

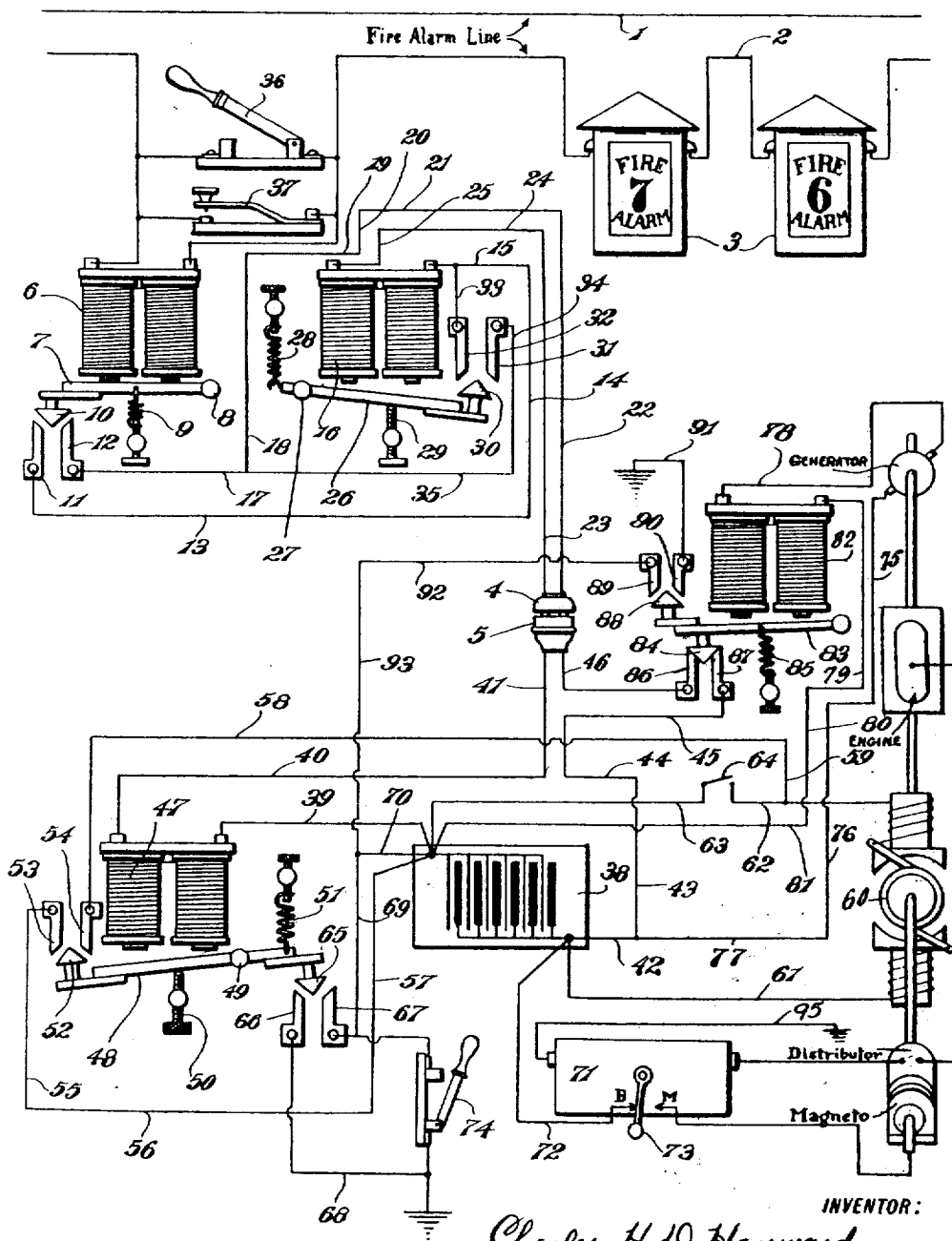
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MEANS FOR STARTING INTERNAL COMBUSTION ENGINES

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MEANS FOR STARTING INTERNAL-COMBUSTION ENGINES.

