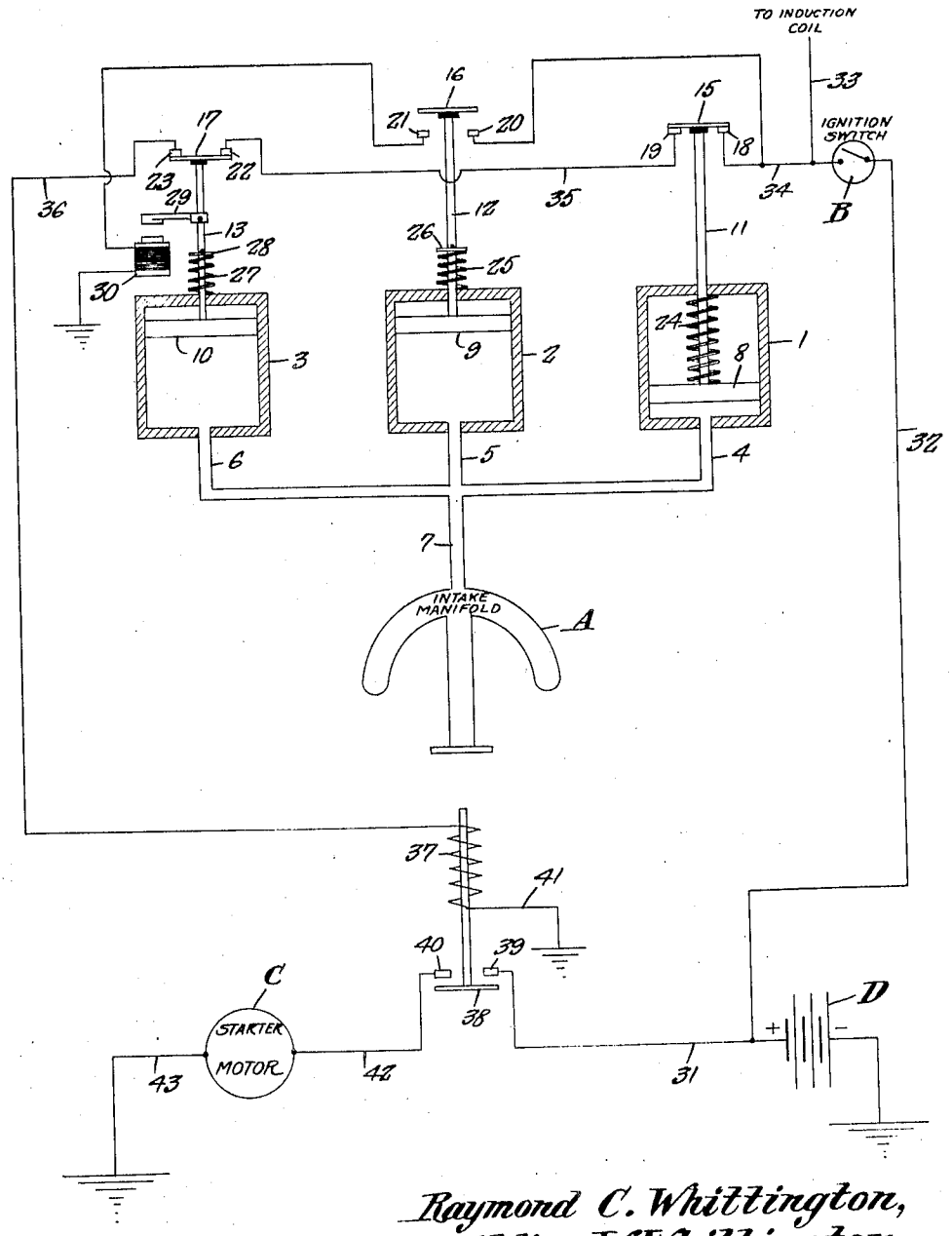
Aug. 29, 1933. R. C. WHITTINGTON ET AL 1,924,633

STARTER FOR ENGINES

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Fig. 1.



