Aug. 12, 1952 P. E. DRUMMOND 2,607,013

ENGINE CONTROL DEVICE

Filed Jan. 8, 1951 3 Sheets-Sheet 1

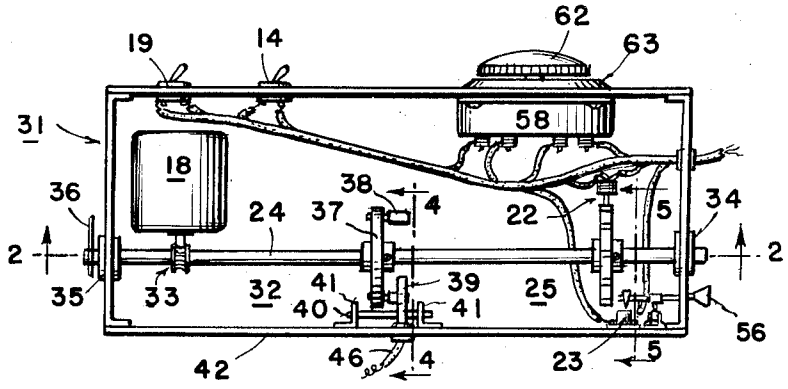


FIG. 1

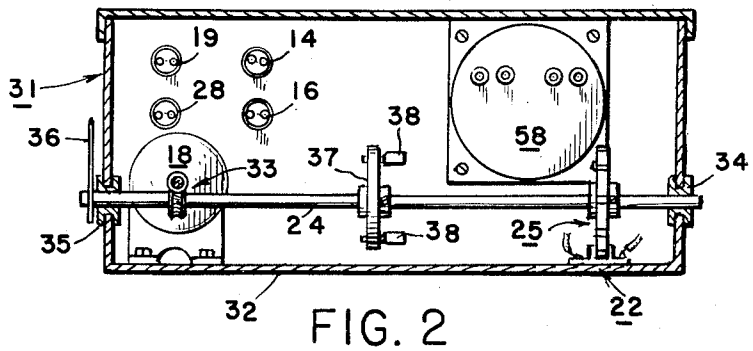


FIG. 2

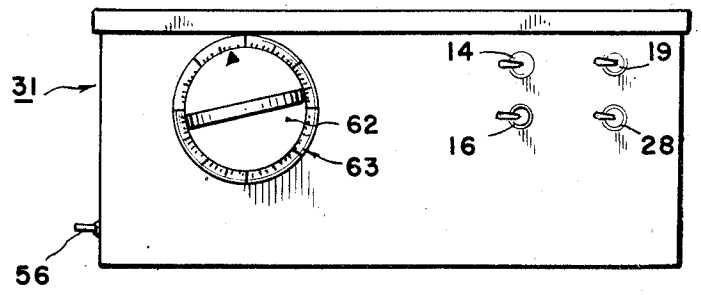


FIG. 3

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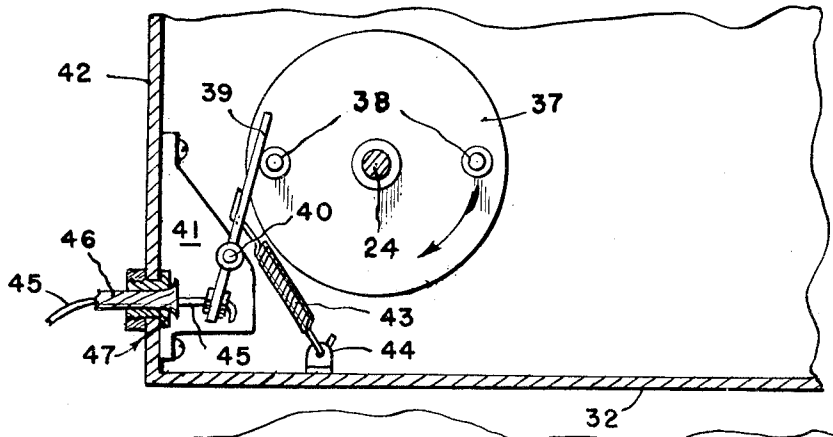
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ENGINE CONTROL DEVICE

