April 15, 1958 A. F. DEMING ET AL 2,831,153

CENTRIFUGAL SWITCH MECHANISM

Filed Nov. 19, 1956

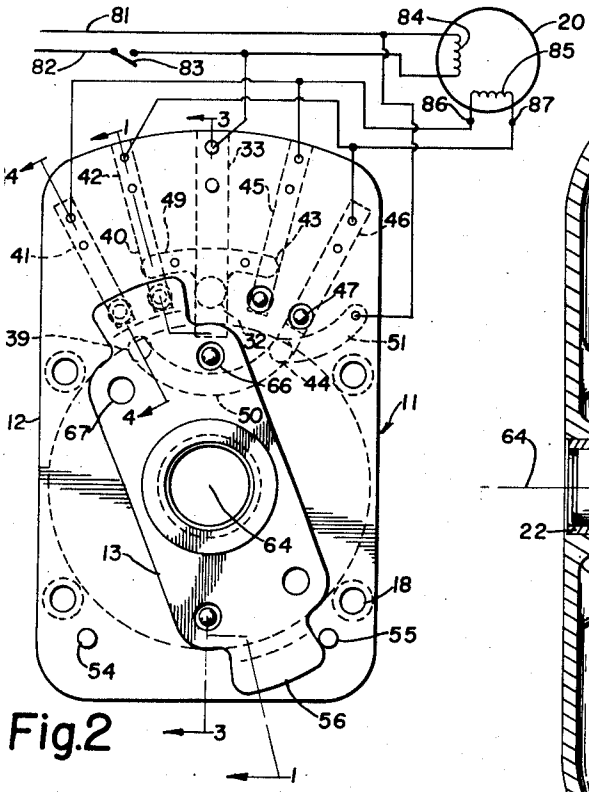

Fig.2

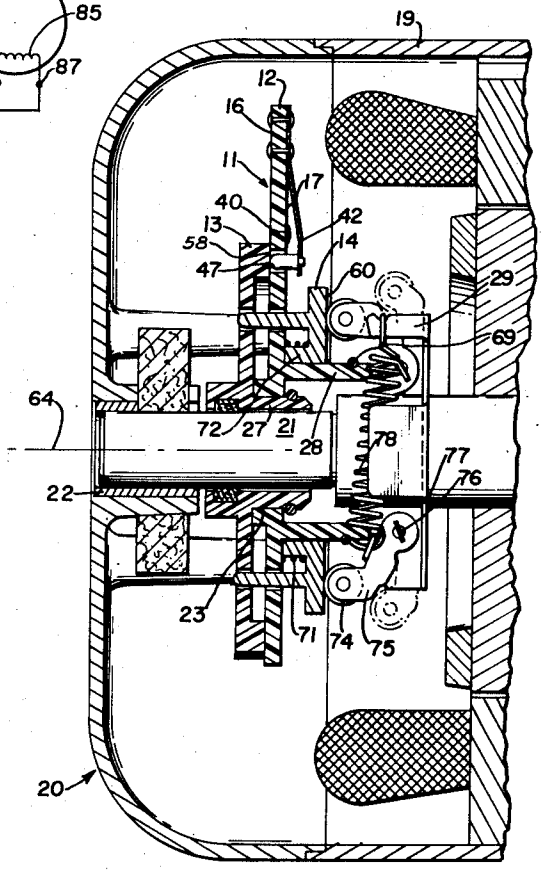

Fig.1

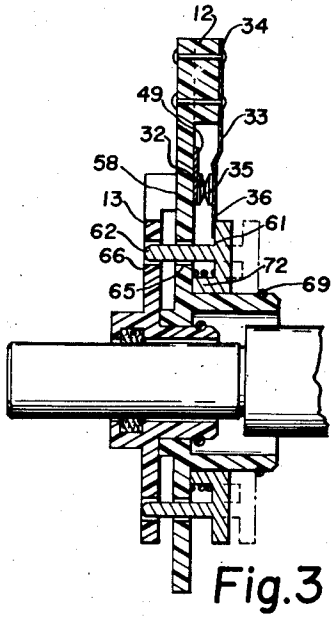

Fig.3

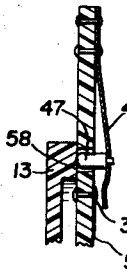

Fig.4

INVENTORS,
ANDREW F. DEMING
RICHARD D. HOUK
BY Woodling & Krost
Atty's.

United States Patent Office 2,831,153 Patented Apr. 15, 1958

2,831,153

CENTRIFUGAL SWITCH MECHANISM

Andrew F. Deming and Richard D. Houk, Alliance, Ohio, assignors to The Alliance Manufacturing Company, Division of Consolidated Electronics Industries Corporation, Wilmington, Del.

