

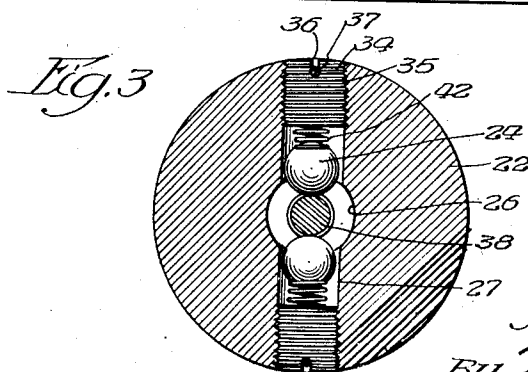
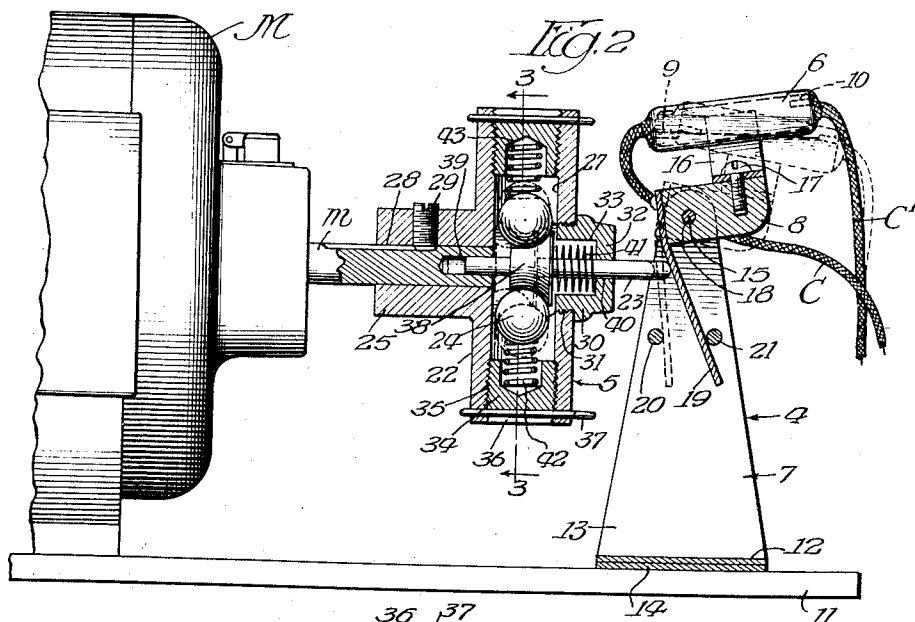
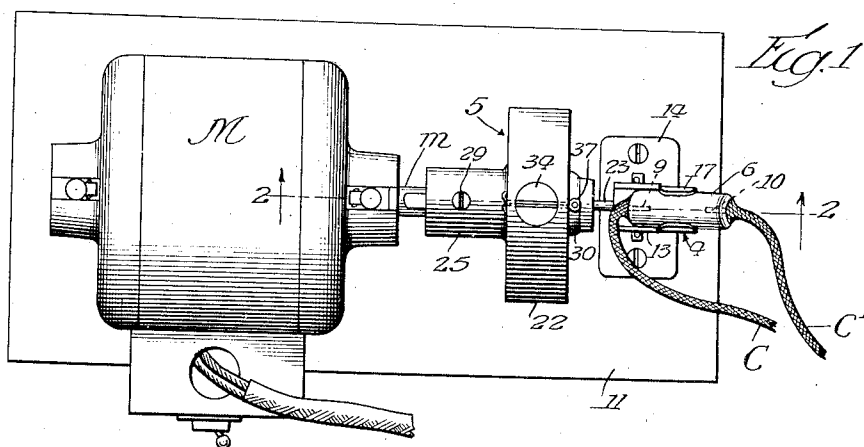
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CIRCUIT CONTROLLING DEVICE

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CIRCUIT CONTROLLING DEVICE

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The present invention relates generally to devices for controlling electric circuits. More particularly the invention relates to that type of circuit controlling device which comprises a switch for the circuit and a shaft driven governor which operates so to control the switch that the switch is shifted into one of its positions when the shaft reaches a predetermined speed and is shifted into its other position when the shaft is driven at a lower speed or drive of the shaft is stopped.

One object of the invention is to provide a circuit controlling device of this type which is simpler in design and more efficient in operation than previously designed devices of the same general character.

