

[54] SWITCH CONTROL WITH LOST MOTION ACTUATOR

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[73] Assignee: General Electric Company, New York, N.Y.

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 246,457, April 21, 1972.

[52] U.S. Cl. 200/153 V, 200/80 R, 310/68 E, 318/221 F

[51] Int. Cl. H01h 3/48

[58] Field of Search.....200/153 R, 153 V, 80 R, 200/61.45 R, 47; 310/68 E; 318/221 F

[56] References Cited

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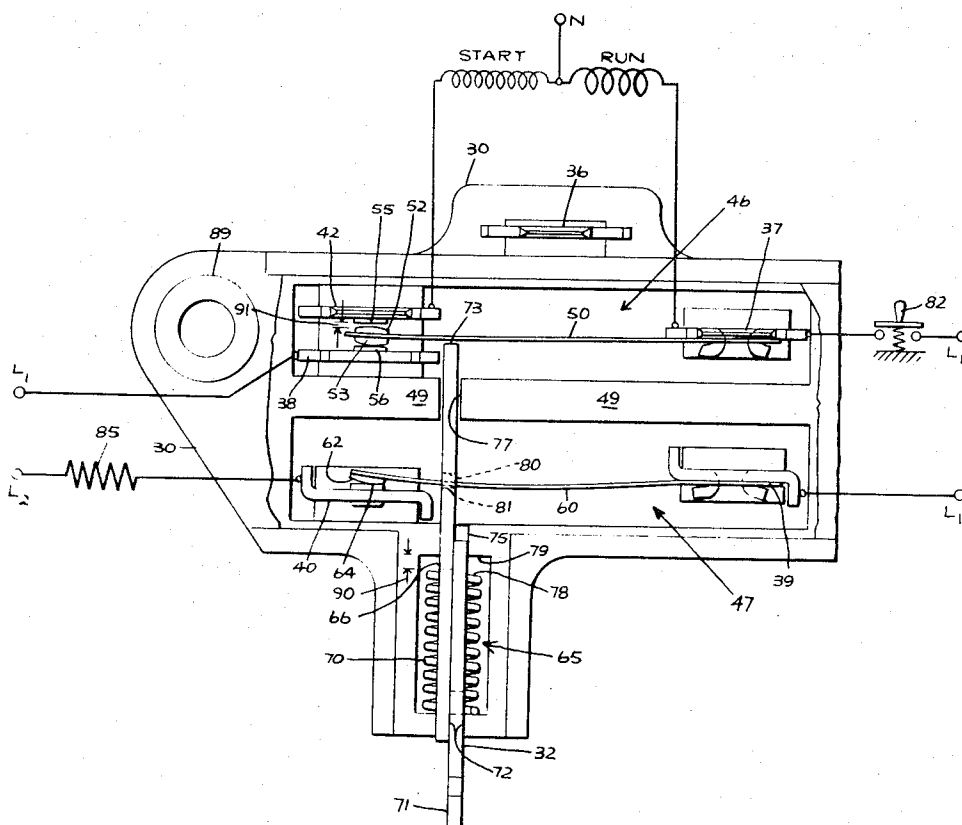
3,110,784	11/1963	Williams et al.	200/153 V
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3,691,415	9/1972	Hancock et al.	200/80 R
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Primary Examiner—David Smith, Jr.
Assistant Examiner—William J. Smith
Attorney, Agent, or Firm—John M. Stoudt et al.

[57] ABSTRACT

A switch control is disclosed for an electric motor having a push collar mounted on a shaft for substantially coaxial movement with respect to the shaft from a first motor run push collar position through successive second, third and fourth push collar imparting switch control operative event positions to a fifth motor stop push collar position. The switch control comprises first means for engaging the push collar with the switch actuator at the push collar second position, and second means for engaging the actuator with a resilient switch blade at the push collar third position. Third means are provided for bringing a mobile switch contact on the resilient switch blade into engagement with an immobile switch contact at the push collar fourth position. The switch control further comprises fourth means for causing the push collar to apply force against the switch actuator at a first rate of force increase as the push collar moves from the fourth push collar position to a push collar position intermediate the fourth and fifth collar positions, and for causing the push collar to apply force against the switch actuator at a second rate of force increase as the push collar moves from the intermediate position towards the fifth push collar position with the second rate of force increase being less than the first rate of force increase.