Application November 19, 1956, Serial No. 623,199

16 Claims. (Cl. 318—207)

The invention relates in general to electrical switch mechanisms and more particularly to a reversing switch mechanism which may be combined with an extra make and break switch function. This reversing switch and extra make and break switch function may be such as is used for a reversing switch for an electric motor together with a starting switch function of permitting closing of either the forward or reverse contacts for a short time during starting conditions of the motor.

The prior art forms of combined starting switches and reversing switches attempted to combine the two functions of switching from forward to reverse conditions and also to hold closed temporarily contacts for the starting winding of an electric motor. Such prior art switches were subject to several defects, however, in that they attempted to use rotary motion of the motor shaft to provide the reverse switching function and attempted to use an axial motion as imparted by a centrifugal force mechanism to give the starting function, with both of these functions being embodied in a single switch part. This single switch part then had to have both arcuate movement and axial movement, and to be successful there had to be sufficient arcuate friction to cause arcuate movement of the switch part, yet there had to be sufficiently low axial friction to permit axial movement by means of the centrifugal mechanism. This dual function was impossible of achievement to any degree of satisfaction because attempts to increase the arcuate friction also increased the axial friction, and the motor switch would either hang up in the open position, thus refusing to start, or would hang up in the closed position, thus burning out the starting windings of the motor.

Accordingly, an object of the present invention is to provide an improved reversing switch for an electric motor.

Another object of the invention is to provide a dependable combined starting and reversing switch for an electric motor.

Another object of the invention is to provide a switch mechanism wherein one part has axial movement and another part has arcuate movement, both parts actuating contact means.

Another object of the invention is to provide a switch mechanism wherein rotatively movable means are separate from axially movable means so that the friction of each is independent and wherein the friction affecting the axially movable means is less than that affecting the rotatively movable means.

Another object of the invention is to provide a switch mechanism wherein a part moves rotatively and another part moves axially to lock and unlock the rotatively movable means.

Another object of the invention is to provide a switch mechanism utilizing a plurality of contacts wherein the circuit is made and broken at only a single set of contacts so that this set of contacts needs to be high quality

to resist burning and pitting and the remaining contacts may be made of more economical material.

Another object of the invention is to provide a switch mechanism having a rotative part and an axially movable part, with one of these parts actuating first and second double-throw contacts and the other part locking and unlocking the first part.

Another object of the invention is to provide a switch having two separate switching functions, one of which is actuated by rotative friction and the other of which is actuated by centrifugal force means, with these two means of actuation being separate and independent.

Other objects and a fuller understanding of this invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a side elevation view of the switch mechanism according to the invention which for illustration is incorporated in an electric motor;

Figure 2 is an end elevation view of the switch mechanism removed from the motor of Figure 1 and schematically showing the wiring connections;

Figure 3 is a sectional view on the line 3—3 of Figure 2; and

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

The invention pertains to a switch mechanism **11** which may take many forms but which in the preferred embodiment shown incorporates three main parts; namely, a stationary plate **12**, a rotatively movable cam **13**, and an axially movable cam **14**. The stationary plate **12** has first and second faces **16** and **17** and carries the contact means of the switch **11**. The stationary plate **12** may be mounted at the mounting holes **18** in any suitable manner to the support, which in this case is the frame **19** of an electric motor **20**. This motor **20** has a shaft **21** journalled in a bearing **22** carried by the frame **19**, and the stationary plate **12** has an aperture **23** surrounding the shaft **21**.

The rotatively movable cam **13** has a sleeve **27** journalled on the shaft **21**, with the stationary plate **12** engaging this sleeve **27** as a form of bearing so that the rotatively movable cam **13** is journalled between the stationary shaft **12** and the shaft **21**. The stationary plate **12** has a sleeve portion **28** coaxial with the shaft **21** and extending from the second face **17**. This sleeve portion **28** carries the axially movable cam **14** for axially sliding movements. A centrifugal force mechanism **29** is fixed to the shaft **21** and coacts with the axially movable cam **14** to provide axial movement thereto.

The contact means carried on the stationary plate **12** include a main contact **32** and a main leaf spring contact **33** having an end **34** fixed to the stationary plate **12** and carrying a movable contact **35** for cooperation with the main contact **32**. The outboard end **36** of the leaf spring **33** extends into the path of movement of the axially movable cam **14** to be actuatable thereby. First and second fixed contacts **39** and **40** are mounted on the stationary plate **12** on one side of the main contact **32**, and first and second leaf spring contacts **41** and **42** cooperate therewith. Third and fourth fixed contacts **43** and **44** are mounted on the stationary plate on the other side of the main contact **32**, and third and fourth leaf spring contacts **45** and **46** cooperate therewith. Each of the leaf spring contacts **41, 42, 45,** and **46** carries a cam follower **47** which is adapted to be actuated by the rotatively movable cam **13**. A conductive strap **49** interconnects the main contact **32** and the second and third fixed contacts **40** and **43**. A conductive strap **50** interconnects the first and fourth fixed contacts **39** and **44** with an ear **51** connected to the strap **50** for external electrical connec-

tion. All of the fixed contacts **32, 39, 40, 43, and 44** are on the second face of the stationary plate **12**, which facilitates ease of manufacture.

