

[54] AUTOMATIC STARTING DEVICE FOR
AUTOMOTIVE ENGINES AND THE LIKE

[76] Inventor: Gim Wong, 1849 Gibbs Road,
Estevan, Saskatchewan, Canada

[22] Filed: May 3, 1971

[21] Appl. No.: 139,800

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 2,250, Jan. 12, 1970,
abandoned.

[52] U.S. Cl. 290/38, 290/37
[51] Int. Cl. H02p 9/04
[58] Field of Search 318/163, 102;
290/37, 38, 38 A; 123/179 B; 307/141.8

References Cited

UNITED STATES PATENTS

3,009,067 11/1961 Janeczko et al. 290/38
3,234,448 2/1966 Link 307/141.8 X

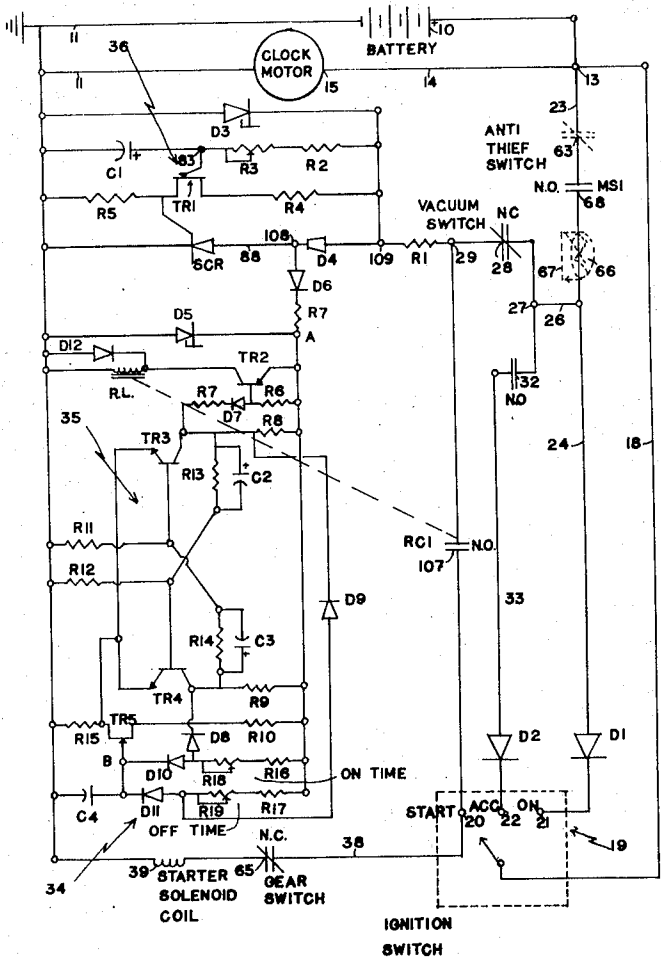
3,234,410 2/1966 Sherman 307/141.8 X
3,154,689 10/1964 Bubbenmoyer 290/38
2,975,296 3/1961 Dominquez-rego 290/38 X
2,710,926 6/1955 Charles 290/37
2,791,699 5/1957 Taylor 290/38
3,043,963 7/1962 Teikari 290/38 X
3,130,318 4/1964 Curtis 290/38

Primary Examiner—G. R. Simmons
Attorney—Kent & Ade

[57] ABSTRACT

A 24-hour time clock has a plurality of setting pins which enable the automatic starting device to be programmed to operate at any interval desired and can eliminate certain days such as Saturday and Sunday if desired. In conjunction with the clock, means limit the attempts to start to a predetermined time interval. The device also switches the engine off after any predetermined amount of running time.

