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SWITCH ACTUATING MECHANISM

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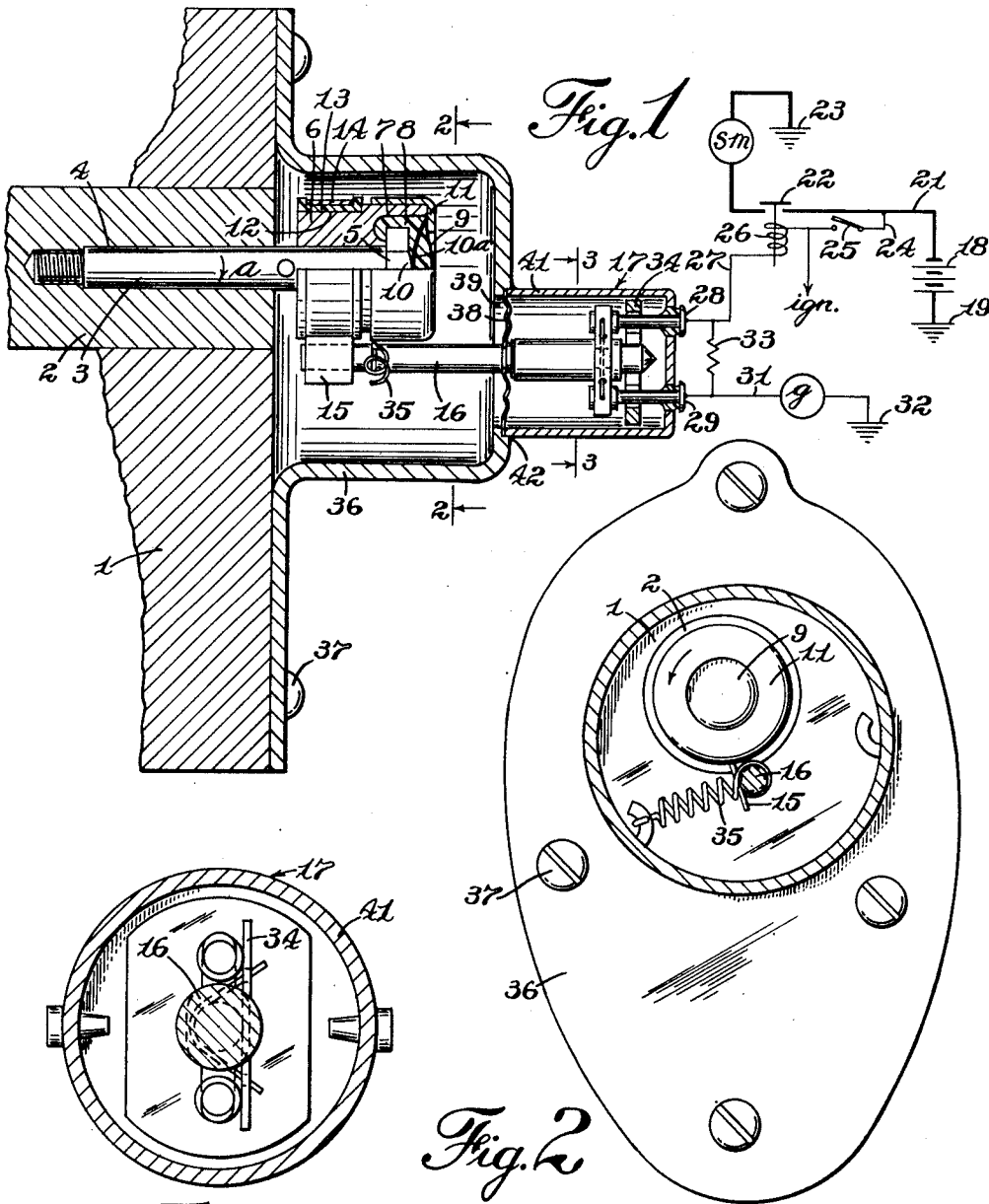


Fig. 3

Fig. 2

WITNESS:

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SWITCH ACTUATING MECHANISM

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4 Claims. (Cl. 200—153)

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The present invention relates to switch actuating mechanism and more particularly to means for controlling an electrical switch in accordance with the rotation of an engine-driven element. The switch may be used to open a circuit such as the ignition circuit or an electrical fuel pump circuit when the engine stops, in order to reduce fire hazard; or it may be adapted to close a control circuit to cause actuation of the starting mechanism in case of engine stall.