The rotatively movable cam may be considered as an arcuately movable switch piece because limit pins **54** and **55** are engaged by a tail piece **56** to establish first and second arcuate or rotational limit positions. A first arcuate limit position is shown in Figure 2, and in this position the rotatively movable cam **13** has a cam face **58** which engages the cam followers **47** on the first and second leaf spring contacts **41** and **42** to open circuit the first and second sets of contacts. This is as shown in Figures 1 and 4. The second rotational limit position of the cam **13** would be when the other side of the tail piece **56** engages the limit pin **54**, and in that position the cam face **58** would engage the cam followers **47** on the third and fourth leaf spring contacts **45** and **46** to open circuit the third and fourth sets of contacts. At this time the first and second sets of contacts would be closed by the resiliency of the first and second leaf spring contacts **41** and **42**.

The axially movable cam **14** is generally cylindrical to slide along the axis or parallel to the axis of the shaft **21** by sliding on the sleeve portion **28**. This axially movable cam **14** has a planar face **60** for cooperation with the centrifugal force mechanism and has an abutment surface **61** to abut the outboard end **36** of the main leaf spring contact **33**. A lock pin **62** extends from this abutment surface **61** and is parallel to the axis **64** of the shaft **21**. This lock pin extends through an aperture **65** in the stationary plate **12** and is adapted to extend into first and second locking apertures **66** and **67**, respectively, in the rotatively movable cam **13**. The lock pin **62** extends into the first locking aperture **66** when the rotatively movable cam **13** is in the first limit positon as shown in Figures 2 and 3, and this lock pin **62** may extend into the second locking aperture **67** when the cam **13** is in the second rotational limit position.

The axially movable cam **14** has first and second axial limit positions, with the first limit position being that shown in Figures 1 and 3, and with the second axial limit position being when the cam **14** is moved to the right against a lock ring **69**. In this second axial limit position the lock pin **62** will still engage the aperture **65** but will not engage either locking aperture **66** or **67**. A coil spring **71** surrounds a collar portion **72** of the axially movable cam **14** and acts between this cam **14** and the stationary plate **12** to urge the cam **14** to the right to the second limit position, shown in dot-dash lines in Figure 3. The centrifugal force mechanism includes weighted rollers **74** carried on arms **75** pivoted at **76** on a carrier **77** which rotates with the shaft **21**. A spring **78** urges the arms **75** toward the shaft **21** but the action of centrifugal force, when the motor **20** is running at or near normal running speed, is enough to cause the rollers **74** and arms **75** to swing outwardly to the dot-dash line position, as shown in Figure 1. This axially moves the rollers **74** to the right as viewed in Figure 1 and permits the coil spring **71** to urge the axially movable cam **14** to the right to its second limit position. When the shaft **21** and centrifugal force mechanism **29** is stationary as shown in full lines in Figures 1, the spring **78** overcomes the coil spring **71**, thus urging the axially movable cam **14** to the left to the first limit position.

The switch mechanism **11** may be used for several purposes, but one specific use is shown schematically in Figure 2 wherein this switch mechanism **11** is connected to control energization to the motor **20**. Single phase alternating current supply lines **81** and **82** may be connected through a switch **83** to the running winding **84** of the motor **20** where such motor may be an induction motor of the split phase type, for example, having not only the running winding **84** but a starting winding **85**. Such a motor may be of the resistance split phase type, of the capacitor start type, of the capacitor run type, of the permanent-split capacitor type, or other suitable types known to the skilled in the art. The starting winding **85** has first and second terminals **86** and **87**, with the first terminal **86** connected to the first and third leaf spring contacts **41** and **45** and with the second terminal **87** connected to the second and fourth leaf spring contacts **42** and **46**. The main leaf spring contact **33** is connected through the line switch **83** to the line **82**.