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To all whom it may concern:

Be it known that I, CHARLES H. D. HAYWARD, a citizen of the United States, and a resident of Newark, in the county of Essex and State of New Jersey, have invented new and useful Improvements in Means for Starting Internal-Combustion Engines, of which the following is a specification.

This invention relates to means by which an internal combustion engine provided with a storage battery and electric starter can be started and said means afterward returned to initial position by the running of the engine, as by the current generated by the engine, and while I have illustrated the invention applied to a piece of motor fire apparatus automatically started by a fire alarm, it will be understood that it can be applied to many other particular uses.

The objects of the invention are to provide means for closing a circuit from the storage battery to actuate the starter which closing means shall be automatically held closed by the current in said circuit; to make said closing means normally open so that it will return to initial position as soon as the circuit is broken; to thus require only closing of the closing means by the operator, and to obviate the necessity for holding the closing means closed and paying any attention to the time it remains closed or to the opening thereof; to enable said time of closure and opening to be automatically determined by the running of the engine when started; to utilize for such closing means an electromagnetic switch in circuit with the storage battery; to use for such switch an electromagnet with an armature which closes the circuit through the magnet; to provide means by which the engine can be operated independent of said closing means, and to obtain other results and advantages as may be brought out by the following description.

Referring to the accompanying drawing, the single figure thereof is a diagrammatic representation of a portion of a fire alarm circuit combined with the circuits of a piece of a fire apparatus according to my invention, and is believed to sufficiently illustrate the same.

In said drawing, the reference numerals 1 and 2 designate the wires of a fire alarm

circuit, one of said wires as 2 being shown passing through fire alarm boxes 3, 3, any number of which may be employed and located as is usual. That portion of my invention which is attached to the firehouse or stationary is shown in the upper part of the drawing and the electrical circuits of the apparatus are shown in the lower part of the drawing, a separable connection consisting of members 4, 5 being provided for connecting such circuits while the apparatus stands in the firehouse. This separable connection may be of any well-known type, the member 5 being fast to the fire apparatus and the other member 4 attached to the firehouse, so that they pull apart or separate automatically as the apparatus goes out.

The stationary portion of my invention, or portion which is attached to the firehouse consists of an electromagnet 6 inserted in the wire or conductor 2 so that it is energized by the passage of a current through the alarm circuit, it being understood that such circuits are commonly of the closed type and open intermittently to sound the alarm. The electromagnet 6 normally attracts the armature 7, pivoted as at 8, and holds it against the power of an adjustable spring 9 to open a circuit closer 10 between terminals 11, 12, one of which is connected by circuit wires 13, 14 and 15 with one binding post of an electromagnet 16 while the other terminal is connected by circuit wires 17, 18, 19, 20, 21 and 22 with one terminal of the separable connection member 4, the other terminal of said separable connection being connected by wires 23, 24 and 25 to the other binding post of the electromagnet 16. In this way when the electromagnet 6 releases its armature 7, so that its circuit closer 10 engages both terminals 11, 12, the electromagnet 16 is placed in a circuit from the storage battery on the fire apparatus and is energized therefrom. Said magnet 16 then attracts its armature 26, pivoted as at 27, and swings it against the power of an adjustable spring 28, away from an adjustable stop 29, to engage a circuit closer 30 with terminals 31, 32, which engagement will be continuous, since the electromagnet 16 is energized from the storage battery of the apparatus. That is, the current from the apparatus passes through

wires 33, 34 and 35 instead of wires 15, 14 and 13, terminals 11, 12 and wire 17, and hence continued opening and closing of the circuit closer 10 by the alarm circuit, during the sounding of the alarm will not affect the circuit closer 30.

