

Feb. 19, 1952

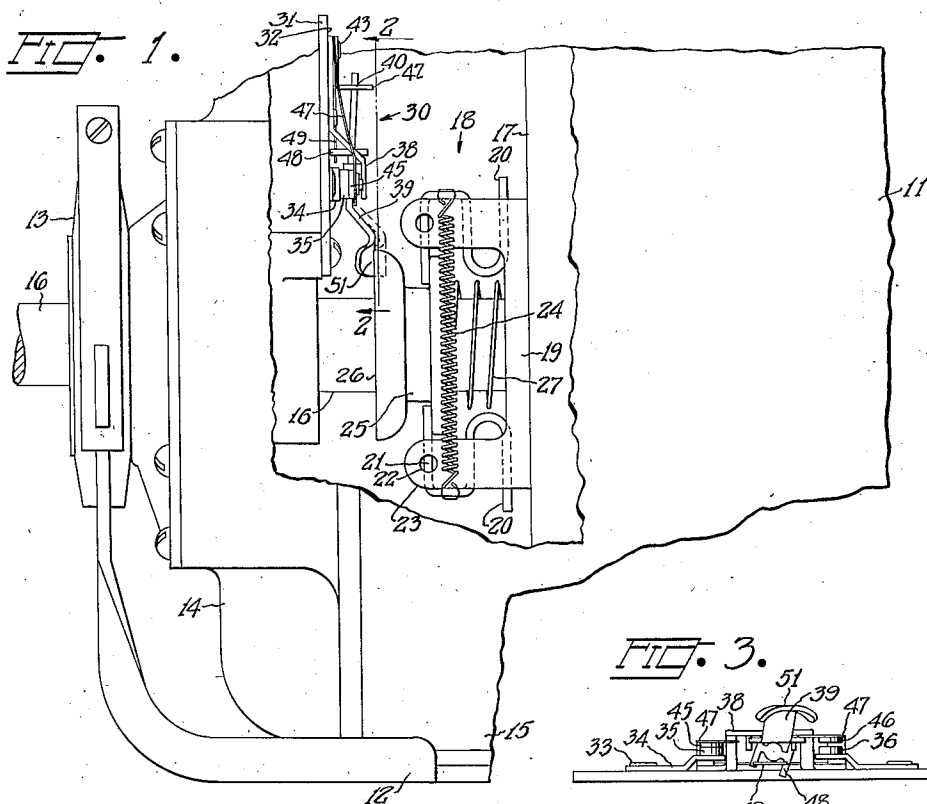
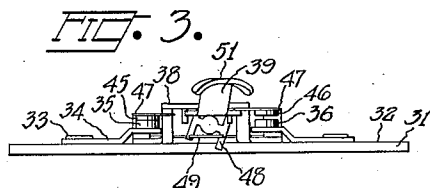
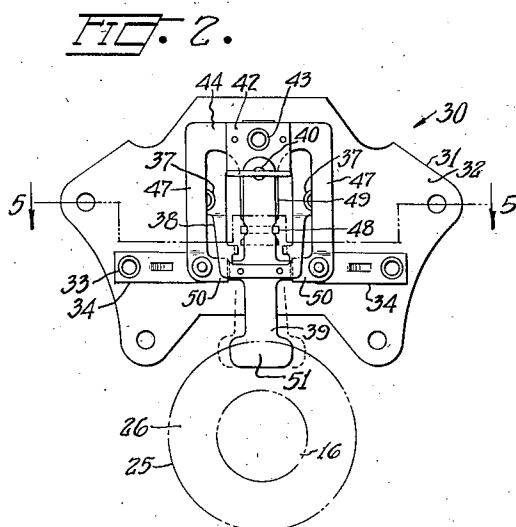
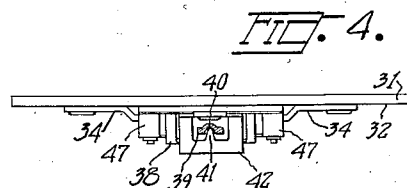
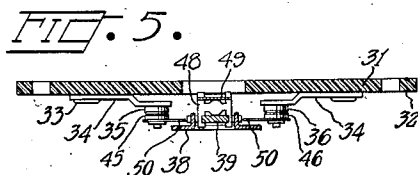
C. E. SPRAGUE ET AL

2,586,734

ELECTRIC CENTRIFUGAL SWITCH

Filed June 20, 1949

2 SHEETS—SHEET 1



INVENTORS
C. E. SPRAGUE
A. L. JUDSON

BY *C. B. Birkenhead.*
ATTORNEY

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2 SHEETS—SHEET 2

FIG. 6.