Operation

The rotatively movable cam **13** is rotatively or arcuately movable between the first limit position shown and a second limit position to provide forward and reverse energization to the motor **20**. This is by selective actuation of the first and second sets of contacts **39—42** and the third and fourth sets of contacts **43—46**. The axially movable cam **14** moves between the first axial limit position shown in full lines in Figure 3 and the second limit position shown in dot-dash lines, with this cam **14** providing two separate functions. When this cam **14** is in the left-hand or first limit positon, the lock pin **62** engages either one or the other of the locking apertures **66** and **67** to prevent any rotative movement of the rotatively movable cam **13**. Also, at this time the abutment surface **61** causes the main contacts **32** and **35** to close. This provides energization to the motor **20**, assuming the switch **83** to be closed. Energization is, of course, supplied to the running winding **84**, and the line **82** is connected through the main contacts **32** and **35** and through the third contacts **43** and **45** to the first terminal **86** of the starting winding **85**. The other terminal **87** of the starting winding **85** is connected through the fourth contacts **44** and **46** and the ear **51** to the line **81**. This causes rotation of motor **20** in one direction, for example, the forward rotation. As the motor accelerates and comes up to a preset speed, the centrifugal force mechanism **29** is actuated so that the rollers **74** move to the dot-dash position shown in Figure 1, whereupon the coil spring **71** moves the axial cam **14** to the right to the second limit position, shown in dot-dash in Figure 3, to first open circuit the main contacts **32** and **35**, and subsequently to unlock the rotatively movable cam **13**. The opening of the main contacts **32** and **35** completely de-energizes the starting winding **85** so that this starting winding is only energized during the short time of acceleration of the motor **20**. The unlocking of the rotatively movable cam **13** by withdrawal of the lock pin **62** permits arcuate movement of this cam **13**. This arcuate movements is effected by friction between the shaft **21** and the sleeve **27**. This friction quickly causes rotative movement of the rotatively movable cam **13** to the second limit position with the tail piece **56** against limit pin **54**, but the opening of the third and fourth sets of contacts **43—46** and the closing of the first and second sets of contacts **39—42** has no effect because the main contacts **32** and **35** are already opened. The fact that the main contacts **32** and **35** are opened before opening of any of the first through fourth contacts means that only the main contacts **32** and **35** need be of high quality material to withstand the arcing so as to prevent pitting and burning. The first through fourth fixed contacts and the first through fourth leaf spring contacts may be made of low quality economical material since they do not make or break current flow in the circuit.

The lock pin **62** maintains the switch mechanism in the selected one of the forward and reverse, or double-throw, conditions so that vibration or jarring will not change the position of this switch mechanism. The motor continues to run in the forward direction until the switch **83** is opened to de-energize the running winding **84**. When next the switch **83** is closed, the motor **20** is energized in the reverse direction because now the rotatively movable cam **13** is in the second arcuate limit position wherein the starting winding **86** is energized in a reverse

condition from that previously established. The motor again accelerates, this time in the reverse direction, and as it accelerates, the centrifugal force mechanism opens up to move the axially movable cam to the right to the second limit position to first break the circuit to the starting winding **85** at the main contacts **32** and **35** and subsequently to unlock the rotatively movable cam **13** so that it returns to the first arcuate limit position shown in Figure 2.

Whenever the switch **83** is opened for either direction of rotation, the motor will decelerate, and as it decelerates, the centrifugal force mechanism **29** will collapse, with the rollers **74** urging the axially movable cam **14** to the left to the first limit position to first lock the rotatively movable cam **13** in its selected position and to subsequently close the main contacts **32** and **35** so that the switch mechanism **11** will be ready for its next starting function.

The axially movable cam **14** slides on the sleeve portion **28** and has an inherent friction therewith which friction is separate from, and independent of, the friction from the shaft **21** to the sleeve **27** which is a part of the rotatively movable cam. This means that the friction between sleeve **27** and shaft **21** may be increased to a satisfactory operating point without affecting the axial friction between axially movable cam **14** and the sleeve portion **28**. Therefore, the friction on this axially movable cam **14** may be made quite low and much less than the friction acting on the rotatively movable cam **13**.

It will be noted that the rotative cam **13** actuates the contact means, and also the axial cam **14** actuates the contact means. In the embodiment shown, these are two separate switching functions, one providing a reversing switching function or double-throw switching function, and the other performing a starting switch function of momentary or short duration until the motor accelerates to near running speed. Also, of these two movable cams, one performs a double-throw switching function and the other performs a locking function to lock and unlock the other.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A switch mechanism having a rotatable shaft, comprising, contact means carried in said switch mechanism, rotatively movable means, axially movable means, first mounting means to mount said rotatively movable means for rotation between first and second rotational positions, second mounting means to mount said axially movable means for movement generally parallel to the axis of said shaft between first and second axial positions, friction means to actuate one of said movable means between said first and second positions and to actuate said contact means thereby, lock means coacting between said axially movable means and said rotatively movable means to lock and unlock said one of said movable means upon the other of said movable means being in said first and second limit positions, respectively, and centrifugal force means separate from said friction means and acting from rotational movement of said shaft to actuate the other of said movable means and hence actuate said lock means.

