

[72] Inventor **Enis C. Egdemir**
 Box 295, RD 2, Kingston, New York 12401
 [21] Appl. No. **768,857**
 [22] Filed **Oct. 18, 1968**
 [45] Patented **Nov. 10, 1970**

3,071,125 1/1963 Leaver 123/179
 3,078,834 2/1963 Wright 123/179

OTHER REFERENCES

Electronics Illustrated, Sept. 1965, Paul Hertzberg—"Automotive Electronics" Pages 52, 53

Primary Examiner—Mark M. Newman

Assistant Examiner—Ronald B. Cox

Attorney—Berman, Davidson and Berman

[54] TIMED CAR STARTER 10 Claims, 6 Drawing Figs.

[52] U.S. Cl. 123/179,
 123/119
 [51] Int. Cl. F02n 15/00,
 F02n 11/00
 [50] Field of Search 123/179

[56] **References Cited**
UNITED STATES PATENTS
 2,949,105 8/1960 Davis 123/179
 3,040,724 6/1962 Kennemer 123/179

ABSTRACT: An automatic presettable car-starting system to warm up a car any time during a future 24-hour period by presetting a clock device. The starting system uses a timer, a motor, a clock-controlled switch mechanism, and a transistorized starting detector circuit. The timer is activated by the clock-controlled switch mechanism and, in turn, controls the sequence of operation during a starting cycle. The system includes a mechanism for depressing the car gas pedal a selected predetermined number of times during the starting cycle.

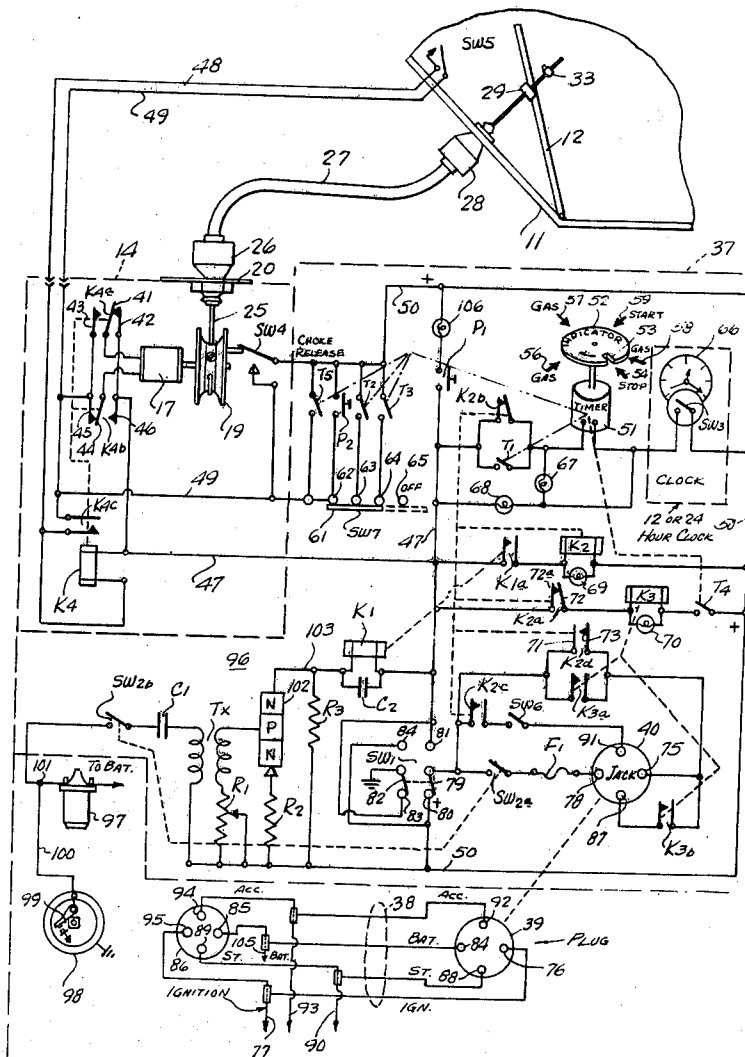


FIG. 1.

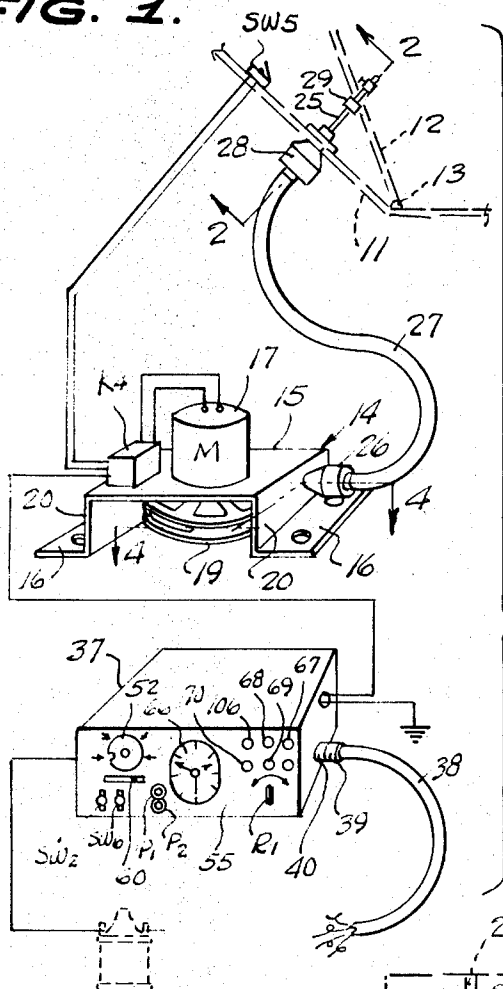


FIG. 2.