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FIG. 4



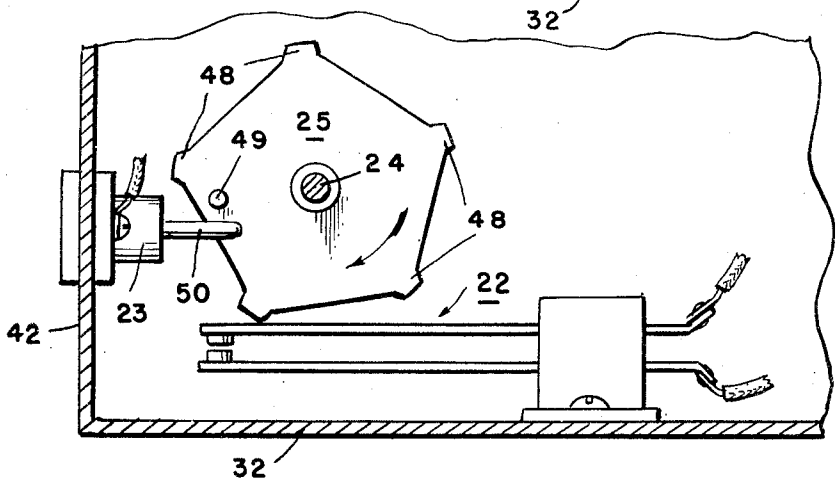


FIG. 5

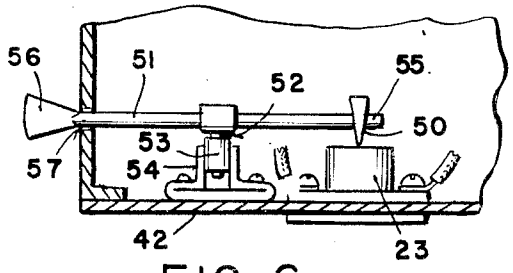


FIG. 6

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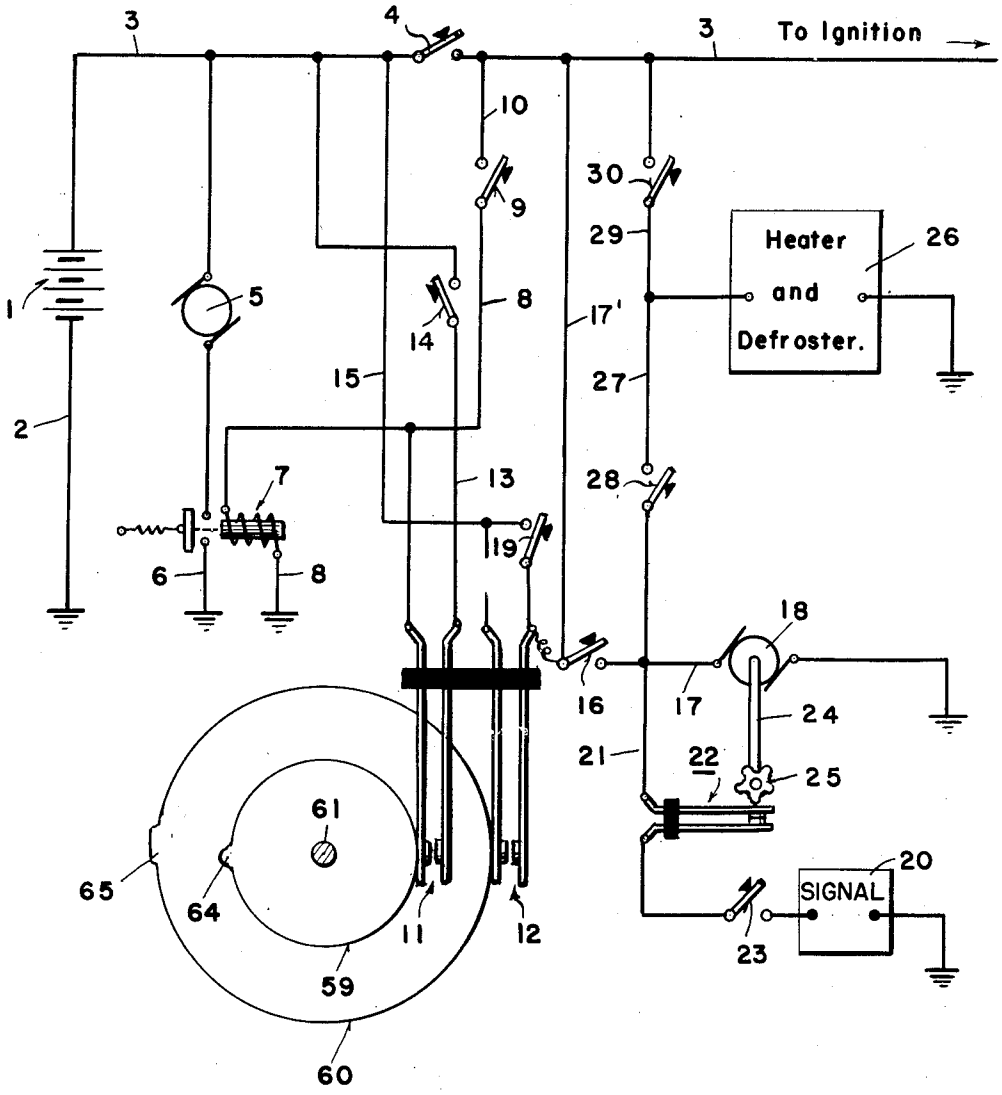


