

June 21, 1938.

H. SCHWARZE

2,121,671

IGNITION STARTER CONTROL

Filed Aug. 22, 1934

2 Sheets-Sheet 1

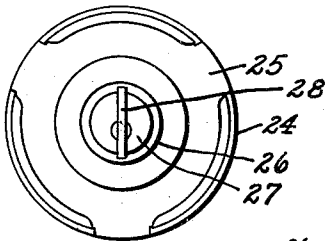


Fig. 1

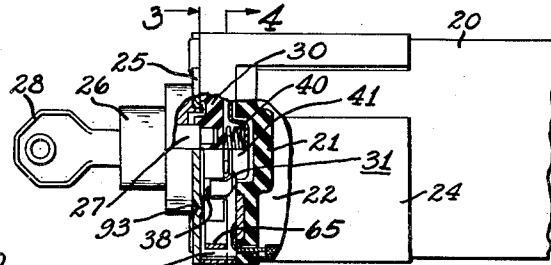


Fig. 2

Fig. 3

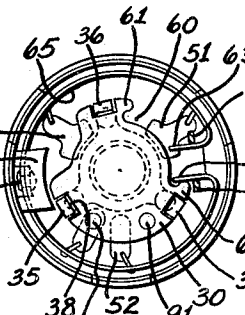


Fig. 4

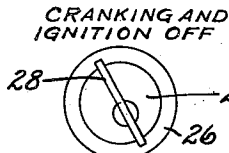
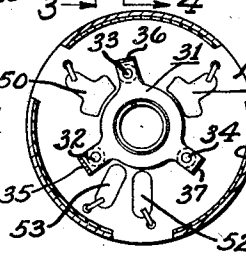


Fig. 5

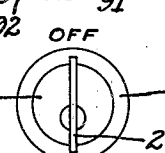


Fig. 6

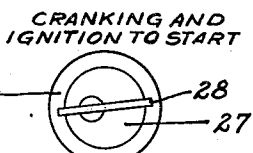


Fig. 7



Fig. 8

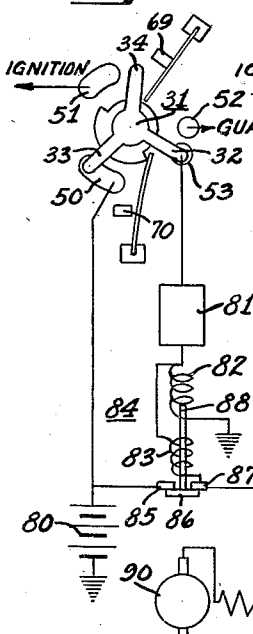


Fig. 9

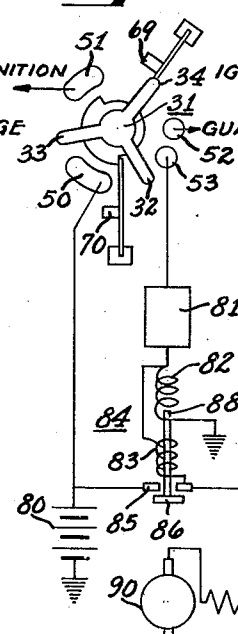


Fig. 10

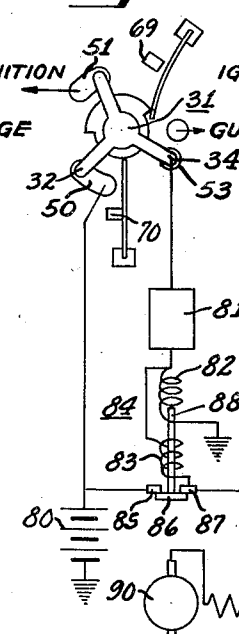


Fig. 11

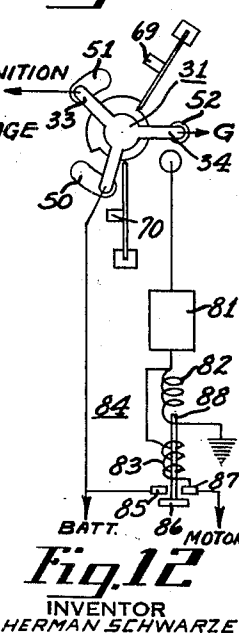


Fig. 12

IN FIGURES 9-10-11-12 THE SWITCH 81 IS NORMALLY CLOSED BUT OPENS IN RESPONSE TO SELF OPERATION OF THE ENGINE

INVENTOR
HERMAN SCHWARZE
DECEASED
BY BRUCE H. SCHWARZE
ADMINISTRATOR
BY *Spencer Hardman & Fehr*
ATTORNEYS

June 21, 1938.

