

AUTOMATIC OPERATING MEANS FOR INTERNAL COMBUSTION ENGINES.

1,386,844.

2 SHEETS--SHEET 1.

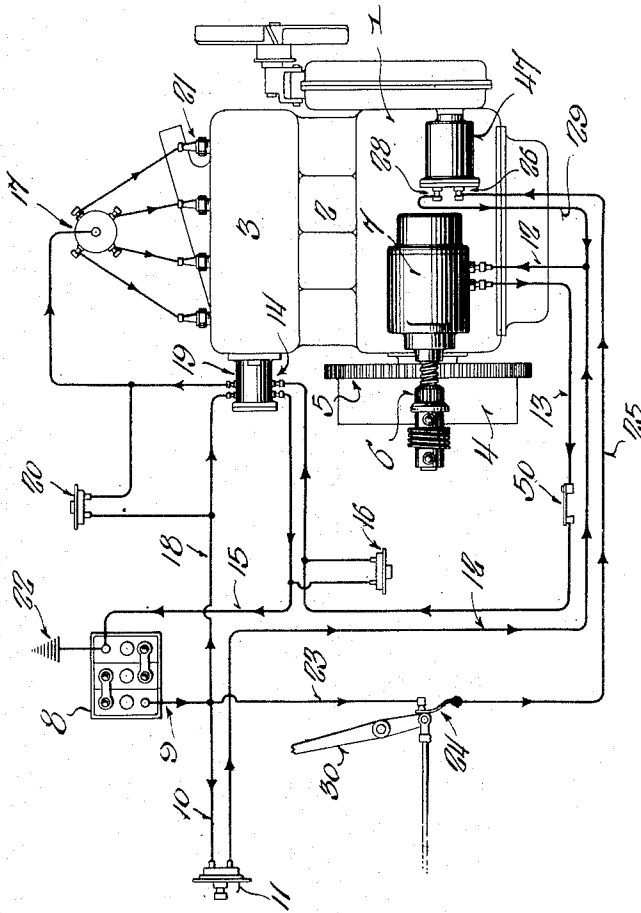


Fig. 1.

Inventor:

Henry K. Cowen

Attorneys

H. K. COWEN.  
 AUTOMATIC OPERATING MEANS FOR INTERNAL COMBUSTION ENGINES.  
 APPLICATION FILED MAR. 1, 1920.

1,386,844.

Patented Aug. 9, 1921.  
 2 SHEETS—SHEET 2.

*Fig. 2.*

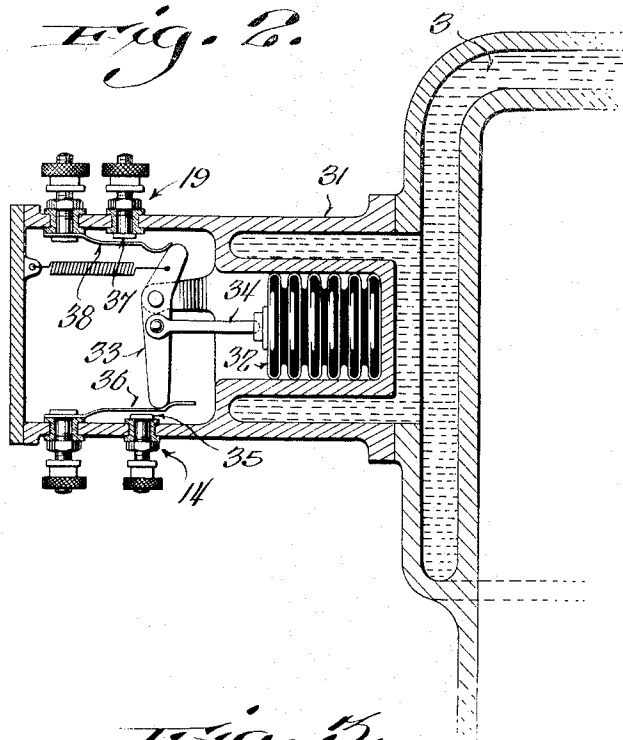
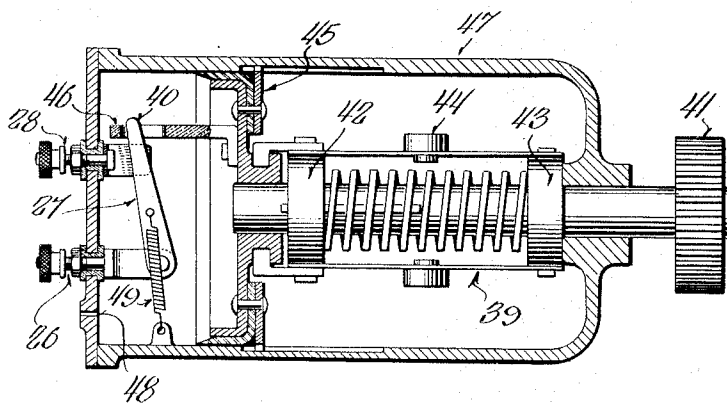


*Fig. 5.*



*Inventor:*

Henry K. Cowen.