17 Claims, 6 Drawing Figures



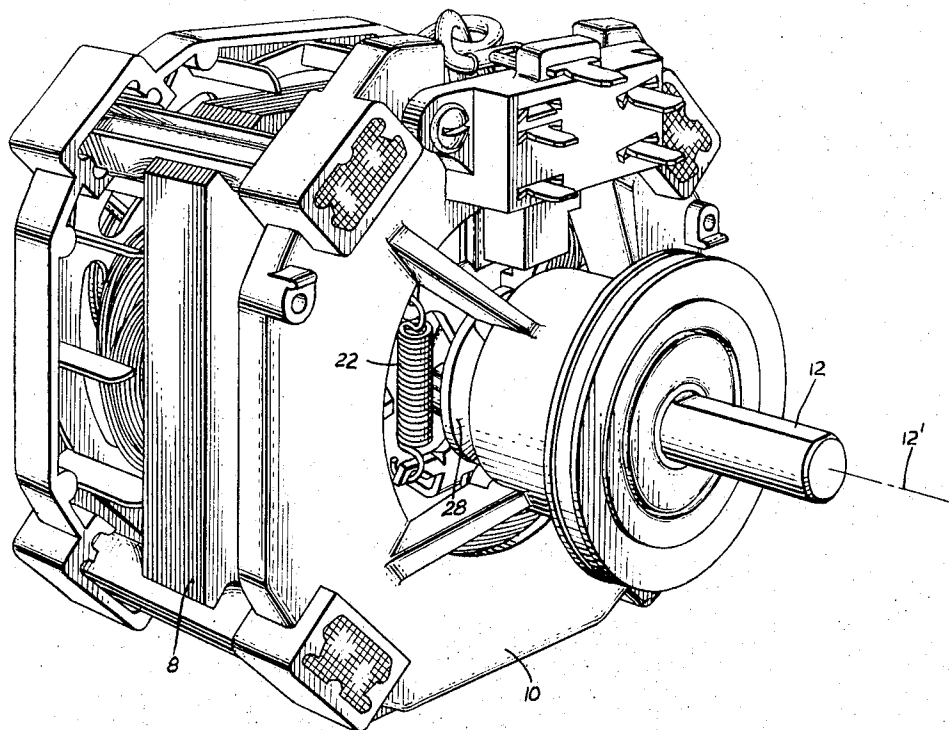


FIG. 1

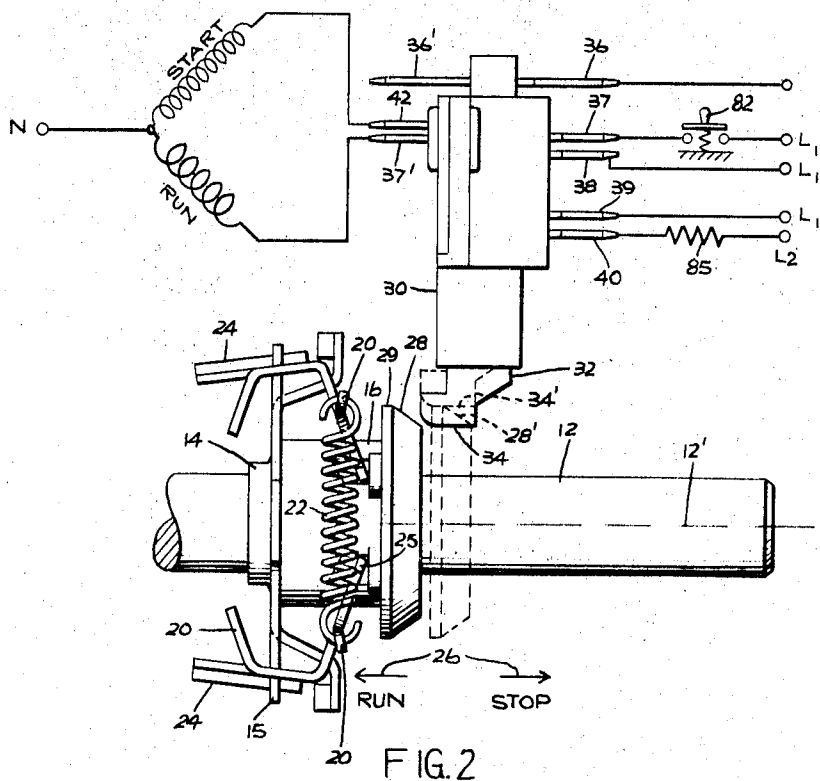


FIG. 2

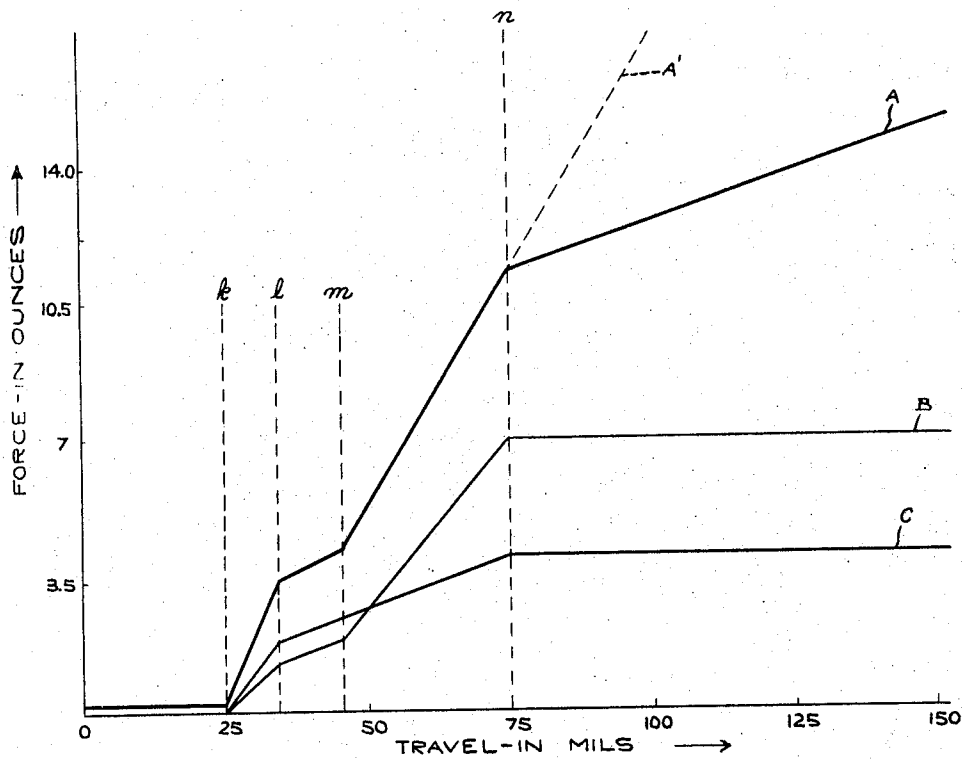


FIG.6

SWITCH CONTROL WITH LOST MOTION ACTUATOR

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of my co-
pending application Serial No. 246,457, filed April 21,
1972.

BACKGROUND OF THE INVENTION

This invention relates generally to switch controls, and particularly to switch controls of the type which employ a resilient switch blade having a mobile switch contact adapted to make and break with a mating immobile switch contact upon actuation of the switch blade.

Switches of the type just described presently enjoy wide usage in controlling electric motors having independent motor start and motor run windings. These motors require, after energization, means for terminating the flow of electric current through the start windings after the motor rotor and drive shaft have reached a certain angular velocity. In some cases such motors also incorporate means for delaying energization of the motor run winding till the rotor and shaft have accelerated.

Switch controls of the type just described have typically comprised at least one resilient switch blade having a mobile switch contact adapted to make and break contact with an adjacent immobile switch contact upon actuation of the switch blade. Actuation itself has typically been accomplished by means of a plunger adapted to move against the switch blade upon rotation of an adjacent lever by action of a push collar secured about the motor shaft. Such mechanisms are exemplified by U. S. Pat. Nos. 3,293,388 and 3,313,905. In other rather similar devices such as that shown in U. S. Pat. No. 3,209,093 actuation has been effected by the use of a single element actuator. In either case, however, great care has had to be exercised in insuring that the forces exerted by the push collar during shaft acceleration and deceleration are sufficient to overcome the reactive forces of the switch control and yet insufficient to overstress sensitive switch control components such as resilient switch blades. In addition, proper bias has had to be provided to reset the actuator during each control cycle. As various mechanical switching operations occur, the forces required to insure proper continuation of switching events typically changes. If during this sequence of events an improper match should occur between the force exerted by the push collar and by the switch control actuator, a stall condition could occur or, conversely, one or more of the switch control elements become overstressed.

Accordingly, it is a general object of the present invention to provide an improved switch control.

More specifically, it is an object of the present invention to provide an improved switch control of the type having a mobile switch contact adapted to make and break with a mating immobile switch contact upon actuation of a switch blade.

Another object of the present invention is to provide an improved electric motor switch control of the type having a mobile switch contact adapted to make and break with a mating immobile switch contact upon actuation of a switch blade by means of a switch actuator

and a push collar mounted on a motor shaft for movement in engagement with the switch actuator.