H. SCHWARZE

2,121,671

IGNITION STARTER CONTROL

Filed Aug. 22, 1934

2 Sheets-Sheet 2

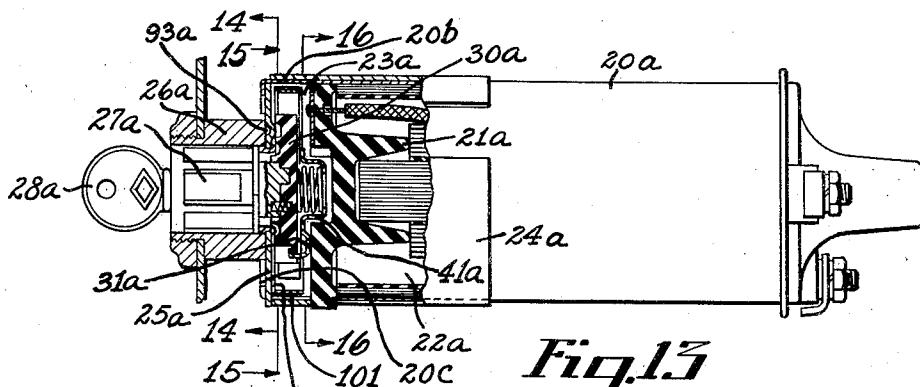


Fig. 13

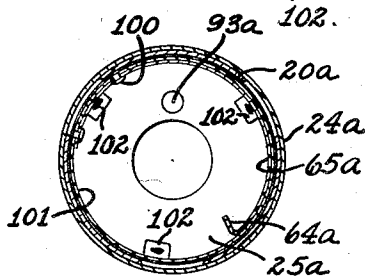


Fig. 14

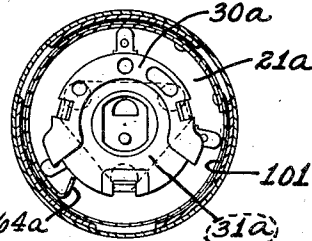


Fig. 15

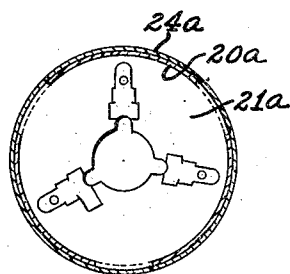


Fig. 16

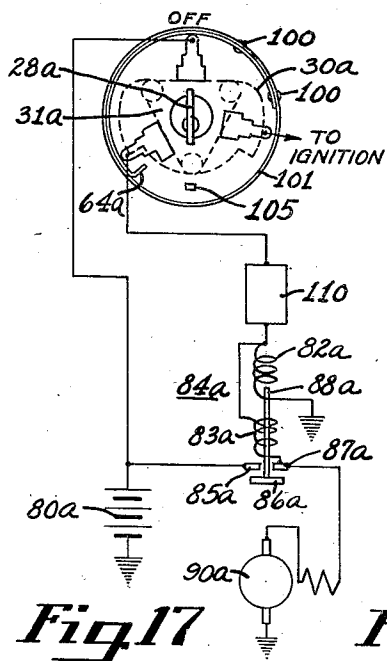


Fig. 17

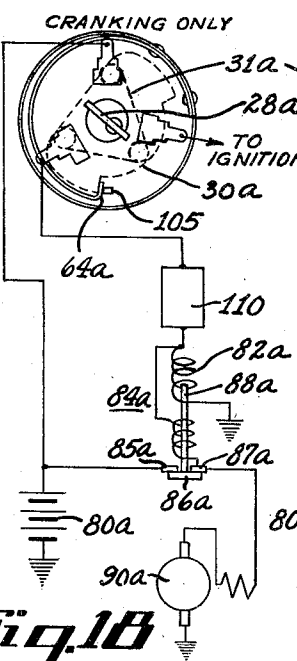


Fig. 18

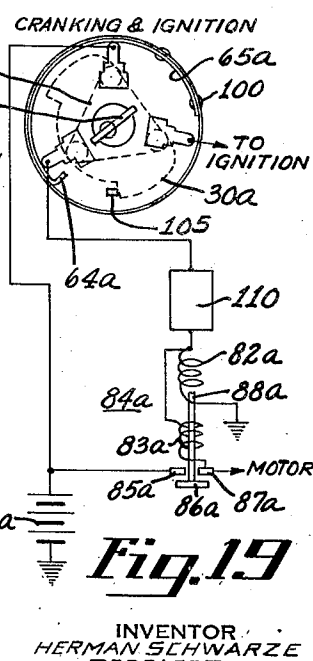


Fig. 19

IN FIGURES 17-18-19 THE SWITCH 110 IS CLOSED BY ENGINE THROTTLE ACTUATOR AND OPENED BY ENGINE INTAKE SUCTION.

INVENTOR
HERMAN SCHWARZE
DECEASED
BY BRUCE H. SCHWARZE
ADMINISTRATOR
BY *James Hardman & Fehr*
ATTORNEYS

UNITED STATES PATENT OFFICE

2,121,671

IGNITION STARTER CONTROL

Herman Schwarze, deceased, late of Pontiac, Mich., by Bruce H. Schwarze, administrator, Birmingham, Mich., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application August 22, 1934, Serial No. 740,960

2 Claims. (Cl. 200—44)

This invention relates to switches for controlling electrical circuits of internal combustion engines, particularly the ignition and engine starting circuit.

One of the objects of the present invention is to provide a switch for connecting a storage battery or other source of current with the ignition circuit and the engine starter control circuit, or with only one of these circuits and to provide for the automatic movement of the switch from one of its circuit controlling positions to another position when the operator releases the switch actuating member. In both of the disclosed forms of the present invention, the switch may be turned from an off position to an engine cranking position, in which the battery is connected with the starting motor circuit and with the engine starter control circuit for the purpose of cranking the engine only. When the switch is moved to this position a spring is engaged, that upon release of the switch actuator returns the switch automatically to the off position. In one of the forms of the invention disclosed, the switch may be turned from an off position to an engine starting position, in which the battery is connected with the ignition circuit in addition to the starting motor circuit and the engine starter control