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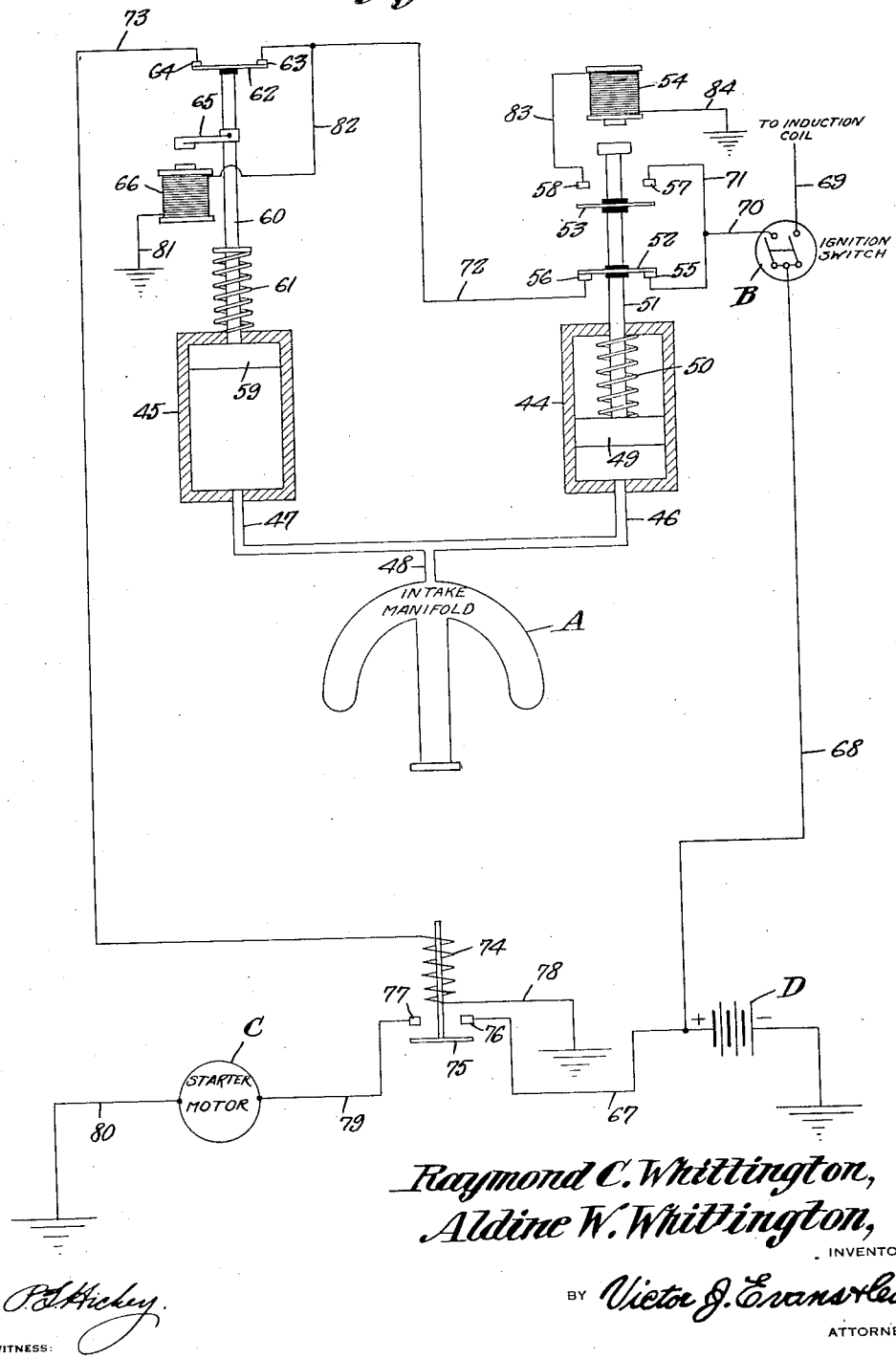
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Fig. 2.



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UNITED STATES PATENT OFFICE

1,924,633

STARTER FOR ENGINES

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Application July 22, 1932. Serial No. 624,130

5 Claims. (Cl. 290—38)

This invention relates to electric starters for engines of the internal combustion type, and its general object is to provide a starting system that is automatic in its action and controlled by the ignition switch of the ignition system of the engine, to the extent that when the ignition switch is closed, a circuit to the starting motor is automatically closed and when the engine starts, the circuit to the starting motor is automatically opened, and in the event the engine should stop running and the ignition switch is closed, the starting action is again put into operation.

A further object of the invention is to provide a starting system of the character set forth, that includes means to open the circuit to the starting motor in the event a back fire should occur, in order to prevent damage to the parts.

Another object of the invention is to provide a starting system that is simple, inexpensive to install, and extremely efficient in operation and service.

This invention also consists in certain other features of construction and in the combination and arrangement of the several parts, to be hereinafter fully described, illustrated in the accompanying drawings and specifically pointed out in the appended claims.

In describing our invention in detail, reference will be had to the accompanying drawings wherein like characters denote like or corresponding parts throughout the several views, and in which:

Figure 1 is a diagrammatic view illustrating one form of our invention.