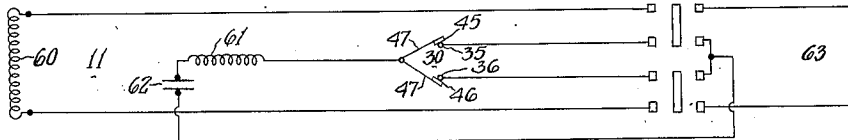


FIG. 7.

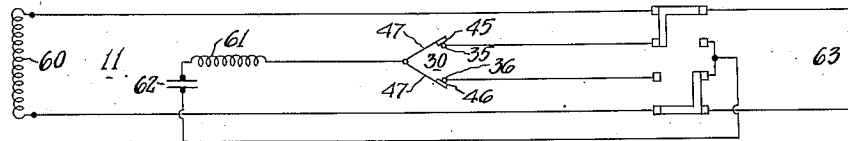


FIG. 8.

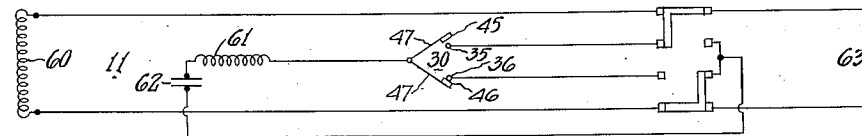


FIG. 9.

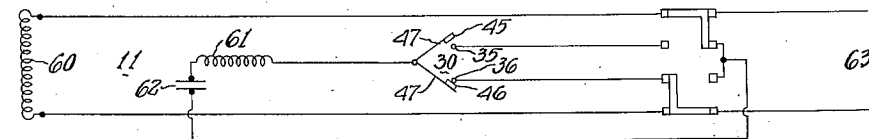
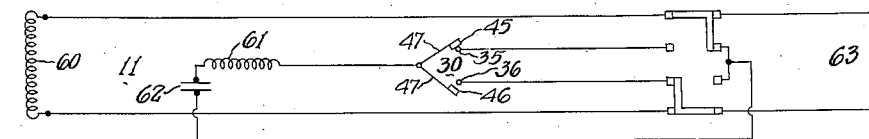


FIG. 10.



INVENTORS
C. E. SPRAGUE
A. L. JUDSON

BY *C. E. Sprague*
ATTORNEY

UNITED STATES PATENT OFFICE

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ELECTRIC CENTRIFUGAL SWITCH

Chester E. Sprague and Albert L. Judson, Portland, Oreg., assignors to Iron Fireman Manufacturing Company, Portland, Oreg., a corporation of Oregon

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3 Claims. (Cl. 200—80)

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This invention relates generally to electric switches and particularly to combination starting and selector switches for split phase motors.

Attention is called to the Chester E. Sprague et al. prior U. S. Patent No. 2,382,827, issued August 14, 1945 on a Reversing Split Phase Motor, and to Chester E. Sprague's pending U. S. Patent application, S. N. 776,660, filed September 29, 1947, now Patent No. 2,528,845, dated November 7, 1950, on a Reversing Split Phase Motor. The resulting operation of a split phase motor equipped with the switch of our present invention would be the same and have the same advantages as the operation of the motors described in the above previous patent and application when equipped with the combined starting and selector switches there shown.

The principal object of the present invention is to provide a combined selector and starting switch for a split phase motor which switch is adapted for use with a centrifugally responsive switch operator in which the switch operating member of the operating mechanism responds to the speed of rotation of the motor and is moved axially of the motor thereby.

A second object of this invention is to provide a two circuit combined selector and starting switch which will be influenced by the motion of its centrifugally influenced operator in such a manner that the switch will have both of its circuits closed below a predetermined speed of rotation of the split phase motor and only a selected one of its two circuits closed above said speed, the selection of the circuit to be closed through the switch being determined by the direction of rotation of the motor as it last rose to said predetermined speed.

A third object is to provide a switch of the above noted type which is simple in design, of few parts, and economical to make and install.

A fourth object is to provide a switch having two spaced stationary contacts, two spaced movable contact members respectively biased to contact said stationary contacts, and a pivoted lever selectively engageable with either of said movable contact members to separate said engaged movable contact from its respective stationary contact.

How these and other objects are attained through the design and use of the mechanism of this invention will be apparent from the following description referring to the accompanying drawings in which,

Fig. 1 is a fragmentary view of a split phase

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motor broken away to show an elevation of the switch of this invention and its centrifugal operator in place in the motor.

Fig. 2 is an elevation of the switch of this invention viewed from along the line 2—2 of Fig. 1.

Fig. 3 is an end view of the switch of this invention viewed from the bottom of Fig. 2.

