United States Patent [19]

Fannin et al.

[11] **3,881,143**

[45] **Apr. 29, 1975**

[54] **CENTRIFUGAL SWITCH ASSEMBLY FOR A MOTOR STARTING CIRCUIT**

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[73] Assignee: **General Motors Corporation,** Detroit, Mich.

[22] Filed: **Apr. 11, 1974**

[21] Appl. No.: **460,042**

[52] **U.S. Cl.** ..... **318/221 F;** 200/80 R

[51] **Int. Cl.** **H02p 1/44**

[58] **Field of Search** ..... 318/221 R, 221 F; 200/80 R

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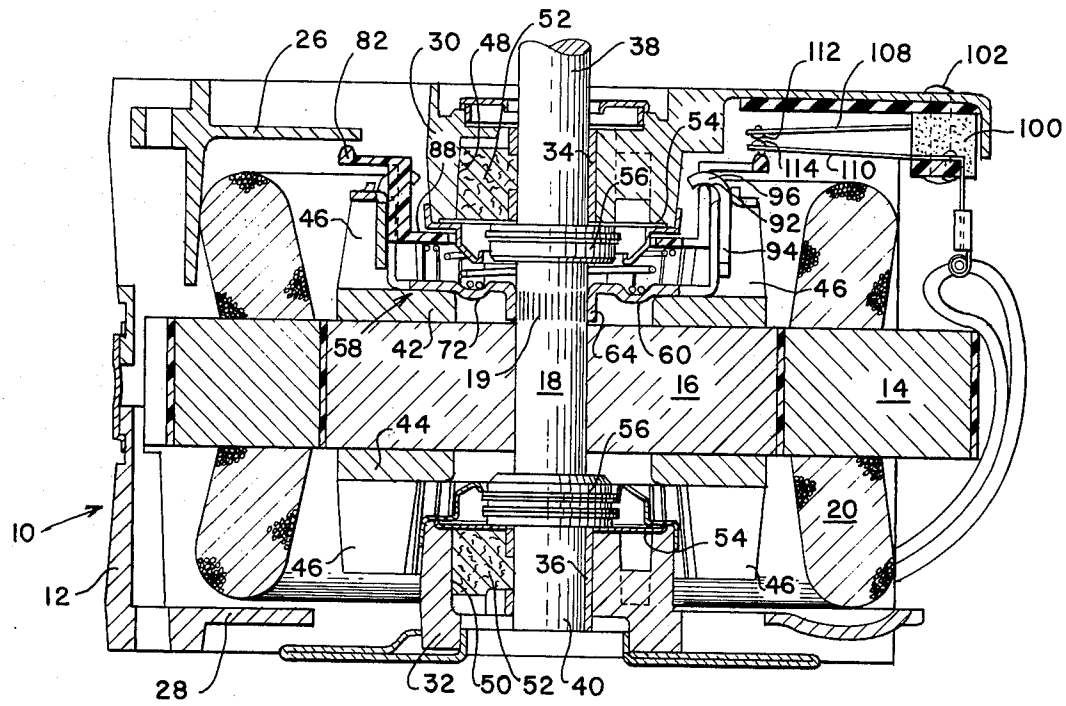
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[57] **ABSTRACT**

A centrifugal switch assembly for a motor having a starting circuit including a basket shaped actuator normally spring biased into engagement with switch contacts maintaining the starting circuit closed during static and motor low speed conditions. The switch actuator is mounted in a support member providing guide slots preventing rotation of the actuator relative to rotating motor components while being spring biased to the switch closed position. Centrifugal force responsive weights are pivotally mounted in the support member and engage the basket switch actuator moving it against the force of the biasing spring opening the switch contacts when the motor reaches a predetermined speed. The components of the actuator assembly are concentrically positioned upon the motor shaft adjacent the rotor and inwardly of the usual lubricating assembly in a manner without increasing the axial length of the motor.

