Oct. 1, 1935. J. P. GERAGHTY 2,015,792

STARTING CONTROL SYSTEM FOR AUTOMOBILE ENGINES

Filed March 31, 1933

Fig. 1.

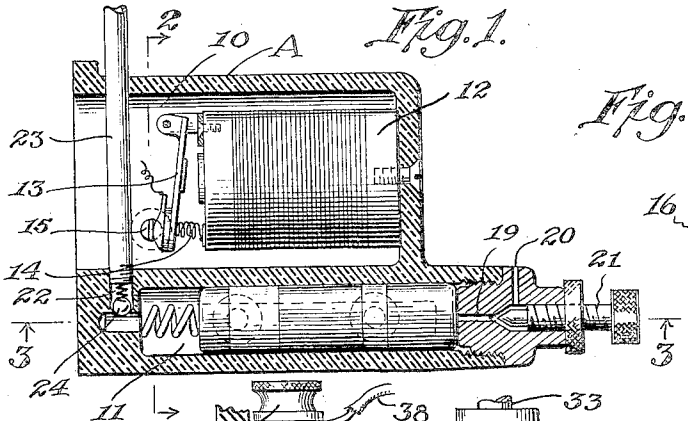


Fig. 2.

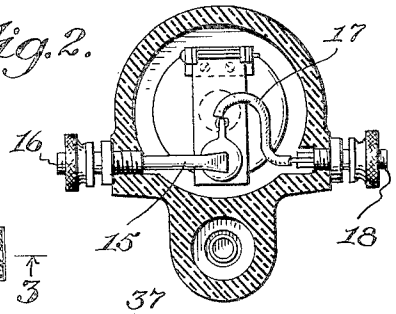


Fig. 3.

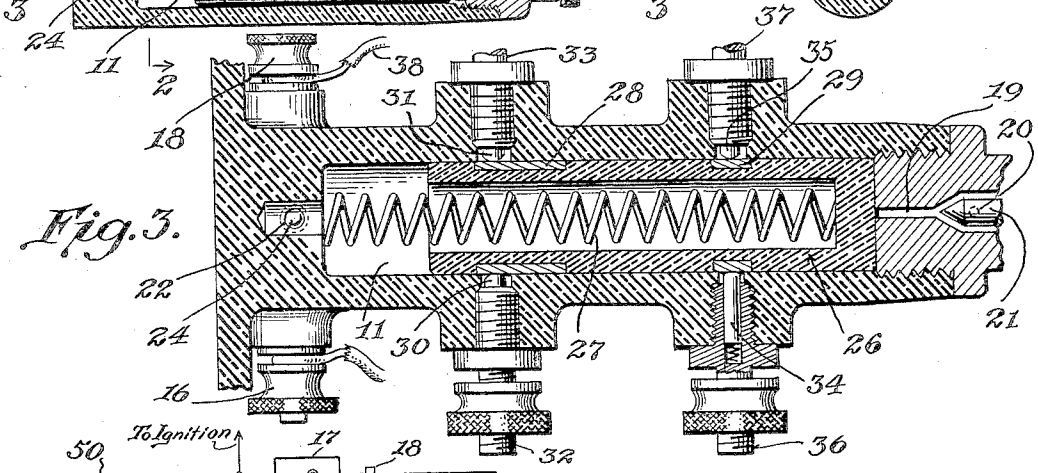
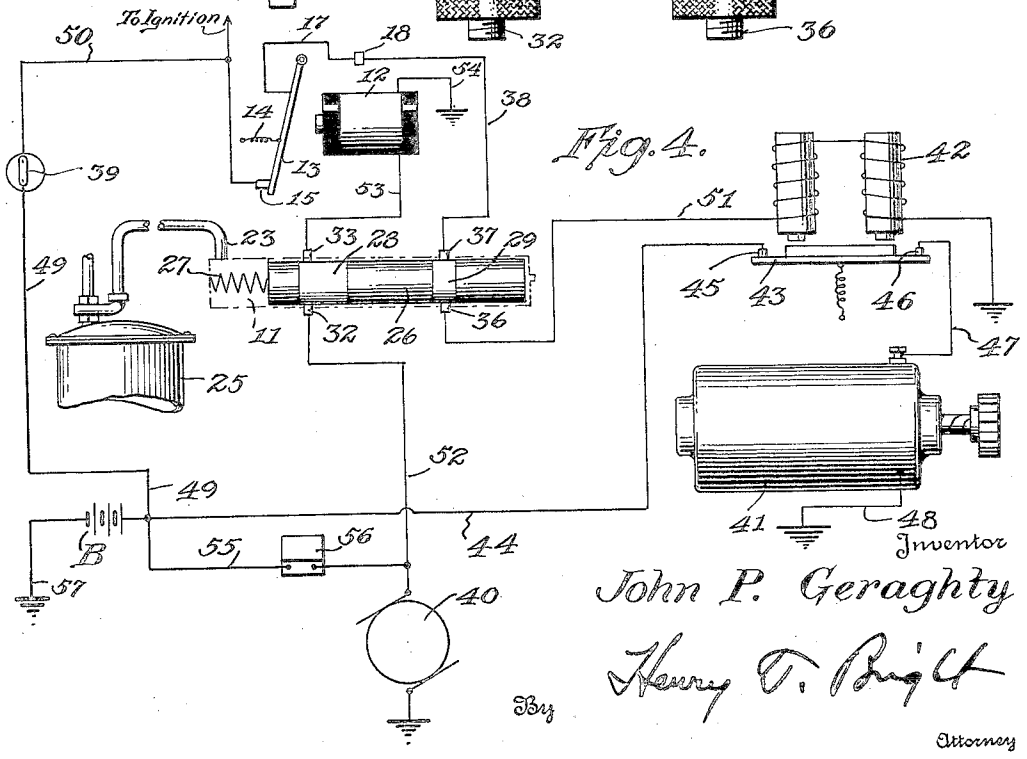