Fig. 4 is an end view of the switch of this invention viewed from the top of Fig. 2.

Fig. 5 is a section through the switch of this invention viewed along the line 5—5 of Fig. 2.

Figs. 6 to 10 are schematic circuit diagrams of a motor equipped with the switch of this invention together with an exterior controller adapted to be used therewith and illustrate the conditions in the circuit for several operating positions of the controller.

Like numerals refer to like parts in the various figures of the drawings.

Now referring to the drawings there is shown a split phase motor 11 having a base 12 supporting a resilient mounting 13 carrying a stator end bell 14 supporting a stator 15. Supported in end bell 14 on bearings, not shown, is a shaft 16 carrying a rotor 17, not shown in detail.

Secured to rotor 17 is centrifugal switch operator 18 comprising base 19 symmetrically located around shaft 16 and carrying flying members 20 having ears 21 journaled in holes 22 perforating wings 23 upstanding on base 19. Springs 24 strained between flying members 20 bias members 20 in their positions of rotation about ears 21 shown in Fig. 1. Further rotation of members 20 in the direction of bias of springs 24 is prevented by the engagement of the long ends of members 20 with base 19 as shown. The short ends of members 20, as shown in Fig. 1, hold insulating switch actuating member 25 having annular face 26 against coil spring 27 abutting base 19. Spring 27 and member 25 are loosely held on shaft 16. As the speed of rotation of rotor 17, shaft 16 and switch operator 18 is increased, the speed of rotation passes through a narrow range where due to centrifugal force acting on the long ends of flying members 20 these long ends are rotated against the bias of springs 24 and 27 to a position of greater radius about shaft 16 and above this narrow speed range this position of greater radius is held. From Fig. 1, it is apparent that, as the motor speed rises through the critical range of speed, actuator 25 will move to the right and, as the speed falls through the critical range, actuator 25 will move to the left and return to the position of rest shown.

Interiorly of stator 15 and secured to end bell

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14 is the electric switch mechanism 30 of this invention. In the form shown, mechanism 30 includes an insulating base member 31 having a mounting surface 32 on which are secured by spun rivets 33 stationary contact arms 34 carrying stationary contacts 35 and 36. Also secured to surface 32 and held by spun rivets 37 is offset bracket 38 for limiting the movement of switch lever 39 rockably pivoted at 40 on pivot 41 formed on pivot bracket 42 secured to base 31 by spun rivet 43 and securing between offset bracket 38 and pivot bracket 42, a resilient E shaped member 44 including moving contact arms 47 carrying moving contacts 45 and 46. Rocking H shaped link 48 is interposed between lever 39 and the center leg 49 of E shaped member 44. It should be noted that moving contact arms 47 have hooked ends 50 having a definite spacing between them and that lever 39 is widened at its position adjacent ends 50 to a width slightly less than the distance between ends 50.

On reference to the above description and the drawings, it will be seen that lever 39 is biased away from surface 32 by resilient member 49 acting through rocking link 48 and that the movement of lever 39 away from surface 32 is limited at one end by pivot 41 and at the other by offset bracket 38. Also arms 47 bias moving contacts 45 and 46 into contact respectively with stationary contacts 35 and 36. Then referring to Fig. 1, it will be seen that, when assembled in a motor, surface 26 of the actuator 25 abuts the crowned surface 51 of the offset extended free end of lever 39 so that when the motor is idle or below the pre-determined critical range of speed in either direction the widened part of lever 39 adjacent hooks 50 on arms 47 is depressed against the bias of leg 49 to a position closer to surface 32 than are hooks 50. It is, therefore, apparent that as the motor starts up in one direction, the friction of face 26 on face 51 will cause lever 39 to rock in the direction of rotation of face 26 so that a part of lever 39 will underlay the hook 50 on the side toward which face 26 is rotating. Then, as the motor goes through the critical speed range and the long ends of flying members 20 assume their positions of greater radius, the short ends of member 20 will retract actuator 25 from contact with lever 39 which, since the bias of leg 49 is greater than the bias of arm 47, will rise under the hook 50 on arm 47 and raise the appropriate moving contact 45 or 46 away from its mating contact 35 or 36 but will leave the other moving contact closed on its mating stationary contact.

Having explained the construction, application and operations of one form of the switch of this invention, the purpose or use of this invention can best be shown by referring to the schematic Figures 6 to 10.

In Figures 6 to 10 are shown a split phase motor 11 having a running winding 60, a starting winding 61, a starting condenser 62 and the switch 30 of this invention with its stationary contacts 35 and 36, its moving contacts 45 and 46 and its moving contact resilient biasing arms 47. The motor is shown as appropriately connected to an electric service 63 through a common type of drum controller having four stationary contacts in each direction, forward and reverse, and an insulated reversing drum carrying two L shaped bridging members.