3 Claims, 4 Drawing Figures



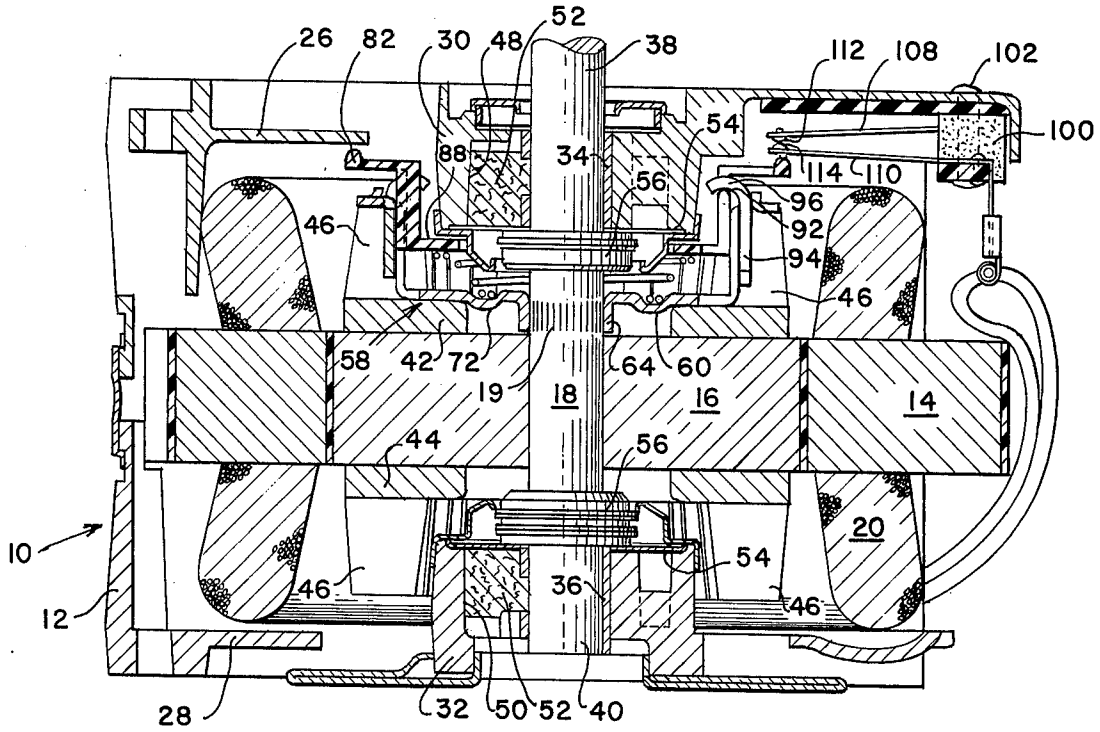


Fig. 1

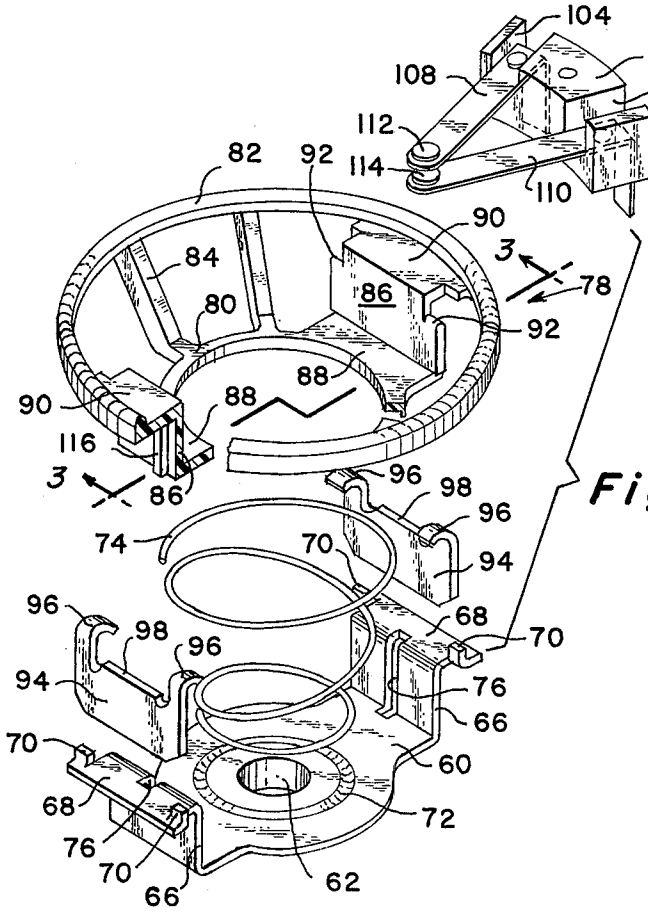


Fig. 2

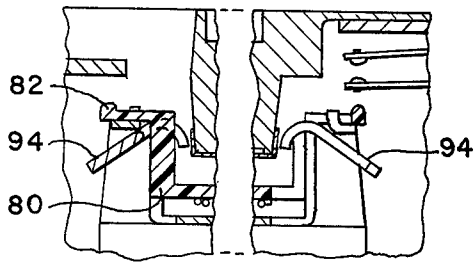


Fig. 3

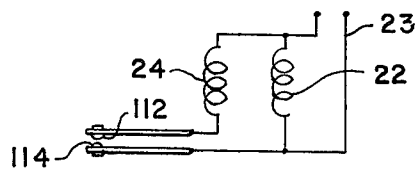


Fig. 4

CENTRIFUGAL SWITCH ASSEMBLY FOR A MOTOR STARTING CIRCUIT

This invention relates to centrifugally actuated switches and more specifically to an improved centrifugal switch assembly for electric motors controlling a starting circuit therein.

Centrifugally actuated switches are commonly employed in single phase AC induction motors which are used in industrial and household devices including appliances such as, clothes washers and dyers, dishwashers, garbage disposals, etc. These motors typically include a main winding and a starting winding which are energized when the motor is turned on. A centrifugal switch mechanism disconnects a starting winding when the motor has reached a predetermined speed and it is no longer desirable to maintain the starting winding energized.

Among the significant features of centrifugal switch mechanisms are the mounting arrangements and utilization of space within the motor housing without changing the size or shape of the electric motor. It is particularly desirable that the centrifugal switch assembly include a minimum of components so that the switch is reliable, easily assembled, and is readily serviceable so that the switch mechanism can be easily manufactured and assembled in the motor housing.

In accordance with the present invention, a centrifugally actuated motor switch assembly includes a support member containing a centrally disposed aperture for concentrically positioning it upon the motor shaft and it includes diametrically opposed axially extending flanges. The axially extending flanges contain guide slots receiving guide members on a basket shaped switch actuator which is slidably mounted relative to the support member and is also concentrically positioned on the motor shaft. A conical coil spring likewise is concentrically positioned on the motor shaft between the support member and the switch actuator normally biasing the switch actuator outwardly of the support member.

A pair of conductive leaf spring switch arms are rigidly secured in an insulating block attached to the motor housing. The switch arms have aligned contacts secured thereon and are normally biased open by their inherent spring characteristics. The basket shaped switch actuator includes a circumferential radially extending flange at its outer periphery terminating in an annular switch actuating rim. The coil spring between the support member and the switch actuator normally biases the rim into engagement with the leaf spring arms retaining the contacts in engagement normally closing the starting circuit. A pair of weight members