circuit of the cranking position. The switch in movement to the starting position engages a spring, and if the operator releases the switch actuator, the switch will be moved automatically by the spring into the running position, in which the ignition circuit remains connected with the battery, but in which the starter control circuit is disconnected from the battery. In the form of the invention first to be described the switch can be moved into one position for connecting the engine starter control circuit only with the battery in order that the engine may be operated without igniting the fuel, and into another position for connecting both the ignition circuit and engine starter control circuit with the battery in order that the engine may be caused to operate under the influence of the ignited fuel. From either of these positions of the switch, return is automatically made to off position and to the running position respectively by spring means whenever the operator releases the switch actuating member.

It is a further object to provide a switch which will operate in the manner described and which can be constructed in compact form thus enabling it to be housed within a small case such as may be provided adjacent one end of an ignition coil.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is an end view of a switch and coil housing enclosing a switch of the type referred to.

Fig. 2 is a fragmentary view of a switch and coil unit partly in longitudinal section.

Figs. 3 and 4 are sectional views taken respectively on the lines 3—3 and 4—4 of Fig. 2.

Figs. 5 to 8 inclusive, are views showing various positions of the switch actuator.

Figs. 9 to 12 inclusive, are wiring diagrams showing diagrammatically the various positions of the switch and circuits controlled thereby when the switch actuating member is positioned as shown in Figs. 5 to 8 respectively.

Fig. 13 is a side view partly in longitudinal section of a switch and coil unit showing a modified form of switch.

Figs. 14, 15 and 16 are sectional views taken respectively on the line 14—14, 15—15 and 16—16 of Fig. 13.

Figs. 17, 18 and 19 are wiring diagrams showing respectively various positions of the switch shown in Figs. 13 to 16.