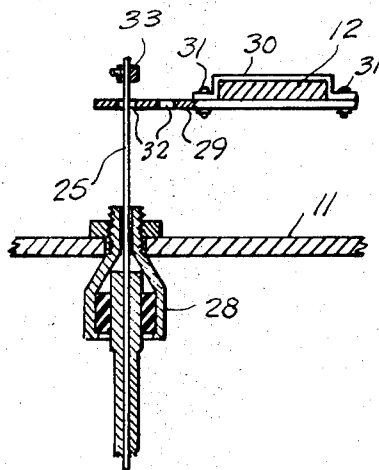


FIG. 3.

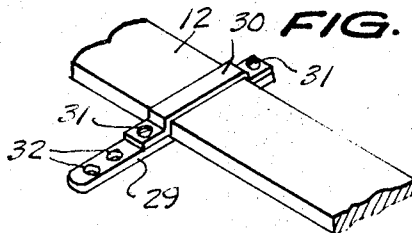


FIG. 4.

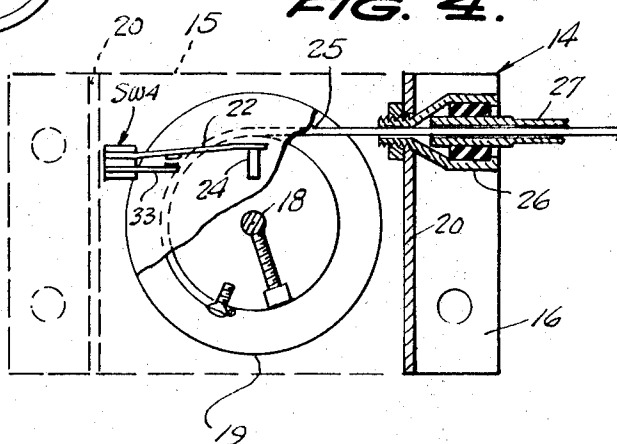
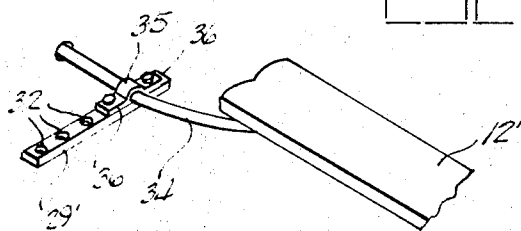


FIG. 5.