Another object of the invention is to provide an electric motor switch control of the type just described which control includes means for inhibiting switch stalls during switch actuation.

Yet another object of the invention is to provide an electric motor switch control of the type just described which control includes means for inhibiting the switch actuator from overstressing the switch blade during switch operation.

SUMMARY OF THE INVENTION

In one form of the present invention a switch control is provided comprising a housing with first and second terminals mounted thereto. A resilient switch blade is mounted within the housing. An immobile portion of the switch blade is electrically connected to the first terminal; a mobile portion of the switch blade has a mobile switch contact mounted thereto. An immobile switch contact electrically connected to the second terminal is mounted within the housing to make and break connection with the mobile switch contact upon actuation of the switch blade. A first actuating member is movably mounted within the housing to engage and move the resilient switch blade mobile portion. A second actuating member is movably mounted within the housing adjacent the first actuating member. Spring means are mounted between the first and second actuating members. Stop means may also be provided adjacent the first actuating member or the spring means to limit movement of the first actuating member while permitting movement of said second actuating member.

In another form of the present invention a switch control is provided for an electric motor having a push collar mounted on a shaft for substantially coaxial movement with respect to the shaft from a first motor run push collar position through successive second, third and fourth push collar imparting switch control operative event positions to a fifth motor stop push collar position. The switch control comprises first means for engaging the push collar with a switch actuator at the push collar second position, and second means for engaging the actuator with a resilient switch blade at the push collar third position. Third means are provided for bringing a mobile switch contact on the resilient switch blade into engagement with an immobile switch contact at the push collar fourth position. The switch control further comprises fourth means for causing the push collar to apply force against the switch actuator at a first rate of force increase as the push collar moves from the fourth push collar position to a push collar position intermediate the fourth and fifth push collar positions, and for causing the push collar to apply force against the switch actuator at a second rate of force increase as the push collar moves from the intermediate position towards the fifth push collar position, with the second rate of force increase being less than the first rate of force increase.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of an electric motor having a switch control mounted thereon which switch control embodies principles of the present invention in one form;

FIG. 2 is a side view in elevation of portions of the motor and switch control shown in FIG. 1 in a motor run condition. Phantom lines indicate relative positions of the associated push collar and switch actuator with the motor in a motor stop condition;

FIG. 3 is a front view in elevation of the switch control shown in FIGS. 1 and 2 with a switch cover removed for purposes of illustration. An associated electrical circuit is also shown schematically;

FIG. 4 is a side view in elevation of the centrifugal mechanism shown in FIG. 2 in a motor stop condition;

FIG. 5 is a perspective view of the switch actuator shown in FIG. 3; and

FIG. 6 is a graph in which force exerted by the lower actuator member of a switch actuator of the type shown in FIGS. 3 and 5 against an associated push collar such as that shown in FIG. 2 is plotted against travel by the lower actuator member as a motor is deenergized.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in more detail to the drawing an electric motor is shown having an end shield 10 through which motor shaft 12 projects along shaft axis 12'. A centrifugal mechanism is secured to shaft 12 with the end shield positioned in spaced relation thereabout. As more clearly seen by reference to FIGS. 2 and 4, the centrifugal mechanism includes a hub 14 secured as by a press fit about shaft 12. A slotted guide plate 15 extends integrally from hub 14 to which plate a push collar 16 is hinged by arms 20. The two arms are themselves linked by two parallel tension springs 22 of which only one, for clarity, is here illustrated.

In FIG. 4 the centrifugal mechanism is shown in a motor stop condition. When the motor is started, shaft 12 accelerates. At a preselected angular velocity centrifugal force acting upon arms 20, to which weights 24 are secured, causes the arms to move radially shaft 12 overcoming the counterbias provided by springs 22. This action causes ends 25 of hinged arms 20 to approach hub 14 and force push collar 16, pivoted thereto, also to approach the hub until the components of the centrifugal mechanism occupy the relative positions shown in solid lines in FIG. 2. A bevelled, annular engagement surface of push collar 16 is thusly moved, as shown by arrows 26, from its motor stop position 28', illustrated by phantom dashed lines, to its motor run position 28 illustrated by solid lines. This movement of the push collar engagement surface causes a lower end of spring biased switch actuator member 32, protruding from switch housing 30, to move substantially radially shaft 12 from a motor stop position 34', shown in phantom dashed lines, to a motor run position 34, shown by solid lines.