Fig. 4.



Inventor

John P. Geraghty

By Henry C. Wright

Attorney

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2,015,792

STARTING CONTROL SYSTEM FOR AUTOMOBILE ENGINES

John P. Geraghty, Jersey City, N. J.; John G. Flanigan executor of said John P. Geraghty, deceased

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4 Claims. (Cl. 290—37)

My invention relates to a starting control system for automobile engines and has for its purpose the provision of a system of the type specified which will effectively prevent the starting motor of an automobile being cut in so long as the engine has any operating movement, but which will automatically place the starting motor in circuit immediately following the complete stoppage of the engine and then automatically cut out the starting motor as soon as the running status of the engine is reestablished.

My invention further contemplates the provision of a starting control system wherein the gaseous pressure status existing on one side of the engine and the usual electrical generator constitute essential elements for the functioning thereof, the arrangement being such however that upon the failure of either of these elements, while the engine is running, a status of the system essential to maintaining the starting motor cut out will be preserved.

Furthermore my invention contemplates the inclusion in the system of means effective to prevent variation in the aforesaid gaseous pressure status, while the engine is running from causing any closure, momentary or prolonged, of the starting motor circuit.

In addition my invention also contemplates an improved control switch for incorporation in the system, the construction of said switch constituting an important factor in rendering my system reliable and certain in operation, not only in automatically cutting the starting motor in and out but also in maintaining the starting motor circuit open momentarily after engine has failed and in maintaining said circuit open, while the engine is running, upon the failure of the generator or gaseous pressure status.

My invention also contemplates an assembly which will enable a manually controlled starting system to be easily and economically converted into an automatically controlled starting system with a minimum of wiring and parts in addition to that which is common to all electric systems of automobiles.

In the drawing chosen to illustrate my invention the scope whereof is set forth in the appended claims.

Figure 1 is a longitudinal section through an assembly employed in my invention and disclosing the control switch and the magnetic switch whose coil is in a circuit having the generator as its source, both switches being shown in their normal or circuit closing status;

Figure 2, a section on the line 2—2 of Figure 1;

Figure 3, a section on the line 3—3 of Figure 1; and

Figure 4, a diagrammatic view of my complete system with the various elements in the positions they would occupy when the associated engine has completely stopped and at the instant the starting motor circuit has been cut in.