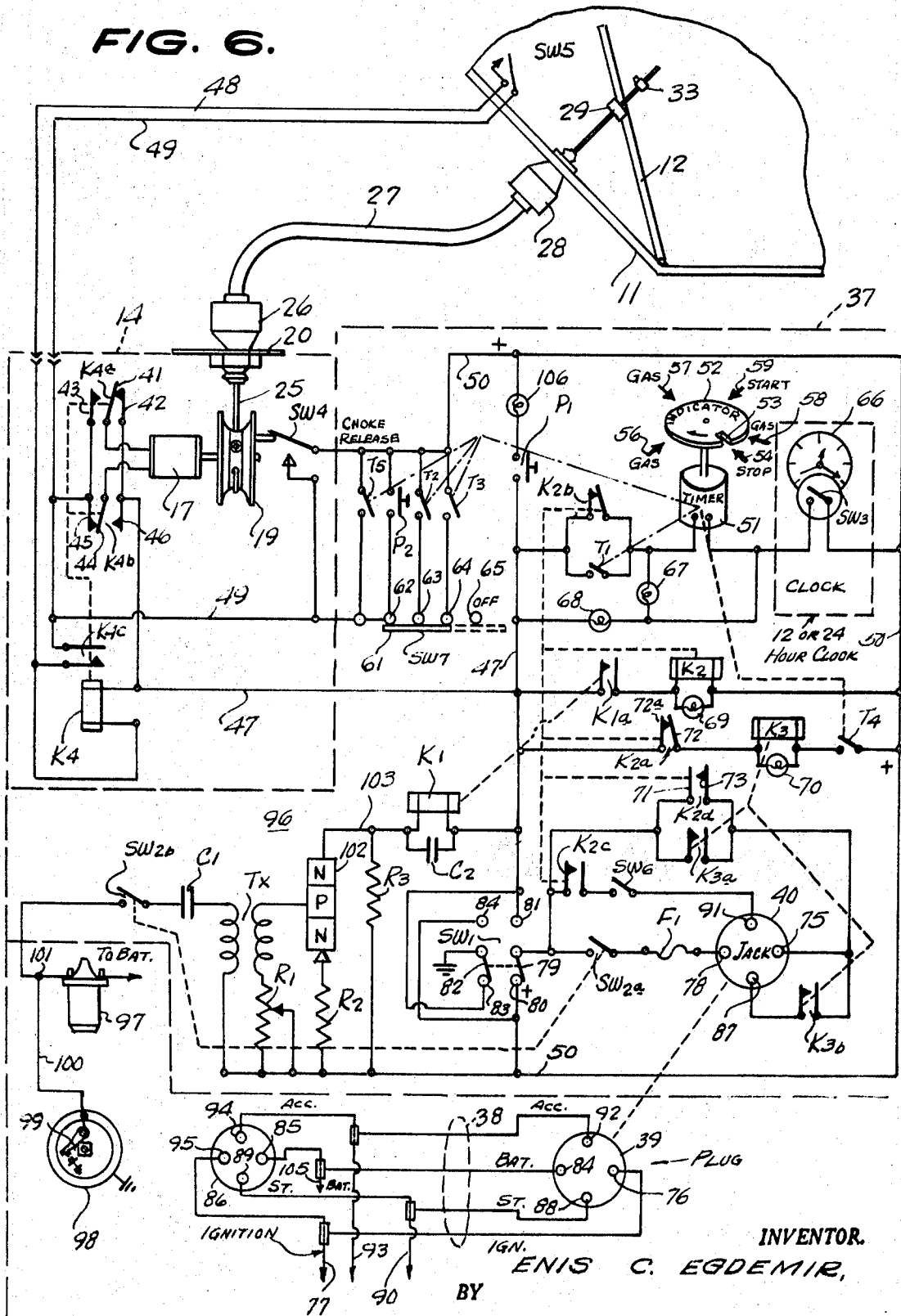


INVENTOR.
ENIS C. EGDEMIR,

BY

Berman, Davidson & Berman
ATTORNEYS.

FIG. 6.



INVENTOR.

ENIS C. EGDEMIR,

BY

Berman, Davidson & Berman
ATTORNEYS.

TIMED CAR STARTER

This invention relates to timed starting devices for automobile or similar engines, and more particularly to an apparatus for automatically starting an automobile at a predetermined time, for example, for the purpose of warming up the engine prior to actual use thereof, whereby to eliminate the inconvenience involved in starting the automobile engine manually under adverse weather conditions and waiting for the engine to warm up.

A main object of the invention is to provide a novel and improved automatic starting device for an automobile engine, said device being adapted to start the engine at a predetermined selected time for the purpose of warming up the engine prior to actual use thereof, the apparatus involving relatively simple components, being easy to operate, and being safe to use.

A further object of the invention is to provide an improved automatic presettable automobile starting apparatus which is easy to set up for use, which provides improved starting action in that it is highly sensitive and detects the starting of the engine instantaneously, thereby eliminating excessive operation of the starting motor or flooding of the engine, and being arranged so that it can be set into operation by relatively simple manipulations.

A still further object of the invention is to provide an improved automatic starting device for starting an automobile engine at a desired preset time, the device being reliable in performance, being economical in use, involving relatively compact parts, and being relatively easy to install.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

FIG. 1 is a perspective view showing certain portions of an improved automatic car-starting system according to the present invention, showing some of the electrical connections of the system, and showing diagrammatically the manner in which the device is mechanically coupled to the accelerator pedal of the automobile with which it is used.

FIG. 2 is an enlarged fragmentary, vertical cross-sectional view taken substantially on the line 2-2 of FIG. 1.

FIG. 3 is a fragmentary perspective view showing a portion of the accelerator pedal of FIG. 2 and the associated bracket employed with the car-starting system of the present invention.

FIG. 4 is an enlarged horizontal cross-sectional view taken substantially on the line 4-4 of FIG. 1.

FIG. 5 is a fragmentary perspective view similar to FIG. 3, but showing a modification of the bracket means employed for coupling the accelerator pedal to the car-starting mechanism of the present invention.

FIG. 6 is a schematic wiring diagram showing the electrical connections employed in an automatic presettable car-starting system according to the present invention.

Referring to the drawings, 11 designates the floorboard of a motor vehicle provided with an improved automatic starting system according to the present invention, and 12 designates the accelerator pedal employed with the vehicle and pivoted at 13 to said floorboard. In accordance with the present invention, an accelerator-operating assembly, designated generally at 14, is mounted in any convenient location subjacent the floorboard 11, for example, at a convenient location in the rear portion of the space beneath the vehicle hood rearwardly adjacent its engine, as will be apparent from FIG. 1.

The accelerator-operating assembly 14 comprises a main supporting channel-shaped body 15 which is inverted, as shown in FIG. 1, and which is provided with apertured securing flanges 16, 16 for fastening body 15 to any convenient rigid portion of the vehicle frame. A reversible electric motor 17 is mounted on the top wall of the channel-shaped body member 15, the shaft of the motor, shown at 18, extending through the top wall and having a flanged reel 19 secured thereto, whereby said reel is housed between the opposite vertical sidewalls 20, 20 of body 15. A switch assembly SW4 is mounted within

the body 15, said switch assembly being of the normally closed type wherein a flexible arm 22 thereof is biased toward normal engagement with a cooperating contact arm 33 thereof, the flexible arm 22 being normally engaged by a lug 24 projecting from one side of reel 19 and normally holding contact 22 disengaged from contact 33, as shown in FIG. 4. Thus, FIG. 4 illustrates the starting position of reel 19.

Secured on the flanged reel 19, between the disc-shaped flanges thereof, is a conventional flexible cable wire 25 which extends through a first guide bushing 26 secured in one of the sidewalls 20 of body 15 and through a flexible cable sheath 27 leading to a guide bushing 28 secured to the inclined portion of floorboard 11 subjacent the accelerator pedal 12.

A bracket arm 29 is secured to accelerator pedal 12 and projects laterally therefrom, as shown in FIGS. 2 and 3. Thus, the arm 29 underlies and extends transverse to the accelerator pedal 12 and is fastened thereto by an inverted U-shaped clamping strap 30 transversely-overlying and receiving the accelerator pedal and being secured to arm 29 by fastening bolts 31, 31, as shown in FIGS. 2 and 3. The laterally-projecting portion of arm 29 is formed with apertures 32, and the upper end of the flexible cable wire 25 extends slidably through one of said apertures, as shown in FIG. 2. An abutment collar 33' is adjustably-secured to the top end portion of wire 25 at an adjusted position above arm 29 such that arm 29 and accelerator pedal 12 will be moved downwardly responsive to the winding up of cable wire 25 on reel 19, as will be presently described.