This application is a continuation in part of applicant's prior co-pending application Ser. No. 96,347 filed May 31, 1949.

It is an object of the present invention to provide a switch responsive to a running function of an internal combustion engine, for controlling auxiliary apparatus such as a fuel pump or the electrical starting system for the engine, and incorporating an improved form of coupling connection to a rotating part of the engine or of a device driven by the engine.

It is another object to provide such a device having a combined viscous and frictional slip connection for actuating the switch which is mechanically strong and rigid, and which is arranged to rapidly dissipate any heat developed by slippage of the frictional connection.

It is another object to provide such a device in which the viscous coupling is connected directly to the engine driven part and the slip connection is located between the viscous coupling and the switch actuating element.

It is another object to provide such a device in which the slip connection includes a spring ring embracing its driving member and arranged to unwrap and reduce its pressure on the driving member responsive to torque transmitted there-through.

Further objects and advantages may be apparent from the following description taken in connection with the accompanying drawing in which:

Fig. 1 is an elevation of a preferred form of the invention, partly broken away and in section, the elements of the electrical system being shown diagrammatically;

Fig. 2 is a section taken substantially on the line 2—2 of Fig. 1; and

Fig. 3 is a section on an enlarged scale taken substantially on the line 3—3 of Fig. 1.

In Fig. 1 of the drawing there is illustrated a portion of a generator frame 1, the shaft 2 of which is arranged to be driven by an internal combustion engine, not illustrated, in a conventional manner. A driving shaft 3 for the switch operating mechanism is rigidly mounted in any suitable manner in an axial opening 4 in the end of the generator shaft 2, and a driving disc 5 is fixed on the end of the driving shaft 3 so as to rotate therewith.

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A coupling member 6 is journaled on the shaft 3 and has a chamber 7 formed in one end thereof enclosing the driving disc 5. The chamber 7 is filled with a slow flowing viscous material 8, preferably a silicone jelly or putty, the viscosity of which varies only slightly throughout a wide range of temperature change. The chamber 7 is closed by an elastic diaphragm 9 retained by a cap 11 suitably fixed on the end of the coupling member 6, whereby the viscous material 8 is retained in the chamber 7 and provides a connection between the driving disc 5 and the coupling member 6, which is substantially rigid as respects sudden impulses transmitted by the driving shaft 3, but which will slowly yield and permit relative rotation responsive to sustained torque.

In order to prevent escape of the viscous material along the bearing of the coupling member 6 on the shaft 3, the driving disc 5 and coupling member are formed with flat radial surfaces forming a thrust bearing as indicated at 10, and a spring 10^a is provided for maintaining these surfaces in engagement with each other.

The coupling member is provided with a peripheral seat or recess 12 for the reception of a channeled or grooved ring of a wear-resisting material such as nylon or the like, fixedly mounted thereon in any suitable manner.

A spring ring member 14 is seated in the channel of the nylon ring 13, closely embracing the same, and is provided with an out-turned arm 15 adapted to engage a spindle 16 which actuates a switch indicated generally by numeral 17.

The spring ring 14 is wrapped around the coupling member 6 in such a direction that when the driving shaft 3 is rotated in the direction of the arrow (a), it unwraps and releases its pressure on the nylon ring 13 in response to the torque transmitted through the frictional connection formed thereby.

In the present instance the switch 17 is used to control the starting mechanism for the internal combustion engine in such manner as to cause the starting mechanism to operate whenever the ignition switch is closed while the engine is stationary, similar to the system illustrated in Fig. 4 of applicant's copending application above cited.

The starting system comprises a battery 18 grounded at 19 and connected by a lead 21 to an electromagnetic starting switch 22 controlling the starting motor SM, which is grounded at 23 to complete the starting circuit. A lead 24 connected to the battery lead 21 is provided with a manual switch 25 for controlling the ignition circuit of the engine, and manual switch 25 is connected to one end of the solenoid 26 which actuates the magnetic starting switch 22. The opposite end of coil 26 is connected by lead 27 to one terminal 28 of switch 17, the other terminal

29 of which is connected by lead 31 to the generator G, which is grounded at 32. Terminals 28, 29 of switch 17 are bridged by a resistor 33 having a value such as to pass just sufficient current to prevent the starting switch 22 from opening after it has been closed.

