July 25, 1950 J. W. DICKEY 2,516,304

ENGINE STARTER CONTROL SWITCH

Filed May 14, 1947

Fig. 1

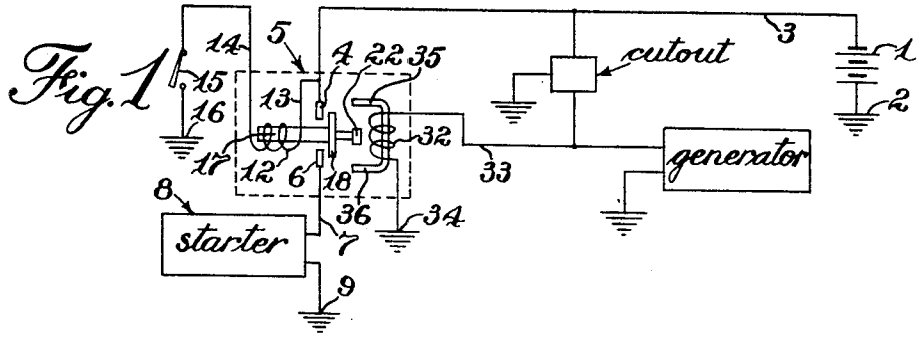


Fig. 2

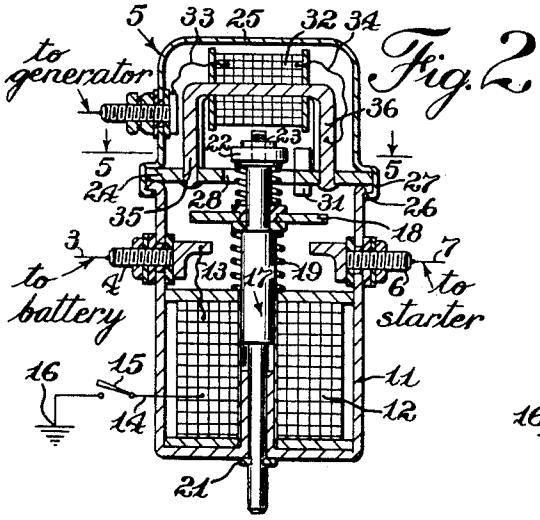


Fig. 3

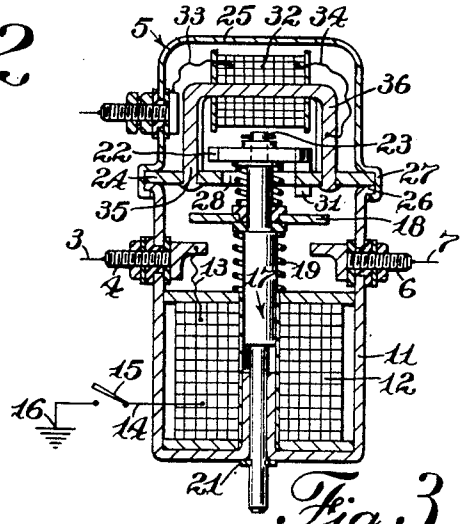


Fig. 4

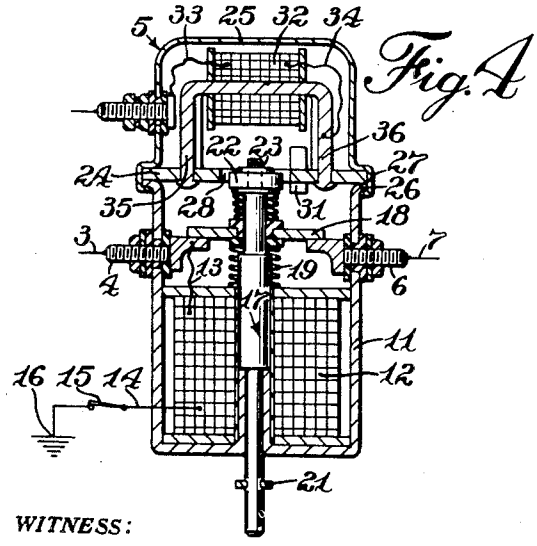
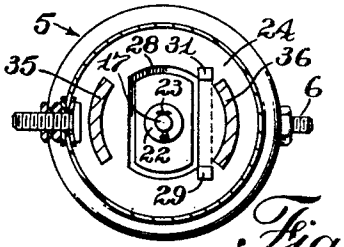


Fig. 5



WITNESS:

Esther M. Stockton

INVENTOR.