The accelerator pedal 12 is biased upwardly toward its normal position by conventional spring means, not shown, and is normally in a position similar to that shown in FIG. 2 wherein the laterally-projecting portion of arm 29 is spaced a short distance beneath the abutment collar 33'.

As will be presently described, means are provided for energizing motor 17 alternately in one direction and the other one or more times to correspondingly cause wire 25 to be alternately retracted and extended, thereby causing the accelerator pedal 12 to be correspondingly depressed and released.

Mounted on the inclined forward portion of the floorboard 11 in the path of movement of the accelerator pedal 12 is a limit switch SW5, which is normally open, as shown in FIG. 6, and which is engaged by accelerator pedal 12 when it is depressed, as will be presently described, to thereby cause the switch SW5 to close when the pedal is moved to the lower end portion of its stroke.

FIG. 5 illustrates a modified coupling arrangement between the motor vehicle accelerator pedal and the operating means therefor. Thus, in the modification illustrated in FIG. 5, the pedal, shown at 12', is provided with an arcuately-curved laterally and forwardly-projecting arm 34 which is adjustably-connected to the coupling arm, shown at 29'. The arm 29' underlies arm 34 and is clampingly-secured thereto by an inverted U-shaped clamping bracket 35 having apertured fastening arms 36, 36 which are secured to the laterally-projecting arm 29' with arm 29' located at an adjusted position along the arcuately-curved accelerator pedal arm 34. The arm 29' is provided with the apertures 32, similar to those provided on arm 29 in the previously-described embodiment of the invention, the coupling wire 25 extending slidably through a selected one of the apertures 32.

The main control portions of the automatic-starting apparatus are contained in a housing 37 which is mounted in any convenient location in the vehicle, for example, beneath the vehicle dashboard and in a position wherein it is readily accessible to the vehicle operator. A suitable multiple-conductor cable 38 is employed to connect the control circuit in housing 37 to other electrical portions of the motor vehicle, as will be presently described. Thus, cable 38 is provided with a connection plug element 39 adapted to electrically couple and interconnect with a corresponding jack element 40 provided on the sidewall of housing 37, in the manner illustrated in FIG. 1. As shown in FIG. 6, the plug and jack elements 39 and 40 are of the four-pin type.

The assembly 14 includes a relay K4 having a pair or normally open holding contacts K4c and having, in addition, respective sets of single-pole, double-throw switch contacts K4a and K4b. The pole 41 of the contacts K4a normally engages a stationary contact 42, but is disengageable therefrom to engage an opposite stationary contact 43 responsive to the energization of relay K4. Similarly, the pole 44 of contacts K4b normally engages stationary contact 45, but is disengageable therefrom to engage an opposite stationary contact 46 responsive to the energization of the relay K4. As will be seen from FIG. 6, one terminal of the winding of relay K4 is connected to the negative battery supply wire 47 and the other terminal of the relay winding is connected by a wire 48, the normally open switch SW5, a wire 49 and the switch SW4 to the positive battery supply wire 50. The holding contacts K4c are connected in parallel with switch SW5.

The control apparatus contained in the housing 37 includes a conventional timer 51 which controls a plurality of switch units designated respectively at T1, T2, T3, T4 and T5. The timer 51 is designed so that upon energization thereof its contacts will close in a predetermined timed sequence. Thus, closure of the timer contacts will be in the following sequence: T1, T3, T2, T4, T5. The closure of these contacts will occur at definite predetermined time intervals succeeding each other in the aforementioned sequence.

The timer 51 is provided with an indicating disc 52 formed with an index notch 53. The notch 53 is normally located adjacent a "stop" marker 54 inscribed on the front panel 55 of housing 37. Said front panel also is provided with respective "gas" markers 56, 57 and 58 adjacent to and spaced around the periphery of disc 52, indicating various points in a full timer cycle at which accelerator pedal 12 will be depressed, said indication being provided by the movement of the index notch 53 adjacent the respective "gas" markers. As will be seen from FIG. 6, the front panel of housing 37 is also provided with a "start" marker 59 located adjacent the periphery of disc 52 and spaced between the "gas" markers 57 and 58. Rotation of disc 52 is in a clockwise direction, as viewed in FIG. 6.

The front panel 55 of housing 37 is provided with a slide switch SW7 having an operating knob 60 which controls the movement of the sliding pole 61 of the switch. The sliding pole 61 can be moved to positions bridging selected stationary contacts 62, 63, 64 and 65, the contact 65 representing the "off" position of the switch. In the "off" position of pole 61, said pole bridges contacts 64 and 65. The pole 61 can be set to various selected positions, for example, to a position wherein it bridges contacts 62 and 63 in which case only the timer switch unit T2 is effective, as will be presently described. Likewise, the pole 61 may be moved to a position wherein contacts 62, 63 and 64 are bridged, in which case the timer switch unit T3 is also effective.

As shown in FIG. 6, timer switch unit T3 is connected between the positive battery wire 50 and contact 64, switch T2 is connected between battery positive wire 50 and contact 63, and timer switch unit T5 is connected between the positive battery wire 50 and the wire 49. A "test" pushbutton switch P2 is connected between the positive battery wire 50 and switch contact 62. The wire 49 is connected to contact 62, as shown in FIG. 6.

Mounted on the front panel 55 of housing 37 is an electric clock assembly 66 provided with a switch unit SW3 operated in a conventional manner by the clock mechanism and being settable to close at a predetermined future time, in the manner of a conventional electric alarm clock.