include a pair of spaced arcuate fingers engaging supporting shoulders on the basket shaped switch actuator. They also engage spaced axially extending mounting lugs on the support member flanges pivotally supporting the weights in the assembly. The weight members are responsive to centrifugal force and pivot upon the support member flanges depressing the basket shaped switch actuator against the force of the coil spring moving the annular ring out of engagement with the leaf spring arms and opening the starting circuit when the motor reaches a predetermined speed.

Accordingly, a primary object of this invention is the provision of an improved centrifugal switch assembly for an electric motor that is compactly mounted internally of the motor in a manner requiring a minimum of housing space.

Another object of this invention is the provision of a centrifugal switch actuator assembly for an electric motor wherein the actuator assembly is mounted concentrically about the motor shaft inwardly of the usual lubricating assembly provided in the area where the shaft is rotatably mounted in the motor housing, the actuator assembly including a basket shaped actuator guided and slidably mounted within a support member for positive actuation in response to centrifugal forces whereby it opens a starting circuit when the motor attains a predetermined speed.

A further object of this invention is the provision of a centrifugally responsive switch actuator assembly within a motor housing positioned concentrically upon the motor shaft axially between the rotor and a lubricating oil well assembly in the motor housing so as to take advantage of available space without increasing the axial length of the motor housing, the actuator assembly including a support member having diametrically opposed axially extending flanges containing guide slots receiving guide lugs on a basket shaped switch actuating member normally spring biased to close contacts on leaf spring switch members, and a pair of weights being pivotally mounted in the support member flanges in engagement with the switch actuating member, the weights moving radially outwardly in response to motor speed thereby moving the switch actuator inwardly within the support member, opening the switch contacts and consequently the starting circuit when the motor attains a predetermined speed.

The novel features which we believe to be characteristic of our invention are set forth with particularity in the appended claims. Our invention itself, however, both as to its organization and method of operation, may be best understood by reference to the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a side elevational sectional view of an electric motor employing a centrifugal switch actuating assembly in accordance with the present invention.