11 Claims, 9 Drawing Figures



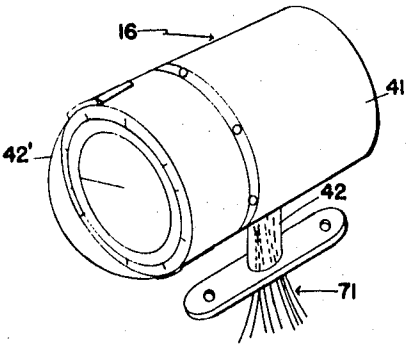


FIG. 1

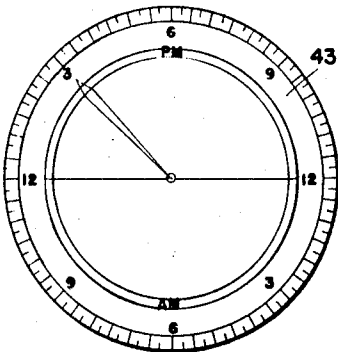


FIG. 3

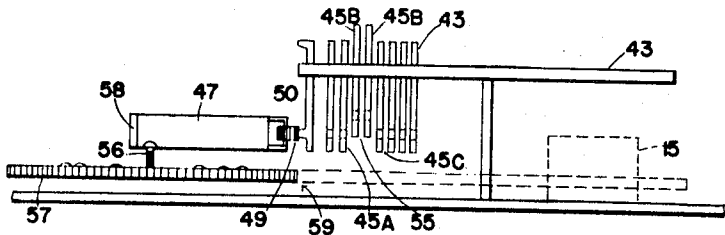


FIG. 5

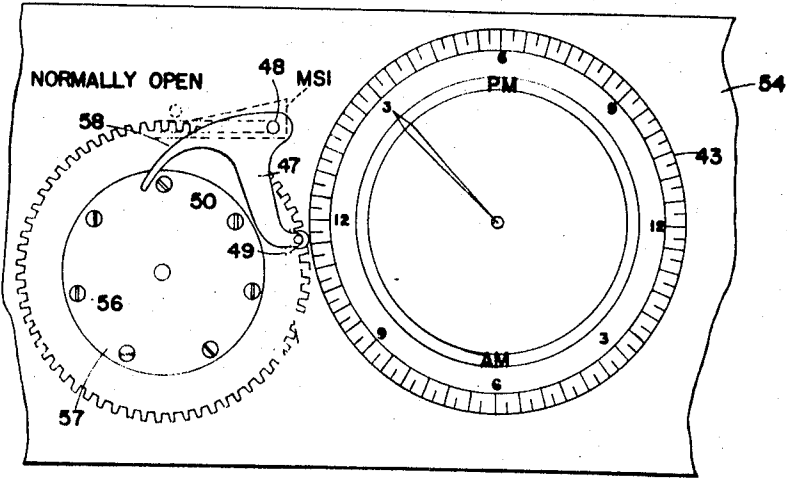


FIG. 6

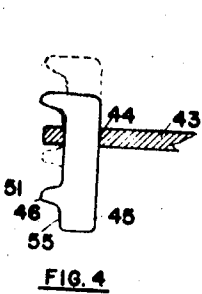


FIG. 4

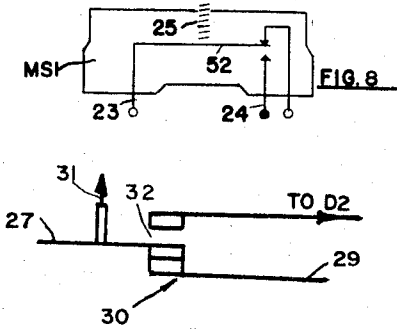


FIG. 9

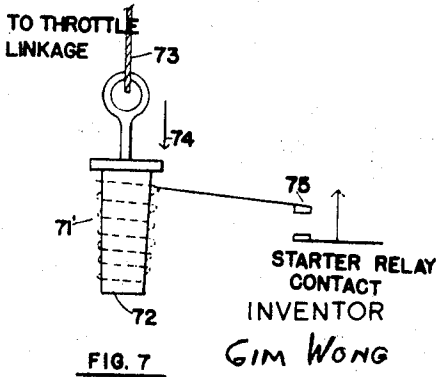


FIG. 7

GIM WONG
BY *Kew J. Lee*

2 Sheets-Sheet 2

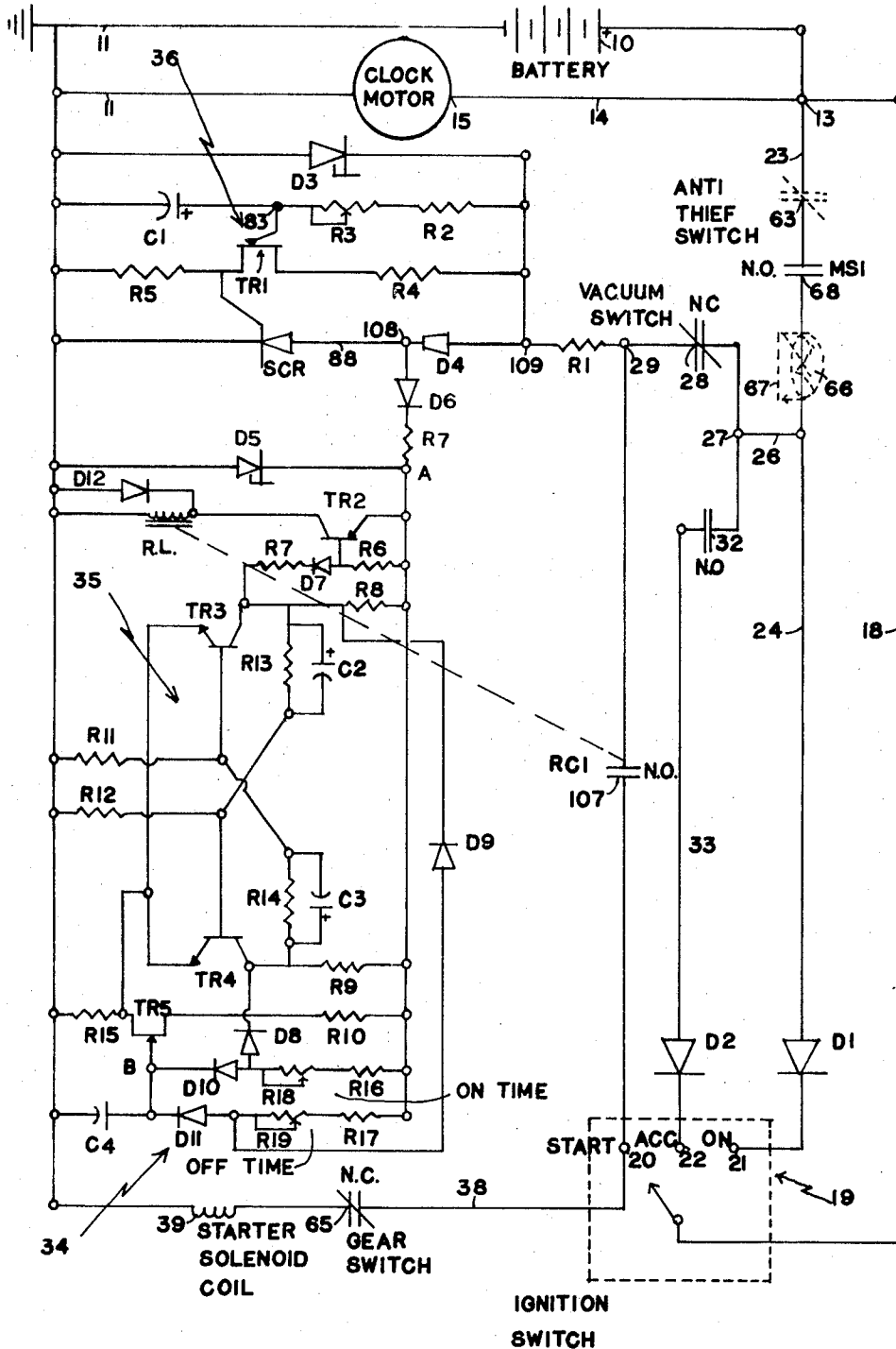


FIG. 2.

INVENTOR.

GIM WONG

BY

[Signature]

AUTOMATIC STARTING DEVICE FOR AUTOMOTIVE ENGINES AND THE LIKE

This invention relates to new and useful improvements in automatic starting devices for automobiles and the like, and constitutes a continuation-in-part of my application Ser. No. 2250 filed Jan. 12th, 1970, now abandoned.

It is desirable, particularly in areas experiencing cold weather, to start the car at intervals when it is left standing for considerable periods.

Of course, it is appreciated that if a source of power is available, block heaters and internal car warmers can be used, but such devices cannot be used in areas without power and in any event, in very cold climates, they are not particularly satisfactory.

Many automatic starting devices have been designed, but they all suffer from several disadvantages.

One of the principal disadvantages is due to the fact that if the engine does not start, then the automatic starting device continues to attempt to start the engine until the battery fails.

Another fault of existing devices is that the accessory switch is required to be "on" if it is desired to have the interior fan heater operate to warm the interior of the car when the car starts. This means that as soon as the automatic device cuts into the circuit, the heater fan begins to operate thus taking a certain amount of current from the battery at a time when all power is required for starting under cold conditions.

A yet further fault of conventional devices is that the timers have to be reset daily otherwise the time continues to operate even under circumstances where it is not desired such as Saturdays or Sundays or holidays.