Referring to Figures 1, 2, and 3 the assembly illustrated therein comprises a housing A of insulating material, preferably phenol condensation product. This housing is shaped to provide parallel chambers 10 and 11 opening through opposite ends of the housing respectively. Mounted in the chamber 10 is a magnetic switch which includes a coil 12 and a pivoted armature 13 normally held in the position shown in Figure 1 by a spring 14, said position being positively determined by a contact 15 associated with a binding post 16 mounted on the housing A. The armature 13 is also electrically connected by a conductor 17 with a binding post 18, which latter is located on the opposite side of the housing A from the binding post 16. The open end of the chamber 11 is closed by a threaded plug 19 having a passage 20 therein one end of which communicates with the chamber 11 and its other with the atmosphere. This passage 20 is controlled by a screw valve 21 mounted in the plug 19 and for a purpose that will hereinafter appear. Formed in the housing A at the end thereof remote from the plug 19 is another passage 22 having a tube 23 engaged in the outer end thereof, while the inner end of said passage 22 communicates with the chamber 11. An outwardly opening check valve 24 controls the passage 22. The tube 22 extends across the chamber 10 and through the housing for connection with the vacuum tank 25 (Figure 4). Mounted for reciprocation in the chamber 11 is a cylindrical switch body 26 of insulating material which is normally held in the position shown in Figures 1 and 3 by a spring 27 reacting from the end wall of the chamber 11 which is nearest the passage 22. The body 26 carries spaced contact bands 28 and 29 the former of which is considerably wider than the latter. When the body 26 is in the position shown in Figure 3 the band 28 is engaged by oppositely disposed spring contacts 30 and 31 associated respectively with binding posts 32 and 33 and at the same time the band 29 is engaged by oppositely disposed spring contacts 34 and 35 associated respectively with binding posts 36 and 37. In the assembly described binding posts 18 and 37 are connected by a conductor 38.

My starting control system is completely shown

in Figure 4 and comprises the battery B, vacuum tank 25, main circuit switch 39, magnetic switch coil 12 and its armature 13, a control switch as heretofore described and shown in Figure 3, a generator 40, a starting motor 41, and a starting motor switch including a coil 42 and armature 43. My system includes a starting motor circuit, a starting motor switch coil circuit and a generator control circuit all of which are automatically controlled in a manner that will hereinafter appear. The starting motor circuit leads from battery B through conductor 44, contact 45, armature 43, contact 46, conductor 47, motor 41 and thence to ground through conductor 48. The starting motor switch coil circuit leads from battery B, through conductor 49, switch 39, conductor 50, contact 15, armature 13, conductor 17, binding post 18, conductor 33, contact 37, contact band 29, contact 36 and thence through conductor 51 to ground, said conductor 51 including the coil of the starting motor switch. The generator control circuit leads from generator 40 through conductor 52, contact 32, band 28, contact 33, conductor 53, coil 12 and thence through conductor 54 to ground. The generator 40 is also electrically connected to the battery B through conductor 55 and conductor 49, the conductor 55 including an automatic circuit breaker 56 as is usual. The battery B is grounded through conductor 57.

In Figure 4 the status of the system is that established when the engine has completely stopped and the switch 39 closed. In this status it will be apparent that the generator 40 is inactive and the coil 12 therefore deenergized so that the spring 14 has moved the armature 13 into engagement with the contact 15, thus closing the starting motor circuit and instituting the operation of the starting motor 41. During the operation of the starting motor 41 the engine turns very slowly and insufficient current is produced by the generator 40 to cause the magnet associated with the coil 12 to attract armature 13 and break the starting motor switch coil circuit. However, when the engine starts to run in a normal manner the current from the generator is increased so as to cause the magnet core associated with the coil 12 to attract armature 13 and break the starting motor switch coil circuit. Furthermore, when the engine starts to run a vacuum forms in the tank 25 and in the end of the chamber 11 adjacent the spring 27 thus establishing a differential pressure on the ends of the control switch body 26 which results in the latter moving to the left in Figure 3 against the influence of spring 27. This movement of the body 26 causes the successive breaking of the starting motor control switch circuit and the generator control circuit owing to the difference in width of the bands 28 and 29 and the location of the point of engagement of the contacts 32 and 33 with band 28 before the body 26 begins to move under the influence of the formation of a vacuum in tank 25. With this dual means of breaking the starting motor control circuit my system assures the positive automatic breaking of said circuit in the event of the failure of either the vacuum or generator while the engine is running. In the event the generator fails, the system and the ignition of the engine are operated entirely on the battery B. However, this condition will immediately become apparent due to the indication on the usual ammeter employed on automobiles that the battery B is discharging. Should the engine stall at any time, the body 26 will, owing to the consequent failure of generator current and vacuum, move to the right to the position shown in Figure 3. However, I retard or slow down this movement through the instrumentality of the passage 30 and valve 21 which restrict the escape of air from the adjacent end of the chamber 11 so as to delay the closing of the starting motor switch circuit until all movement of the engine has ceased so as to avoid any possibility of jamming or gear clashing when the starting motor is cut in. By making and breaking the generator circuit as a result of variation in vacuum I am enabled, when the engine is running normally, to advantageously deliver all the current produced by the generator 40 to the battery B and ignition. Should there be even a slight diminution in vacuum while the engine is running, the generator circuit will be closed and the starting motor circuit will be positively broken by the movement of the armature 13 under the influence of energized magnet 12 and thereby introduce an additional factor of prevention against the closing of the starting motor circuit in the event the vacuum should further decrease during running of the engine sufficient to cause the band 29 to engage the contacts 36 and 37. The construction and arrangement heretofore described is also advantageous in that it avoids the employment of a latch, as exemplified in my prior Patent 1,952,667, to maintain the generator circuit closed and the starting motor circuit open when the vacuum fails to an extent which would otherwise close the starting motor circuit.