2. A switch mechanism having a rotatable shaft, comprising, contact means, rotatively movable means, axially movable means, first mounting means to mount said rotatively movable means for rotation between first and second arcuate limits, second mounting means to mount said axially movable means for movement parallel to the axis of said shaft between first and second axial limits, means to actuate said contact means in accordance with the first and second limit position of one of said movable means, means to actuate said contact means in accordance with the first and second limit positions of the other of said movable means, centrifugal force means, means for actuating said centrifugal force means from the rotation of said shaft to provide first and second conditions of said centrifugal force means in accordance with the stationary condition and at least one moving condition of said shaft, respectively, means for connecting said centrifugal force means to move said axially movable means between said first and second limit positions for said first and second conditions of said centrifugal force means, drive means coacting with said shaft and said rotatively movable means at said first mounting means to rotate said rotatively means between said first and second arcuate limits in accordance with the rotational direction of said shaft, and said second mounting means being separate from said first mounting means to be independent of said drive means.

3. A switch mechanism having a rotatable shaft, comprising, contact means, rotatively movable means, axially movable means, first mounting means to mount said rotatively movable means for rotation between first and second arcuate limits, second mounting means to mount said axially movable means for movement parallel to the axis of said shaft between first and second axial limits, means to actuate said contact means in accordance with the first and second limit position of one of said movable means, lock means coacting between said axially movable means and said rotatively movable means to lock said one of said movable means upon the other of said movable means being in said first limit position, centrifugal force means, means for actuating said centrifugal force means from the rotation of said shaft to provide first and second conditions of said centrifugal force means in accordance with the stationary condition and at least one moving condition of said shaft, respectively, means for connecting said centrifugal force means to move said axially movable means between said first and second limit positions for said first and second conditions of said centrifugal force means, drive means coacting with said shaft and said rotatively movable means at said first mounting means to rotate said rotatively movable means between said first and second arcuate limits in accordance with the rotational direction of said shaft, and said second mounting means being separate from said first mounting means to be independent of said drive means.

4. A switch mechanism for an electric motor having a rotatable shaft, said switch mechanism, comprising, contact means carried in said switch mechanism, rotatively movable means, axially movable means, first mounting means coaxial with said shaft to mount said rotatively movable means for rotation between first and second arcuate limits, second mounting means coaxial with said shaft to mount said axially movable means for movement parallel to the axis of said shaft between first and second axial limits, means to connect said contact means to said motor, means to actuate said contact means in accordance with the first and second limit position of one of said movable means, means coacting between said axially movable means and said rotatively movable means upon the other of said movable means being in said first limit positions, centrifugal force means, means for actuating said centrifugal force means from the rotation of said shaft to provide first and second conditions of said centrifugal force means in accordance with the stationary condition and at least one running condition of said motor shaft, respectively, means for connecting said centrifugal force means to move said axially movable means between said first and second limit positions for said first and second conditions of said centrifugal force means, first friction means coacting with said shaft and said rotatively movable means at said first mounting means to rotate said rotatively movable means between said first and second arcuate limits in accordance with the rotational

direction of said shaft, and said second mounting means being separate from said first mounting means to be independent of said first friction means.

5. A starting and automatic reversing switch mechanism for an electric motor having a starting winding and a rotatable shaft, said switch mechanism, comprising, contact means including forward and reverse contacts, rotatively movable means, axially movable means, first mounting means coaxial with said shaft to mount said rotatively movable means for rotation between first and second arcuate limits, second mounting means coaxial with said shaft to mount said axially movable means for movement along the axis of said shaft between first and second axial limits, means to connect said forward and reverse contacts to said starting winding, means to selectively actuate said forward and reverse contacts to the closed circuit condition in accordance with the first and second limit position, respectively, of one of said movable means, means to actuate said contact means in accordance with movement of the other of said movable means, lock means coacting between said axially movable means and said rotatively movable means to lock and unlock said one of said movable means upon the other of said movable means being in said first and second limit positions, respectively, combined spring and centrifugal force means, means for actuating said centrifugal force means from the rotation of said shaft to provide first and second conditions of said combined spring and centrifugal force means in accordance with the stationary condition and at least one running condition of said motor shaft, respectively, means for connecting said combined spring and centrifugal force means to move said axially movable means between said first and second limit positions for said first and second conditions, respectively, of said combined spring and centrifugal force means, said first mounting means being separate from said second mounting means, first friction means coacting with said shaft and said rotatively movable means at said first mounting means to rotate said rotatively movable means between said first and second arcuate limits in accordance with the rotational direction of said shaft, and said second mounting means being independent of said first friction means and having an inherent friction less than said first friction means.