Figure 2 is a similar view of a modified form.

Referring to the drawings in detail, the letter A indicates the intake manifold of the internal combustion engine, B the ignition switch, C the starting motor and D the battery, which are shown in both of the figures of the drawings.

The preferred form of the invention is illustrated in Figure 1, and includes three cylinders indicated respectively by the reference numerals 1, 2 and 3 and each of these cylinders is provided with a branch pipe indicated respectively by the reference numerals 4, 5 and 6 and these branch pipes are arranged in communication with one of the ends of the cylinders and in communication with the intake manifold through the instrumentality of a branch pipe 7 for a purpose which will be later described.

Each of the cylinders has mounted for reciprocation therein a piston and the pistons are indicated respectively by the reference numerals 8, 9 and 10. Extending through the opposite ends of the cylinders are piston rods 11, 12 and 13 and each of the piston rods have secured thereto to be carried thereby bridging contact strips 15, 16 and 17 that have arranged in the path thereof pairs of spaced parallel contact members, and the contact members for the strip 15 are indicated by the reference numerals 18 and 19, the contact members for the strip 16 by the reference numerals 20 and 21, and the contact members for the strip 17 by the reference numerals 22 and 23.

The piston rod 11 has surrounding the same a coil spring 24 which has its end convolution engaging one end of the cylinder 1 and its opposite end is engageable with the piston 8. The piston rod 12 is likewise provided with a coil spring 25 that surrounds the same and has one end convolution engaging a collar 26 that is fixed to the rod 12, while the opposite end of the spring engages the outer surface of one end of the cylinder 2, and the piston rod 13 has surrounding the same a coil spring 27 which engages the collar 28, and the cylinder 3, with the result it will be apparent that each of the pistons are spring pressed for a purpose which will be later described. Secured to the piston rod 13 is an arm 29 that is adapted to be attracted by a solenoid 30.

Extending from the battery D and of course in electrical connection therewith is a conductor 31, the latter having connected thereto a conductor 32 which is connected with the ignition switch B, and of course the ignition switch is in connection with an induction coil not shown through the medium of a conductor 33 that is connected to a conductor 34, the latter being connected with the ignition switch.

The conductor 34 is in connection with the contact member 18 while the contact member 19 has connected thereto a conductor 35 which in turn is connected to the contact member 22 and the contact member 23 has connected thereto a conductor 36 which is in connection with a relay switch 37. The core of the switch 37 has secured thereto a contact strip 38 for the purpose of bridging contact members 39 and 40 and the relay switch is grounded through the medium of a conductor 41.

The contact member 39 has connected thereto the conductor 31 and the contact member 40 has connected thereto a conductor 42 which in turn is connected to the starter motor C and of course the starter motor is grounded through the instrumentality of a conductor 43.

It will be obvious from the foregoing and upon inspection of Figure 1, that when the ignition switch is closed, the current will pass from the battery D through the medium of the conductor 32, through the switch B, conductor 34, contact member 18, contact strip 15, contact member 19, conductor 35, contact member 22, contact strip 17, contact member 23, conductor 36, to the relay 37 to energize the same, thence the current will pass to the ground through the medium of the conductor 41. When the relay 37 is energized, the contact strip 38 is bridging the contact members 39 and 40, with the result the circuit is from the battery through the conductor 31, contact mem-

ber 39, contact strip 38, contact member 40, conductor 42 to the starting motor which is put into operation and from the starting motor the current passes to the ground through the medium of the conductor 43.

When the circuit to the relay is completed, the engine connected with the starter motor is put into operation which will result in a vacuum or suction being created in the pistons 2 and 3, as these pistons are connected to the intake manifold through the pipes 5, 6 and 7. This vacuum will cause the pistons 9 and 10 to be lowered against the tension of the springs 25 and 27, and as the piston rod 13 has connected thereto the contact strip 17, the circuit to the relay switch 37 will be broken, therefore the core of the relay switch will drop to open the circuit to the starter motor.

The vacuum within the cylinder 2 will cause the piston 9 to be lowered, which will result in the contact strip 16 bridging the contact members 20 and 21 so as to energize the solenoid 30, and as the latter is arranged in the path of the arm 29, the contact strip 17 will be held out of contact with respect to the contact members 22 and 23.

In the event the engine should stop, the vacuum within the cylinders 2 and 3 will be lost, therefore the piston 9 will be moved upwardly by the spring 25 and break the circuit across the contact members 20 and 21, and as that circuit is to the solenoid 30, the arm 29 will be released with the result the contact strip 17 will again bridge the contact members 22 and 23 to close the circuit to the relay switch 37 to again close the circuit to the starter motor C, to start the engine running.