The clock 66 may be either a conventional electric clock, or a conventional spring-wound clock, in either case being provided with means so that it can be set to close its switch contact SW3 at a settable future time within 12 or 24 hours in the future, depending upon whether the clock is of the 12-hour type, or of the 24-hour type.

As shown in FIG. 6, one terminal of the motor of timer 51 is connected to the positive battery supply wire 50 through the

clock switch contact SW3. The other terminal of the timer motor is connected to the negative battery supply wire through the normally closed contact K2b of a relay K2. The timer switch unit T1 is connected in parallel with relay contact K2b. The timer indicating lamp 67 is connected in parallel with the terminals of the timer motor. Another indicating lamp 68 is connected across the battery wires 47 and 50 through the clock-controlled switch contacts SW3.

The winding of the relay K2 is connected across the battery wires 50 and 47 through the contacts K1a of a detector relay K1. An indicator lamp 69 is connected in parallel with the winding of the relay K2.

As will be seen from FIG. 6, the contacts K2b are normally closed, whereby timer 51 will become energized responsive to the closure of the clock-controlled contacts SW3. Also, the timer will be held energized shortly thereafter by the closure of its timer switch unit T1.

Housing 37 also contains a starter relay K3. The winding of relay K3 is connected between positive battery supply wire 50 and negative battery supply wire 47 through the normally closed contacts K2a of the relay K2 and the timer switch unit T4. An indicator lamp 70 is connected in parallel with the winding of the relay K3. The contacts K2a of relay K2 comprise a pole 72 normally in engagement with a stationary contact 72a, but disengageable therefrom responsive to energization of the relay K2. Relay K3 is provided with a set of auxiliary contacts K3a which close responsive to energization of relay K3. The contacts K3a are connected between the polarity switch SW1 pole 79, and a terminal 75 of the jack 40. Terminal 75 connects with a corresponding prong 76 of plug 39, leading to the ignition wire 77. Thus, said ignition wire 77 becomes connected to the positive battery wire 50 responsive to the closure of contacts 71-73 associated with the relay K2, and the ignition wire 77 is maintained connected to said battery positive wire 50 by the closure of the contacts K3a of the relay K3.

Housing 37 has a double-pole manually-controlled switch SW2 mounted on its front panel 55, said switch comprising the respective switch sections SW2a and SW2b. The switch section SW2a is connected through a fuse F1 between a terminal 78 of jack 40 and one pole 79 of a two-pole manually-controlled switch assembly SW1. The switch SW1 is provided to take care of situations wherein the ungrounded terminal of the automobile electrical system may be either positive or negative. It will be seen that the pole 79 in one position engages a stationary contact 80 connected to the positive battery wire 50. In the opposite position of pole 79, it engages a contact 81 connected to the negative battery wire 47. Thus, the jack terminal 78 may be connected through the contacts of SW2a either to the wire 50 or the wire 47, depending upon the position of pole 79 of switch SW1. The cooperating pole 82 of switch SW1 is connected to ground and may correspondingly be engaged with either a contact 83 connected to wire 47 or a contact 84 connected to wire 50, whereby the appropriate one of the battery supply wires may be grounded. In the position of the switch poles of switch SW1 illustrated in FIG. 6, the positive battery supply wire 50 is the ungrounded battery terminal and the negative supply wire 47 is connected to ground through switch pole 82 and contact 83.

The main control switch SW2 is a double-pole switch, having respective sections SW2a and SW2b. As previously mentioned, section SW2a is connected in circuit with pole 79 and jack terminal 78.

Jack terminal 78 is conductively-engaged by a prong 84 of the four-pin jack 39, said prong 84 being connected through the cable 38 to the "battery" terminal 85 of the key-operated, conventionally-operated key ignition switch 86.

Another terminal 87 of jack 40 is connected through a set of contacts K3b of relay K3 to positive battery wire 50 through the parallel-connected contacts K3a and 71-73 of the set of contacts K2a and elements 79-80 of switch SW1. Terminal 87 is engaged by a pin 88 of plug 39, said pin being connected by a conductor of cable 38 to the "starter" terminal 89 of the key-controlled switch 86.

Pin 88 is also connected to the starter relay-energizing wire 90 controlling the conventional starter motor relay of the vehicle. The starting relay is thus suitably energized responsive either to the operation of the conventional key-controlled switch 86 or the connection of jack terminal 87 to wire 50 through the relay contacts K_{3b} and either K_{3a} or 71—73 and switch SW1 elements 79—80.

Jack 40 is also provided with an "accessory" terminal 91 which is connected through a manually-controlled switch SW6 and the contacts K_{2c} of relay K_2 and through elements 79—80 of SW1 to positive battery wire 50. Plug 39 has a pin 92 engageable with terminal 91, the pin 92 being connected through a conductor cable 38 to the "accessory" energizing wire 93 of the motor vehicle, and also to the "accessory" terminal 94 of the conventional key-controlled switch 86. The "ignition" terminal 95 of switch 86 is connected to the ignition wire 77, previously-mentioned, whose energization is controlled by relays K_3 and K_2 , since terminal 75 is connected to positive wire 50 through either contacts K_{3a} or 71—73.

