May 6, 1952 C. H. DEDERICK 2,595,930

CENTRIFUGAL ACTUATOR

Filed Feb. 7, 1948

Fig. 1.

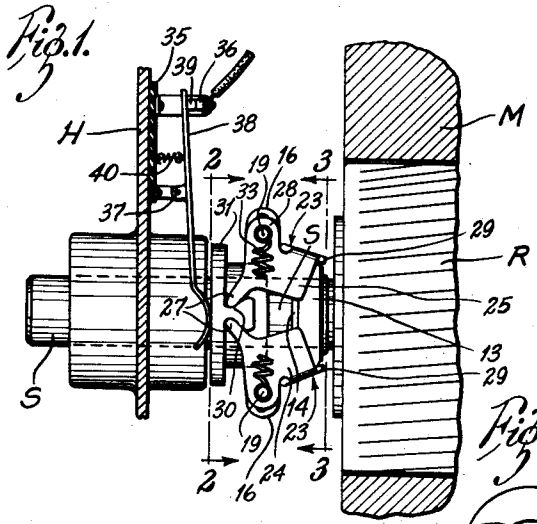


Fig. 2.

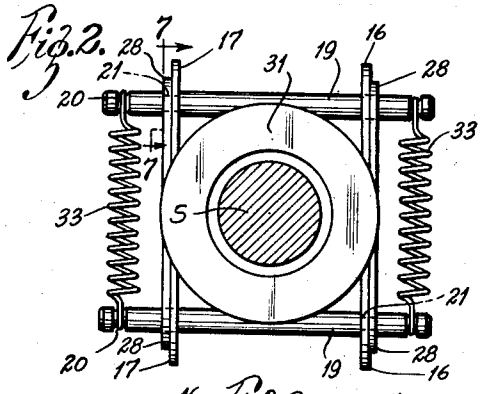


Fig. 7.

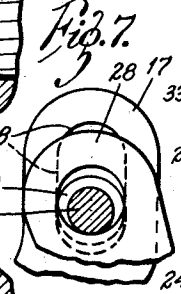


Fig. 3.

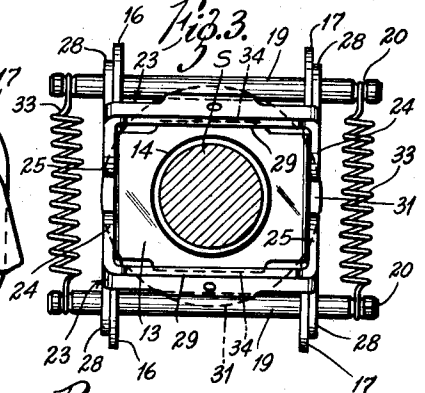


Fig. 4.

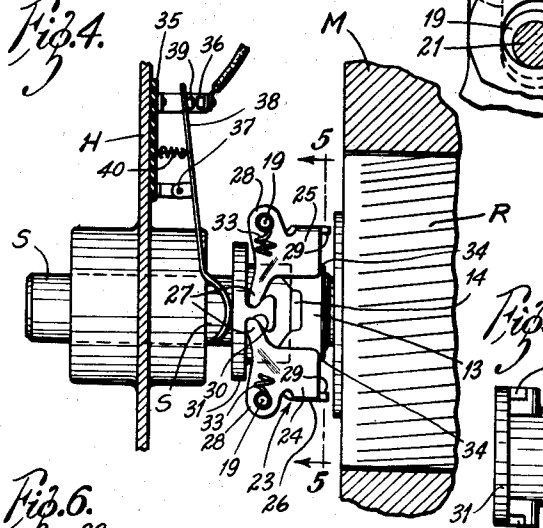


Fig. 11.

Fig. 5.

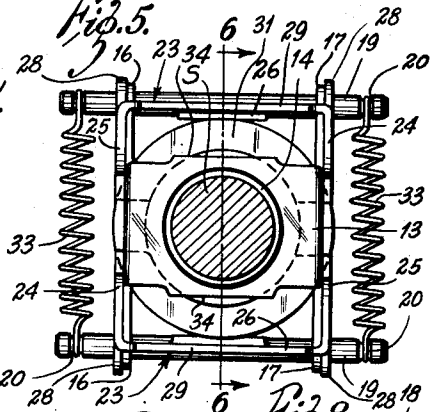


Fig. 6.

