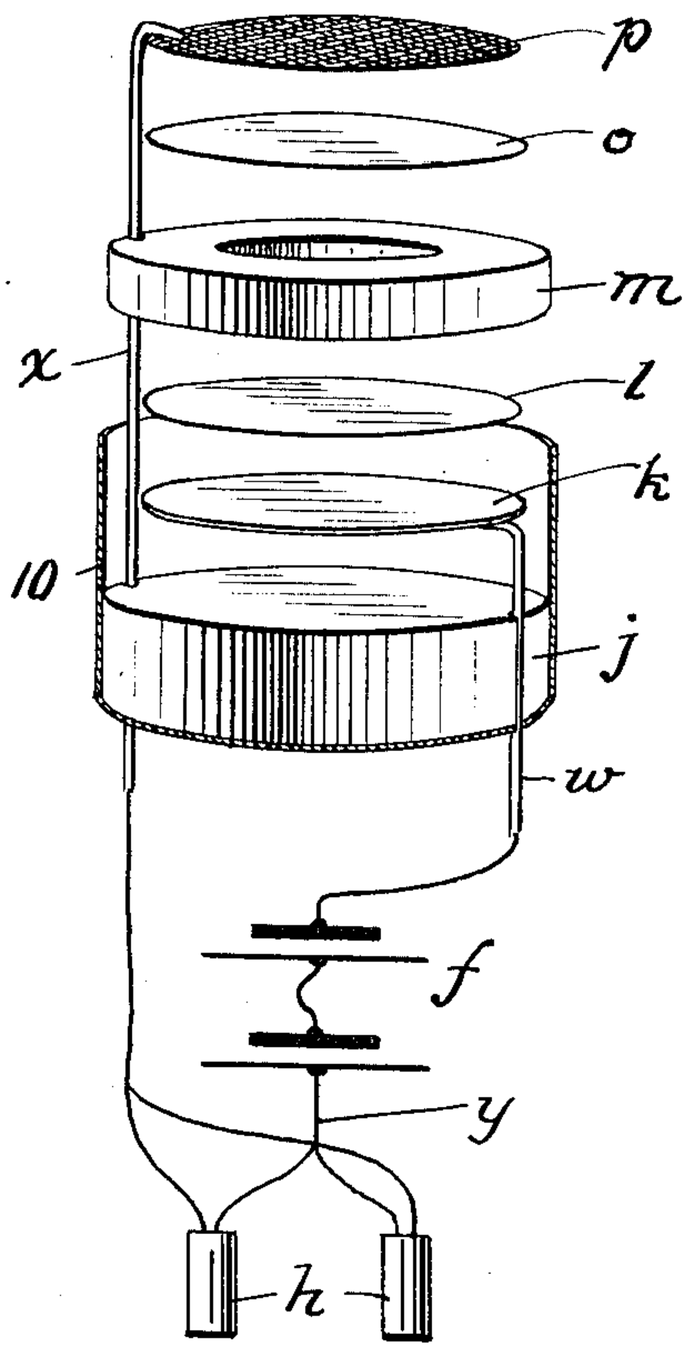

FIG. 2.

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UNITED STATES PATENT OFFICE.

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DETONATOR.

Application filed May 18, 1921. Serial No. 470,591.

To all whom it may concern:

Be it known that I, JACOB BARAB, a citizen of the United States, residing at Atlantic City, county of Atlantic, and State of New Jersey, have invented a new and useful Improvement in Detonators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

This invention relates to detonators adapted to be fired by closing an electric circuit and particularly to such detonators for shooting wells of any depth, including wells in which the charge is subjected to high liquid pressure.

Detonators of this type comprise a casing, an explosive charge, such as blasting gelatin, contained therein, a firing device, such as an electric blasting cap, within the explosive charge, a wire leading from a sheave above ground and from which a torpedo containing the detonator is supported and lowered through the well into position for firing, and insulated conducting wires leading from a source of current above ground and extending along and tied to the supporting wire and extending into the detonator to the firing device. Upon closure of the circuit above ground, the blasting cap is fired, which in turn fires the detonating charge.

The main factor in the cost of manufacture of these detonators consists in the cost of the wires for conducting the electric circuit. These wires, when firing deep wells, are very expensive, and they cannot safely be used again.