FIG. 2 is an exploded perspective view illustrating the components of our centrifugal switch actuating assembly in aligned positions removed from the electric motor.

FIG. 3 is a fragmentary sectional view taken on line 3—3 of the switch actuator shown in FIG. 2 with the remaining components in assembled relationship illustrating the switch actuating mechanism in a centrifugal force operated position.

FIG. 4 illustrates an electrical schematic diagram including the switch contacts actuated by our centrifugal force responsive mechanism.

Referring now to FIG. 1, an electric motor **10** of a single phase AC induction motor type includes a motor housing **12**, a stator **14**, and a rotor **16** affixed to a shaft **18** for rotation therewith. The stator **14** is supported within housing **12** and includes a stator winding **20** comprising a main winding **22** and a starting winding **24** shown schematically in FIG. **4**. The motor housing **12** is substantially cylindrical in form and includes end frames **26** and **28** enclosing opposite ends thereof. The end frames **26** and **28** include annular bearing supports **30** and **32** which contain bearing assemblies **34** and **36**, respectively. The shaft **18** includes a forward portion **38** rotatably supported in bearing **34** which provides an

output driving connection for the motor **10** while a rearward portion **40** of the motor shaft **18** is supported by bearing **36.** In a preferred embodiment, the shaft **18** is vertically disposed although, of course, the shaft can be disposed horizontally without departing from the principal features of the present invention.

The rotor **16** includes a plurality of squirrel cage bars, not shown, which extend through the rotor and electrically connect with a pair of end rings **42** and **44** disposed on opposite ends of the rotor **16.** The end rings **42** and **44** can be made of a cast aluminum or other suitable conductive material and electrically interconnect with the squirrel cage bars, as previously indicated, in a well known manner. The end rings **42** and **44** have fan blades **46** cast integrally therewith for circulating air through the interior of housing **12** as the shaft **18** rotates. The fan blades **46** extend axially from the end rings **42** and **44** and are circumferentially spaced so that open spaces between the blades are formed radially of the shaft **18.**

The annular bearing supports **30** and **32** define cavities **48** and **50** each containing a quantity of porous material **52** impregnated with a lubricant so as to effectively lubricate the shaft **18** in the areas of bearings **34** and **36** during operation of the motor. The cavities **48** and **50** are substantially enclosed at the interior end thereof by thrust washers **54** secured to the annular bearing supports **30** and **32** and extending into engagement with the outward side of annular flanges **56** attached to the shaft **18.**

A centrifugal switch actuating assembly **58,** constructed in accordance with my invention, is positioned between the rotor **16** and the annular flange **56** near the driving end **38** of shaft **18.** The switch actuating assembly **58** includes a support member **60** containing a central aperture **62** defined by an annular flange **64** which provides for the concentric positioning of the support **60** upon shaft **18** adjacent rotor **16** in engagement with end ring **42.** The annular flange **64** has an inner surface engaging a splined surface **19** on shaft **18** providing a driving connection therebetween. The support member **60** includes diametrically oppositely positioned axially extending flanges **66** which terminate in radially extending flanges **68** being deformed to include vertically extending lugs **70** as is best illustrated in FIG. **2.** The support member **60** contains an annular depression **72** receiving one end of a conically shaped coil spring **74.** The axially extending flanges **66** each contain a centrally positioned slot **76** for a purpose to be later described.

A switch actuator **78** substantially in the form of a basket includes a bottom portion **80** and an upper annular switch actuating rim **82** connected with the bottom member via a plurality of struts **84.** The switch actuator **78** also includes diametrically opposed vertical walls **86** which connect with bottom surface **80** via an integral extended portion **88** and connect with the switch actuating rim **82** by means of an integral radially extending flange **90.** The vertical walls **86** are cut away to provide rounded shoulders **92** on either side of the vertical wall as is specifically illustrated in FIG. **2.**

A pair of centrifugal force responsive weights **94** include spaced arcuate fingers **96** at either end of the top edge defining a notch therebetween. The axially extending flanges **66** of the support member **60** are of a width sufficient to permit positioning of the arcuate fingers **96** of weights **94** on either side thereof adjacent the vertically extending lugs **70.** Likewise, the vertical wall **86** of the basket switch actuator **78** is of a width sufficient to permit positioning of the arcuate fingers **96** upon rounded shoulders **92** so that in an assembled relationship the weights **94** are operative to pivot relative to the support member **60** and move the switch actuator **78** against the force of spring **74** as will be later described with respect to operation of our improved centrifugal switch actuating mechanism.