In Fig. 6 the controller is shown in off or neutral position with all contacts open and all motor windings de-energized. The motor is at

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rest and both pairs of internal switch contacts 35—45 and 36—46 are closed.

In Fig. 7 the controller has been thrown to the left which we will call the forward position. It is seen that in this position of the controller both the starting and running windings of the motor are energized and the motor is starting up, the starting winding being energized through internal switch contacts 35—45. As the motor goes through its predetermined critical speed range, contacts 35—45 open as previously explained and the motor continues to run in forward direction as shown in Fig. 8.

Now, if it is desired to stop the motor in the commonly used way it is merely necessary to return the controller to neutral as shown in Fig. 6 and the motor will slow down and stop, returning the internal switch to the condition shown in Fig. 6. However, if it is desired to "plug" or suddenly stop the motor when it is running at rated speed in the forward direction as shown in Fig. 8, we have only to throw the control through the neutral position to the reverse position shown in Fig. 9. By doing so, it is seen that the running winding is energized with the same polarity as before but that now the starting winding is energized with reversed polarity through contacts 36—46 and the motor has its own torque as well as the drag of its friction and its load to stop it. The motor will rapidly come to a stop and at this time the controller can be thrown to neutral if it is desired to leave it stopped. The internal switches will both be closed as shown in Fig. 6.

However, if it is desired to have the motor continue and run in the reverse direction, the controller is left in the position shown in Fig. 9, the running winding is energized and the starting winding is energized in the reverse direction through contacts 36—46. Until the motor has speeded up to its critical speed range in the reverse direction, both internal switches will remain closed but at the critical range of speed as previously explained contacts 36—46 will open, the starting winding is de-energized and the motor continues to run in the reverse direction but, as shown in Fig. 10, contacts 35—45 remain closed, so again the motor may be "plugged" or reversed by throwing the controller, in this case, through neutral to the forward direction of Fig. 7.

Having thus clearly described the construction, application, operation, and use of one form of the switch of this invention, we claim:

1. An electric switch comprising an insulating base having a mounting surface thereon, two spaced stationary contacts mounted on said base, two spaced movable contacts each biased toward said surface to contact respectively one of said stationary contacts, an operating lever rockably pivoted near one end for motion about three mutually perpendicular axes passing through the pivot point of said lever, means rockably biasing the other end of said lever away from said mounting surface, means for limiting the motions of said lever, and co-operating means on said lever and said movable contacts whereby, when the free end of said lever is moved a pre-determined distance toward said surface each of said movable contacts will contact its respective stationary contact and if, whenever said free end of said lever is within said pre-determined distance of said surface, said lever is rocked toward one of said stationary and moving contact pairs and re-

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leased to move away from said surface, only said one pair of contacts will be opened.

2. An electric switch comprising a first stationary contact, a first moving contact, a first means biasing said first moving contact toward said first stationary contact, a second stationary contact, a second moving contact, a second means biasing said second moving contact toward said second stationary contact, a rockable member, means for limiting the motion of said rockable member and a third means biasing said rockable member oppositely to the direction of bias of said first and second biasing means, said rockable member including means for selectively engaging said first or second moving contacts whereby, when said rockable member is moved a predetermined distance opposed to said third biasing means, then rocked toward said first moving contact and released, said first moving contact will be moved away from said first stationary contact and when said rockable member is moved said pre-determined distance opposed to said third biasing means, then rocked toward said second moving contact and released, said second moving contact will be moved away from said second stationary contact.

3. In combination with a shaft and means for driving said shaft in either direction of rotation, an electric switch and a switch operating mechanism therefore, the mounting of said switch being stationary, said mechanism being carried by said shaft to rotate in either direction therewith, said mechanism comprising a switch operating

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member having an annular surface substantially concentric with and in a plane perpendicular to said shaft, the axial position of said annular surface along said shaft being responsive to the rotational speed of said shaft, said switch comprising two pairs of switch contacts and an operating lever, each of said pairs comprising a stationary contact and a moving contact, means biasing each of said pairs of switch contacts to the closed position, means adapting said lever to co-operate with said annular surface to position one end of said lever axially of said shaft responsive to the speed of said shaft and to rock said one end of said lever angularly in the direction of rotation of said shaft, means adapting said lever to open one of said pairs of contacts when said shaft is rotating at more than a predetermined speed in one direction and means adapting said lever to open the other of said pairs of contacts when said shaft is rotating at more than said predetermined speed in the other direction.

CHESTER E. SPRAGUE.
ALBERT L. JUDSON.

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The following references are of record in the file of this patent:

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