The object of my invention is to dispense with these conducting wires, provide the detonator with a self-contained generator and electric circuit and close the circuit and thereby effect ignition by mechanical means controlled from above ground. The specific detonator herein shown and described represents one of many possible embodiments of my invention and can be made at a very small fraction of the cost of any of the electrically fired detonators now in use.

In the drawings:

Fig. 1 is a vertical sectional view through the detonator.

Fig. 2 is a diagrammatic view showing the principal elements of the detonator separated for the purpose of more clearly showing certain parts.

The detonator comprises a casing composed of a cylindrical body *a* and bell-shaped end caps *b* and *c* adapted to be closed by plugs *d* and *e* respectively.

The cylindrical body portion of the detonator contains one or more electric batteries. In the drawings are shown two flash light cells *f*, *f* connected in series. Below the batteries is the mass of explosive *g* encasing one or more (in the drawings two are shown) blasting caps *h*, *h*. The batteries are encased in hard asphaltum *i*, upon which rests a bed of sealing wax *j*.

Above the bed *j* of sealing wax is an annular fibre washer *m* enclosing a center of soft asphaltum *n*. Between the members *m n* and the bed *j* are a sheet of tin foil *l* and a zinc disc *k*. Resting on the members *m n* is a sheet of tin foil *o* and above this a copper gauze disc *p*. The central part of the copper gauze disc is covered with a thin layer of sealing wax *z*.

Above the elements *m*, *n*, *o*, *p* is an annular body of sealing wax *q* enclosing a mass of soft asphaltum *r*. The space enclosed by the upper end cap *c* is filled with soft asphaltum *s*. The space enclosed by the lower end cap *b* is filled with hard asphaltum *t*.

The plug *e* for the end head *c* is hollow and through it extends loosely a circuit-closing pin *u*, preferably a headed brass nail the shank of which extends also through the bodies of asphalt *s*, *r*.

The supporting wire *v* extends down through a hole in the head of the nail *u* and is wrapped around the neck of the end head *c*.

A wire *w* is secured to the zinc disc *k* and extends through the bed *j* and is connected with one pole of the battery. A wire *x* is secured to the copper gauze disc *p* and extends down through a notch in the periphery of the washer *m* and through the bed *j* and the asphaltum battery-casing *i*. The blasting caps *h*, *h* are connected in parallel with this wire *x*. The circuit is completed by connecting the other pole of the battery, by means of a wire *y*, with the blasting caps.

The parts are assembled by first constructing as a unit the parts *j*, *k*, *l*, *m*, *n*, *o*, *p*, and *q*. This unit, which may be enclosed in a paper tube 10, and the batteries *f*, *f* (the latter preferably enclosed in paper) are inserted into the casing *a*. The casing is then inverted and asphaltum *i* run in to encase

the batteries. A paper disc 11 is then placed over the asphaltum *i*, the blasting caps *h*, *h* are connected with the wires *x* and *y*, and the explosive gelatin introduced. The asphaltum is then run into the end opening in the cap *b*, which is then closed by the plug *d*. In a similar manner, the other end of the detonator is filled with asphaltum *s* and closed by the end plug *e*.

After the detonator is in position, the operator slips a short length of metal tubing 12 over the end of the supporting wire *v* that is above ground and drops it into the well. In its fall, the tube 12 is guided by the wire *v* so that it strikes the head of the circuit-closing pin with considerable force, thus acting as a drop hammer to drive the pin completely through the discs *p* and *o*, the asphaltum *n* and the discs *l* and *k*, the depth of penetration of the pin being limited by impact of its head against the plug *e*. As soon as the point of the pin penetrates beyond the layer of asphalt *n*, it closes the circuit between the copper gauze disc *p* and the tin disc *k*, thus closing the circuit through the battery and blasting caps *h*, *h*, firing the blasting caps and thereby exploding the detonating charge.

It is obvious that the cost of the entire detonator will be only a fraction of the cost of merely the wires ordinarily used for connecting the detonator, when positioned in the well, with an overground source of electric current.

It is clear, also, that the invention may be embodied in many specific forms, it being understood that the embodiment above described contains details of construction that are merely preferable and not essential; the main features of the invention being that the electrically operating devices are self-contained and that the normally open circuit is closed by mechanical means the operation of which is controllable from above ground.