In order to cut out the device of my invention from the fire alarm circuit; when desired, a cut-out switch 36 is provided between adjacent portions of the wire 2 on opposite sides of the electromagnet 6, and furthermore to enable the current through said electromagnet 6 to be broken whenever desired to test my improved device, a test key 37 is also inserted between said adjacent portions of the wire 2. Obviously when the switch 36 is closed by improved starting means, is independent of the fire alarm circuit and the armature 26 of the magnet 16 can be operated by hand instead of automatically. It will also be seen that automatic means other than those specifically described in connection with a fire alarm circuit, can be employed to operate the electromagnetic switch automatically.

Coming now to the electrical circuits and devices on the piece of apparatus, and which are shown at the lower part of the drawing, below the separable connection members 4, 5, 38 indicates the usual storage battery, from the terminals of which wires 39, 40, 41 and wires 42, 43, 44, 45, 46 lead to the separable connection member 5, so that when the circuit closers 10 and 30 operate, as has already been described, they close the circuit through the wires leading to the storage battery as just described. The closing of this circuit energizes an electromagnet 47 in said circuit on the apparatus and shown as between the wires 39 and 40, so that this magnet operates an armature 48, pivoted as at 49, and swings it away from an adjustable stop 50 against which it is normally held by an adjustable spring 51, to draw a circuit closer 52 into engagement with its terminals 53, 54. One of these terminals 53 is connected by wires 55, 56 and 57 direct to the storage battery, while the other 54 is connected by wires 58 and 59 to one terminal of a starting motor 60, the other terminal of which is connected by a wire 61 to the storage battery, so that the circuit closer 52 operates the starter to set the apparatus motor running.

The starter is also connected by wires 62, 63 to the storage battery, and the usual foot-operable switch 64 provided for use when desired.

At the same time that the circuit closer 52 is actuated by the armature 48, another circuit closer 65 at the other end of said armature is moved into engagement with terminals 66, 67 from which wires 68 and 69, 70 lead to the ground or apparatus frame and to the storage battery respectively, so

that the circuit closer serves to complete the circuit through the coil box 71, said coil box being shown connected to the storage battery by a wire 72, and the current from said coil box is grounded in the usual manner through the wire 95. These ignition circuits vary somewhat in different machines, and that which I have shown is intended to be illustrative of all arrangements, since the details have nothing to do with my invention. I may say, however, that the switch lever 73 of the coil box must of course be thrown in advance to the battery side, as shown, for the circuit closer 65 to complete the circuit. This having been done, operation of said circuit closer automatically completes the ignition circuit at the same time that the starter is actuated. In case it is desired at any time to operate the machine manually by actuation of the foot operable switch 64 the switch lever 73 must of course stand open or in neutral position, and so I have provided a switch 74 between the wires 68 and 69 on opposite sides of the terminals 66, 67 for said circuit closer 65; by closing this the ignition can be controlled by the lever 73, as usual; and by opening it and throwing said lever onto the battery, the engine may be started by the automatic control.

The apparatus is provided with a generator as is usual in motor vehicles, and while it has been deemed unnecessary to illustrate the same, I have shown the circuit wires leading therefrom to the storage battery, one being marked with reference figures 75, 76, 77, and the other with reference figures 78, 79, 80 and 81. Into one of these circuits, as between the wires 78 and 79, is inserted an electromagnet 82, and thus as the generator is started running, by the starting of the motor, said electromagnet swings an armature 83 to actuate a circuit breaker 84 between the wires 45 and 46 which lead from the separable connection member 5 to the storage battery, said circuit breaker being held by an adjustable spring 85 in engagement with its terminals 86, 87 while the generator is idle. By this means the storage battery circuit through the electromagnet 47 is broken and the armature 48 released to disengage the circuit closer 52 from its terminals to stop the starter 60 as soon as the motor is running. Since this also disengages the circuit closer 65 and breaks the ignition circuit, it is necessary to provide some means for keeping the latter closed, which I have illustrated by a circuit closer 88 on the same armature 83 with the circuit breaker 84 and adapted to be engaged with its terminals 89, 90 as the circuit breaker 84 is disengaged from its terminals 86, 87. One of these terminals, as 90, is grounded to the frame by a wire 91,

and the other terminal 89 is connected by wires 92, 93 to the wire 70 coming from the storage battery, and thus as the starter is automatically stopped, the ignition circuit is not disturbed.