6. A starting and automatic reversing switch mechanism for an electric motor having a starting winding and a rotatable shaft, said switch mechanism, comprising, contact means including a main contact and forward and reverse contacts, rotatively movable means, axially movable means, first mounting means coaxial with said shaft to mount said rotatively movable means for rotation between first and second arcuate limits, second mounting means coaxial with said shaft to mount said axially movable means for movement along the axis of said shaft between first and second axial limits, means to connect said forward and reverse contacts to said starting winding, means to selectively actuate said forward and reverse contacts to the closed circuit condition in accordance with the first and second limit position, respectively, of one of said movable means, lock means coacting between said axially movable means and said rotatively movable means to lock and unlock said one of said movable means upon the other of said movable means being in said first and second limit positions, respectively, means to selectively actuate said main contact in accordance with movement of the other of said movable means from one of said limits to the other thereof prior in time to the unlocking of said lock means, whereby the electrical circuit to said motor is made and broken at said main contact rather than at said forward and reverse contacts, combined spring and centrifugal force means, means for actuating said centrifugal force means from the rotation of said shaft to provide first and second conditions of said combined spring and centrifugal force means in accordance with the stationary condition and a running condition of said motor shaft, respectively, means for connecting said axially movable means and said combined spring and centrifugal force means to move said axially movable means between said first and second limit positions for said first and second conditions, respectively, of said combined spring and centrifugal force means, said first mounting means being separate from said second mounting means, first friction means coacting with said shaft and said rotatively movable means at said first mounting means to rotate said rotatively movable means between said first and second arcuate limits in accordance with the rotational direction of said shaft, and said second mounting means being independent of said first friction means and having an inherent friction less than said first friction means.

7. A double-throw switch mechanism having first and second conditions and operable from an arcuately movable shaft, said switch mechanism, comprising, first and second contacts, rotative means, first friction means coacting with said shaft and said rotative means to rotate same between first and second arcuate limits in accordance with the rotational direction of said shaft, means to selectively actuate said first and second contacts in accordance with rotative positioning of said rotative means at said first and second arcuate limits, respectively, axial means separate from said rotative means and movable parallel to the axis of said shaft between first and second axial limits, centrifugal force means, means for actuating said centrifugal force means from the rotation of said shaft to provide first and second conditions of said centrifugal force means in accordance with the stationary condition and at least one moving condition of said shaft, means for connecting said centrifugal force means to move said axial means between said first and second limit positions for said first and second conditions of said centrifugal force means, mounting means to mount said axial means for said axial movement and inherently having friction which is independent of said first friction means, and means coacting between said axial and rotative means when said axial means is in said first limit position.

8. A double-throw switch mechanism having first and second conditions and operable from an arcuately movable shaft, said switch mechanism, comprising, contact means including first and second contacts, rotative means, first friction means coacting with said shaft and said rotative means to rotate same between first and second arcuate limits in accordance with the rotational direction of said shaft, means to selectively actuate said first and second contacts in accordance with rotative positioning of said rotative means at said first and second arcuate limits, respectively, axial means separate from said rotative means and movable parallel to the axis of said shaft between first and second axial limits, centrifugal force means, means for actuating said centrifugal force means from the rotation of said shaft to provide first and second conditions of said centrifugal force means in accordance with the stationary condition and at least one moving condition of said shaft, means for connecting said centrifugal force means to move said axial means between said first and second limit positions for said first and second conditions of said centrifugal force means, mounting means to mount said axial means for said axial movement and inherently having friction which is less than and independent of said first friction means, and means to actuate said contact means from said axial means.

9. An automatic reversing switch mechanism for an electric motor having a rotatable shaft, said switch mechanism, comprising, forward and reverse contacts, rotative means, first friction means coacting with said shaft and said rotative means to rotate same between first and second arcuate limits in accordance with the rotational direction of said shaft, means to connect said forward and reverse contacts to said motor to govern the rotational direction thereof, means to selectively actuate said for-

ward and reverse contacts in accordance with rotative positioning of said rotative means at said first and second arcuate limits, respectively, axially moving means separate from said rotative means and movable parallel to the axis of said shaft between first and second axial limits, lock means coacting between said axially moving means and said rotative means to rotatively lock said rotative means upon said axially moving means being in said first limit position and said lock means adapted to free said rotative means for rotation when said axially moving means is in said second limit position, centrifugal force means, means for actuating said centrifugal force means from the rotation of said shaft to provide first and second conditions of said centrifugal force means in accordance with the stationary condition and at least one rotating condition of said motor shaft, means connecting said axially movable means and said centrifugal force means to move said axially moving means between said first and second limit positions for said first and second conditions of said centrifugal force means, and mounting means to mount said axially moving means for said axial movement and inherently having friction therein which is less than and independent of said first friction means.