It will of course be apparent that my system is automatically operative to cut the starting motor in and out upon closing the switch 39 or upon stalling of the engine when said switch is closed. It will also be apparent that the installation of my system is rendered exceedingly simple and economical as it only requires the assembly shown in Figure 1 and a minimum of parts and wiring in addition to the parts and wiring common to all automobiles.

While I have shown and described the vacuum on one side of the engine as the instrumentality for creating a differential pressure on the switch body 26 to move the latter it will be apparent that other instrumentalities common to automobile engines and automobiles, such as exhaust gas pressure, oil pressure and air pressure associated with a braking system could be employed without departing from the spirit and scope of my invention.

I claim:

1. In a starting motor control system for automobile engines, a battery, a starting motor, a main circuit switch, a magnetic starting motor switch including a coil and an armature, a generator, a circuit having the generator as its source and including the coil of the second magnetic switch, a circuit including the main switch, the armature of the second magnetic switch and the coil of the starting motor switch, a two-movement control switch automatically operating in response to the functional status of the engine to open and close said circuits, said control switch during one of its movements opening the first mentioned circuit after it has opened the second mentioned circuit and during the other of its movements closing the first mentioned circuit in advance of closing the second mentioned circuit, a circuit including the starting motor and the armature of the starting motor switch, and a circuit connecting the generator and battery.

2. In a starting control system for automobile

engines, a battery, a starting motor, a main circuit switch, a magnetic starting motor switch including a coil and armature, a second magnetic switch incuding a coil and armature, a generator, a circuit having the generator as its source and including the coil of the second magnetic switch, a circuit including the main circuit switch, the armature of the second magnetic switch and the coil of the starting motor switch, a control switch automatically operating in response to the functional status of the engine to open and close the circuits which respectively include the coil of the second magnetic switch and the coil of the starting motor switch, means for varying the rapidity of the movement of the control switch to circuit closing position, and a circuit including the starting motor and the armature of the starting motor switch.

3. In a starting control system for automobile engines, a battery, a starting motor, a main circuit switch, a magnetic starting motor switch including a coil and armature, a second magnetic switch including a coil and armature, a generator, a circuit having the generator as its source and including the coil of the second magnetic switch, a circuit including the main circuit switch, the armature of the second magnetic switch and the coil of the starting motor switch, a member movable in response to the functional status of the engine and having bridge contacts thereon operating to open and close said circuits respectively, the bridge contact which opens and closes the circuit having the generator as its source being of greater extent in the direction of the movement of the member than the bridge contact which opens and closes the circuit including the coil of the starting motor switch, a circuit including the starting motor and the armature of the starting motor switch, and a circuit connecting the generator and battery.

4. In a starting control system for automobile engines, a battery, a starting motor, a main circuit switch, a magnetic starting motor switch including a coil and armature, a second magnetic switch including a coil and armature, a generator, a circuit having the generator as its source and including the coil of the second magnetic switch, a circuit including the main circuit switch, the armature of the second magnetic switch and the coil of the starting motor switch, an axially reciprocating member movable in response to the functional status of the engine and having bridge contacts thereon operating to open and close circuits respectively, the bridge contact which opens and closes the circuit having the generator as its source being of greater extent in the direction of the axial movement of the member than the bridge contact which opens and closes the circuit including the coil of the starting motor switch, a circuit including the starting motor and the armature of the starting motor switch and a circuit connecting the generator and battery.

JOHN P. GERAGHTY.