It will be noted that the circuit breaker in thus breaking the starter circuit, also breaks the circuit through the separable connection members 4, 5 and releases the armature 26 of the armature magnet 16 forming a part of the stationary device or portion attached to the firehouse, so that said armature returns to initial position and all parts of that portion of the apparatus are ready to operate again as has been described. The apparatus goes out of the firehouse, separating the connection members 4, 5, and obviously upon its return when the motor is stopped the circuit breaker 84 returns to its position as shown in the drawing, so that when the connection members 4, 5 are again joined all parts of the entire device are in initial position as shown in the drawing and ready to operate again as has been described.

By my invention I thus provide means for starting the motor of the fire apparatus so as to have said apparatus all ready to go out the instant the firemen reach it, and also I provide means for at my time testing all electrical circuits both of my device and of the piece of fire apparatus. Furthermore, all this is done from through the fire alarm circuit and in such a way as to be automatic and not interfere with the ordinary use of said fire alarm circuit. Many modifications may be made in the detail arrangement of the circuits and other parts of my invention, in constructing it, and I do not wish to be understood as limiting myself except as required by the following claims when construed in the light of the prior art.

Having thus described the invention, what I claim is:

1. The combination with an internal combustion engine, a generator driven therewith, a storage battery and an electric starter, of a normally open electromagnetic switch the closing of which places its magnet in circuit with the storage battery, means in said circuit for closing normally open ignition and starter circuits, and means in circuit with the generator for breaking the said electromagnetic switch circuit and forming another ignition circuit.

2. The combination with an internal combustion engine, a generator driven therewith, a storage battery and an electric starter, of a normally open electromagnetic switch the closing of which places its magnet in circuit with the storage battery, means in said circuit for closing normally open ignition and starter circuits, and a normally open electromagnetic switch in circuit with

the generator adapted to be closed thereby to break the circuit of the first-mentioned switch and form another ignition circuit.

3. The combination with an internal combustion engine, a generator driven therewith, a storage battery and an electric starter, of a normally open electromagnetic switch the closing of which places its magnet in circuit with the storage battery, a second normally open electromagnetic switch in circuit with the first-mentioned switch and adapted to be energized by the closing of said first-mentioned switch to close starter and ignition circuits from the storage battery, and a normally open electromagnetic switch in circuit with the generator adapted to be closed thereby to break the circuit of the other two said switches and form another ignition circuit.

4. The combination with an internal combustion engine, a generator driven therewith, a storage battery and an electric starter, normally open circuits from said storage battery to said starter and the engine ignition respectively, and manual control means in the ignition circuit for controlling it independent of the starter, of an electromagnetic switch for closing said ignition and starter circuits, means for actuating said switch from the storage battery, a shunt in the starter circuit around said electromagnetic switch, manual control means in said shunt for controlling the starter independent of the ignition, a shunt in the ignition circuit around said electromagnetic switch, a manually operable switch in said shunt, and means for deenergizing said electromagnetic switch and establishing another ignition circuit by current from the generator.

5. The combination with an internal combustion engine, a generator driven therewith, a storage battery and an electric starter, of a normally open switch in circuit with the storage battery, means by which a current through said switch holds it closed, means in said circuit for closing normally open ignition and starter circuits, and means in circuit with the generator for breaking said first-mentioned circuit and forming another ignition circuit.

6. The combination with an internal combustion engine, a generator driven therewith, a storage battery and an electric starter, of a normally open switch in circuit with the storage battery, an electromagnet in series with said switch adapted to hold it closed, means in said circuit for closing normally open ignition and starter circuits, and means in circuit with the generator for breaking said first-mentioned circuit and forming another ignition circuit.