Housing 37 also includes a starting detecting circuit, designated generally at 96. The vehicle ignition coil is shown diagrammatically at 97, said ignition coil being pulsed in the conventional manner by the distributor mechanism diagrammatically illustrated at 98. The breaker points, shown at 99, include the grounding wire 100 connected to the low tension coil portion of ignition coil unit 97. The low tension terminal 101 of ignition coil 97 is connected through the contacts SW2b of switch SW2 and a capacitor C1 to one terminal of the primary of the input transformer TX of the detection circuit 96. The other terminal of the primary coil of transformer TX is connected to the positive battery wire 50. One terminal of the secondary winding of transformer TX is connected through an adjustable resistor unit R1 to battery supply wire 50. The remaining terminal of the secondary winding of transformer TX is connected to the base or "N" terminal of a suitable PNP transistor 102, as shown in FIG. 6. The collector, or upper P terminal of transistor 102 in FIG. 6 is connected to one terminal of the winding of a sensitive relay K1, by a wire 103, as shown, the other terminal of the winding of the relay K1 being connected to the negative battery wire 47. A filter capacitor C_2 is connected in parallel with the winding of relay K_1 . Said filter capacitor is of the order of 100 microfarads at a working voltage of 12 volts. The input capacitor C_1 is of the order of 10 microfarads at a suitable working voltage, and acts as a coupling capacitor. A resistor R_3 of the order of 3300 ohms is connected between the collector wire 103 and the battery wire 50. An emitter return resistor R_2 is connected between the emitter, or lower P terminal of transistor 102, as shown in FIG. 6, and the battery wire 50. Resistor R_2 is of the order of 82 ohms in resistance. The variable resistor R_1 is employed for the purpose of adjusting detector sensitivity, and comprises a potentiometer having a maximum resistance of the order of 5000 ohms.

The contacts K_{1a} of relay K1 are connected between one terminal of the winding of the relay K_2 and the negative battery wire 47, the other terminal of the relay winding of relay K_2 being connected to battery wire 50, as previously described.

Transistor 102 is of a suitable conventional germanium type, for example, of a suitable PNP type, usable as a relay driver. The level of the input signal is adjusted by the step-down transformer and the adjustable resistor R_1 to the proper level for the base of the transistor 102. The input transformer TX is likewise of a conventional type, for example, having a primary resistance of 1500 ohms and a secondary resistance of 500 ohms.

In operation, assuming the polarity switch SW1 to be set in the proper position corresponding to the associated vehicle, for example, in the "negative ground" position shown in FIG. 6, the power switch SW2 is turned on. This closes switch SW2a and SW2b. This connects the supply wire 50 to the positive terminal of the vehicle battery, since this connects the switch pole 79 to the vehicle positive battery wire shown at

105 in FIG. 6. The closure of the switch unit SW2b connects the low tension distributor coil terminal 101 to the primary winding of the transformer TX at the input of the detector circuit 96, and thus allows the detector circuit to receive signals from the car ignition system. It will also be seen that the switch unit SW2b, when in its open position, protects the transistor 102 from damage from extraneous input signals when the apparatus is not in use.

At this point, the availability of power may be checked by closing a pushbutton switch P, connected in series with an indicator lamp 106 between wires 47 and 50. If the vehicle battery is properly charged, the lamp 106 will accordingly glow brightly when the pushbutton switch P is closed.

The clock-controlled switch SW3 is set for closure at a predetermined future time by the conventional setting means provided on the clock device 66.

When the designated starting time is reached, the switch unit SW3 closes, energizing the timer 51 through the normally closed relay contacts K_{2b} . At this point the indicator lamp 67 connected in parallel with timer 51 becomes energized. Closure of the timer switch unit SW3 also energizes the indicator lamp 68, which stays energized as long as switch SW3 remains closed. The lamp 67 remains energized as long as the timer 51 is running.

Timer 51 starts running from its stopped (normal) position, shown in FIG. 6, with index marker 54 located adjacent notch 53 of disc 52. Disc 52 shows the energization of the timer 51 by its rotation, and likewise indicates when the accelerator pedal 12 will be depressed when the unit will attempt to start the engine, namely, by the location of the index marker 58 and the location of the index marker 59. Likewise, additional operations of the accelerator pedal 12 can be predicted from the locations of index markers 57 and 56.

Shortly after the timer 51 starts to operate, the timer switch unit T1 closes, shunting the relay contact K_{2b} .

Let it be assumed that the slide switch SW7 has its pole 61 in the position illustrated in FIG. 6, namely, the "2" position. In the course of operation of the timer 51, the next switch closure occurs when the switch unit T3 closes. In this position the indicator disc 52 has been rotated to bring the notch 53 adjacent the indicator marker 56. The accelerator pedal-operating motor 17 is energized through a circuit comprising battery supply wire 50, switch unit T3, contact 64, slide switch pole 61, wire 49, relay contacts 45—44, the winding of motor 17, relay contacts 41—42, and the ground wire 47. Motor 17 winds up cable 25 on reel 19, allowing the contacts of switch SW4 to close because of the disengagement of lug 24 from spring arm 22. This shunts the timer switch units T3, T2, and T5, as will be apparent from FIG. 6. Cable 25 pulls accelerator pedal 12 downwardly. When the accelerator pedal is completely depressed, switch SW5 closes. This energizes relay K4 through a circuit comprising wire 50, switch SW4, wire 49, switch SW5, wire 48, the winding of relay K4, and grounded wire 47. This reverses the current applied to motor 17 since relay pole 41 swings into engagement with contact 43 and relay pole 44 swings into engagement with contact 46. Also, the holding contacts K_{4c} of relay K4 close, holding relay K4 energized and maintaining motor 17 energized in its reversed connection until reel 19 returns to its starting position, causing switch SW4 to open. The return of reel 19 to its starting position causes cable 25 to unwind and releases the accelerator pedal 12, which returns to its normal position by the action of its associated biasing spring means. Since, at this time, the switch unit T3 and the switch SW4 are both open, the relay K4 becomes deenergized.