FIG. 7

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Patented Aug. 12, 1952 2,607,013

UNITED STATES PATENT OFFICE

2,607,013

ENGINE CONTROL DEVICE

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Application January 8, 1951, Serial No. 204,923

6 Claims. (Cl. 290—38)

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This invention relates to engine control devices, and particularly to a device for automatically starting a cold internal combustion engine, such as the engine of an automobile, at a predetermined time.

In cold climates, users of automotive vehicles are ordinarily forced to start the engine of the vehicle in advance of the time at which it is desired to drive the vehicle, in order that the engine may warm up sufficiently to be driven safely. This practice is not only time consuming, but also requires exposure of the operator to the cold. The present invention provides an automatic engine starting device which may be preset to start the engine at any given time and will thereafter maintain the engine operative until warm. The device of the present invention includes both means for operating the engine starting motor and means coordinated therewith for actuating the throttle control of the engine to assist in the initial starting action and to keep the engine running while still below operating temperature.

In its preferred form, the invention embodies novel means for operating an electric signalling device, of any suitable type, to notify the operator that the engine has been started and is ready for use. According to one embodiment, this signal is operated cyclically over a period of time, and is thereafter automatically deenergized.

In order that these and other features of the invention may be understood in detail, reference is had to the accompanying drawings forming a part of this specification and in which:

Fig. 1 is a plan view of one embodiment of the invention, with the cover of the casing thereof removed;

Fig. 2 is a vertical sectional view taken on the line 2—2, Fig. 1, parts being shown in elevation;

Fig. 3 is a front view of the device shown in Fig. 1;

Fig. 4 is a detail vertical sectional view taken on the line 4—4, Fig. 1;

Fig. 5 is a detail vertical sectional view taken on the line 5—5, Fig. 1;

Fig. 6 is a detail elevational view of a manual switch reset device employed in the device illustrated in Fig. 1; and

Fig. 7 is a circuit diagram for the preferred embodiment of the invention.

Referring now to the drawings in detail, and first to Fig. 7 thereof, it will be seen that the invention is illustrated as applied to the conventional electrical system of an automotive engine, including the battery 1 connected by the conductor 2 to ground and by a conductor 3, through

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the usual ignition switch 4, to the engine ignition system. The engine starting motor 5 is connected between the power conductor 3 and ground by a conductor 6, which conductor includes the normally open contacts of a conventional starting relay 7. The winding of the relay 7 is connected between ground and the conductor 3, at a point beyond the ignition switch 4, by a conductor 8, the ordinary manual starter switch 9 and the conductor 10.

As hereinafter described in detail, the invention employs a time switch including two sets of normally open contacts, and these contact sets are illustrated at 11 and 12 in Fig. 7. Contacts 11 of the time switch are connected between the conductor 8 and the power line 3, at a point before the ignition switch 4, by means of a conductor 13 and a manual switch 14. It will thus be seen that, should the contacts 11 and the manual switch 14 both be closed, the relay 7 will be energized to complete the circuit to the starting motor, regardless of whether or not the ignition switch 4 is closed. That is, when the contacts 11 and the switch 14 are both closed, there is a complete control circuit from the battery 1, through conductors 3, 13 and 8, and the winding of the relay 7, to ground and return.

One side of the contact set 12 is connected to the power lead 3 through a conductor 15 while the other side of the contact set is connected through a manual switch 16 and a conductor 17 to one terminal of an electric motor 18, the other terminal of the motor being connected to ground. Thus, when both the contacts 12 and the switch 16 are closed, there is completed a second control circuit, which circuit serves to energize the electric motor 18 from the battery 1. Connected in this circuit, in parallel with the contact set 12, is a manual switch 19, so that the motor 18 can be energized independently of the contacts 12, for a purpose hereinafter explained.