John W. Dickey

BY

Clinton L. James

ATTORNEY

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ENGINE STARTER CONTROL SWITCH

John W. Dickey, Newfield, N. Y., assignor to Bendix Aviation Corporation, Elmira Heights, N. Y., a corporation of Delaware

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4 Claims. (Cl. 200—98)

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The present invention relates to an engine starter control and more particularly to a device for preventing closure of a starting switch when the engine is rotating.

In automatic engine starter controls it has been customary to utilize the current produced by an electrical generator driven by the engine to prevent actuation of the starting motor while the engine is in operation. Such arrangements are convenient and economical, but since the voltage of the generator is very low when the engine is idling slowly or rocking prior to coming to rest, it is customary to supplement the generator lockout with various other devices such as intake vacuum lockouts, time delays, etc. to prevent premature or untimely actuation of the starting mechanism.

It is an object of the present invention to provide a novel automatic engine starter control utilizing a generator lockout which is so sensitive that it is effective as long as the engine is rotating sufficiently to make it undesirable to actuate the starting mechanism.

It is another object of the present invention to provide such a device which is equally positive in its action irrespective of variations in generator voltage.

It is a further object to provide such a device which may be readily built on an ordinary starting relay at a slight additional expense.

Further objects and advantages will be apparent from the following description taken in connection with the accompanying drawing in which Fig. 1 is a diagrammatic representation of an electrical system for internal combustion engines embodying a preferred form of the present invention.

Fig. 2 is an enlarged vertical section of the starting switch and generator controlled lockout therefor, showing the parts in idle position;

Fig. 3 is a view similar to Fig. 2 showing the parts in the positions assumed while the engine is running;

Fig. 4 is a view similar to Fig. 2 showing the parts in cranking position;

Fig. 5 is a section taken substantially on the line 5—5 of Fig. 2.

In Fig. 1 of the drawing there is illustrated a starting system for an internal combustion engine not shown, comprising a battery 1 grounded at 2 and connected by a lead 3 to one contact 4 of a starting switch indicated generally by numeral 5. The opposite contact 6 of the starting switch is connected by a lead 7 to the starting motor 8 which is grounded at 9 to complete the starting circuit.

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As shown in Fig. 2, the starting switch 5 comprises a casing 11 in which is mounted a solenoid 12 one end of which is connected by a lead 13 to the switch contact 4 that is connected to battery 1, while the other end is connected by a lead 14 to a manual switch 15 which is grounded at 16 whereby closure of the switch 15 causes energization of the solenoid. A switch plunger 17 is slidably mounted within the solenoid 12 and carries a bridging contact 18 adapted to connect the switch contacts 4 and 6 when the solenoid is energized, to thereby cause actuation of the starting motor 8. The switch is normally held open by a spring 19, the open position of the switch being defined by a thrust ring 21 seated in the switch plunger and adapted to abut the casing 11 to limit the upward movement of the plunger.

A small permanent bar magnet 22 is pivotally mounted on the upper end of the plunger 17 as indicated at 23. This bar magnet is formed with an irregular outline as best seen in Fig. 5, where it is shown as generally circular in shape with two diametrically opposite segments removed.

A partition 24 is fixedly attached to the end of the switch casing 11 as by means of a cap 25, the edge of which is crimped over a lip 26 of the casing as shown at 27. The partition 24 has an opening 28 (Fig. 5) which is similar in outline and slightly larger than the bar magnet 22 whereby the magnet may enter the opening in the partition when the switch plunger 17 is moved by the solenoid 12 to close the switch, provided that the magnet is properly oriented with respect to said opening. Means normally maintaining the bar magnet so oriented is provided in the form of one or more blocks 29, 31 of magnetic material mounted on the partition 24 close to the bar magnet in such position as to cause the attraction of the bar magnet to rotate the magnet into substantial alignment with the opening 28.