The present invention overcomes all of these disadvantages by providing a clock which can be set to operate at intervals throughout a 24-hour period and which furthermore can be set to not operate on certain days in a 7-day period.

A further object of the invention is to provide a device of the character herewithin described in which the engine can be operated for predetermined amounts in 15-minute increments.

A yet further object of the invention is to provide a device of the character herewithin described which automatically shuts off if the car has not started within a predetermined period. The time I normally utilize for this purpose is 4 minutes.

Another object in conjunction with the foregoing object is to provide a device of the character herewithin described in which the starter operates for a few seconds, in each of the minutes the car is attempted to be started. For example, and on a purely arbitrary basis, I have designed the device to attempt to start the car for 7 seconds, and then to rest for 53 seconds in a 4-minute starting sequence. This enables the battery to recuperate.

A further object of the invention is to provide a device of the character herewithin described which is automatically eliminated from the ignition and starter circuit once the engine has started with the exception that the engine is automatically switched off after a predetermined amount of time set upon the timing device or clock.

With the foregoing in view, and such other or further purposes, advantages or novel features as may become apparent from consideration of this disclosure and specification, the present invention consists of, and is

hereby claimed to reside in, the inventive concept which is comprised, embodied, embraced or included in the method, process, construction, composition, arrangement or combination of parts, or new use of any of the foregoing, of which concept, one or more specific embodiments of same are herein exemplified as illustrative only of such concept, reference being had to the accompanying Figures in which:

FIG. 1 is an isometric view of the device enclosed in a casing and suitable for mounting within the car body.

FIG. 2 is a circuit diagram of the device.

FIG. 3 is a front elevation of the clock face.

FIG. 4 is an enlarged fragmentary sectional view of one side of the clock dial showing one of the setting pins.

FIG. 5 is a side elevation partly schematic of the clock face with the setting pins and actuating arm.

FIG. 6 is a plan view of FIG. 5.

FIG. 7 is a partly schematic view of the throttle actuating device.

FIG. 8 is a schematic view of one of the micro switches.

FIG. 9 is a schematic view of a vacuum switch.

In the drawings like characters of reference indicate corresponding parts in the different figures.

Proceeding therefore to describe the invention in detail, reference should first be made to FIG. 2 in which 10 illustrates the battery of the automobile with a lead 11 to ground and the positive lead 12 connected to a junction 13.

One lead 14 extends from the junction 13 to a time clock motor 15 of a time clock collectively designated 16, ground lead 11 connected the other side to ground.

A further lead 18 extends from junction 13 to a conventional ignition switch collectively designated 19 which includes a starting solenoid terminal 20, a "on" terminal 21, and an accessory terminal 22. As the operation of this ignition switch is conventional, further details are not believed necessary.

A further lead 23 extends from junction 13 to a first switch means taking the form of a micro switch MS1 and lead 24 extends from MS1, through a blocking diode D1, to the "on" terminal 21 of the ignition switch. MS1 is a normally open type micro switch, the circuitry being shown schematically in FIG. 8. The lead 23 connects to the micro switch which is normally held in the position shown in FIG. 8 by means of spring 25 which is biased upwardly with respect to FIG. 8.

A branch lead 26 extends from lead 24 to vacuum switch 30 which is shown schematically in FIG. 9. It is normally connected as illustrated in FIG. 2 with lead 27 extending to normally closed contacts 28 which in turn connects to lead 29. The vacuum switch is operatively connected to the inlet manifold of the engine (not illustrated) and this connection is indicated schematically by reference character 31 in FIG. 9.

When the contacts 32 are closed by the vacuum of the engine 30, current from the battery extends via lead 26, through contacts 32 to lead 33 and thence to the accessory terminal 22 via blocking diode D2 as clearly shown in FIG. 2. This means that when the engine is running, and the ignition switch is at the accessory position, items such as the fan motor will operate.

However, when the engine is not running, current will be blocked to accessory terminal 22 because vacuum switch contact points 32 would be open.

FIG. 1 shows a preferred embodiment of the timer clock 16 including a casing 41 and a support 42 which will enable the device to be secured within the passenger compartment of a car so that it is readily visible. However, it will be appreciated that the clock can be mounted anywhere that it is desired.

A plastic cover 42' made of clear plastic covers a movable clock face or rim 43, said rim being divided into 15-minute increments as clearly shown and having certain hour indicia marked thereon, it being understood that one revolution of the rim 43 takes place every 24 hours.