Closing of the contacts 12 also serves to short circuit the ignition switch 4, since the conductor 17 is connected to the conductor 3 by a conductor 17', the connection being, on the one hand, at a point between the contacts 12 and the switch 16, and on the other hand, between the switch 4 and the ignition system.

An electric signalling device 20 of any suitable type is connected between the conductor 17 and ground by a circuit including a conductor 21, a normally open switch 22, and a two-position switch 23. The motor 18 drives a shaft 24 carrying a cam 25 arranged to close the switch 22 cyclically so long as the motor is energized. By

means later described in detail with reference to Fig. 5, rotation of the cam 25 through one complete revolution serves to actuate the switch 23 to open position, thus preventing further cyclic closing of the switch 22 from energizing the signalling means 20. After each operation, the switch 23 is manually reset to closed position.

The conventional heater and defroster unit of the vehicle, illustrated diagrammatically at 26, is supplied with current from the battery either by a circuit comprising the conductor 27 and a manual switch 28, or by the conventional power circuit comprising conductor 29 and the usual heater control switch 30.

The time switch employed is preferably so designed as to cause the contacts 11 and 12 to close simultaneously. When this occurs, the starter motor 5 is actuated to start the engine. Simultaneously, the motor 18 is energized to rotate the shaft 24. The shaft 24, by rotating the cam 25, cyclically completes the signal circuit to energize the signal 20 a predetermined number of times only. Also, as will be explained, the shaft 24 provides a source of power for actuating the engine throttle control to keep the engine running so long as the contacts 12 are closed. And, of course, closing of the contacts 12 supplies current to the ignition system, via the conductor 17'.

Referring now to Figs. 1 and 2, it will be seen that the shaft 24 extends across the interior of a casing 31, which casing houses the control device as a whole and may be mounted on the vehicle dash or on the fire wall. The motor 18 is mounted on the base 32 of the casing, and may drive the shaft 24 through any suitable means, such as the worm gearing 33. The shaft 24 is journalled at 34 and 35 in the end walls of the casing 31, and one end of the shaft is extended beyond the corresponding end wall and there provided with a suitable position indicator or pointer 36. The pointer 36 cooperates with calibrations on the casing end wall, so as to indicate the rotational position of the shaft 24.

Rigidly mounted on the shaft 24 is a disk 37 provided with axially protruding rollers 38, the disk 37 and its rollers 38 constituting cam means positioned to operate a throttle control actuating lever 39. As best seen in Fig. 4, the lever 39 is provided with a pivot pin 40 journalled in spaced brackets 41 (Fig. 1) carried by the rear wall 42 of the casing 31. The lever 39 is biased into the path of rotation of the cam rollers 38 by a tension spring 43, the ends of which are attached respectively to the lever 39 above the pivot 40 and to suitable anchoring means 44 on the base 32 of the casing. Attached to the end of the lever 39, below the pivot 40, is a throttle control operating wire 45. The wire 45 is preferably a conventional Bowden wire, such as that usually employed to connect the throttle control to the manual throttle adjusting knob on the automobile dash, and is thus provided with the usual flexible outer covering 46 having its end secured to the casing 32 by means of a clamping bushing 47.

Thus, as the shaft 24 is rotated by the motor 18, the disk 37 is also rotated, so that the cam rollers 38 come successively into contact with the lever 39, pivoting the lever against the action of the tension spring 43. Such pivotal movement of the lever 39 reciprocates the throttle control wire 45 to open the throttle, just as would a similar adjustment of the conventional hand throttle control. I have found that a lever mechanism as just described constructed to give a one-half inch movement to the throttle control operating wire is satisfactory for the purpose of the invention. Though two diametrically disposed cam rollers 38 have been illustrated, it will be understood that only one roller may be used, or that more than two rollers may be used, as dictated by the particular application of the device.