Should a back-fire occur in the intake manifold, a pressure is created, and this pressure will cause the piston 8 to move upwardly and carry the contact strip 15 accordingly through the medium of the rod 11, therefore breaking the circuit across the contact members 18 and 19 and opening the circuit to the relay switch 37, with the result damage to the parts will be eliminated, in the event a back-fire should take place.

In the form of the invention just described, it will be obvious that in the event the engine should stop, it is automatically started without touching the ignition switch, but in the form as shown in Figure 2, the ignition switch must be turned off and on again in order to start the engine. In this form, we also show the intake manifold A, ignition switch B, the starting motor C, and battery D, as well as two cylinders, one of which is indicated by the reference numeral 44 and the other by the reference numeral 45. Extending from the cylinder 44 is a branch pipe 46 and extending from the cylinder 45 is a branch pipe 47. These branch pipes communicate with the intake manifold A through the medium of a pipe 48.

Mounted in the cylinder 44 is a piston 49 that is spring pressed and for this purpose we employ a coil spring 50 that has its end convolutions engaging the piston 49 and the upper wall of the cylinder as shown. The piston has secured thereto a piston rod 51 that carries a pair of spaced contact strips 52 and 53 and arranged in the path of the piston rod 51 is a solenoid 54, while arranged in the path of the contact strip 52 is a pair of contact members 55 and 56, and the contact strip 53 has arranged in the path thereof contact members 57 and 58.

Mounted in the cylinder 45 is a piston 59 that has secured thereto a piston rod 60, the latter being spring pressed through the instrumentality of a coil spring 61 to urge the piston 59 to the position as shown, and the piston rod 60 carries a contact strip 62 that has arranged in the path thereof contact members 63 and 64. The piston rod 60 also carries an arm 65 that has disposed in its path a solenoid 66.

Connected to the battery D in Figure 2 is a conductor 67 that has connected thereto a conductor 68, the latter being connected to the ignition switch B that in turn is connected to the induction coil through the medium of a conductor 69, while a conductor 70 connects the ignition switch to a conductor 71 that has its ends connected to the contact members 55 and 57 respectively as shown.

Connected to the contact member 56 is a conductor 72 that is likewise connected to the contact member 63 and the companion contact member 64 has connected thereto a conductor 73 that leads to and is connected with a relay switch 74, the core of which carries the contact strip 75 adapted to bridge contact members 76 and 77. The relay switch is grounded through the medium of a conductor 78.

The contact member 76 has connected thereto the conductor 67, while the contact member 77 has connected thereto a conductor 79 which in turn is connected to the starting motor C that is grounded through the instrumentality of a conductor 80. In the form just described, it is believed that it will be obvious that when the ignition switch is closed, the circuit is from the battery D, through the conductor 68, to the switch B, thence through the conductor 71 to the contact member 55, and as the contact strip 52 bridges the contact members 55 and 56, the circuit extends to the contact member 56, thence through the conductor 72 to the contact member 63, across the contact strip 62, then to the contact member 64. From the latter, the circuit is passed through the conductor 73 to the relay switch 74 to energize the latter and cause the contact strip 75 to bridge the contact members 76 and 77 to close the circuit to the starting motor C and this circuit is from the battery D through the conductor 67, to the contact member 76, across the contact strip 75 to the contact member 77, thence to the starter motor C through the medium of the conductor 79, and then to the ground by the conductor 80.

When the engine is started by the starter motor, a vacuum is created in the cylinder 45 which will result in the piston 59 being moved downwardly to break the circuit across the contact members 63 and 64, which will result in the circuit being broken to the relay switch 74, therefore the starter motor circuit will likewise be broken due to the fact that the contact strip 75 will be disengaged from the contact members 76 and 77.

In view of the fact that the vacuum within the cylinder 45 may become weak at times during the running of the engine, the solenoid 66 is employed, and the latter is grounded by a conductor 81 and is connected to the conductor 72 by a conductor 82, therefore it will be apparent that while the engine is running, the contact strip 62 is held out of engagement with the contact members 63 and 64.