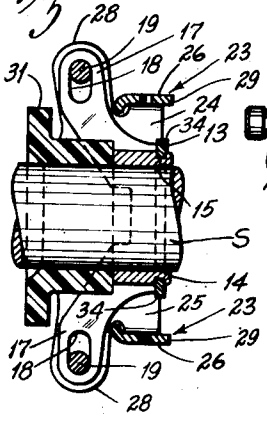


Fig. 9.

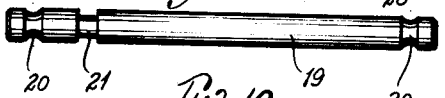


Fig. 10.

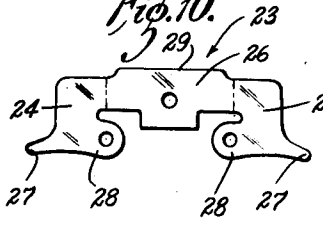
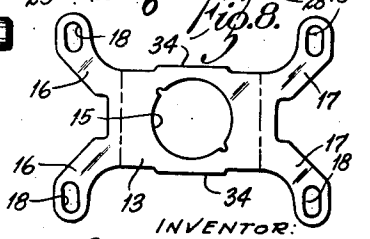


Fig. 8.



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CENTRIFUGAL ACTUATOR

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10 Claims. (Cl. 264—15)

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The present invention relates to a centrifugal actuator. More particularly, it relates to the type of centrifugal actuator that can be used on motors for opening circuits when the motors attain predetermined speeds. It is especally valuable in connection with motors having separate starting windings that should be taken out of circuit when the motor comes up to running speed.

It is an object of the invention to provide a centrifugal actuator of this type that, with simplified construction, will give a snap action; that is to say, once it has attained a critical speed, it will rapidly move from its rest position to its operating position; and such that it will do likewise upon return movement from its operating position to its rest position.

A further object of the invention is to provide an actuator that will operate with a minimum of friction, with a minimum of moving parts, that can be constructed of readily available and simply fabricated materials, and that can be easily assembled.

In the drawing:

Fig. 1 is a side elevation, partly broken away, of the actuator mounted on a motor shaft with an actuated switch shown closed and partly in section;

Fig. 2 is a transverse section at the outer end of the actuator, taken on the line 2—2 of Fig. 1;

Fig. 3 is a transverse section at the inner end of the actuator, with the rotors in their inner positions, the view being taken on the line 3—3 of Fig. 1;

Fig. 4 is a view similar to Fig. 1, but with the weights in outer positions;

Fig. 5 is a transverse section on the line 5—5 of Fig. 4, showing the weights in their outer positions;

Fig. 6 is a diametrical section, taken on the line 6—6 of Fig. 5, the weights being in their outer positions;

Fig. 7 is a section of one of the pin mountings, taken on the line 7—7 of Fig. 2;

Fig. 8 is a view of the stamping from which the weight supporting bracket is made;

Fig. 9 is an elevation of one of the pivot pins;

Fig. 10 is a view of the stamping from which each of the weights may be made; and

Fig. 11 is a plan view of a flanged collar included in the actuator mechanism.

A motor is generally indicated at M, it having a rotor R and a shaft S. The motor housing is generally indicated at H, with a hub in which the shaft S has bearing.

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The centrifugal actuator includes a bracket 13 that is attached to a hub 14 (Fig. 6), the hub being tightly fitted on the shaft S to rotate therewith. The bracket 13 may be formed of a stamping, as indicated by the blank in Fig. 8, with a central opening 15 that fits over an outer diameter of the hub 14. As shown in Fig. 6, the part of the hub inwardly of the bracket is peened over the bracket to secure the parts together. Diametrically opposed notches in the opening bind the bracket 13 against rotation on the shaft S.

The bracket blank 13, appearing in Fig. 8, has its ends turned at right angles, approximately on the dotted lines in Fig. 8, to provide side portions that extend parallel to the shaft S, and pairs of arms 16 and 17 on opposite sides of the shaft. Each of these arms is slotted at 18 at its extremity. As appears, for example, in Fig. 3, this arrangement affords what, in the positions illustrated, may be termed an upper set of arms 16 and 17 and a lower set of arms 16 and 17. Each pair of arms projects beyond the shaft, upwardly or downwardly as the case may be, so that each set may receive a pin 19. The two pins extend across the shaft at opposite sides thereof and are substantially parallel.