The motor housing **12** has an insulating block **100** secured thereto by means of a rivet **102,** shown in FIG. **1.** The insulating block **100** is notched at **104** and **106** and leaf spring switch actuating members **108** and **110** are respectively secured therein as best shown in FIG. **2.** The leaf spring members **108** and **110** have contacts **112** and **114** secured thereon in axial alignment for engagement in a switch closed position. The switch actuating arms **108** and **110** are connected in series electric circuitry with one power line **23** and the starter winding **24,** as schematically illustrated in FIG. **4.**

The basket switch actuator **78** includes integral axially extending guide lugs **116** extending outwardly of the vertical walls **86** which are slidably received within notches **76** in the axial extending flanges **66** of support member **60.** This arrangement provides for sliding movement of the basket member **78** relative to the support member **60** as influenced by the coil biasing spring **74** while preventing relative rotation between support **60** and actuator **78.** As previously mentioned, the annular flange **64** of the support member **60** includes an inner surface engaging the splined surface **19** formed upon the shaft **18** drivingly connecting the support **60** with shaft **18.** In this manner the shaft **18** is effective to rotate the support member **60** while the guide members **116** residing in slots **76** provide a driving connection between the support member and the basket member **78** so that it is positively rotated with rotor **16** during operation of the motor. This arrangement is necessary to retain the switch actuator assembly in a fixed angular position out of interference with the cooling fan blades **46** on the end ring **42.**

In operation, with the motor in a static condition or in a low speed initial operating condition, the coil spring **74** is effective to maintain the basket switch actuator **78** in an extended position moving contact **114** into engagement with contact **112** maintaining the circuit through starting winding **24** closed. The extended movement of the basket switch actuator **78** is limited by engagement of rounded shoulders **92** of the basket switch actuator **78** with arcuate portions **96** of weights **94** which in turn has the top edge of notch **98** in engagement with the radially extending flanges **68** of support member **60,** as illustrated in FIG. **1.** When the motor attains a predetermined speed, the weights **94** pivot radially outwardly with the arcuate portions **96** remaining in engagement with the vertically extending lugs **70** while simultaneously continually engaging rounded shoulders **92** on vertical wall **86** of basket switch actuator **78.** This outward pivotal movement depresses the switch actuator **78** against the force of spring **74** and permits leaf spring switch member **110** to move its contact **114** out of engagement with contact **112** on leaf spring member **108.** In this manner the circuit through the starting winding **24** is opened and the motor continues to operate by means of a closed circuit through main winding **22.**

From the above description it is apparent that our invention provides a compact centrifugal force responsive switch actuating mechanism which fits within a conventional motor structure without increasing the axial length thereof. A conventional motor structure can be slightly modified to accommodate this arrangement, the only necessity being that a splined surface **19** be provided upon the motor shaft **18.** The incorporation of guide members **116** on the basket shaped switch actuator **78** insures rotation of the basket member with rotor **16** while preventing undesirable tilting or binding of the components so that it can readily move axially relative to the shaft **18** under the influence of coil spring **74** or in response to centrifugal forces sensed by the weights **94.** Also, engagement of guide members in support member slots **76** fixes the radial position of the switch actuator **78** relative to the rotating motor components permitting unobstructed motor operation.

While we have shown and described a particular embodiment of the present invention it will, of course, be understood that various modifications and alternative constructions thereof may be made without departing from the true spirit and scope of our invention and that we intend by the appended claims to cover all such modifications and alternative constructions as fall within the true spirit and scope of our invention.

We claim:

1. A centrifugal switch actuator assembly for an electrical motor including a main winding; a starting winding; a shaft; a housing enclosing said windings and rotatably supporting said shaft; and a rotor fixedly mounted to said shaft for rotation within said housing; said centrifugal switch actuator assembly comprising: an electrical switch assembly mounted on said housing and including first and second contacts having mutually engaging and disengaging positions; a series electrical circuit including said starting winding and said first and second contacts; a support member containing a centrally positioned aperture receiving said shaft; said support member including axially extending flanges; a basket-shaped switch actuator mounted within the flanges of said support member; guide means on both said support flanges and said basket switch actuator cooperating and preventing rotation of said actuator relative to said support member while guiding axial movement of said actuator relative to said support member; a peripheral rim on said switch actuator positioned for axial movement between a switch contact engaged position and a switch contact disengaged position; a coil spring positioned between said support and said actuator normally biasing the basket actuator away from said support to a contact engaged position; and a plurality of weights pivotally attached to said basket switch actuator whereby said weights respond to the centrifugal forces developed at a predetermined motor speed moving said actuator against the force of said biasing spring positioning said rim out of engagement with contacts opening the circuit to said starting winding.