Should the engine stop, and it is desired to again start the same, the operator will open the ignition switch which will break the circuit to the solenoid 66, and as there is no vacuum at that time in the cylinder 45, the coil spring 61 will

cause the piston rod to carry the contact strip 62 upwardly to bridge the contact members 63 and 64. The ignition switch is then closed which will again result in energizing the relay switch 74 to close the circuit to the starter motor. Should a back-fire occur in the intake manifold, a pressure will be created in the cylinder 44 and cause the piston 49 to be moved upwardly against the pressure of the spring 50, therefore the contact strip 52 will be moved from the contact members 55 and 56 to break the circuit to the relay switch 74, and at the same time the contact strip 73 will bridge the contact members 57 and 58 and close a circuit to the solenoid 54 through the medium of a conductor 83, and as the solenoid 54 is grounded by a conductor 84, the solenoid will be energized and hold the contact strip 53 in engagement with the contact members 57 and 58. The circuit to the relay switch cannot again be closed until the ignition switch is turned off and then on again, it being obvious that when the ignition switch is turned off, the circuit to the solenoid 54 is broken to allow for the contact strip 52 to again bridge the contact members 55 and 56.

From the above description and disclosure of the drawings, it will be obvious that we have provided a starting system that is automatic in its action and is controlled solely by the ignition switch.

It is thought from the foregoing description that the advantages and novel features of our invention will be readily apparent.

We desire it to be understood that we may make changes in the construction and in the combination and arrangement of the several parts, provided that such changes fall within the scope of the appended claims.

What we claim is:—

1. In a starting system for an engine, a starter motor circuit, a starter motor and a source of current in the circuit, a normally open switch for controlling the circuit, a second circuit from the source of current to the switch, manual means in the second circuit to close the normally open switch, a normally closed switch in the second circuit, a cylinder in communication with the intake manifold of the engine, a spring actuated piston in the cylinder and having connection with the normally closed switch to open the same upon the starting of the motor, a third circuit connected with the second circuit, means in the third circuit for holding the normally closed switch in open position, and the last mentioned means being releasable when the manual means is actuated to close the normally closed switch.

2. In a starting system for an engine, a starter motor circuit, a starter motor and a source of current in the circuit, a normally open switch for controlling the circuit, a second circuit from the source of current to the switch manual means in the second circuit to close the normally open switch, a normally closed switch in the second circuit, a cylinder in communication with the intake manifold of the engine, a spring pressed piston mounted in the cylinder, a piston rod connected with the piston and the normally closed switch respectively to open the latter, a third circuit connected with the second circuit, means carried by the piston rod, a solenoid arranged in the path of the piston rod carried means to attract the same for holding the normally closed switch in open position, and said piston rod carried means being releasable to close the normally closed switch when the manual means is actuated.

3. In a starting system for an engine, a starter motor circuit, a starter motor and a source of current in the circuit, a normally open switch for controlling the circuit, a second circuit from the source of current to the switch, manual means in the second circuit to close the normally open switch, a pair of normally closed switches in the second circuit, means in communication with the intake manifold of the engine, and operable by suction from the manifold to open one of said normally closed switches, means in communication with the intake manifold and operable by pressure from the intake manifold to open the other normally closed switch, a third circuit connected to the second circuit, a solenoid in the third circuit for holding the suction operated switch in open position, a normally open switch in the third circuit and means having connection with the intake manifold to close the last mentioned switch.

4. In a starting system for an engine, a starter motor circuit, a starter motor and a source of current in the circuit, a normally open switch for controlling the circuit, a second circuit from the source of current to the switch, manual means in the second circuit for closing the normally open switch, a pair of normally closed switches in the second circuit, means operated by suction from the intake manifold of the engine to open one of said normally closed switches, means operated by pressure from the intake manifold to open the other normally closed switch, a third circuit connected to the second circuit, means in the third circuit for holding the suction operated normally closed switch in open position and being normally deenergized, a normally open switch in the third circuit and means operated by suction from the intake manifold to close the last mentioned normally open switch for energizing the holding means.

5. In a starting system for an engine, a starter motor circuit, a starter motor and a source of current in the circuit, a normally open switch for controlling the circuit, a second circuit from the source of current to the switch, manual means in the second circuit to close the normally open switch, a pair of normally closed switches in the second circuit, a cylinder for each switch and being in communication with the intake manifold of the engine, spring pressed pistons in said cylinders and one piston being operable by suction created in the intake manifold and connected with one normally closed switch for opening the latter, the other piston being operable by pressure from the intake manifold to open the other normally closed switch, a third circuit connected with the second circuit, means in the third circuit for holding the suction operated switch in open position, a third cylinder in communication with the intake manifold, a spring pressed piston in the third cylinder and being operable by suction in the intake manifold, a normally open switch connected with the third piston and adapted to close the last mentioned normally open switch to energize the holding means.

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