The rim or face 43 is rotated by the clock motor 15 through gears in the normal way and a plurality of apertures 44 are formed around the periphery of the rim, there being one aperture for every 15-minute increment marked on the clock rim. Friction engaging setting pins 45 engage apertures 44 and may be moved from the normally "down" position shown in full line in FIG. 4 to the "up" or "set" position shown in phantom in FIG. 4. Each pin is provided with an offstanding projection 46 facing outwardly of the rim 43, which projection moves upwardly adjacent the underside of the rim when the pin is moved to the "up" or "set" position.

Mounted adjacent the rim 43 is a pivot arm 47 mounted upon a pivot pin 48 and having a roller 49 journaled upon one leg 50. This roller 49 normally engages the outer surfaces 51 of the setting pins 45 when they are in the "down" position, a simple spring (not illustrated) maintaining the roller 49 in contact with these projections as the clock face or rim revolves. Pivot pin 48 is connected to the actuating arm 52 of micro switch MS1 and the projections 46 of the setting pins 45 maintain this micro switch in the normally open position.

However, when any of the setting pins 45 are in the "up" position, then the roller will move when it reaches this particular pin thus rotating pivot pin 48 and closing micro switch MS1 and supplying current to the circuit through the normally closed contacts 28 of the vacuum switch 30.

The electronic circuitry shown in FIG. 2 includes time constant circuit comprising a resistor and capacitor network collectively designated 34 and a bi-stable multivibrator circuit collectively designated 35. The circuitry of 34 and 35 are conventional in operation.

A further electronic timer switching circuit is collectively designated 36 and the time delay is dependent on the value of the resistance of the resistors R2 and R3 and capacitor C1 together with the characteristics of the unijunction transistor TR1 and the silicon control rectifier SCR. Desirably, the RC time constant is invariable between 4 minutes and 8 minutes by varying the setting of the reostat of R3 which, if set for the RC time constant of 4 minutes, will delay the full charge of capacitor C1 to the peak voltage for this time. However, when the peak voltage has been reached, TR1 triggers the SCR 4 minutes after the initial voltage is applied to the circuit by the closing of MS1.

The resistor R1 and the zener diode D3 forms a voltage stabilizer network for the circuitry and R5 is the gating resistor of the SCR, with D4 the clamping diode for same.

The bistable multivibrator circuit 35 is triggered by the unijunction transistor TR5 and the "off" timer of this circuit depends on the value of the resistors R17,

R19 and C4 of the timing circuitry 34 and this time varies from 45 seconds to 70 seconds desirably, by varying the setting of R19. As an example, if this setting is 53 seconds, then after this period, TR2 is cut off.

The resistors R16, R18 and capacitor C4 forms another timer network and the "on" time (TR2 is in a conducting or "on" state) is dependent on the value of the resistors R16, R18 and capacitor C4. The RC time constant may be varied from 5 to 10 seconds by setting R18 and desirably 7 seconds, an optimum setting.

The transistor TR2 is a relayed driver transistor and it conducts only when TR3 is "on" or in the conducting state.

The transistors TR3 and TR4 form the bistable multivibrator which is triggered by a positive pulse from R15 which connects to the base of the unijunction transistor TR5.

This means that two different C4 charging circuits are formed firstly by R16 and R18 (on time) and R17 and R19 (off time) and the bistable multivibrator operated in diode gate that selects the charging circuit at any particular instance.

The zener diode D5 and resistor R7 form a voltage stabilizer network to supply a constant voltage for transistors TR2, TR3, TR4, TR5 and the associated circuitry.

In operation, MS1 is normally open but when closed by the clock timer setting pins as hereinbefore described, current from the battery 10 flows through leads 12, 23, 24 and 26 to the common contact 27 through normally closed contacts 28 to junction 29 and thence to R1 through D4, D6 and R7 to junction A. If it is assumed that TR3 is in the "on" or conducting state, then D9 is forward biased and D8 is reversed biased so that R17 and R19 are out of the circuit and C4 is charged via R16 and R18 only. When TR3 is conducting and TR4 is in the cut off state, TR3 forwardly biases TR2 via D7 and R7 which drives TR2 to conduct and thus energizes a relay coil RL for the preset time due to R16 and R18 and C4, namely, for this example, 7 seconds. The relay coil RL operates the normally open switch RC1 so that current may flow from junction 29, through the RC1 switch 107 to the ignition switch start terminal 20, through the lead 38 and the gear switch of the vehicle 65 (assuming the vehicle is in the "park" or "neutral" position) thus energizing the starter solenoid 39 to start the engine.