2. A centrifugal switch actuator assembly for an electrical motor including a main winding; a starting winding; a shaft; a housing enclosing said windings and rotatably supporting said shaft; and a rotor fixedly mounted to said shaft for rotation within said housing; said centrifugal switch actuator assembly comprising: an electrical switch assembly mounted on said housing and including first and second contacts having mutually engaging and disengaging positions; a series electrical circuit including said starting winding and said first and second contacts; a support member containing a centrally positioned aperture receiving said shaft; diametrically opposed flanges extending axially of said motor and terminating in radially extending flanges on said support member; a basket-shaped switch actuator; said switch actuator including a bottom portion; an annular peripheral rim; a plurality of angularly extending web members securing said rim to said base; diametrically opposed vertical walls integral with said switch actuator extending between the bottom of said actuator and said annular rim; a guide lug on each of said vertical walls; said axially extending support flanges containing guide notches slidably receiving said lugs; a coil spring concentrically positioned about said shaft engaging said support member and the bottom of said switch actuator normally biasing said switch actuator away from said support member into a position engaging said first and second contacts; said vertical walls of said switch actuator each including spaced shoulders; said radial flanges of said support member each including spaced axially extending lugs; and two weight members each comprising a pair of spaced arcuate fingers engaging said shoulders on said walls and being retained by said axially extending lugs on said support member whereby a predetermined centrifugal force resulting from a predetermined motor speed causes said weights to move radially outward forcing said basket shaped switch actuator against the force of said coil spring moving said annular rim out of engagement with one of said switch contacts permitting disengagement of said first and second contacts thereby opening the series circuit to said starting winding.

3. A centrifugal switch actuator assembly for an electrical motor including a main winding; a starting winding; a shaft; a housing enclosing said windings and rotatably supporting said shaft; an annular flange fixed on said shaft; a thrust washer secured to said housing in contact with the outer face of said flange effectively sealing the interior of said housing from the atmosphere; and a rotor fixedly mounted to said shaft for rotation within said housing; said centrifugal switch actuator assembly comprising: an electrical switch assembly mounted on said housing; said switch assembly including first and second leaf spring switch members; a contact on each of said leaf spring members; and leaf spring members normally being inherently spring-biased to a circuit open position; a series electrical circuit including said starting winding and said leaf spring members; a support member containing a centrally positioned aperture providing for the positioning of said support member concentrically upon said shaft between said rotor and the inner side of said shaft annular flange; diametrically opposed flanges extending axially of said motor and terminating in radially extending flanges on said support member; a basket-shaped switch actuator; said switch actuator including a base; an annular peripheral rim secured to said base by a plurality of angularly extending web members; diametrically opposed vertical walls integral with said switch actuator extending between the base of said actuator and said annular rim; a guide lug on the outer side each of said vertical walls; said axially extending support flanges containing guide notches slidably receiving said lugs; the base of said actuator containing an aperture receiving said motor shaft; said lugs in said notches and said vertical walls in conjunction with said axially ex-

tending flanges all cooperating for concentrically positioning said basket-shaped switch actuator upon said shaft; a coil spring concentrically positioned about said shaft engaging said support member and the base of said switch actuator normally biasing the switch actuator away from said support member into a position engaging the contacts on said first and second leaf spring members; said vertical walls of said switch actuator each including spaced shoulders; said radial flanges of said support member each including spaced axially extending lugs; and two weight members each comprising a pair of spaced arcuate fingers engaging said shoulders on said walls and being retained by said axially extending lugs on said support member whereby a predetermined centrifugal force developed at predetermined motor speed moves said weights radially outwardly generating an axial force of a greater magnitude than the force of said coil spring positively forcing said basket-shaped switch actuator against the force of said coil spring moving said annular rim out of engagement with one of said leaf spring members permitting positive disengagement of their respective contacts opening the series circuit to said starting winding.

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,881,143

DATED : April 29, 1975

INVENTOR(S) : Wayne V. Fannin and Edwin H. Halsted

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

Column 1, line 11, "dyers" should read -- dryers --.
Column 3, line 64, after "notch" insert -- 98 --.
Column 6, line 46, after "members;" change "and" to -- said --.

Signed and Sealed this

nineteenth Day of *August 1975*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks

UNITED STATES PATENT AND TRADEMARK OFFICE

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