May 15, 1934. J. W. McNAIRY 1,959,173

CENTRIFUGAL SWITCH

Filed Jan. 25, 1934

Fig. 1.

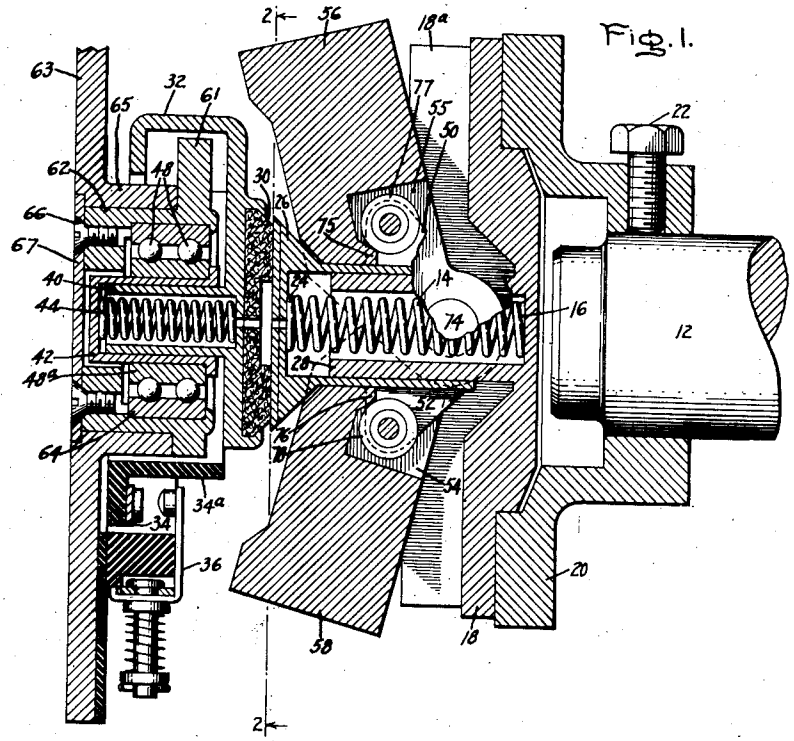
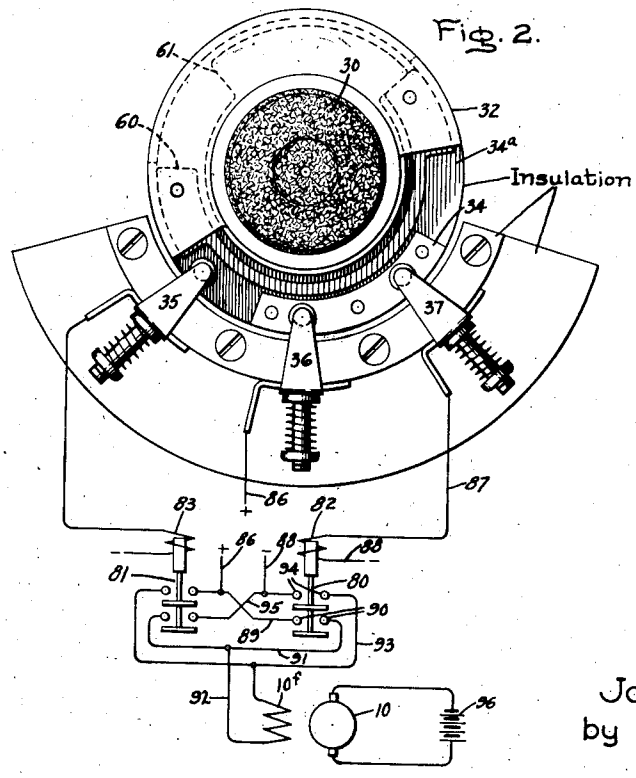


Fig. 2.



Inventor:
Jacob W. McNairy,
by Harry E. Dunham
His Attorney.

Patented May 15, 1934

1,959,173

UNITED STATES PATENT OFFICE

1,959,173

CENTRIFUGAL SWITCH

Jacob W. McNairy, Erie, Pa., assignor to General Electric Company, a corporation of New York

Application January 25, 1934, Serial No. 708,222

4 Claims. (Cl. 200—80)

My invention relates to centrifugal switches and has for an object the provision of a simple, reliable and inexpensive centrifugal switch which operates as a function of speed and which indicates the direction of rotation.