Assuming, for this example, that the first time the engine fails to start after 7 seconds, RC1 opens due to the time delay operating the relay RL. This is because the voltage at point B reaches the peak voltage of TR5 to fire and trigger the bistable multivibrator by the positive pulse from R15. This switches off transistor TR3 and removes the forward bias on the base of TR2 thus turning TR2 to the "off" or cut-off position and de-energizing the relay coil RL.

When TR3 is in the cut-off state, TR4 is conducting due to the characteristics of the bistable multivibrator operation. This is conventional and it is not believed necessary to give further explanation.

TR4 is conducting and the collector of TR4 is at zero voltage so that D8 is forward biased and D10 is reversed biased. This means that no current is flowing to C4 via R16 and R18.

The collector of TR3 at this time is near full positive supply voltage so D9 is reversed biased and D11 is forward biased which means that C1 is charged via R17

and R19 only. At the end of the preset time cycle, for example, 53 seconds, TR5 fires and triggers the multivibrator so that TR4 is cut off and TR3 is switched on. Under these circumstances, D9 is forward biased and D8 is reversed biased so that R17 and R19 are cut out of the circuit and C4 is then charged by R16 and R18 with TR2 being forward biased. This energizes the relay coil RL thus once again closing switch RC1 (107) so that once again current flows to the starter solenoid coil in an attempt once again to start the engine.

If the engine fails to start, the first, second, third or fourth time, the circuit will automatically cut off because after 4 minutes of the initial voltage applied to the timer circuits 36, the silicone rectifier SCR is fired because when the initial voltage is applied to the circuit via battery 10 to leads 24, 26, 27, 28, 29, R1 and 109, the capacitor C1 commences to charge through R2 and R3. The time taken for C1 to charge to the peak voltage of TR1 is the RC time constant of R2, R3 and C1.

When C1 is charged to the peak voltage of transistor TR1 (4 minutes, for example) then the unijunction transistor TR1 is fired so that a positive pulse is applied to R5 the gate resistor, to trigger the SCR.

Once SCR is fired, a heavy current flows in the anode circuit 88 so that a large voltage drop occurs across R1 and D4 to clamp the voltage. The voltage at junction 108 with respect to ground is approximately 1 to 2 volts and this depends on the characteristics of the individual silicone control rectifier SCR employed. The SCR is held in this state until the supply voltage is removed from the anode circuit by MS1 and the circuit operation repeats as soon as MS1 is switched "on" again.

If the engine is started say, for example, at the third attempt, the vacuum operates the vacuum switch 30 to move the movable arm 27. This opens the normally closed contact 28 and closes the normally open contact 32. With contacts 28 open, no current will flow through 29 and the following circuitry as hereinbefore described, when contact 32 is closed current may flow to the accessory circuit of the ignition switch of the vehicle to operate the appliances such as heater, fan motor, or the like always assuming that the manual switch of the individual appliance is in the "on" position.

The engine will run for the predetermined time set on the clock pin. As long as MS1 is open, there will be no current flow to the circuitry so that the automatic starter device is not operative. The circuitry can be installed on vehicles with positive ground simply by reversing the connection of junction 29 to ground and ground 11 to junction 29 position as shown in FIG. 2.

Furthermore, the circuits of the multivibrator 35 and the relay drive transistor TR2 can readily be replaced by any integrated circuit on the market with similar operation and functions.

Referring back to FIGS. 5 and 6, the roller 49 on the pivot arm 47 normally engages the outer surface 51 of the setting pins as hereinbefore described.

However, if one or more of the setting pins are raised as shown in FIGS. 4 and 5, when the roller 49 reaches the pin specifically designated 45A immediately before the raised pin specifically designated 45B, the roller commences to move inwardly as it rolls down the side of the pin 45A towards the outwardly facing lower side 55 of the raised pin 45B. This actuates micro switch MS1 and closes same and this micro switch MS1 will remain closed until it hits the next lowered pin specifically designated 45C. In FIG. 5, it will be noted that

there are two raised pins 45B so that micro switch MS1 would be closed for a period of 30 minutes, it being understood that each pin represents a time interval of 15 minutes. However, these times are purely arbitrary and they depend entirely upon the construction of the clock which is conventional.

From the foregoing, it will be appreciated that MS1 can be actuated in 15-minute increments at any time during a 24-hour period and can remain actuated or closed for any length of time in multiples of 15 minutes.