Means actuated by the engine driven generator for causing the bar magnet 22 to rotate out of alignment with the opening 28 is provided in the form of an electromagnet 32 one end of the winding of which is connected by a lead 33 directly to the generator as shown in Fig. 1, while the other end of the winding is grounded as indicated at 34 whereby the winding is energized by the current produced by the generator when it is rotated by the engine.

Electromagnet 32 is provided with a pair of pole pieces 35, 36 which are located transversely with respect to the bar magnet 22 when the mag-

net is in alignment with the opening 28, and are anchored in the partition 24, which is preferably of non-magnetic material. It will thus be seen that a very slight energization of the electromagnet 32 will cause the bar magnet 22 to rotate on the plunger 17 out of alignment with the opening 28 so as to prevent the plunger from moving sufficiently to close the starting switch.

In operation, when the engine is stationary and the bar magnet 22 in alignment with the opening 28 in partition 24, closure of the manual switch 15 causes energization of the solenoid 12 which pulls down the plunger 17 so as to bring the bridging contact 18 into engagement with the switch contacts 4 and 6 thus completing the starting circuit and energizing the starting motor.

The travel of the plunger 17 to close the starting switch is so coordinated with the spacing of the bar magnet 22 above the partition 24 that when the switch is closed, the magnet has entered the opening 28 in the partition for a substantial distance as shown in Fig. 4.

When the engine starts, the operator opens the manual switch 15, thus deenergizing the solenoid 12 whereby the plunger 17 is returned by the spring 19 to its normal position, thereby opening the starting circuit. Rotation of the generator by the engine causes energization of the electromagnet 32 so that the bar magnet 22 is rotated on the plunger 17 into the position illustrated in Fig. 3. If the manual switch 15 should be closed under these circumstances, closure of the starting switch is prevented by the engagement of the bar magnet 22 with the upper surface of the plate 24 so that untimely actuation of the starting system is effectively prevented. When the engine is stopped, the coil 32 becomes deenergized, and since the blocks 29, 31 are located closer to the magnet 22 than the pole pieces 35, 36, the blocks become effective to rotate the magnet into alignment with the opening 28. This function might of course be accomplished by a centering spring, but the blocks 29, 31 are simpler and more satisfactory.

Although but one embodiment of the invention has been shown and described in detail, it will be understood that other embodiments are possible and that various changes may be made in the design and arrangement of the parts without departing from the spirit of the invention as defined in the claims appended hereto.

What is claimed is:

1. In an electrical system for internal combustion engines of the type which includes an engine driven generator and a starting system for the engine, the combination of a starting switch having a reciprocable plunger, a bar magnet rotatably mounted on said plunger, a fixed plate in the path of movement of said magnet having an opening conforming to the shape of the magnet, an electromagnet arranged when energized to rotate the bar magnet out of alignment with said opening, and connections for energizing the electromagnet.

2. The combination set forth in claim 1 including further, means normally maintaining the bar magnet in alignment with the opening in said fixed plate.

3. The combination set forth in claim 1 including further, a block of magnetic material adjacent the normal position of the bar magnet for attracting the magnet into alignment with the opening in said fixed plate.

4. In an electrical system for internal combustion engines of the type which includes an engine driven generator and a starting system for the engine, the combination of a magnetic starting switch, said starting switch comprising a casing having a fixed partition, a plunger slidably mounted in the casing and passing through the partition; a permanent magnet of irregular outline pivotally mounted on said switch plunger, said partition having an opening loosely conforming to the outline of the magnet, means normally orienting the magnet with respect to said opening, and electromagnetic means for turning the magnet transverse to the opening, said partition being so located that movement of the plunger to close the switch causes the magnet to enter the opening in the partition prior to closure of the switch.

JOHN W. DICKEY.

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