It should be noted that in a motor stop condition actuator member 32 rests upon an annular engagement surface extension 29 of the push collar bevelled engagement surface which annular extension is substantially coaxial shaft 12. The static forces between the push collar and switch actuator in the motor stop condition are thus directed radially the shaft. As a consequence, springs 22 do not counterbias the resilient switch blades of the switch control, which switch blades are hereinafter described in more detail, while the motor is in a stop condition. Though both of the en-

gagement surfaces of the push collar and switch actuator are bevelled with respect to axis 12' such is, of course, not mandatory since radial force could be imparted to the actuator with only one engagement surface so bevelled. In addition, the bevelled annular engagement surface of the push collar may be formed concave rather than as that of the illustrated conic frustum.

With particular reference now to FIGS. 2 and 3, the switch control itself is seen to comprise an insulative switch housing 30 from one side of which terminals 36-40 protrude, and from an opposite side of which terminals 36', 37' and 42 protrude. Terminals 37' and 42 extend from the switch housing towards stator core 8 whereby they may be easily connected with independent motor run and start windings, respectively. Terminals 37, 38 and 39 protrude from the switch housing side facing away from stator core 8 and end shield 10 where they may easily be connected to voltage line L₁. Terminal 40 also extends from this side where it may also be easily connected to voltage line L₂. Terminals 36 and 36' are merely auxiliary, passive, interconnected terminals in this embodiment.

With continued reference to FIG. 3, switch housing 30 is seen to define two cavities 46 and 47 separated by insulative partition 49. Within cavity 46 one end or immobile portion of a resilient switch blade 50 is mounted to terminal 37. To the opposite sides of the free end or mobile portion of the switch blade are mounted switch contacts 52 and 53, respectively. To terminal 42 is mounted an immobile switch contact 55 facing switch contact 52. To terminal 38 is mounted an immobile switch contact 56 facing switch contact 53. Resilient switch blade 50 is spring biased with contact 53 in engagement with contact 56 and with contact 52 spaced from contact 55.

Within cavity 47 one end or immobile portion of a resilient switch blade 60 is mounted or immobile portion to terminal 39. To the free end of this switch blade is mounted a mobile switch contact 62 facing a mating a mobile switch contact 64 mounted to terminal 40. Resilient switch blade 60 is spring biased with switch contact 62 in engagement with switch contact 64. Where not required in controlling extrinsic circuitry, the switch within cavity 47 may, of course, be eliminated.

Switch housing 30 defines a third cavity 65 in which are slidably housed actuator or actuating members, such as elongated bars 32 and 66 which may be made of a laminated paper phenolic. As seen by reference to FIG. 5, the actuator members each have a central, longitudinal slot aperture into one of which tab 68 projects from member 66 and into one of which tab 69 projects from member 32. A spring means, such as compression spring 70, is mounted within the slots with one spring end disposed about tab 68 and the other spring end disposed about tab 69. The actuator and spring assembly is slidably housed within cavity 65 with a bevelled end 71 of actuator member 32 protruding through a slot or portal 72 adjacent the bevelled annular engagement surface of push collar 16, and with actuator member 66 extending through slot or passageway 75 which communicates between cavities 47 and 65 and slot 77 which communicates between cavities 46 and 47. Actuator end surface 73 is thereby positioned adjacent resilient switch blade 50 within cavity 46.

The switch control components are depicted in FIG. 3 with the motor in a motor run condition. When the motor is de-energized, the push collar moves axially axis 12' and engages bevelled surface 71 of actuator member 32 forcing it, spring 70, and actuator member 66 to move upwardly towards the resilient switch blades. This upward movement continues substantially unimpeded until end 78 of compression spring 70 engages a stop means, such as a cavity wall 79 while a lower end 78a of the compression spring is disengaged from another or opposite stop means, such as an opposite or lower cavity wall 79a. This engagement prevents spring end 78 from further upward movement and accordingly terminates further upward travel of actuator member 66 in shoulder contact therewith about tab 68. Further upward movement of actuator member 32 merely serves to compress compression spring 70 further thereby preventing the switch blades from exerting additional force against the switch actuator and push collar and preventing the switch blades from being overflexed by further upward movement of actuator member 66.

