Jan. 10, 1939. E. M. CLAYTOR 2,143,102

CENTRIFUGAL SWITCH

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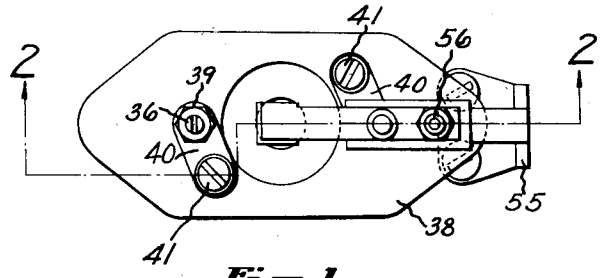


Fig. 1

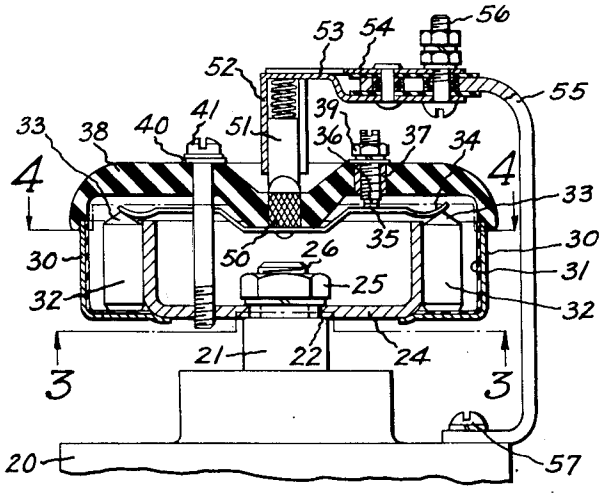


Fig. 2

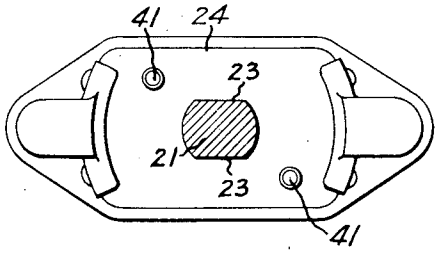


Fig. 3

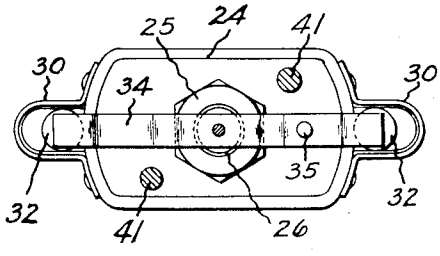


Fig. 4

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CENTRIFUGAL SWITCH

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5 Claims. (Cl. 200—80)

This invention relates to speed responsive devices and more particularly to centrifugally operated switches.

It is an object of the present invention to secure a relatively great speed differential between the speed at which a centrifugally operated switch will depart from its normal or at rest condition and the speed at which the switch will be restored to normal condition. This object is accomplished in the disclosed form of the present invention by the use of one or more permanent magnets which are movable away from an axis of rotation due to centrifugal force and are moved toward the axis of rotation due to the attractive force of the permanent magnet and the magnetizable body against which the magnet is located in its normal position. A relatively great centrifugal force is required to act upon the permanent magnet before it will leave the magnetizable body; but once the magnet has left this body, the attracting force is much weakened due to the widening of the air gap between the magnet and the magnetizable body. Therefore, centrifugal force acting upon the magnet must be considerably reduced before it is overcome by the attractive force between the magnet and magnetizable body. In this way relatively high speed of rotation of the centrifugal switch is required before the status of the switch is changed from normal or stationary condition to a running condition; and a very much less speed of rotation is required to restore the switch to its normal condition.

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

In the drawing:

Fig. 1 is a plan view of the switch embodying the present invention.

Fig. 2 is a sectional view on the line 2—2 of Fig. 1.

Fig. 3 is a sectional view on the line 3—3 of Fig. 2.

Fig. 4 is a sectional view on the line 4—4 of Fig. 2.

Referring to the drawing, 20 designates the framework of a mechanism having a shaft 21 which supports and drives the centrifugal switch. Shaft 21 is provided with a shoulder 22 and flats 23. The switch includes an elongated cup shaped member 24 having a hole shaped to conform to the cross section of the shaft 21 as shown in Fig. 3. The cup 24 is secured against the shoulder 22 of the shaft 21 by a clamping nut 25 received by the threaded end 26 of the shaft 21.

The cup 24 is made of magnetizable material such as sheet steel. Each of its shorter sides, which are located more remote from the shaft 21 than are the longer sides of the cup, receives a pocket member 30 made of magnetic metal and lined with a non-metallic lining 31. Each pocket 30 supports and guides a cylindrical permanent magnet 32. Normally each magnet 32 clings to the magnetizable cup 24; but a certain speed of rotation of the cup 24 will cause a centrifugal force to act upon the magnet 32 in excess of the magnetic force which holds it against the cup 24. Then the magnet 32 will move away from the cup 24 until it reaches the wall of the pocket most remote from the shaft 21. The nonconducting lining 31 which is in engagement with the magnet 32 prevents the making of a circuit through the magnet and thence through the pocket 30 and the cup 24 when the magnet 32 has just begun to touch the contact 34, but before the magnet 32 has engaged the cup 24. It is not desirable for the circuit to be made until the magnet 32 has engaged the cup 24, therefor, the insulation lining 31 is provided. Incidentally, the lining 31 tends to reduce the noise of moving the magnet 32 within the cup 30.