However, it is sometimes desirable not to actuate the device on, for example, Saturdays or Sundays, under which circumstances what are referred to as "day" screws 56 are used.

A disc 57 is mounted upon the support plate 54 adjacent pivot arm 47 and this disc is provided with seven set screws 56 maintained normally flush with the upper surface of disc 57. A second leg 58 of the pivot arm curves towards the circle defined by the day screws 56 and the plate 57 is connected by gearing generally designated 59 to the clock motor so that the disc rotates once in 7 days.

If it is desired that the clock does not operate the micro switch MS1 on 1 specific day, the relevant day screw 56 is screwed upwardly so that when it reaches the second leg 58, it maintains the pivot arm 47 in the normal position and prevents the roller 49 from dropping down onto the set pins 45B. As the day screw passes the end of the arm 58 by rocking the pivot arm, the device resets automatically and actuates the next following day.

Referring back to FIG. 2, and the operation of the device.

The various setting pins are pulled upwardly at preselected times for automatically starting and operating the automobile engine.

The clock permits the device to actuate at any time in a 24-hour period and for increments of 15 minutes or multiples thereof.

When the roller 49 of the arm 47 reaches a pin 45B which has been pulled upwardly, the operating sequence occurs as hereinbefore described.

One of the important aspects of the invention resides in the fact that current is not available to the accessory terminal 22 until the car actually starts thus avoiding draining of the battery through the heater motor, for example, when all power is required at the starter solenoid.

The car will operate until roller 49 hits the next down pin 45C at which time it will climb this pin and be engaged by the projection 46 thus opening the normally open micro switch MS1 and removing current from the "on" terminal 21 of the ignition switch thus shutting down the motor until the next "up" pin is reached.

It will, therefore, be appreciated that the car can be started at any time during a 24-hour period, can be set to run for any given period in multiples of 15 minute increments, and can be set so that it does not start on any given day such as Saturdays or Sundays, for example.

Another important point is the fact that only four attempts to start can be made at any one setting and each of these attempts can only last for a period of 7 seconds in 1 minute thus giving the battery a 53-second rest period between attempts.

Incorporated in the circuit shown in FIG. 2, is an anti-theft switch 63 connected between lead 23 and micro

switch MS1 by means of lead 64. This anti-theft switch may be incorporated with steering and gear shift locks sometimes found on new automobiles and can be operated by a key in the normal manner.

Also in circuit between the start terminal 20 of the ignition switch and the starter solenoid is the conventional gear selector switch 65 which breaks the circuit to the starter solenoid unless the gear shift lever is in neutral or park.

Situated between MS1 and lead 24 is a conventional thermostat control 66 which may be bridged by a switch 67 shown in phantom if desired. This is designed so that the interior of the car may reach a given temperature whereupon the thermostatic switch opens and shuts down the engine even although the roller 49 may still be running across raised pins. Contact points 68 and 69 are present on MS1 and thermostat 67 and contact points 70 connect the thermostat to the lead 24. These contact points have been given reference characters so that the various leads collectively designated 71 extending from the support 42 of the clock, may be identified.

On cars not provided with automatic throttle control devices, I provide such a device shown in FIG. 9. A relay coil 71' surrounds a core 72 which is connected via cable 73 to throttle linkage (not illustrated) so that when the core is moved into the direction of arrow 74, the throttle is advanced slightly and a charge of gasoline is fed therethrough.

The coil 71' is connected between ground and the starter relay contact points 75 which operate when the starter solenoid 39 is actuated. Inasmuch as it is connected to the starter solenoid, when RC1 opens after the engine starts, the coil 71' de-energizes thus permitting the conventional throttle linkage springs to return the throttle to normal position. This facilitates the starting operation particularly in relatively cold climates.

Various modifications can be made within the scope of the inventive concept which is herein disclosed and/or claimed.