*Witness:*  
*Edmund H. Cowen*

*Witness:*

*Chas. E. Cowen*  
*Attorney*

# UNITED STATES PATENT OFFICE.

HENRY K. COWEN, OF MILWAUKEE, WISCONSIN.

AUTOMATIC OPERATING MEANS FOR INTERNAL-COMBUSTION ENGINES.

1,386,844.

Specification of Letters Patent.

Patented Aug. 9, 1921.

Application filed March 1, 1920. Serial No. 362,622.

*To all whom it may concern:*

Be it known that I, HENRY K. COWEN, a citizen of the United States, and resident of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Automatic Operating Means for Internal-Combustion Engines; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention relates to new and useful improvements in internal combustion engines and in the means for automatically starting and stopping the same.

This invention is designed primarily for use on engines of automobiles or other motor vehicles which are provided with water or liquid cooling systems. It is well known that in the case of such engines it is very difficult during cold weather to secure sufficient vaporization of the liquid fuel when the engine is cold to permit the same to readily start operating. If a vehicle is permitted to stand idle with the engine out of operation for any length of time when the temperature is low, cooling of the metal parts thereof and the liquid of the cooling system results.

One means to insure vaporization of the liquid fuel and ease in starting, is to operate the engine at intervals while the vehicle is standing idle and continue to run it for a short time or until the cooling liquid is heated. By this means the metallic parts of the engine are kept more or less warm as is the cooling water or other liquid and the liquid fuel is permitted to vaporize and prevented from condensing after once having been converted into a vaporous fluid. Furthermore the lubricating oil is prevented from congealing and the liquid of the cooling system is kept from freezing.

The aim of the present invention is to carry out this result by automatically maintaining, within certain predetermined limits, the temperature of the cooling liquid without the personal presence of the vehicle driver.

In other words the engine is caused to start through the instrumentality of an automatically operated starting motor and to continue to operate for a length of time necessary to raise the cooling liquid to a predetermined temperature.

An additional object of the invention is

to provide a simply constructed electrical system for carrying out the automatic starting and stopping of the engine.

A still further object is to associate such improved electrical system and parts controlled thereby with the ordinary ignition and starting systems of the usual motor vehicle engine, the latter consisting of a generator for supplying current to the storage battery and separate motor for starting the engine.

With these general objects, and the obvious advantages resulting therefrom in view, the invention consists in the novel features of construction, combination and arrangement of parts which will be hereinafter more particularly described and claimed.

In the accompanying drawings:

Figure 1 represents a side elevational view of an internal combustion engine having a water cooling system, the starting of which engine is procured through an electrical starting motor, together with a diagrammatic showing of the several electrical circuits used in the operation thereof.

Fig. 2 is an enlarged longitudinal sectional view through a portion of the water jacket of the engine shown in Fig. 1 showing the manner of associating a pair of thermostatically governed switches therewith.

Fig. 3 is a similar view of an improved mechanically governed switch for making and breaking the starting motor circuit.

Referring more particularly to the accompanying drawings, it will be seen that the numeral 1 denotes an internal combustion engine of conventional type, the cylinders 2 of which are surrounded by a water jacket 3. The periphery of the fly wheel 4 of the engine is provided with a gear ring 5, the teeth of which are designed to be meshed with the drive pinion 6 of an electric starting motor 7.

The current for operating the starting motor 7 is supplied from a suitable storage battery 8 through circuit wires 9 and 10, a manually actuated normally open switch 11 and a third wire 12. From the motor 7 the electric current flows through a conducting wire 13, through a switch 14, when the same is closed, and back to the storage battery 8 through a wire 15. When the switch 14 is open, the circuit between the wires 13 and 15 may be made by a normally open man-

110

ually actuated switch 16. By this arrangement current may flow from the storage battery to the starting current motor and back again through said several conducting wires 5 when the switch 11 is closed, provided the switch 14 is likewise closed, or if open, through the switch 16, the same having been manually closed.