Having now fully described my invention, what I claim and desire to protect by Letters Patent is:—

1. An electrically operable detonator comprising a casing, electrical means, including a generator, enclosed in the casing, an explosive element enclosed in the casing and adapted to be fired by said electrical means, a suspending device for the detonator, mechanical means extending within the casing and controllable from a point outside the detonator to cause said electrical means to fire said detonator, and masses of non-explosive material within the casing and normally holding the mechanical means extending within the casing and the electrical means in fixed relationship to prevent accidental explosion.

2. An electrically operable detonator comprising a casing, electrical means, including a generator enclosed in the casing, an explosive element enclosed in the casing and adapted to be fired by said electrical means, a mechanically operable contrivance extending within the casing and adapted to cause said electrical means to fire said detonator, and suspensory means for the detonator, said contrivance being movable independently of the suspensory means and controllable from a point outside and distant from the detonator, and a mass of non-explosive material within the casing, and normally holding the mechanically operable contrivance in inoperative position.

3. An electrically operable detonator comprising a casing, electrical means, including a generator, enclosed in the casing, an explosive element enclosed in the casing and adapted to be fired by said electrical means, a mechanically operable contrivance adapted when operated to render said electrical means operative to fire said explosive element, a rigid but forcibly disruptable medium normally holding said contrivance in fixed position and adapted to offer substantial opposition to its operation, and means controllable from a point outside the detonator to forcibly drive said contrivance against the opposition of said disruptable medium and disrupt the same and shift said contrivance into position to render said electrical means operative to fire said explosive element.

4. An electrically operable detonator comprising a casing, electrical means, including a generator, enclosed in said casing, an explosive element enclosed in said casing and adapted to be fired by said electrical means, a circuit closing pin adapted to be moved in the direction of its length to render said electrical means operative to fire said explosive element, masses of non-explosive material enclosing the pin and through a part of which said pin must so move to function as specified, said material normally holding the pin in fixed position, and means controllable from a point outside the detonator to forcibly move said pin through the material in front of it.

5. An electrically operable detonator comprising a casing, an explosive charge, a blasting cap, a generator, two disc terminals, an open electric circuit from one terminal to the other including the blasting cap and generator, a mass of penetrable material separating the disc terminals and insulating them from each other, a circuit closing pin adapted to be driven from one disc terminal through said material to the other disc terminal and thereby close the electric circuit, and means mechanically controllable from a point outside the detonator to so operate the circuit closing pin.

6. An electrically operable detonator comprising electrical means including a generator, a mass of detonating explosive, a

blasting cap, and a common casing in which said elements are enclosed, a contrivance extending within the casing and controlling the operation of said electrical means, means mechanically controllable from outside the casing to operate said contrivance, and masses of non-explosive material within the casing and within which said generator and contrivance are embedded and normally holding the embedded elements in fixed relationship.

7. An electrically operable detonator comprising a single casing, an explosive detonating charge and a blasting cap at the lower end of the casing, an electric battery above the explosive charge, a mass of non-explosive material in which said battery is embedded, an electric circuit including said blasting cap and battery, spaced apart circuit terminals above the battery, a circuit closing member adapted when operated to connect said terminals, means to normally hold said circuit closing member out of operation, and other means controllable from outside the casing to actuate the circuit closing member to close the circuit.

8. An electrically operable detonator comprising an explosive charge, a blasting cap, a generator, two disc terminals spaced apart and an open electric circuit from one terminal to the other including the blasting cap and generator, a casing in which the foregoing elements are contained, a circuit closing pin adapted to be driven from one disc terminal to the other and thereby close the electric circuit, and means mechanically controllable from a point outside the detonator to so operate the circuit closing pin.

9. An electrically operable detonator comprising a cylindrical body, end closures, a detonating charge at the lower end of the cylinder, a battery above the detonating charge, a blasting cap within said charge, a disc terminal above the battery, a second disc terminal above and spaced from the second disc terminal, an electric circuit extending from one terminal to the other and including the blasting cap and battery, a pin above the second terminal and extending through the upper closure, self hardening media filling the spaces around the elements specified, said pin adapted, upon impact from outside, to be driven from one disc terminal to the other and thereby close the electric circuit.

In testimony of which invention, I have hereunto set my hand, at Wilmington, Del., on this 16th day of May, 1921.

JACOB BARAB.