In applying an axle-driven generator to rail car service it is necessary to maintain the correct generator polarity regardless of the direction in which the car may be moving. Heretofore the polarities of small capacity generators have been controlled by the movement of the brush holder. However, this method of controlling the polarity is not readily applicable to generators of large size, such for example of a size sufficient for air conditioning service, since the heavy current leads cannot readily be designed to give sufficient flexibility to permit the rotation of the brush holder.

In carrying out my invention in one form thereof, I provide a centrifugal switch which is arranged to insure the proper polarity for a generator irrespective of the direction of rotation of the generator, the energization of the generator being accomplished only after it is operating at a predetermined speed.

For a more complete understanding of my invention, reference should now be had to the accompanying drawing wherein I have shown in Fig. 1 a switch embodying my invention whilst in Fig. 2 I have shown a view taken on the lines 2—2 of Fig. 1 with a control circuit diagrammatically applied to the contacts of the centrifugal switch.

Referring now to the drawing, I have shown my invention in one form as applied to the control of the polarity of an axle driven generator 10, the switch being applied to one end of the generator shaft 12. In order to control the polarity of the generator 10 in accordance with the direction of rotation of the generator shaft 12, a spring 14 has one end 16 resting against a plate 18 which is secured to an end plate 20, the plate 20 being suitably secured to the shaft 12 as by means of a set screw 22. The opposite end 24 of the spring 14 bears against a plunger 26 slidably mounted on a cylindrical extension 28 of the plate 18. The outer face of the plunger 26 bears against a friction disk 30 formed of suitable material and supported by a switch member 32 arranged for both rotational and longitudinal movement. As shown, the spring 14 maintains the switch member 32 in its left-hand position so that a contact plate 34 mounted on an insulating member 34*a* supported from the switch member 32 is held in spaced relation with three cooperating stationary contacts 35, 36 and 37. In order to provide for the longitudinal movement of the switch member 32 a cylindrical extension 40 of the switch member 32 slidably nests within a cylindrical member 42, a compression spring 44 being mounted between the opposite ends of the cylindrical members 40 and 42 so as to urge the switch member 32 and the friction disk 30 against the end of the plunger 26. By means of the ball bearings 48 the switch member 32 can be rotated with a minimum amount of frictional resistance, the member 42 being secured to the inner race 48*a* of the ball bearing assembly.

Assuming now that the shaft 12 is rotated in a clockwise direction, it will be observed that the end member 20, the plate 18 and the plunger 26 are rotated with it, the rotation of the plunger 26 being insured by a pair of lever arms 50 and 52 secured to the plunger 26 and arranged to nest within notches 54 and 55 provided in a pair of contrifugal weights 56 and 58, the weights being secured to ledges 18*a* formed integrally with the plate 18. As the plunger 26 is rotated, the frictional drag exerted on the disk 30 of the switch member 32 causes the switch member to be rotated in a clockwise direction. It should again be observed that the movable connecting plate 34 is in spaced relation with the stationary contacts. As soon as the connecting plate 34 has been rotated from the position shown in Fig. 2 to a position wherein it is opposite the stationary members 35 and 36, an outwardly extending projection 60 carried by the insulating member 34*a* strikes against a corresponding projection 61 forming a part of a cylindrical member 62 secured to the end shield of the generator or stationary support 63. The outer race 64 of the ball bearing and the member 62 are rigidly mounted within a boss 65 of the end shield by means of screws 66 which extend through a cover plate 67 into threaded engagement with member 62. The cover plate is seated in an annular recess formed in the end shield 63.

As the speed of the generator shaft 12 is increased centrifugal force is developed by the weights 56 and 58 which tends to overcome the force of the spring 14. When a predetermined speed is reached the weight 56 moves in a clockwise direction about its pivot 74 which pivot is supported on members 18*a*, whilst the weight 58 moves in a counterclockwise direction about the same pivot. Each of said weights is provided respectively with projections 75 and 76 which bear against rollers 77 and 78 carried by the arms 50 and 52, which it will be remembered are formed integrally with the plunger 26. The plunger 26

is consequently operated in a right-hand longitudinal direction to break the frictional driving connection with the friction disk 30, the spring 44 thereupon operating the movable switch member 32 in a right-hand direction to complete a connection by the conducting plate 34 between the stationary contacts 35 and 36.

Since the plunger 26 and the friction disk 30 forming the driving connection are disengaged upon the attainment of the predetermined speed of the generator shaft 12, it will be observed that there are no frictional losses or any frictional wear on the parts for all operations of the generator above the predetermined speed. Furthermore, since the switch contacts are not operated until after a predetermined speed is reached the generator field winding is not energized until the predetermined speed has been attained.