The ignition for the engine 1 is also supplied through the storage battery 8, current flowing to a timer or distributor 17 through said wire 9, a second conducting wire 18 connected thereto, through a switch 19, when the same is closed, or through a manually actuated switch 20 when the former is open. The current is distributed to the several spark plugs 21 by the timer 17 and thence flows through a ground from the motor 1 to the storage battery 8, one side of which is grounded as at 22. When the engine 1 is to be operated under normal conditions without the use of the improved automatic starting and stopping system forming the basis of the invention, the switch 20 is closed, thus short circuiting the switch 19 which is automatically and thermostatically operated as will be hereinafter more particularly set forth.

In associating my improved system with the usual starting motor and ignition circuits, several additional conducting wires are used. For instance a wire 23 is connected with the wire 9 so that the current may flow from the storage battery 8 to a switch 24 and through a conducting wire 25 to one pole 26 of a switch 27, the other pole 28 of said switch being connected through a wire 29 with the wire 12. Inasmuch as my improved automatic starting means is not used except when a vehicle is stationary, the switch 24 is provided to prevent a flow of current from the storage battery 8 to the starting motor 7 until the emergency brakes of said vehicle are set. In other words the lever 30 which is used for controlling said emergency brakes is adapted to close said switch 24 when the brakes are in operation.

With the switch 24 closed and the switch 16 open, the circuit used for automatically starting the motor 7 is controlled entirely through the switch 14, which is closed when the cooling liquid in the water jacket is at a predetermined low temperature and open when said liquid is at a predetermined high temperature. The preferred means for automatically controlling this switch 14 is shown particularly in Fig. 2, wherein it will be seen that I have connected a suitable casing 31 with the side of the water jacket 3 in such a manner that a thermostat 32 is surrounded by the cooling liquid from said jacket. Within the casing 31 is pivoted a switch actuating lever 33 which is connected with and moved by the thermostat 32 through a link 34. The switch 14 in-

cludes a stationary contact 35 and a spring arm comprising a movable contact 36 which is engaged by the lever 33.

The hereinbefore mentioned switch 19 is also carried by the casing 31 and comprises a stationary contact 37 and a movable contact 38, both of which parts are substantially similar to the corresponding parts of the switch 14. The movable contact 38 is also designed to be actuated by the lever 33 to open or close the switch in coördination with the movement of the thermostat 32. Inasmuch as both of the movable contacts 36 and 38 are actuated by the lever 33, it will be seen that both the starting motor and the ignition circuits are controlled by the thermostat when the vehicle is idle and without manual control.

The hereinbefore described switch 27 is actuated by means of a mechanical centrifugal governor 39. In other words a movable switch 40 normally bridges the poles 26 and 28 so that current may flow to the starting motor 7, but as soon as the engine is operating under its own power and its speed has reached a predetermined degree, the governor 39 acts to move the switch arm 40 to open position. Referring particularly to Fig. 3 it will be seen that the shaft of the governor 39 is geared through a pinion with the crank shaft (not shown) of the engine, and that when the sliding collar 42 of the governor is moved toward the relatively stationary collar 43 by the centrifugal action of the governor weights 44, a piston is moved in the same direction. The piston carries a yoke 46 which engages the switch arm 40 to move the same from open to closed position and vice versa.

It will also be noticed from this figure that the piston 45 may be readily moved toward the collar 43 in view of the fact that the nature of its construction permits air to leak between it and the wall of the cylinder 47 when the same is shifted in this direction. On the other hand, return movement of the piston when the governor 39 is no longer active is relatively slow in view of the fact that air cannot leak therepast, but must be forced from the left hand end of the cylinder 47 through a bleed 48. The switch arm 40 is so mounted that it will quickly make or break the connection with the poles 26 and 28.

In other words a spring 49 is used to snap the switch arm to opposite sides of dead center when shifted to this position by the yoke 46.

The operation of my automatic control system for starting and stopping the engine may be briefly explained as follows: Assuming that the vehicle on which the engine is mounted is idle and the brakes are set to close the switch 24 and that the water in the water jackets of the engine has reached a

predetermined low temperature, the thermostat 32 will operate to close the switches 14 and 19. The governor actuated switch 27 is closed, while the manually operable switches 11, 16 and 20 are open. Current from the storage battery 8 will now flow through the wires 9 and 23, the switch 24, the wire 25, and through the switch 27 and the wires 29 and 12 to the motor 7 as shown by the arrows on the diagram of Fig. 1. Returning from the motor 7 to the storage battery 8, the current passes through a wire 13 having a circuit breaker 50 therein, through the switch 14 and the wire 15. The current for the ignition system flows from the storage battery in a manner herein before described.