What is claimed to be the present invention is:

1. An automatic starting device for automotive internal combustion engines and the like which includes a battery and a battery charging means together with an ignition circuit, an electric starter, a starter solenoid circuit for energizing said electric starter, an accessory circuit for energizing electrical automobile accessories, and an engine intake manifold in combination with an electric motor operated clock timer having a revolving clock member and a plurality of circularly arranged setting pins incorporated in and dividing said clock member into equal time increments, normally open switch means selectively operable by any one of said setting pins to close said normally open switch means at a preset time and for a first predetermined time interval, said normally open switch means being connected on its one side to one side of said battery, and on its other side through a first circuit to the starting solenoid circuit, through a second circuit to the accessory circuit, and through a third circuit to the ignition circuit, a normally open relay switch in said first circuit, a first electronic timing means operable after said normally open switch means is closed for alternately closing said normally open relay switch for a second predetermined time interval and for opening said normally open relay switch means at the end of said second predetermined time interval for a third predetermined

time interval in continuing sequence, said normally open relay switch means when closed operatively connecting the battery to the starter solenoid circuit for starting said engine, and a second electronic timing means for deenergizing said starter solenoid circuit after said normally open switch means has been closed for a fourth predetermined time interval, said fourth predetermined time interval being less than said first predetermined time interval, and greater than said second and third predetermined time intervals.

2. The device according to claim 1 wherein said first electronic timing circuit includes a bistable multivibrator having alternating output states, means operable when said multivibrator is in one of said output states for energizing said normally open relay switch to close said relay switch, and operable when said multivibrator is in its other output state to deenergize said normally open relay switch, a first time delay circuit means for determining the length of time said multivibrator remains in said one output state, and a second time delay circuit means for determining the time the multivibrator remains in said other output state.

3. The device according to claim 2 wherein said first and second time delay circuit means include resistor-capacitor time constant circuits and adjustable resistor means for varying the time delay periods of the respective time delay circuit means.

4. The device according to claim 1 wherein said second electronic timing means includes a resistor-capacitor time constant circuit and means operable after the time delay interval established by said resistor-capacitor time constant circuit for deenergizing said normally open relay switch and opening same thereby deenergizing said starter solenoid circuit.

5. The device according to claim 1 which includes a vacuum switch means between said normally open switch means and said first and second electronic timing means, said vacuum switch means including a set of normally closed contacts in said first circuit between said normally open switch and said normally open relay switch, and a second set of contacts in said second circuit between said normally open switch and said accessory circuit, said vacuum switch means being operatively connected to the inlet manifold of said engine whereby vacuum in said manifold operates said vacuum switch and opens said normally closed contacts and closes said normally opened contacts.

6. The device set forth in claim 1 together with an ignition switch having a start terminal connected to said starter solenoid circuit, an accessory terminal connected to said accessory circuit, and an on terminal connected to said ignition circuit, and a movable contact means connected to said one side of said battery for selective engagement with said terminals of said ignition switch, said first, second and third circuits being connected to the start terminal, the accessory terminal and the on terminal respectively of said ignition switch, said first, second and third circuits in series with said normally open switch paralleling the movable contact means of said ignition switch and its connection to said one side of said battery whereby said automatic starting device may be used in lieu of said ignition switch for starting said engine.

7. The device according to claim 1 in which said first switch means takes the form of a normally open micro switch, said clock including a pivot arm operatively connected to said micro switch, a roller also on said

pivot arm operatively engaging said setting pins of said clock, said roller maintaining said micro switch open when engaging said setting pins, said roller closing said micro switch when it rolls off one of said pins to a location in which the next pin is withdrawn.

8. The device according to claim 2 in which said first switch means takes the form of a normally open micro switch, said clock including a pivot arm operatively connected to said micro switch, a roller also on said pivot arm operatively engaging said setting pins of said clock, said roller maintaining said micro switch open when engaging said setting pins, said roller closing said micro switch when it rolls off one of said pins to a location in which the next pin is withdrawn.

9. The device according to claim 3 in which said first switch means takes the form of a normally open micro switch, said clock including a pivot arm operatively connected to said micro switch, a roller also on said pivot arm operatively engaging said setting pins of said clock, said roller maintaining said micro switch open when engaging said setting pins, said roller closing said

micro switch when it rolls off one of said pins to a location in which the next pin is withdrawn.

10. The device according to claim 4 in which said first switch means takes the form of a normally open micro switch, said clock including a pivot arm operatively connected to said micro switch, a roller also on said pivot arm operatively engaging said setting pins of said clock, said roller maintaining said micro switch open when engaging said setting pins, said roller closing said micro switch when it rolls off one of said pins to a location in which the next pin is withdrawn.

11. The device according to claim 5 in which said first switch means takes the form of a normally open micro switch, said clock including a pivot arm operatively connected to said micro switch, a roller also on said pivot arm operatively engaging said setting pins of said clock, said roller maintaining said micro switch open when engaging said setting pins, said roller closing said micro switch when it rolls off one of said pins to a location in which the next pin is withdrawn.

* * * * *

25

30

35

40

45

50

55

60

65