Referring to Figs. 1 and 2 a coil case 20 carries a non-conducting partition 21 which separates the space within the housing 20 into an ignition coil chamber 22 and a switch chamber 23. The housing 20 is surrounded by a tube 24 which provides a cylindrical wall for the switch chamber 23. A plate 25 carries a bearing 26 within which a key-operated cylinder 27 is rotated. The cylinder 27 is operated by key 28 which can be inserted or removed from the cylinder 27 only when the latter is in the off position. The cylinder 27 is drivingly connected with a nonconducting carrier 30 which carries a movable contact 31 provided with contact bosses or fingers 32, 33 and 34, and with projecting arms 35, 36 and 37 each of which is received by a notch 38 provided by the carrier 30. A spring 40 located between the carrier 30 and the contact 31 and received by a cup-shaped depression 41 provided by the contact 31 yieldingly urges the contact 31 toward the partition 21 or yieldingly urges the carrier 30 toward the plate 25. The movable contacts 32, 33 and 34, cooperate with stationary contacts 50, 51, 52 and 53 which are connected as shown in the wiring diagram respectively with the battery, the ignition apparatus, the gasoline gauge and the engine starter control circuit.

The carrier 30 is provided with a notch 69, the ends of which are defined by the projections 61 and 62 adapted to cooperate with the end portions 63 and 64 respectively of a spring 65 attached at its middle portion by one or more rivets 66 to a bracket 67 which is carried by the plate 25. The spring part 63 is biased against a stop 69 and the spring part 64 is biased against a stop 70. The stops 69 and 70 are also carried by the plate 25.

Figs. 6 and 10 show the switch in the off position. It will be noted that none of the movable contacts 32, 33 and 34 are in engagement with a stationary contact 50 connected with a storage battery 80 or with the contact 51 connected with the ignition circuit or with the contact 52 connected with an electrical gasoline gauge or with the contact 53 connected with the engine starter control circuit. The engine starter control circuit comprises a switch 81 which is normally closed but which opens in response to the self-operation of the engine, for example, in response to a certain amount of suction developed in the intake manifold of the engine when running under its own power. The switch 81 is connected between the contact 53 and the windings 92 and 93 of an electro-magnetic switch 84 which comprises stationary contacts 85 and 87 and a movable contact 86 attached to the solenoid armature 88 of the switch 84. Contact 85 is connected with the battery 80 and contact 87 with an electric starting motor 90. Windings 82 and 83 cooperate to attract the solenoid 88 into circuit closing position in which position the motor 90 is connected with the battery 80 but the winding 83 is shortcircuited. The armature 88 is held in circuit closing position by the coil 82 only.

When it is desired to start the engine the operator will turn the key 28 as far as it will go in a clockwise direction. By so doing the carrier 30 is moved so that its projection 61, shown in Fig. 3, engages the spring part 63 and moves it away from the stop 69 and into engagement with the spring part 64. The turning of the key is therefore arrested due to the fact that the spring parts 63 and 64 both bear against the stop 70. Fig. 7 shows this position of the key and Fig. 11 shows diagrammatically the circuits which are completed. It will be seen that the movable contact 31 connects the battery contact 50 with the ignition contact 51 and with the engine starter contact 53. This causes the switch 84 of the engine starter to be closed thereby causing the engine to be cranked while the ignition is on. When the engine starts the switch 81 automatically opens the circuit between the battery 80 and the coil 82 of the electro-magnetic switch 84 thereby causing the magnet to be deenergized and permitting the contact 86 to move by gravity or otherwise away from the contacts 85 and 87. After the engine has been started the operator releases the key 28 which is turned automatically from the position shown in Fig. 7 to the position shown in Fig. 8, due to the fact that the spring part 63 exerts a turning force against the carrier projection 61 until the spring part 63 reengages the stop 69. The movement thus imparted to the carrier 30 by the spring part 63 is sufficient to return the contact 31 from the position shown in Fig. 11 to the position shown in Fig. 12. In Fig. 12 the contact 31 connects the battery contact 50 with the ignition contact 51 and with an electrical gasoline gauge contact 52. The carrier 30 is yieldingly held in the running position shown in Fig. 8, due to the fact that its recess 91 yield-

ingly receives a projection or boss 93 of the plate 25 due to the action of the spring 40 which urges the carrier 30 against the plate 25. To turn off the ignition and stop the engine the operator turns the key from the position shown in Fig. 8 to the position shown in Fig. 6. The carrier 30 is yieldingly held in this off position due to the fact that the boss 93 of plate 25 yieldingly cooperates with the other recess 92 provided by the carrier.