7. The combination with an internal combustion engine, a generator driven therewith, a storage battery and an electric

starter, of a normally open switch in circuit with the storage battery, an electromagnet in series with said switch adapted to hold it closed, means for energizing said electromagnet to close the switch, means in said circuit for closing normally open ignition and starter circuits, and means in circuit with the generator for breaking said first-mentioned circuit and forming another ignition circuit.

8. The combination with an internal combustion engine, a generator driven therewith, a storage battery and an electric starter, of a normally open switch in circuit with the storage battery, an electromagnet in series with said switch, an armature for said electromagnet adapted to close said switch, means in said circuit for closing normally open ignition and starter circuits, and means in circuit with the generator for breaking said first-mentioned circuit and forming another ignition circuit.

9. The combination with an internal combustion engine, a generator driven therewith, a storage battery and an electric starter, of a normally open switch in circuit with the storage battery, an electromagnet in series with said switch, an armature for said electromagnet adapted to close said switch, means for energizing said electromagnet to close the switch, means in said circuit for closing normally open ignition and starter circuits, and means in circuit with the generator for breaking said first-mentioned circuit and forming another ignition circuit.

10. The combination with an internal combustion engine, a generator driven therewith, a storage battery and an electric starter, of an electromagnet in circuit with the storage battery, an armature for said electromagnet adapted to close said circuit through the electromagnet, said armature normally standing open, means in said circuit for closing normally open ignition and starter circuits, and means in circuit with the generator for breaking said first-mentioned circuit and forming another ignition circuit.

11. The combination with an internal combustion engine, a generator driven therewith, a storage battery and an electric starter, of a normally open electromagnetic switch the closing of which places its magnet in circuit with the storage battery, a second normally open electromagnetic switch in circuit with the first-mentioned switch and adapted to be energized by the closing of said first-mentioned switch to close starter and ignition circuits from the storage battery, means for deenergizing said electromagnetic switches and establishing another ignition circuit by current from the generator, and means in circuit with the

generator adapted to be closed thereby to break the circuit of the two said switches and form another ignition circuit.

12. The combination with an internal combustion engine, a generator driven therewith, a storage battery and an electric starter, of an electromagnet in circuit with the storage battery, an armature for said electromagnet adapted to close said circuit through the electromagnet, said armature normally standing open, means other than said armature for closing said circuit, means in said circuit for closing normally open ignition and starter circuits, and means in circuit with the generator for breaking said first-mentioned circuit and forming another ignition circuit.

13. The combination with an internal combustion engine, a generator driven therewith, a storage battery and an electric starter, of an electromagnet, an armature for said electromagnet the closing of which places the electromagnet in circuit with the storage battery, said armature normally standing open, a shunt in said circuit around said electromagnet, normally open means in said shunt for closing it, means in said circuit for closing normally open ignition and starter circuits, and means in circuit with the generator for breaking said first-mentioned circuit and forming another ignition circuit.

14. The combination with an internal combustion engine, a generator driven therewith, a storage battery and an electric starter, of an electromagnet, an armature for said electromagnet the closing of which places the electromagnet in circuit with the storage battery, said armature normally standing open, a shunt in said circuit around said electromagnet, a normally open switch in said shunt for closing it, means in said circuit for closing normally open ignition and starter circuits, and means in circuit with the generator for breaking said first-mentioned circuit and forming another ignition circuit.

15. The combination with an internal combustion engine, a generator driven therewith, a storage battery and an electric starter, of an electromagnet, an armature for said electromagnet the closing of which places the electromagnet in circuit with the storage battery, said armature normally standing open, a shunt in said circuit around said electromagnet, a normally open electromagnetic switch in said shunt for closing it, means in said circuit for closing normally open ignition and starter circuits, and means in circuit with the generator for breaking said first-mentioned circuit and forming another ignition circuit.

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