10. An automatic reversing switch mechanism for an electric motor having a rotatable shaft, said switch mechanism, comprising, forward and reverse contacts, rotative means, first friction means coacting with said shaft and said rotative means to rotate same between first and second arcuate limits in accordance with the rotational direction of said shaft, means to connect said forward and reverse contacts to said motor to govern the rotational direction thereof, means to selectively actuate said forward and reverse contacts in accordance with rotative positioning of said rotative means at said first and second arcuate limits, respectively, axially moving means separate from said rotative means and movable parallel to the axis of said shaft between first and second axial limits, lock means coacting between said axially moving means and said rotative means to rotatively lock said rotative means upon said axially moving means being in said first limit position and said lock means adapted to free said rotative means for rotation when said axially moving means is in said second limit position, combined spring and centrifugal force means, means for actuating said centrifugal force means from the rotation of said shaft to provide first and second conditions of said combined spring and centrifugal force means in accordance with the stationary condition and at least one rotating condition of said motor shaft, means for establishing coaction between said axially movable means and said combined spring and centrifugal force means to move said axially moving means between said first and second limit positions for said first and second conditions of said combined spring and centrifugal force means, and mounting means to mount said axially moving means for said axial movement and inherently having friction therein which is less than and independent of said first friction means.

11. A starting and automatic reversing switch mechanism for an electric motor having a starting winding and a rotatable shaft, said switch mechanism, comprising, forward and reverse contacts, rotative means, first friction means coacting with said shaft and said rotative means to rotate same between first and second arcuate limits in accordance with the rotational direction of said shaft, means to connect said forward and reverse contacts to said starting winding, means to selectively actuate said forward and reverse contacts to the closed circuit condition in accordance with rotative positioning of said rotative means at said first and second arcuate limits, respectively, axially moving means separate from said rotative means and movable parallel to the axis of said shaft between first and second axial limits, lock means coacting between said axially moving means and said rotative means to rotatively lock said rotative means upon said axially moving means being in said first limit position and said lock means freeing said rotative means for rotation when said axially moving means is in said second limit position, combined spring and centrifugal force means, means for actuating said centrifugal force means from the rotation of said shaft to provide first and second conditions of said combined spring and centrifugal force means in accordance with stationary and normal running conditions of said motor, respectively, means for establishing coaction between said axially movable means and said combined spring and centrifugal force means to move said axially moving means between said first and second limit positions for said first and second conditions, respectively, of said combined spring and centrifugal force means, and second friction means in said switch mechanism independent of said first friction means and acting on the axial movement of said axially movable means.

12. A starting and automatic reversing switch mechanism for an electric motor having a starting winding and a rotatable shaft, said switch mechanism, comprising, contact means including a main contact and forward and reverse contacts, rotative means, first friction means coacting with said shaft and said rotative means to rotate same between first and second arcuate limits in accordance with the rotational direction of said shaft, means to connect said forward and reverse contacts through said main contact to said starting winding, means to selectively actuate said forward and reverse contacts to the closed circuit condition in accordance with rotative positioning of said rotative means at said first and second arcuate limits, respectively, axially moving means separate from said rotative means and movable parallel to the axis of said shaft between first and second axial limits, lock means coacting between said axially moving means and said rotative means to rotatively lock said rotative means upon said axially moving means being in said first limit position and said lock means freeing said rotative means for rotation when said axially moving means is in said second limit position, combined spring and centrifugal force means, means for actuating said centrifugal force means from the rotation of said shaft to provide first and second conditions of said combined spring and centrifugal force means in accordance with stationary and normal running conditions of said motor, respectively, means for establishing coaction between said axially movable means and said combined spring and centrifugal force means to move said axially moving means between said first and second limit positions for said first and second conditions, respectively, of said combined spring and centrifugal force means, second friction means in said switch mechanism independent of said first friction means and acting on said axially movable means in axial movement thereof, and means to open said main contact from said axially moving means in movement from said first limit to said second limit prior in time to the unlocking of said rotative means, whereby the electrical circuit is made and broken at said main contact rather than at said forward and reverse contacts.

13. A switch mechanism having a rotatable shaft, comprising, a stationary plate, contact means carried on said stationary plate, an arcuately movable cam, friction means acting between said shaft and said cam to move same between first and second positions to actuate said contact means, an axially movable cam having first and second axial positions and cooperating to actuate said contact means, centrifugal force means operating from said shaft and having a stationary and a rotating condition with said stationary condition acting to urge said axially movable cam to said first position, and said rotating condition acting to urge said axially movable cam to said second position.