At the engagement point of spring end 78 with wall 79, actuator end surface 73 has pushed resilient switch blade 50 sufficiently upwardly to cause contacts 53 and 56 to break connection and contacts 52 and 55 to make connection. This operation is insured by having spacing 90 between spring end 78 and wall 79 exceed spacing 91 between contacts 52 and 55 with contacts 53 and 56 closed. Shoulder 81 of slot notch 80 in actuator member 66 has simultaneously moved against resilient switch blade 60 causing contacts 62 and 64 to break connection. Upon motor re-energization push collar 16 moves coaxially shaft axis 12' out from under actuator member 32 enabling the bias provided by compression spring 70 and the two resilient switch blades to return the actuator assembly to the position shown in FIG. 3 causing contacts 52 and 55 to break connection, contacts 53 and 56 to make connection, and contacts 62 and 64 to make connection.

As shown schematically by the circuit diagram portion of FIG. 3, contact 55 may be connected through terminal 42 to motor start windings, contact 56 to voltage line L_1 through terminal 38, and contacts 52 and 53 mounted on switch blade 50 connected to voltage line L_1 through push-to-start switch 82 and motor run windings through terminal 37. Contact 64 may be connected to voltage line L_2 through terminal 40 and an auxiliary load 85 such as a dryer heating element. Contact 62 may further be connected to voltage line L_1 through switch blade 60 and terminal 39. The motor start and run windings may be connected to line N through terminals 36 and 36', if desired. A suitable voltage potential exists, of course, across the two voltage lines such as 110 VAC across L_1 and N, 110 VAC across L_2 and N, and 220 VAC across L_1 and L_2 .

Upon motor energization, as by manual closure of push-to-start switch 82, actuator member 66 is in engagement with switch blades 50 and 60 forcing contacts 52 and 55 closed thereby connecting the motor starting windings across voltage lines L_1 and N. Energization of the motor start winding causes the motor rotor disposed within stator core 8, and shaft 12 connected thereto, to accelerate. At a preselected rotational velocity, the centrifugal mechanism permits the spring biased actuator members to move downwardly thereby opening contacts 52 and 55, closing contacts

53 and 56, and closing contacts 62 and 64. These switching operations disconnect the motor start windings from across voltage lines L_1 and N and connect load 85 across L_1 and L_2 . Upon motor de-energization, which may be effective through the use of auxiliary switch means in the line connected to terminal 38, the push collar forces the actuator assembly upwardly away from the position shown in FIG. 3 to re-break connection between contacts 62 and 64 and contacts 53 and 56, and to remake connection between contacts 52 and 55. This action serves to de-energize load 85 and the motor run windings and to reposition contacts 52 and 55 for restart.

In FIG. 6 force exerted by lower actuator member 32 upon push collar 16 is plotted against travel by the actuator member by plot A. Slight deviations from empirical measured slots have been made here for clarity. The plot does typify force versus travel relations of switch controls embodying principles of the present invention as that shown in FIGS. 1-5.

When the motor shown in FIG. 1 is de-energized, the engagement surface of push collar 16 moves to the right as seen in FIG. 2 from position 28 towards position 28'. After initial travel, the push collar engages switch actuator member 32 with the actuator member occupying position 34. This point of engagement is denoted by the zero travel and zero force point on the graph of FIG. 6. After engagement, continued movement of the push collar to the right forces switch actuator member 32 to move upwardly until actuator member 66 contacts switch blades 50 and 60 at point k. During this travel to point k, the force exerted by actuator member 32 against push collar 16 is merely that required in lifting the actuator members and spring 70.

With continued reference to plot A in FIG. 6, it is seen that the force exerted by actuator member 32 against the push collar increases at a high rate as the actuator member travels to point L. This is occasioned by the fact that during the k-L travel interval actuator member 66 moves against resilient switch blades 50 and 60 which bias contacts 53 and 62 against contacts 56 and 64, respectively. At point L this continued upward movement of actuator member 32 forces separation of these switch contacts. Movement beyond point L increases the force exerted by the switch blades against upper actuator member 66 which force is transmitted to the lower actuator member and the push collar. The rate of force increase after point L is reached is, however, less than that between points k and L. The latter rate remains substantially linear until point m is reached by the lower actuator member. At point m the upper actuator member forces contacts 52 and 55 closed. After this switch control event has occurred, the counterbiasing force exerted by switch blade 50 increases against the switch actuator members at a higher rate as the lower actuator member moves between points m and n. This, of course, is due to the fact that neither end of switch blade 50 is now free to move.

Continued movement of the push collar forces lower actuator member 32 to move further upwardly until point n is reached at which point spring end 78 engages wall 79. After this, continued upward movement of lower actuator member 32 serves to compress spring 70, whose spring rate approximates that of plot A at point n. Thus, upper actuator member 66 is not forced upwardly further against the two switch blades. As the spring rate of spring 70 is less than that of the two

switch blades beyond point *n* with contacts 53 and 55 closed, the rate of force increase decreases thereafter. Were the movement of the spring not so limited either by the presence of the stop or by the spring preload of the compression spring being surpassed, the rate of force increase would continue as shown by plot A'. Were this permitted to occur, a stall condition could occur in the centrifugal force mechanism. Furthermore, one or both of the switch blades could become overflexed.