A pin 19 is shown separately in Fig. 9. It has outer grooves 20 to receive springs, as will appear; and it has one inner groove 21. The pins are inserted through their sets of arms 16 and 17 in the drawings. The pins 19 are inserted to dispose the grooves 21 diagonally oppositely.

A pair of centrifugal weight members 23 are likewise mounted on the pins 19. One of these weights appears in blank form at 23 in Fig. 10. Its ends 24 and 25 are bent over approximately on the dotted lines of Fig. 10 to right angles with respect to the main portion 26 of the blank. The end portions 24 and 25 are shaped to afford rocker pivots 27 and upstanding projections 23 having holes to receive the pins 19. The main portions 25 constitute the main part of the centrifugal weights. Each main portion has a slight projection 29 on one edge for a purpose to appear.

The weight members, duly formed, are disposed on opposite sides of the shaft S and astride the same, with their pivot points 27 engaged in sockets 30 disposed on opposite sides of a flanged collar 31, and with their side portions 24 and 25 alongside the arms 16 and 17. The collar 31 may desirably be formed of a plastic material; and it is slidably mounted on the shaft S.

When the parts are thus positioned, the pins

19 may be installed as shown in the drawings, each pin 19 pivotally attaching one weight member to one pair of arms 16, 17 of the bracket 13. As each pin 19 is positioned, its groove 21 will engage one hole in a projection 28 of the weight member 23. As noted before, the two grooves 21 are diagonally opposite. With the pins thus in position, two coil springs 33 are hooked over the ends of the pins in the grooves 20.

Reference to Fig. 1 will show that these coil springs 33 apply a force eccentric to the pivots 27 and draw the main body portions 26 of the weights 23 toward the shaft S, until their projections 29 come to rest against corresponding projections 34 on the body portion of the bracket 13 on opposite sides of the shaft.

The flange of the collar 31 is adapted to control operation of a switch. This switch is shown here in simple form as including a bracket 35 supported on the motor housing H. This bracket has a fixed contact 36. The bracket also supports a pivot means 37 for a switch arm 38 that has a contact 39 on it. The switch arm extends down and is forked to straddle the shaft S and engage the flange of the collar 31. A coil spring 40 normally draws the contact 39 away from the fixed contact 36, and holds the lower end of the arm 38 in engagement with the collar 31.

Operation

The two weight members 23, in position and acted upon by the springs 33, are rockable on the collar 31 about the pivots 27. The springs 33 draw the pins 19 together, these pins being eccentric with respect to the pivots 27, so that they will transmit the spring forces eccentrically to the weight members, urging them rockably to bring their main portions 25 toward the shaft. As the pins 19 are restricted by the slots 18 of the brackets 13 to movement in radial planes, the pivots 27 are required to move axially during the rocking movements of the weight members. In the rest position of the actuator, the main portions 25 move inwardly until their projections 29 abut the stops 34 on the bracket 13.

When the rotor R rotates, the weight members 23 exert centrifugal forces, and, owing to the disposition of substantially their entire masses eccentrically of the pivots 27, these forces seek to rock the inner ends of the weight members 23 outwardly. The centrifugal forces are opposed by the springs 33, acting with lever arms equal to the axial distance from the center lines of the springs to the pivot points. In the rest position, this lever arm is at a maximum.

It will also be observed that the weights are designed so that their centers of gravity are at points toward the rotor R from the pivots 27 and radially outward from the shaft S, so as to be toward the rotor R and inwardly from the pins 29. By this arrangement, when the weights swing outwardly about the pivots 27, the centers of gravity and the spring forces both lose in lever arms, but the springs lose at more rapid rates. Also, as the pins move outwardly during the rocking movement, they are slightly extended, but the centers of gravity move out at greater rates, gaining in centrifugal force owing to larger radius of rotation.

The result of the foregoing is that, when the rotor attains a predetermined critical speed, the weight members will develop enough centrifugal force to swing outwardly an increment. But once outwardly by this increment, the greater centrifugal force, coupled with the relatively great loss

of lever arm of the springs, existing at such incrementally outward position, will be such as to continue outward movement of the weights even without further increase of rotor speed. The result of this is that, once outward movement of the weights begins, it will continue with dispatch until the weight members reach their outer positions, limited by abutment of the collar 31 against the hub 14, as shown in Fig. 6. In this position, the center lines of the springs 33 are close to the pivots 27, but still on the rotor side thereof. The outward movement of the weight members thus produces a snap action of the switch.