As has already been mentioned, the cam 25, seen also in Fig. 7, is carried by the shaft 24 and rotates therewith. As best seen in Fig. 5, the normally open switch 22, which is preferably of the leaf spring type as shown, is mounted on the base 32 of the casing 31 in a position such that the successive cam elements 48 of the cam 25 cyclically close the switch as the cam is rotated by the shaft 24. The switch 22 closes the circuit to the signal 20, Fig. 7. It will be understood that the device as a whole is controlled by the time switch to start the engine and thereafter maintain the engine running for a predetermined period of time to allow the same to come to operating temperature. It is undesirable to have the signal operated throughout this predetermined period of time, and the switch 23 is therefore provided to break the signal circuit. The cam 25 is provided with an axially projecting pin 49, and the switch 23, which may be a conventional toggle switch, is so mounted that its operating member or toggle 50 is positioned in the path of rotation of the pin 49 so that the pin 49 actuates the switch to open positon during rotation of the cam. Thus, if the first revolution of the cam 25 in an operation of the device commences at the position shown in Fig. 5, the five cam elements 48 will cause the switch 22 to be closed five successive times, and after the fifth closing of the switch the pin 49 will open the switch 23, thus interrupting the signal circuit and assuring that subsequent operation of the switch 22 will be ineffective to energize the signal.

It is therefore necessary that the switch 23 be reset to closed position before each operation of the engine starting device by means independent of the cam 25. To accomplish this, I provide the manual switch operating lever 51, Figs. 1 and 6, this lever being omitted from Fig. 5 for purposes of clarity. The lever 51 is carried by a pivot shaft 52 operating in a bushing 53 mounted by means of a bracket 54 on the back wall 42 of the casing. The bracket 54 is so located on the back wall 42 that the end 55 of the lever is adjacent the actuator 50 of the two-position switch 23. The opposite end of the lever 51 constitutes a thumbpiece 56, and the lever extends through a suitable slot 57 in the end wall of the casing 31, so that the lever may be actuated manually from outside of the casing to re-close the switch. It is thus seen that the two-position switch 23 is automatically opened after one revolution of the cam 25, and is manually reset.

The time switch, indicated at 58, Figs. 1 and 2, may be of any conventoinal type capable of automatically closing two contact sets at a predetermined time. It is preferred that a time switch which is operated by spring powered clock-work be employed. For purposes of illustration, the time switch 58 may include rotary cams 59 and 60 to close the contacts 11 and 12, respectively, as indicated in Fig. 7, such cams being normally connected to the drive shaft 61 of a spring powered clock mechanism designed to complete one revolution in twenty-four hours, but being disconnectable from said shaft for purposes of adjusting the starting position of the cams. For this purpose, the time switch 58 is provided with

a manual adjusting knob 62 cooperating with a scale or dial 63 exposed on the front panel 64 of the casing and calibrated in time. Contact sets 11 and 12, Fig. 7, may be of the spring leaf type, and the cams 59 and 60, as shown, are so positioned as to allow said contact sets to be normally open. The cam 59 is provided with a raised cam surface or element 64 of relatively short length, so that, during each rotation of the cam, the element 64 causes the contacts 11 to be closed momentarily, or for a short length of time dependent upon the speed of rotation of the cam. The cam 60 is similarly provided with a raised cam element 65 relatively longer in length, so that during each rotation of the cam the contacts 12 are closed for a predetermined period of time. For example, the cam 59 may be designed to close the contacts 11 for 30 seconds, or for a somewhat longer period, or for successive short periods, and the cam 60 may be designed to close the contacts 12 for 10 minutes or a like period suitable for warming the engine to which the device is to be applied.

Many different types of time switches are now commonly available to the trade, and the cam switch illustrated herein is chosen only for simplicity of illustration. It will be understood, also, that where necessary a time switch may be employed such that the duration of the periods during which the contact sets 11 and 12 are closed is adjustable.

In operation of the device as described, the time switch 58 is adjusted manually by means of the knob 62 to select a particular time of day at which it is desired to start the engine to which the device is applied. The clockwork for the time switch is then wound and set in motion. The on-off switch 16 is first closed. Manual switch 19 is then closed to energize the motor 18 until the position indicator 36 shows that the shaft 24 is in starting position with the cams 25 and 37 in the orientation shown in Figs. 5 and 4. The switch 19 is then opened, deenergizing the motor 18. The switch 16 remains closed in all normal operation of the device until after the engine starts, and the ignition switch 4 is of course open. The switch 23 is manually actuated to closed position. Assuming that the time switch has been adjusted to operate at a later time, contact sets 11 and 12 are open, and the starter relay 7, the motor 18, the signal 20, and other components remain deenergized. When the period for which the time switch 58 is adjusted expires, the contacts 11 and 12 are simultaneously closed. The relay 7 is thus actuated to energize the starter motor 5 to turn the engine over. At the same time, the motor 18 begins to rotate, turning shaft 24 and the cam 37 to operate the throttle control. As the shaft 24 turns, the cam 25 is rotated, successively closing the normally open switch 22, and thus cyclically energizing the signal 20 to announce that the engine has been started.