As the spring rate of compression spring 70 approximates plot A force at point *n*, the stop provided by wall 79 may, if desired, be eliminated. Alternatively, the stop could engage upper actuator member 66 directly rather than the spring or either configuration arrest upward movement of the upper actuator member. Furthermore, a tension spring may be substituted for compression spring 70 by inclusion of suitable means connecting one end of the tension spring to the lower actuating member and the other spring end to the upper actuating member.

Plot B denotes the force exerted by upper actuator member 66 against switch blade 50. Plot C similarly denotes the force exerted by member 66 against switch blade 60. With reference to both plots B and C, it may be seen that the force applied by the upper switch actuator member against each switch blade remains substantially constant beyond point *n*. Upon reenergization of the motor, push collar 16 moves to the left as viewed in FIG. 2, and lower actuator member 32 concurrently drops to position 34. Plot A is substantially retraced with the force, which actuator member 32 exerts against the push collar, continuously decreasing. This provides the proper bias to reset push collar 16 in its motor run position inasmuch its associated centrifugal mechanism has a negative spring rate. Stalls are thusly avoided.

It should be understood that the just described embodiments merely illustrate principles of the invention. Many modifications may be made thereto without departure from the spirit and scope of the invention as set forth in the following claims.

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

1. A switch control comprising a housing; first and second terminals mounted to said housing; a resilient switch blade having an immobile portion mounted within said housing and electrically connected to said first terminal, and a mobile portion carrying a mobile switch contact; an immobile switch contact mounted within said housing adjacent said mobile switch contact and electrically connected to said second terminal; a first actuating member movably mounted within said housing to engage and move said resilient switch blade mobile portion; a second actuating member movably mounted within said housing adjacent said first actuating member; spring means mounted between said first and second actuating members to translate motion of said second actuating member relative to said switch blade to said first actuating member through said spring means; and stop means mounted within said housing adjacent said spring means to limit movement of said spring means and thereby limit the translation of motion of said second actuating member to said first actuating member.

2. A switch control in accordance with claim 1 wherein said stop means is integrated with said housing.

3. A switch control in accordance with claim 1 wherein said stop means comprises two spaced walls limiting movement of said spring means therebetween.

4. A switch control in accordance with claim 1 wherein said housing defines a portal through which an external portion of said second actuating member may slidably pass.

5. A switch control in accordance with claim 1 wherein said housing defines two cavities; said switch blade is mounted in one of said cavities; and said spring means is mounted in the other of said cavities.

6. A switch control in accordance with claim 5 wherein said housing defines a passageway communicating between said two cavities through which passageway said first actuating member may slidably pass.

7. A switch control in accordance with claim 1 comprising third and fourth terminals mounted to said housing; a second resilient switch blade having an immobile portion mounted within said housing and electrically connected to said third terminal, and a mobile portion; a second mobile switch contact mounted to said second switch blade mobile portion, a second immobile switch contact mounted within said housing adjacent said second mobile switch contact and electrically connected to said fourth terminal; and wherein said first actuating member has a notch through which said second switch blade mobile portion passes.

8. A switch control comprising a housing; first and second terminals mounted to said housing; a resilient switch blade having an immobile portion mounted within said housing and electrically connected to said first terminal, and a mobile portion having a mobile switch contact; and immobile switch contact mounted within said housing adjacent said mobile switch contact and electrically connected to said second terminal; a first actuating member movably mounted within said housing to engage and move said resilient switch blade mobile portion; a second actuating member movably mounted within said housing adjacent said first actuating member for movement in unison with said first actuating member; said first and second actuating members defining aligned apertures; and a compression spring mounted within said aligned apertures.

9. A switch control in accordance with claim 8 wherein said first actuating member has a first tab projecting into said first actuating member aperture; said second actuating member has a second tab projecting into said second actuating member aperture; and said compression spring has a first spring end and a second spring end with said first spring end mounted about said first tab and with said second spring end mounted about said second tab.

10. A switch control actuator adapted to be slidably mounted in a switch control housing which housing defines a cavity, a portal through which a portion of the actuator may pass from the housing cavity to the housing exterior, and two confronting spring stops, said switch control actuator comprising a first actuator bar member having a first longitudinal slot; a second actuator bar member having a second longitudinal slot in juxtaposition with said first longitudinal slot; and a compression spring mounted within said first and sec-

and longitudinal slots with a first spring end disposed adjacent the first spring stop and a second spring end disposed adjacent the second spring stop.