If the rotation of the shaft of the motor 7 does not start the engine within a predetermined time, the circuit breaker 50 will automatically break the starting motor circuit to prevent dissipation of the energy of the storage battery 8. However, if the engine is started, the switch 27 will be automatically opened when the engine speed attains a predetermined number of revolutions as heretofore set forth. With the starting motor circuit broken by the switch 27, the starting motor 7 remains idle until it is again necessary to turn over the engine crank shaft.

After the engine has been in operation for a certain length of time, the cooling water in the water jacket reaches a predetermined high temperature, whereupon the thermostat 32 becomes operative to open the switches 14 and 19, stopping the engine; and these switches will remain in this position until the temperature of said water again reaches a predetermined low degree. Consequently until this low degree is reached the engine cannot be automatically started.

If, on the other hand, it is desired to start the engine in a customary manner, while the temperature of the cooling water is still high and the switches 14 and 19 open, the manual switches 16 and 20 are closed. The ignition circuit will be thus completed, as will be the starting motor circuit when the switch 11 is closed.

I claim:

1. In an apparatus of the class described, the combination with an internal combustion engine and a vehicle operated thereby, of means for automatically and successively starting the operation of the engine when the same attains a certain predetermined temperature, and stopping the operation thereof when a second predetermined temperature is reached, comprising an electric starting motor, an ignition circuit, a starting motor circuit, a source of current for said circuit, a thermostatically controlled switch for each of said circuits, for automatically closing the circuits when the en-

gine is at a predetermined temperature, and automatically opening the circuits when the latter attains a second predetermined temperature, means for automatically opening the starting circuit when the engine reaches a predetermined speed, and means for preventing operation of the first mentioned means when the vehicle is moving.

2. In an apparatus of the class described, the combination with an internal combustion engine, and a vehicle operated thereby, of means for automatically and successively starting the operation of the engine when the same attains a certain predetermined temperature and stopping the operation thereof when a second predetermined temperature is reached comprising an electric starting motor, an ignition circuit, a starting motor circuit, a source of current for said circuit, a thermostatically controlled switch for each of said circuits for automatically closing the circuits when the engine is at a predetermined temperature and automatically opening the circuits when the latter attains a second predetermined temperature, a normally closed centrifugally governed switch in the starting motor circuit for automatically opening the circuit when the engine is operating at a predetermined speed, and means for preventing operation of the first mentioned means when the vehicle is moving.

3. In an apparatus of the class described, the combination with an internal combustion engine, and a vehicle operated thereby, said vehicle having a brake, of means for automatically and successively starting the operation of the engine when the same attains a certain predetermined temperature and stopping the operation thereof when a second predetermined temperature is reached comprising an electric starting motor, an ignition circuit, a starting motor circuit, a source of current for said circuits, a thermostatically controlled switch for each of said circuits for automatically closing the circuits when the engine is at a predetermined temperature and automatically opening the circuits when the latter attains a second predetermined temperature, a normally closed centrifugally governed switch in the starting motor circuit for automatically opening the circuit when the engine is operating at a predetermined speed, and means for preventing operation of the first mentioned means except when said brake is in active position.

4. In an apparatus of the class described, the combination with an internal combustion engine, and a vehicle operated thereby, said vehicle having a brake, of means for automatically and successively starting the operation of the engine when the same attains a certain predetermined temperature and stopping the operation thereof when a

second predetermined temperature is reached comprising an electric starting motor, an ignition circuit, a starting motor circuit, a source of current for said circuits, a thermostatically controlled switch for each of said  
5 circuits for automatically closing the circuits when the engine is at a predetermined temperature and automatically opening the circuits when the latter attains a second predetermined temperature, a normally closed  
10 centrifugally governed switch in the start-

ing motor circuit for automatically opening the circuit when the engine is operating at a predetermined speed, and a normally open safety switch in said starting motor circuit, 15 said switch being closed by the movement of the brake to active position.

In testimony that I claim the foregoing I have hereunto set my hand at Milwaukee, in the county of Milwaukee and State of 20 Wisconsin.

HENRY K. COWEN.