By means of the cam 59, the contacts 11, controlling the starter relay 7, may be closed only long enough to cause the starting motor 5 to turn the engine over sufficiently to start. By means of the cam 60, the contacts 12, controlling the ignition circuit and energizing the motor 18, may be maintained closed for any period suitable for warming the engine. The cam elements 64 and 65 of the cams 59 and 60 are preferably so oriented that the contacts 11 and 12 are closed simultaneously.

What is claimed is:

1. In an automatic starting device for an internal combustion engine including a starting motor and a throttle control, the combination of a time switch including first and second normally open contact sets and adjustable means for causing said contact sets to close at a predetermined time, a circuit including said first set of contacts for actuating said starting motor, an electric motor, a circuit including said second set of contacts for energizing said electric motor, cam means rotated by said electric motor, a movable control member, and means operated by said movable control member for actuating said throttle control, said control member being normally biased into the path of rotation of said cam means and said cam means being positioned to move said control member at least once during each rotation to actuate said throttle control.

2. In an automatic starting device for an internal combustion engine including a starting motor and a throttle control, the combination of a time switch including first and second normally open contact sets and adjustable means for causing said contact sets to close simultaneously at a predetermined time, a circuit including said first set of contacts for actuating said starting motor, an electric motor, a circuit including said second set of contacts for energizing said electric motor, cam means rotated by said electric motor, a pivoted lever, and means operated by pivotal motion of said lever for actuating said throttle control, said lever being normally biased into the path of rotation of said cam means and said cam means being positioned to pivot said lever at least once during each rotation to actuate said throttle control.

3. In an automatic starting device for an automotive engine having a starting motor and a throttle control, the combination of a time switch including first and second normally open contact sets and adjustable means for causing said contact sets to close at a predetermined time; a circuit including said first set of contacts for actuating said starting motor; an electric motor; a circuit including said second set of contacts for energizing said electric motor; first and second cam means rotated by said electric motor; a control element normally biased into the path of rotation of said first cam means; means operated by said control element for actuating said throttle control, said first cam means being constructed to move said control member at least once during each rotation to actuate said throttle control; a normally open switch positioned for actuation by said second cam means, said second cam means including a cam element for closing said switch during each rotation; electric signalling means, and a circuit including said normally open switch for energizing said signalling means.

4. In an automatic starting device for an automotive engine having a starting motor and a throttle control, the combination of a time switch including first and second normally open contact sets and adjustable means for causing said contact sets to close at a predetermined time; a circuit including said first set of contacts for actuating said starting motor; an electric motor; a circuit including said second set of contacts for energizing said electric motor; first and second cam means rotated by said electric motor; a control element normally biased into the path of rotation of said first cam means; means operated by said control element for actuating said throttle control, said first cam means being constructed to move said control member at least

once during each rotation to actuate said throttle control; a normally open switch positioned for actuation by said second cam means, said second cam means including successive cam elements for cyclically closing said switch as said cam means rotates; electric signalling means; a circuit including said normally open switch for energizing said signalling means; a two-position switch in said last mentioned circuit; means associated with said second cam means for actuating said two-position switch from closed to open position, and means independent of said cam means for closing said two-position switch.

5. In an automatic starting device for an internal combustion engine including a starting motor and a throttle control, the combination of a time switch including first and second normally open contact sets and adjustable means for causing said contact sets to close at a predetermined time, a first circuit including said first set of contacts for actuating said starting motor, an electric motor, a second circuit including said second set of contacts for energizing said electric motor, cam means rotated by said electric motor, a movable control member, means operated by said movable control member for actuating said throttle control, said control member being normally biased into the path of rotation of said cam means and said cam means being constructed to move said control member at least once during each rotation to actuate said throttle control, position indicating means rotated by said electric motor for indicating the

position of said cam means relative to said control member, and a manually operated switch connected in said second circuit in parallel with said second set of contacts, whereby said electric motor may be energized under manual control to bring said cam means to a desired position.

6. In an automatic starting device for an automotive engine having a starting motor and a throttle control, the combination of a time switch, means controlled by said time switch for energizing said starting motor at a predetermined time, actuating means for said throttle control, power means controlled by said time switch for cyclically operating said actuating means simultaneously with energization of said starting motor, electric signalling means, switching mechanism operated by said power means for cyclically energizing said signalling means, and manually resettable means combined with said switching mechanism for automatically interrupting operation of said signalling means at a predetermined time after said starting motor is energized.

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