14. A starting and automatic reversing switch for a reversible motor having a rotatable shaft, said switch, comprising, a stationary plate, rotational selection contacts and a main contact connected to said motor and

carried on said stationary plate, an arcuately movable cam, friction means acting between said shaft and said cam to move same between first and second positions to alternately select actuation of said rotational selection contacts to provide alternate forward and reverse rotation of said motor, an axially movable actuator having first and second positions and cooperating with said arcuately movable cam, means for actuating said main contacts to a closed condition upon said actuator being in said first position, combined centrifugal and spring means having a stationary and a rotating condition with said stationary condition acting to urge said actuator to said first position, and said rotating condition acting to urge said actuator to said second position to first open said main contact and secondly to permit said friction means to rotate said arcuately movable cam whereby the circuit is made and broken at said main contact rather than at said rotational selection contacts.

15. A starting and automatic reversing switch for a reversible induction motor having a rotatable shaft, said switch, comprising, a stationary plate, rotational selection contacts and a main contact connected to said motor and carried on said stationary plate, an arcuately movable cam, friction means acting between said shaft and said cam to move same between first and second limit positions to alternately select actuation of said rotational selection contacts to provide alternate forward and reverse rotation of said motor, an axially movable locking cam having first and second limit positions and cooperating with said arcuately movable cam to lock same in a fixed position when said locking cam is in the first limit position, means for actuating said main contacts to a closed condition upon said locking cam being in said first limit position, first spring means urging said locking cam axially to said second limit position, combined centrifugal and second spring means driven from said shaft and having a stationary and a rotating condition with said stationary condition acting on said locking cam to overpower said first spring means and urge said locking cam to said first limit position, and said rotating condition permitting said first spring means to urge said locking cam to said second limit position whereat said arcuately moving cam is free to rotate by said friction means to move same between said first and second limit positions in accordance with the rotational direction of said shaft, and movement of said locking cam from said first limit position to said second limit position first opening said main contact and secondly releasing the lock on said arcuately movable cam whereby the circuit is made and broken at said main contact rather than at said rotational selection contacts.

16. A starting and automatic reversing switch for a single split phase induction motor having a rotatable shaft and run and start windings, comprising, a stationary insulating switch plate having first and second faces and mounted at one end of said motor perpendicular to the shaft axis, a main fixed contact mounted on said stationary plate, a main leaf spring contact mounted on said stationary plate for cooperation with said main contact, first and second fixed contacts mounted on said stationary plate on one side of said main contact and third and fourth fixed contacts mounted on said stationary plate on the other said of said main contact, first, second, third, and fourth leaf spring contacts mounted on said stationary plate for cooperation with said first, second, third, and fourth contacts, respectively, means for connecting together said second, third, and main fixed contacts, means for connecting together said first and fourth fixed contacts, first conductor means for energizing said run winding from first and second terminals of an alternating current source, second conductor means for connecting said main leaf spring contact to said first terminal of said alternating current source, third conductor means for connecting said first and third leaf spring contacts to one end of said start winding, fourth conductor means for connecting said second and fourth leaf spring contacts to the other end of said start winding, all said contacts mounted on said second face of said stationary plate, an arcuately movable cam mounted on said shaft adjacent said first face of said stationary plate, means providing arcuate friction between said shaft and said cam to tend to rotate said ram in either of two directions according to the selected rotation of said shaft to first and second arcuate limit positions, a cam follower on each of said first and second leaf spring contacts extending through apertures in said stationary plate and being engaged by said arcuate cam in said first limit position to position said first and second left spring contacts out of engagement with said first and second fixed contacts, respectively, a cam follower on each of said third and fourth leaf spring contacts extending through apertures in said stationary plate and being engaged by said arcuate cam in said second limit position to position said third and fourth leaf spring contacts out of engagement with said third and fourth fixed contacts, respectively, a sleeve portion coaxial with said shaft and fixedly attached to said second face of said stationary plate, an axially moving lock cam surrounding and axially movable on said sleeve portion, an axially parallel aperture in said stationary plate, first and second locking apertures in said arcuate cam, an axially parallel pin carried by said locking cam and extending into said axially parallel aperture and being aligned with said first and second locking apertures upon said arcuate cam being in said first and second limit positions, respectively, a coil spring surrounding said sleeve portion and engaging said stationary plate second face and said lock cam to urge said lock cam away from said second face to a position whereat said pin engages neither of said locking apertures, centrifugal roller means carried on said shaft to cooperate with said lock cam to urge said lock cam axially toward said stationary plate with said pin extending into the selected one of said locking apertures when said shaft is stationary and upon rotation of said shaft at normal motor running speed to cease said urging to permit said coil spring to move said lock cam pin out of engagement with the selected locking aperture whereby said friction means arcuately moves said arcuate cam from one limit position to the other to establish electrical connections for reversed rotation of said motor upon subsequent de-energization and re-energization.

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