Switch 17 is provided with a bridging contact 34 arranged to connect the terminals 28, 29 when spindle 16 is in its normal position as determined by a spring 35. This spring connects the spindle to a casing 36 which encloses the switch actuating mechanism and is attached as indicated at 37 to the generator frame 1. The spindle 16 is fulcrumed on a flexible diaphragm 38 which is sealed in an opening 39 in casing 36 by means of a switch housing 41 suitably attached to the casing 36 as by soldering or brazing as indicated at 42.

The arm 15 of spring 14 is arranged to engage the free end of the spindle 16 and move it in a direction to open the switch 17 against the action of the spring 35 responsive to torque transmitted through the viscous coupling 5, 6, 8 and the friction coupling 13, 14.

In operation, starting with the parts in idle position, closure of the manual switch 25 causes energization of the starting switch coil 26 since the switch 17 is closed by the spring 35. This causes closure of the starting switch 22 and consequent actuation of the starting motor to crank the engine. Rotation of the generator shaft 2 by the engine is transmitted through the viscous and friction couplings so as to apply torque to the spring arm 15 which swings the switch spindle 16 against the action of spring 35 and opens switch 17. The starting switch 22 however, is held closed by the current traversing the resistor 33 since the voltage of the generator when rotated at cranking speed is insignificant.

When the engine starts, the voltage of the generator builds up and prevents passage of current through the coil 26, thus causing the starting switch 22 to open and deenergize the starting circuit.

Thereafter, actuation of the starting system is prevented as long as the engine is rotating by reason of the opened condition of switch 17. When the engine stops for any reason, the viscous coupling 5, 6, 8 yields slowly, permitting the spring 35 to move the spindle 16 so as to cause closure of the switch 17 after a suitable time delay so as to permit the engine to come completely to rest. If the ignition switch 25 is then closed, the starting operation is repeated as above set forth.

Although but one embodiment of the invention has been shown and described, it will be understood that various changes may be made in the design and arrangement of the parts without departing from the spirit of the invention.

I claim:

1. In combination with a rotary member and a switch to be actuated thereby, a driving shaft connected to rotate with said member having a driving disc fixed thereon; a coupling member journaled on the driving shaft having a chamber enclosing said disc, a slow-flowing material in said chamber forming a viscous connection from the disc to the coupling member rotating the coupling member substantially in unison with the disc, a spring member embracing the coupling member mounted for limited arcuate movement and having a friction connection therewith; means connecting the spring member to the switch for actuating the switch responsive to rotation of the coupling member, and elastic means

for returning the spring member to idle position, through yielding of the viscous connection, a pre-determined time after the driving shaft stops rotating; in which said chamber is substantially filled with the viscous material, and including further an elastic closure for said chamber sealing it against escape of the viscous material while permitting expansion and contraction thereof.

2. In combination with a rotary member and a switch to be actuated thereby, a driving shaft connected to rotate with said member having a driving disc fixed thereon; a coupling member journaled on the driving shaft having a chamber enclosing said disc, a slow-flowing material in said chamber forming a viscous connection from the disc to the coupling member rotating the coupling member substantially in unison with the disc, a spring member embracing the coupling member mounted for limited arcuate movement and having a friction connection therewith; means connecting the spring member to the switch for actuating the switch responsive to rotation of the coupling member, and elastic means for returning the spring member to idle position, through yielding of the viscous connection, a pre-determined time after the driving shaft stops rotating; in which the driving shaft is rigidly mounted on the rotary member coaxially therewith and including further means for preventing longitudinal movement of the coupling member on said shaft.

3. The combination set forth in claim 2 in which the coupling member is provided with a flat bearing surface cooperating with a corresponding surface on the side of the driving disc; and including further, spring means compressing said surfaces together to prevent escape of the viscous material between said surfaces.

4. In combination, a rotatable element, an electrical switch, means for actuating the switch responsive to rotation of the element including a drive shaft rigidly mounted on the rotatable element coaxially therewith, a driving disc fixed on said shaft, a coupling member journaled on the shaft having a circular recess loosely housing the disc, a semi-solid material in the recess forming a viscous connection between the disc and coupling member, said coupling member having a circular peripheral channel, and a spring ring member seated in said channel forming a friction connection therewith and having a radially extending arm, said switch having an actuating lever positioned to be engaged and operated by the spring arm, and elastic means limiting the arcuate movement of the ring member, and operative to return the ring member to idle position, through yielding of the viscous connection, a pre-determined time after the drive shaft stops rotating; in which one of the rubbing surfaces of the frictional connection is formed of nylon.

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