If the switch SW7 is in the "1" position, pole 61 does not engage contact 64, but only engages contacts 62 and 63. Thus, under these circumstances, the closure of switch T3 does not cause the accelerator pedal 12 to become depressed, as above-described. However, the above-described operation will occur with the closure of the timer switch unit T2, which is the next step taking place in the cycle of operation of timer 51. At this time, the disc 52 has been rotated so that the notch 53

is adjacent the second "gas" indicator marker 57, whereas the closure of the switch T_3 occurred when notch 53 was opposite the first "gas" indicator 56. With the pole 61 of switch SW7 in the "off" position, the closure of the switch units T_3 and T_2 does not cause energization of motor 17 so that the accelerator pedal 12 is not depressed.

The next step of operation of the timer 51 causes the closure of switch unit T_4 , at which time, the disc 52 has been rotated so that the notch 53 is adjacent the "start" index marker 59. Relay K_3 becomes energized by a circuit comprising wire 50, switch T_4 , the winding of relay K_3 , the contacts 72a-72 of relay K_2 , and ground wire 47. The indicator lamp 70 connected in parallel with the winding of relay K_3 becomes energized at this point. Relay contacts K_{3a} and K_{3b} close, energizing the ignition system of the vehicle by connecting ignition wire 77 to positive battery wire 50 through pin 76, terminal 75, and relay contacts K_{3a} , and connecting the starter relay wire 90 through pin 88, terminal 87, and relay contacts K_{3b} and K_{3a} to said positive battery wire 50.

As soon as the engine starts, a signal from the ignition coil terminal 101 is applied to the base of transistor 102 through the coupling capacitor C_1 and the coupling transformer TX. The transistor 102 conducts, causing the relay K_1 to become energized.

The detecting circuit 96 may be adjusted as to sensitivity by means of the potentiometer R_1 so that it will be sensitive to the starting of the vehicle engine sufficiently to cause the desired energization of relay K_1 .

With the energization of relay K_1 , its contacts K_{1a} close, causing the relay K_2 to become energized. This also causes energization of the "run" indicator lamp 69. Relay contacts K_{2a} are operated responsive to energization of relay K_2 , causing contacts 72a and 72 to open, thereby deenergizing relay K_3 . This opens relay contacts K_{3b} , causing the vehicle starting motor to stop. Relay contacts K_{3a} open, but the ignition circuit is maintained intact by the closure of contacts 71-73 of relay contact pair K_{2d} . If the accessory control switch SW₆ is closed, the accessories are also energized by the closure of relay contacts K_{2c} .

The timer contacts T_4 stay closed for a period of about 5 seconds, said period of closure being adjustable by conventional means provided in timer 51. While the contacts T_4 remain closed, if the vehicle engine starts, relay K_2 becomes energized and relay K_3 becomes deenergized. However, if the motor stalls, the relay K_2 becomes deenergized, causing relay K_3 to become energized. Thus, the reenergization of relay K_3 produces another attempt to restart the vehicle motor. This action continues until the vehicle motor starts and runs, or until timer contacts T_4 open, or the manually-operated switch SW2 is opened.

If the motor has started, the timer 51 continues and operates the timer contacts T_5 , namely, when notch 53 reaches the index marker 58, producing another actuation of the accelerator pedal 12, for the purpose of releasing the automatic choke, thus preventing the engine from running at a high speed longer than necessary. The interval between starting and the closure of the contacts T_5 is adjustable and is of the order of 2 or 3 minutes.

After one complete timer cycle, if the automobile engine is still not running, the timer 51 will not stop, but will go through another cycle. If the automobile motor does not run, the cycles will be repeated until the clock-controlled switch SW₃ opens, the number of cycles being determined by the duration of closure of the switch unit SW₃ and the timer cycle of timer 51. Alternatively, the manually-operated switch SW2 may be manually opened.

The dwell of the clock-controlled contacts SW₃ preferably should be sufficient to allow a reasonable number of starting cycles, for example, approximately six starting cycles.

After the car starts, the timer 51 will always stop responsive to the opening of the contacts T_1 of the timer. The opening of contacts T_1 takes place when the notch 53 reaches the "stop" index marker 54. Thus, the next operation will start with disc 52 in the position shown in FIG. 6.

The provision of the test pushbutton switch P_2 connected across wire 50 and terminal 62 allows testing of the accelerator pedal operating mechanism without any attempt to start the engine. Closure of switch P_2 has the same effect as closure of any other timer contacts T_5 , T_2 , or T_3 , as above-described, and will cause a complete cycle of operation of the accelerator pedal-depressing mechanism.

As has been previously-mentioned, the present invention allows a person to have his car started, warmed up and heated any time during a twenty-four-hour period, simply by presetting a clock alarm, thus eliminating the inconvenience of having to start the car manually under adverse weather conditions and waiting for the engine to warm up. With the present invention, the operator needs only to set the clock alarm the previous evening before leaving the car for the night, in order to find it started, warmed up, and heated the next morning when he is ready to drive.

In addition to the above general advantageous feature of the invention, the present invention also provides the following important advantages:

1. It improves the starting action of a car, that is, it is more sensitive than human responses and detects the starting of the engine instantaneously, thereby eliminating human mistakes such as:
 - a. keeping the ignition key on "start" position too long; or
 - b. flooding the engine.
2. It becomes an indicator to the operator as to when the car needs a tuneup or maintenance in the starting system, that is, when the unit of the present invention is unable to start the car.