As long as the rotor speed exceeds the operating value, the weights will remain out, held by a net outward force greater than the net outward force that started their outward movement. Only when the rotor R is reduced in speed to a rate below that critical value will the weights start in. The reverse of the opening action will then occur, and the weights will rapidly move in, reclosing the switch with quick action.

The construction of this actuator is simple, it consisting largely of stampings and die formed elements. Its assembly is easy. In this, the single grooves 21 of the pins 19 aid, for one such groove on each pin suffices to hold the pins against axial displacement, when provided as described, and eliminates the need for accurate machining that would attend the use of two grooves on each pin.

What is claimed is:

1. A centrifugal actuator for use with a rotating shaft, comprising a collar axially disposable on the shaft, a bracket fixable on the shaft and coaxial with the collar, the bracket having arms extending outwardly on opposite sides of the shaft, the arms having parallel slotted ends, a weight member having a main portion for disposition across the shaft, and end portions on opposite sides of the shaft, the end portions having parts lying alongside the slotted ends of the bracket arms, and having pivot points rockably engaging opposite sides of the collar, a pin passing through the slots and the parts of the weight member arms alongside the same, spring means acting on the pin to urge it toward the shaft, the pivot points being at one end of the weight members, measured along the shaft, the spring means being displaced along the shaft therefrom, and the center of gravity of the weight member being axially beyond the spring means.

2. A centrifugal actuator for use upon a rotating shaft, comprising a bracket adapted to be fixed to the shaft, said bracket having side portions disposed on opposite sides of the shaft, and each side portion having slots extending outwardly of the shaft, a pair of pins extending across the shaft on opposite sides thereof transversely to the slots, a pair of weight members and an axially movable collar, each weight member comprising a middle portion for extending across the shaft at one side of the pins, and end portions for lying alongside the sides of the bracket, said end portions of each weight member having pivot portions rockably interengageable with the collar, and axially displaced to the opposite sides of the pins from the body portion, and the side portion of each weight member having an opening of a size to receive the end of one of the pins to pivotally attach one side of the weight member thereto, the pins projecting beyond the weight members, and springs hooked from the ends of one projecting pin to the ends of the other pin on the opposite side of the shaft.

3. A centrifugal actuator for use upon a rotating shaft, comprising a bracket adapted to be fixed to the shaft, said bracket having side portions disposed on opposite sides of the shaft, and each side portion having slots extending outwardly of the shaft, a pair of pins extending across the shaft on opposite sides thereof transversely to the slots and engaging adjacent its ends in corresponding slots of the two sides, a pair of weight members and an axially movable collar, each weight member comprising a middle portion for extending across the shaft at one side of the pins, and end portions for lying alongside the sides of the bracket, said end portions of each weight member having pivot portions rockably interengageable with the collar, and axially displaced to the opposite sides of the pins from the body portion, and the side portion of each weight member having holes to receive one of the pins to pivotally attach the weight member thereto, the pins projecting beyond the weight members, and springs hooked from one projecting pin to the other, each pin having a cut-away portion adjacent at least one end thereof whereby it may lock against axial displacement from the bracket.

4. In a centrifugal actuator for use on a shaft rotating about an axis, a bracket adapted to be fixed to the shaft, the bracket comprising a plate-like element wtih a middle portion having a hole therethrough to receive the shaft so that the middle portion may be disposed transversely of the axis, the plate-like element having side portions extending at angles to the middle portion, for disposition parallel to the axis of the shaft on opposite sides thereof, said side portions extending outwardly and having outwardly extending slots in their outer ends that extend beyond the shaft, a pair of pins extending transversely across the axis and engageable with the side portions, each of the pins having its ends disposed adjacent the slots of two opposed side portions, a pair of weight members, and a collar for axial movement, each weight member comprising a plate-like element with a middle portion and opposite end portions extending at angles thereto so that the middle portion may lie across the axis parallel to one of the pins and the end portions may lie alongside the side portions of the bracket, the end portions of each weight member having pivot extensions rockably engageable with the collar on opposite sides thereof, and the end portions of each weight member having outwardly extending ears with openings of a size to receive one of the pins, the pivot extensions being axially displaced to the opposite side of the pin receiving opening from the middle portion of each weight member, and a pair of springs connecting the ends of the pins to urge the pins toward each other.