11. A switch control actuator in accordance with claim 10 wherein said first actuator bar member has a first longitudinal tab projecting from a first slot defining surface into said first longitudinal slot, and said second actuator bar member has a second longitudinal tab projecting from a second slot defining surface into said second longitudinal slot.

12. A switch control actuator in accordance with claim 11 wherein said first spring end is disposed about said first tab in contact with said first slot defining surface, and said second spring end is disposed about said second tab in contact with said second slot defining surface.

13. A switch control actuator in accordance with claim 11 wherein said first actuator bar member has a notch through which a portion of a switch blade may pass.

14. A switch control comprising a housing; first, second and third terminals mounted to said housing; first and second switch contacts mounted apart within said housing facing one another and electrically connected to said first and second terminals, respectively; a switch blade having a fixed end portion mounted within said housing and electrically connected with said third terminal, and a free end disposed between said first and second switch contacts; a third switch contact on said switch blade free end to make and break contact with said first switch contact upon actuation of said switch blade; a fourth switch contact on said switch blade free end to make and break contact with said second switch contact upon actuation of said switch blade; and said second and fourth switch contacts being spaced apart a first distance when said first and third switch contacts are closed; a first actuating member movably mounted within said housing to actuate said switch blade; a second actuating member movably mounted within said housing adjacent said first actuating member; a compression spring of predetermined length uncompressed having a first spring end mounted to said first actuating member and a second spring end mounted to said second actuating member; and two spring stops affixed to said housing disposed apart a second distance facing said spring ends as with said second distance being at least as great as said spring predetermined uncompressed length plus said first distance.

15. A switch control in accordance with claim 14 wherein said housing defines a portal through which a portion of said second actuating member projects.

16. A switch control comprising a housing; first, second and third terminals mounted to said housing; first and second switch contacts mounted apart within said housing facing one another and electrically connected to said first and second terminals, respectively; a switch

blade having a fixed end portion mounted within said housing and electrically connected with said third terminal, and a free end disposed between said first and second switch contacts; a third switch contact on said switch blade free end to make and break contact with said first switch contact upon actuation of said switch blade; a fourth switch contact on said switch blade free end to make and break contact with said second switch contact upon actuation of said switch blade; said second and fourth switch contacts being spaced apart a first distance when said first and third switch contacts are closed; a first actuating member comprising a first elongate bar movably mounted within said housing to actuate said switch blade; a second actuating member comprising a second elongate bar movably mounted within said housing adjacent said first actuating member; said first and second elongate bars having aligned longitudinal slots; a compression spring of predetermined length uncompressed seated in said longitudinal slots and having a first spring end mounted to said first actuating member and a second spring end mounted to said second actuating member; and two spring stops disposed apart a second distance facing said spring ends with said second distance being at least as great as said spring predetermined uncompressed length plus said first distance.

17. A switch control comprising a housing; first, second and third terminals mounted to said housing; first and second switch contacts mounted apart within said housing facing one another and electrically connected to said first and second terminals, respectively; a switch blade having a fixed end portion mounted within said housing and electrically connected with said third terminal, and a free end disposed between said first and second switch contacts; a third switch contact on said switch blade free end to make and break contact with said first switch contact upon actuation of said switch blade; a fourth switch contact on said switch blade free end to make and break contact with said second switch contact upon actuation of said switch blade; said second and fourth switch contacts being spaced apart a first distance when said first and third switch contacts are closed; a first actuating member movably mounted within said housing to actuate said switch blade; a second actuating member movably mounted within said housing adjacent said first actuating member; a compression spring of predetermined length uncompressed having a first spring end mounted to said first actuating member and a second spring end mounted to said second actuating member; and two spring stops forming integral portions of said housing disposed apart a second distance facing said spring ends with said second distance being at least as great as said spring predetermined uncompressed length plus said first distance.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3,790,730

DATED : February 5, 1974

INVENTOR(S) : Alvin D. Wyland

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 4,

line 39, delete "or immobile por-";

line 40, delete "tion"; same line, after "end" insert
--or immobile portion--;

line 50, delete "elongated" and insert --elongate--.

Col. 7, line 29, delete "boint" and insert --point--.

Col. 9, line 34, delete "and".

Signed and Sealed this

Seventh Day of September 1976

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

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[SEAL]

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