Referring to Fig. 2 of the drawing, it will be observed that the field winding 10*f* of the generator 10 is controlled by a pair of direction switches 80 and 81, the operating coils 82 and 83 of which are controlled by the speed and directional switch. Thus for example, if it is assumed that the conducting plate or bridging contact 34 completes a connection between the stationary contacts 36 and 37 a circuit can be traced from the positive source of supply 86, stationary contact 36, conducting plate 34, stationary contact 37, conductor 87, operating coil 82 of the direction switch and to the negative source of supply. The direction switch 80 is thereupon operated to the closed position to energize the field winding 10*f* through a circuit which may be traced from the positive source of supply 86, by conductor 89, contacts 90, conductors 91 and 92, field winding 10*f*, conductor 93, contacts 94 and by conductor 95 to the negative source of supply 88.

Similarly, if it be assumed that the bridging contact 34 completes an energizing circuit through the stationary contact members 35 and 36 the direction switch 81 completes an energizing circuit for the field winding 10*f* with its polarity reversed. Therefore, the generator 10 always causes a current to flow to its load, for example the battery 96, in the same direction irrespective of the direction of rotation of the generator armature.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I, therefore, contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. In combination, a speed and directional switch comprising a plurality of direction selecting contacts, biasing means normally biasing said contacts to a circuit-interrupting position, means mounting said biasing means for rotation, centrifugal means operatively associated with said biasing means for operating said biasing means to release said contacts, friction means forming a driving connection between said biasing means and said contacts for producing different circuit-controlling connections between said contacts in response to the direction of rotation of said friction means, means for biasing said contacts to a circuit-closing position, said centrifugal means disengaging said frictional driving connection when said switch is rotated at a predetermined speed.

2. A speed and directional switch comprising a plunger arranged for longitudinal movement between predetermined limits, a spring for biasing said plunger to one of said limits, centrifugal means operatively associated with said plunger for operating said plunger to the other of said limits against said bias, circuit-controlling means operable between open and closed circuit positions and normally biased to one of said positions, a friction plate operatively engaged by said plunger, means mounting said friction plate on said circuit controlling means for maintaining said circuit-controlling means in the other of its positions against said bias and for forming a frictional driving connection between said plunger and said circuit-controlling means, and means permitting relative movement of said circuit-controlling means in accordance with the direction of rotation of said friction means whereby said circuit-controlling means is operated in accordance with the direction and the speed of rotation of said centrifugal means.

3. An attachment for a generator comprising an end plate, means for securing said plate to one end of said generator shaft, a pair of centrifugal weights, means for supporting said weights from said plate, a plunger normally biased to one position and operable by said weights to a second position, means connecting said plunger for rotation with said plate, circuit-controlling means operatively associated with said plunger, friction material interposed between the face of said plunger and said circuit-controlling means to form a frictional driving connection between said plunger and said circuit-controlling means, means for permitting a rotational movement of said circuit-controlling means between predetermined limits, means responsive to the rotation of said circuit-controlling means for completing different circuit-controlling connections, means permitting longitudinal movement of said circuit-controlling means between predetermined limits for disabling said connecting means whereby upon operation of said generator said circuit-controlling means is rotated to one or the other of its positions and is thereafter operated to one or the other of said circuit-controlling positions after said generator has attained a predetermined speed of rotation.

4. In combination, an axle-driven generator provided with an end shield, a plate, means for driving said plate at the same speed and in the same direction as said axle-driven generator, a plunger operable between predetermined positions, centrifugal weights operatively connected to said plate and to said plunger, biasing means normally biasing said plunger to one of its positions, rollers supported from said plunger and engaging said weights for biasing said weights in a predetermined position, circuit-controlling means supported from said end shield of said generator comprising a switch member, friction material secured to said member and arranged in cooperative relation with said plunger, means mounting said switch member for rotational and longitudinal movements between predetermined limits, a predetermined low speed rotation of said plunger in one direction rotating said switch member to one of its limits and the rotation of said plunger in the opposite direction rotating said switch member to the other of its limits, said biasing means when said generator is rotating at said predetermined low speed normally maintaining said plunger in engagement with said friction material and said switch member in

one of its limits, circuit controlling contacts located in spaced relation with said switch member for completing predetermined circuits in accordance with the speed and direction of rotation of said generator, said centrifugal weights operating said plunger in a longitudinal direction from said first position to said second position to permit said switch member to move into engagement with said stationary contacts and to disengage said plunger from said frictional material after said generator speed rises above said predetermined low speed.

JACOB W. McNAIRY.