Further summarizing the mode of operation of the present invention, it will be understood that the car is left in "neutral" or "park" condition. Following are the general steps in the operation of the invention:

1. Depending upon the setting of the switch SW7, when the appropriate switch unit or switch units close, the gas pedal is depressed and released by the motor once, twice, or not depressed at all if switch SW7 is left in the "off" position.
2. The starter of the car is activated while battery voltage is simultaneously supplied to the ignition system.
3. The starting and running of the car are detected electronically by the detector circuitry 96.
4. With the starting of the car, the starter is deactivated, the motor is kept running, and the timer 51 is allowed to complete its cycle.
5. If the motor does not start, the apparatus will keep trying until it does start, or the clock alarm or the power switch SW2 is turned off.
6. The sequence of operation is monitored by the indicators on the control panel 55.
7. Battery powers accessories after the car starts if switch SW6 and the appropriate controls on the vehicle dashboard are turned on.

The operator may choose one of the following procedures to follow after the car starts:

1. Without use of the ignition key, he may drive the car, allowing the timer to complete its cycle automatically. The indicator lamp 69 stays energized until he turns the engine off by use of the power switch SW2.
2. The operator may turn the power switch SW2 off and restart the car with the ignition key.
3. He may insert the ignition key and turn it to its "on" position, avoiding a complete turn to its "start" position. After the timer completes its cycle, the operator turns the power switch SW2 off.

If the car fails to start by the action of the apparatus of the present invention, the power switch SW2 should be turned off (and the timer 51 set manually to "stop" position by turning the timer disc 52 to this position, in the same direction as the normal direction of rotation, namely, in a clockwise direction, as viewed in FIG. 6), while the car is started manually.

As previously described, the apparatus of the present invention is designed to be used in cars, or other vehicles, both with

positive or negative grounds. The polarity switch SW1 must initially be set for the proper polarity. When this is done, the timer, the detector circuit, the motor 17, and the release relay K4 will always receive the proper polarity of voltage, as indicated in FIG. 6, and described above.

While a specific embodiment of an improved automatic starting system for a motor vehicle has been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore, it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

I claim:

1. In an automatic starting system for a motor vehicle of the type having an accelerator pedal, an ignition system including an ignition coil and breaker contacts connected to said coil and an electric starter, a clock having a clock switch and means to close said clock switch at a selected future time, an electric timer having at least three sequentially-closing timer switch units, the first of which is a normally open timer-cycle-holding switch unit held closed during a definite running cycle of the timer, starting-responsive relay means having a pair of normally closed contacts, opening responsive to energization thereof, a source of current connected to said timer through said clock switch and contacts, circuit means connecting said holding switch unit across said contacts, means to energize said timer sufficiently to close said holding switch unit responsive to closure of said clock switch, electrical accelerator pedal-operating means to depress and release said pedal, means to energize said pedal-operating means responsive to closure of a second timer switch unit, means to simultaneously energize said ignition coil and starter responsive to closure of a third timer switch unit, means to generate a steady pulsating electrical signal responsive to steady operation of said breaker contacts after the vehicle engine has been started, means to energize said relay means, whereby to open said contacts, responsive to said steady pulsating electrical signal, and means to deenergize said starter responsive to the energization of said relay means, wherein said accelerator-operating means comprises a reversible electric motor, means drivingly-connecting said motor to the accelerator pedal, and means to reverse the connections of the motor responsive to a substantial amount of depression of said pedal, and wherein the means drivingly-connecting the electric motor to the pedal comprises a pulley connected to the motor shaft, a flexible cable wound on said pulley, an arm secured to the pedal,

means slidably-connecting said flexible cable to said arm, and abutment means adjustably-mounted on said cable drivingly-engageable with the arm responsive to winding up of the cable on the pulley, whereby the amount of depression of the pedal required to reverse the connection of the motor can be regulated in accordance with the adjusted position of said abutment means on said cable.

2. The automatic starter system of claim 1, and wherein the timer has at least one additional timer switch unit closing subsequent to the closure of the second timer switch unit during the running cycle of the timer, and means to reenergize said pedal-operating means responsive to closure of said additional timer switch unit.

3. The automatic starter system of claim 2, and wherein said additional timer switch unit closes before the closure of said third timer switch unit.

4. The automatic starter system of claim 2, and wherein said additional timer switch unit closes subsequent to the closure of said third timer switch unit.

5. The automatic starter system of claim 2, and wherein the vehicle includes a circuit for accessories, and means to energize said accessory circuit responsive to energization of said starting-responsive relay means.

6. The automatic starting system of claim 5, and means to apply the proper battery polarities, whether the vehicle has a negative or positive grounded electrical system, to said ignition coil and starter and to said circuit for accessories.

7. The automatic starter system of claim 1, and wherein the means to reverse the motor connections comprises reversing relay means having a pair of poles and reversing contacts connected in circuit with the motor, switch means operated responsive to said substantial amount of depression of said pedal, and a source of current connected to said reversing relay means through said last-named switch means.

8. The automatic starter system of claim 7, and wherein said arm extends laterally from said pedal and is formed with an aperture, said flexible cable extending slidably through said aperture, and wherein said abutment means comprises a collar adjustably secured on said cable above said arm.

9. The automatic starter system of claim 8, and wherein said last-named switch means comprises a normally open limit switch mounted subjacent the free end portion of the accelerator pedal.

10. The automatic starting system of claim 1, and means to adjust the sensitivity level of said relay means so as to energize responsive to said pulsating electrical signal.

50

55

60

65

70

75