The movements of the magnets 32 are utilized to operate an electric switch or switches, there being one switch member for each of the magnets 32. Each magnet 32 has a conical upper end 33 which is engageable with a leaf spring contact 34 made preferably of bronze and carrying a contact 35 engageable with the lower end of a contact screw 36 which is threaded into an insert 37 molded in a cover plate 38 which is shaped to provide a top enclosure for the cup 24 and the pockets 30. Each screw 36 is held in the desired position of adjustment by a lock nut 39. Each insert 37 is connected with a strap 40. The cover 38 is retained in position by screws 41 each passing through a strap 40 and threaded into the cup 24. Screws 41 serve also as electrical conducting members in conjunction with the strap 40 to connect electrically the contact screws 36 with the cup 24 which is grounded through the shaft 21 and the frame 20 of the apparatus of which shaft 21 is a part.

The two contacts 34 are integral being made of a single piece of material which is attached at its center to an insert 50 molded in the cover 38. Insert 50 is electrically connected with a circuit by means of a brush 51 guided in a metallic brush holder 52 attached by plates 53 and 54 to a bracket 55, but insulated therefrom.

These plates are electrically connected with a terminal screw 56. The bracket 55 is attached by screws 57 to the apparatus frame 20.

The normal or at rest condition of the switch is shown in Fig. 2. Due to the magnetism in the permanent magnets 32, these magnets attract themselves against the shorter side walls of the cup 24; and, by doing so, urge the spring members 34 into contact making position as shown. When the speed of rotation of the shaft 21 attains a predetermined value, the centrifugal force acting upon the magnets 32 will exceed the force of magnetic attraction between the magnets and cup 24. Then the magnets 32 will leave the cup 24 and move to those portions of the pockets 30 which are most remote from the axis of the shaft 21. As the magnets 32 move in this direction, the spring members which are normally biased downwardly as viewed in Fig. 2 will move into contact opening position. After the magnets 32 have separated themselves from the cup 24, the attractive force between them and the cup is materially weakened due to increase in the air gap. Therefore, it requires much less centrifugal force to keep the magnets in the position most remote from the shaft 21 than required to overcome the magnetic force between the magnets and the cup 21 before the separation of these members took place. Consequently, at the speed of the shaft 21 at which the magnets 32 will return into contact with the cup 24 will be much less than that speed required to effect movement of the magnets away from the cup. Thus a substantial speed differential is obtained between the opening and closing of the switch contacts.

A centrifugal switch having substantial speed differential can be used in many applications. For example, such a switch is adapted for the control of electrically operated starting apparatus for internal combustion engines and particularly automobile engines. There are engine starting systems for automobiles in which a starter circuit is controlled by a switch operated by the driver's foot. It has been found desirable to use a single pedal member for controlling the carburetor throttle valve and the engine starting switch. In order to prevent the use of the engine starter while the engine is in operation, various devices have been used to interrupt the starter circuit at a point other than at the pedal operated switch. Such devices have included centrifugal switches operated by the engine. The switch of the present invention is particularly useful as the centrifugal switch for a circuit of this type. It is required that such switches do not open the engine starter circuit while the engine is being cranked, but that the switch open the circuit as soon as the engine becomes self operative. Another requirement is that the centrifugal switch do not re-establish the engine starter circuit except at very low speed, the lower the better.

It is possible to construct a centrifugal switch in accordance with the present invention so that its contact will be opened or otherwise moved from normal condition at a speed which is practically three times as great as the speed to which the switch must decrease before the contact will be restored to normal condition. For example, it is possible to build a switch which will open a circuit at speeds around 300 to 450 R. P. M., but the circuit closing speed of the switch will be around 100 to 150 R. P. M.

The switch disclosed herewith is particularly adapted for automobile use as it may be easily attached to the shaft of a device driven by the engine such as the automobile generator.

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. A centrifugal switch comprising a movable permanent magnet and a rotatable support therefor including a magnetizable body to which the magnet tends to cling, a nonmagnetizable guide extending from the body for supporting and guiding the magnet and for limiting movement of the magnet away from the body, and a switch operated by the permanent magnet.

2. A centrifugal switch comprising a movable permanent magnet, a rotatable magnetizable body adapted to be mounted upon a shaft and to be driven thereby, a nonmagnetizable pocket member attached to the body and adapted to receive the magnet and to guide it in its movements away from and toward said body, and a switch operated by the magnet.

3. A centrifugal switch comprising movable permanent magnets, a magnetizable cup-like body adapted to be mounted upon a shaft and to be driven thereby, pocket members of nonmagnetizable material attached exteriorly to the side walls of the cup-like body and symmetrically disposed, each pocket member receiving and guiding a magnet, a cover for the body and pockets, and switches carried by the cover and operated upon by the magnets.

4. A centrifugal switch comprising a movable permanent magnet and a rotatable support therefor including a magnetizable body to which the magnet tends to cling, said body being one of the contacts of the switch, a non-magnetizable guide extending from the body for supporting and guiding the magnet and for limiting movement of the magnet away from the body, a switch contact directly engaged by the magnet and electrically connected with the body when the body is engaged by the magnet.

5. A centrifugal switch according to claim 4 in which the pocket is provided with a nonmagnetizable and nonconducting lining with which the magnet makes contact, whereby an electrical circuit is not made through the engagement of the contact with the magnet until the magnet engages the body.

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