When it is desired to crank the engine without turning on the engine the operator turns the key as far as it will go in a counter-clockwise direction or from the position as shown in Fig. 6 to that shown in Fig. 5. Motion of the key in this direction is limited due to the fact that the carrier projection 62 pushes the spring part 64 against the spring part 63 which is already being urged against the stop 69. The spring parts 64 and 63 are spaced sufficiently to permit movement of the contact 31 from the position shown in Fig. 10 to that shown in Fig. 9. Fig. 9 shows that the contact 31 connects the battery contact 50 with the engine starter contact 53. When the operator releases the key 28 it will move automatically back to the off position shown in Fig. 6 due to the action of the spring part 64 against the carrier projection 62 which action continues until the spring part 64 bears again against the stop 70.

Although the switch illustrated in Figs. 1 to 12 has four positions, the manipulation of the switch is very simple. The operator has only to remember, that by turning the switch key as far as it will go in a clockwise direction, that the engine will be started, and that by turning the key as far as it will go in a counterclockwise direction that the engine may be cranked without the ignition being turned on. This last feature is particularly desirable, in that all of the electrical energy is available, when cranking the engine without ignition, in order to break the engine loose from stiff congealed oil in cold weather. In both instances, by releasing the key the switch will be automatically turned to off or running position respectively, without further attention on the part of the operator. But starting will not be expected unless the operator turns the key in a clockwise direction.

Figs. 13 to 19 show a modified form of switch which provides for cranking the engine with the ignition turned off, but does not provide for a running position without the engine starter control circuit. As this second form of switch is very similar to the first form of switch, its construction and mode of operation will not be described in detail except as to certain features which are not found in the first form. Parts of the second switch which are similar in construction and function to the corresponding parts of the first form are referred to by the same reference numerals as those applied to the parts of the first form, but with the affixed *a*.

In the second form of switch only the spring part 64a is required for the purpose of automatically returning the switch contact 31a from the cranking only position shown in Fig. 18, to the off position shown in Fig. 17. Therefore, this form of switch does not use a spring having two free ends and fixed at an intermediate point but uses a spring 65a which is fixed by rivets 100 to a supporting ring 101 provided with lugs or ears 102 shown in Fig. 14. One of these ears is shown in section in Fig. 13. By means of the ears 102, the ring 100 is attached to the plate

25a. The ring 100 is supported so as to be concentric with respect to the switch case member 24a and is spaced therefrom so as to permit extensions 20b of the coil case 20a to be located between the ring 100 and the part 24a and in order that these extensions 20b may be folded over at 20c against the outside of the plate 25a as has been described with reference to the first form of switch. The second form of switch does not use a stop 70. The stop 70 can be omitted in the second form of switch because the spring 65a is so biased as to bear normally against the inside of the ring 101. Movement of the switch contact member 31a in a counter-clockwise direction from the off position shown in Fig. 17 to the cranking only position shown in Fig. 18 is limited due to the fact that the spring part 64a strikes a stop 105 when the switch is turned from off position to cranking position shown in Fig. 18. Stop 105 also limits movement of the carrier 30a from off position to the cranking and ignition position shown in Fig. 19. The switch 110 shown in the wiring diagram Figs. 17, 18 and 19 is one that is closed by the engine throttle actuator or accelerator pedal and is opened by engine intake suction when the engine becomes self operating. A form of such switch is disclosed in the copending application of John B. Dyer Serial No. 734,740 filed July 12, 1934, which discloses a switch which is opened by the accelerator pedal in wide open throttle position when engine suction may be low and insufficient to hold the switch open. The switch 81 shown in the wiring diagrams Figs. 9 to 12 inclusive, could be the same form of switch as the switch 110, however, this is not necessary in the circuit shown in Figs. 9 to 12 for the reason

that the engine starter control circuit is broken by the ignition switch in its engine running position.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. An electric switch comprising, in combination, stationary contacts; rotatable bridging contacts; a rotatable contact carrier supporting the bridging contacts, said carrier being provided with a notch; and spring means for returning the carrier into one of its positions, said spring means comprising a leaf-spring located in the plane of the carrier and being secured to a fixed part and having said free end extending into an elongated notch provided by the carrier; and a stop member engaged by the free end portion of the spring.

2. An electric switch comprising, in combination, a plurality of stationary contacts; a rotary bridging contact; a contact carrier supporting the bridging contact and provided with an elongated notch and spring means for returning the contact carrier to positions intermediate its extreme position of movement in either direction, said spring means comprising a leaf spring comprising an intermediate portion secured to a fixed portion and its free end portions extending into said notch of the carrier and stop means limiting movement of each free end of the spring in one direction.

BRUCE H. SCHWARZE,

*Administrator of the Estate of Herman Schwarze,
Deceased.*