5. In a centrifugal actuator for use on a shaft rotating about an axis, a bracket adapted to be fixed to the shaft, the bracket comprising a plate-like element with a middle portion having a hole therethrough to receive the shaft so that the middle portion may be disposed transversely of the axis, the plate-like element having side portions extending at angles to the middle portion, for disposition parallel to the axis of the shaft on opposite sides thereof, said side portions extending outwardly and having outwardly extending slots in their outer ends that extend beyond the shaft, a pair of pins engageable across the axis, transversely to the side portions, each of the pins being disposed adjacent its opposite

ends in the slots of two side portions, a pair of weight members, and a collar for axial movement, each weight member comprising a plate-like element with a middle portion and opposite end portions extending at angles thereto so that the middle portion may lie across the axis parallel to one of the pins and the end portions may lie alongside the side portions of the bracket, the end portions of each weight member having pivot extensions rockably engageable with the collar on opposite sides thereof, and the end portions of each weight member having outwardly extending ears with holes to receive one of the pins, the pivot extensions being axially displaced to the opposite side of the pin holes from the middle portion of each weight member, and a pair of springs connecting the ends of the pins to urge the pins toward each other, each pin having one groove around it where it engages with one of the weight members, to lock the pin against axial displacement.

6. A centrifugal actuator for use upon a rotating shaft, comprising a bracket adapted to be fixed to the shaft, said bracket containing a plate-like body portion having an opening in the center to receive the shaft and side portions extending at an angle to the body portion, said side portions containing elongated slots with closed ends normal to the axis of the shaft; a pair of rod-like members disposed in the slots on opposite sides of the shaft, said rod-like members having limited radial movement; and a pair of weight members pivotally mounted on the rod-like members, said weight members containing arm-like portions extending to one side of the rod-like members, the centers of gravity of the weight members being on the sides of the rod-like members opposite to the arm-like portions.

7. A centrifugal actuator for use upon a rotating shaft, comprising a bracket adapted to be fixed to the shaft, said bracket containing a plate-like body portion having an opening in the center to receive the shaft and side portions extending at an angle to the body portion, said side portions containing elongated slots with closed ends normal to the axis of the shaft; a pair of rod-like members disposed in the slots on opposite sides of the shaft, said rod-like members having limited radial movement; a pair of weight members pivotally mounted on the rod-like members, said weight members containing arm-like portions extending to one side of the rod-like members, the centers of gravity of the weight members being on the sides of the rod-like members opposite to the arm-like portions; and yieldable means biasing the rod-like members together.

8. A device of the type described, comprising a bracket member containing a plate-like body portion and side portions extending normal to the body portion at the edges thereof, said side portions containing parallel slots; a rod-like member disposed in said slots; a U-shaped weight member pivotally mounted on the rod-like member, the later passing through the leg portions of the U-shaped member; the rod-like member containing an annular groove adjacent one end thereof to receive a side portion of the bracket member and a leg portion of the U-shaped member so as to limit the relative transverse movement between the latter and the rod-like member.

9. A centrifugal actuator for use upon a rotatable shaft, comprising a sleeve slidable on the shaft; a supporting bracket adapted to be fixedly mounted on the shaft so as to extend on opposite sides thereof; a pair of actuating members piv-

otally mounted on the bracket on opposite sides of the shaft, means interconnecting the actuating members and the bracket for limited transverse movement of the actuating members relative to the shaft, each of the actuating members including an arm-like portion extending axially along the shaft to one side of the pivot for engagement with the sleeve to move it along the shaft, the center of gravity of each actuating member being disposed on the side of the pivot opposite to the arm-like portion; and yieldable means connected between the actuating members at their pivots biasing them toward the shaft.

10. A centrifugal actuator for use upon a rotatable shaft, comprising a sleeve slidable on the shaft; a supporting bracket adapted to be fixedly mounted on the shaft so as to extend on opposite sides thereof; a pair of actuating members pivotally mounted on the bracket on opposite sides of the shaft, means interconnecting the actuating members and the bracket for limited transverse movement of the actuating members relative to the shaft, each of the actuating members including an arm-like portion extending axially along the shaft to one side of the pivot for engagement with the sleeve to move it along the shaft, the center of gravity of each actuating

member being disposed on the side of the pivot opposite to the arm-like portion and inwardly of the pivot when the shaft is stationary so that the center of gravity of the actuating member will move axially away from the pivot on the side opposite to the arm-like portion when the shaft is rotated; and yieldable means connected to the actuating members at their pivots biasing them toward the shaft.

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