Another object of the invention is to provide a circuit controlling device of the type and character under consideration in which the governor comprises a cylindrical or disk-like housing on the shaft and an axially shiftable switch actuating shaft in the central portion of the housing and also comprises a group or set of ball type weights which are mounted in radial guide-ways in the housing for movement to and from the switch actuating shaft and have applied to the outer portions thereof compression springs which when the governor driving shaft drops below its predetermined speed are adapted to overcome outward thrust of the weights resulting from centrifugal force and force the weights inwards against a tapered member on the switch actuating shaft in such manner as to cause the weights to coast with said member and shift the last mentioned shaft axially in one direction for switch actuating purposes.

A further object of the invention is to provide a circuit controlling device of the last mentioned character in which the governor embodies a comparatively light spring for shifting the switch actuating shaft axially in the opposite direction for switch actuating purposes when the ball type weights are flung outwards away from the tapered member as the result of sufficient centrifugal force to overcome the pressure of the compression springs in the outer portions of the guide-ways in the housing.

A still further object of the invention is to provide a circuit controlling device which is generally of new and improved construction and in which the switch is so arranged and constructed that it assumes automatically one of its positions in response to axial shift of the actuating shaft by the action of the light spring and is not engaged by the actuating shaft or subject to wear

by the latter when the governor is operative, that is, when the weight type elements are flung outwards against the force of the compression springs as the result of the governor driving shaft being driven at or above the predetermined speed.

Other objects of the invention and the various advantages and characteristics of the present circuit controlling device will be apparent from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by claims at the conclusion hereof.

In the drawing which accompanies and forms a part of this specification or disclosure and in which like numerals of reference denote corresponding parts throughout the several views:

Figure 1 is a plan view of a circuit controlling device embodying the invention;

Figure 2 is a vertical longitudinal sectional view showing in detail the arrangement and design of the governor and switch and the manner in which the actuating shaft of the governor serves to hold the switch in one of its circuit controlling positions when the governor and governor driving shaft are at rest or driven at a speed less than the predetermined speed; and

Figure 3 is a vertical transverse sectional view taken on the line 3—3 of Figure 2 and illustrating the manner in which the ball type weights coast with the tapered member on the switch actuating shaft to shift the latter axially in one direction as the result of inward shift of the weights by the compression springs.

The device which is shown in the drawing constitutes the preferred embodiment of the invention and is adapted for use in controlling a circuit consisting of a pair of conductors C and C¹. It is shown in connection with an electric motor M having an armature shaft *m* and comprises a switch 4 and a governor 5. The governor is fixed to rotate with the armature shaft *m* of the electric motor and operates, as hereinafter described, so to control the switch that the switch is shifted into one of its positions when the armature shaft reaches a predetermined speed and is shifted into its other position when the shaft is driven at a lower speed or drive of the shaft is stopped.

The switch 4 is connected to and forms a part of the circuit consisting of the conductors C and C¹, and comprises as the main parts thereof a tube 6, a U-shaped bracket 7, and a tube holder 8. The tube is formed of glass or like material.

It is partially filled with mercury or like fluid type conductor material and embodies contacts 9 and 10 in the end walls thereof. The conductors C and C¹ are connected respectively to these contacts 9 and 10. The tube 6 is positioned substantially horizontally and is supported by the holder 8 for vertical tilting movement. When the tube is tilted in one direction, as shown in dotted lines in Figure 2, the mercury contacts with both contacts 9 and 10 and forms an electrical connection between the conductors C and C¹ whereby the circuit in which the latter are included is completed. When the tube is tilted in the opposite direction, as shown by full lines in Figure 2, the mercury flows to one end of the tube and breaks the electrical connection between the two contacts. When the mercury bridges the two contacts the switch is in its closed position and when the tube is tilted so that the mercury is at one end of the tube and does not form an electrical connection between the two contacts the switch is in its open position. The bracket 7 is mounted on a base 11 on which the motor M is supported. It is located next to the governor 5 and consists of a cross-wall 12 and a pair of upwardly extending laterally spaced side walls 13. The cross-wall fits against a plate 14 which overlies the top face of, and is secured by screws or other attaching devices to, the base 11. The side walls 13 are arranged in parallel relation and extend in the direction of the armature shaft *m* of the motor M. The holder 8 is in the form of an elongated block of metal and fits between the upper ends of the side walls of the bracket. One end of the holder is pivotally supported by a pin 15 and the other end of the holder embodies an upstanding U-shaped clip 16. The latter is fixedly secured to the holder by means of a screw 17 and grips yieldingly the side wall of the mercury filled tube 6. The pin 15 extends between and is carried by the upper ends of the side walls 13 of the bracket and passes through a cylindrical hole 18 in the tube supporting holder 8. It extends horizontally and so pivotally supports the holder that the latter together with the mercury filled tube is free to tilt or swing vertically. Vertical tilting of the holder and tube is limited by means of an arm 19 and a pair of stops 20 and 21. The arm 19 is fixed to and depends from the end of the holder which is pivotally supported by the pin 15. The stops 20 and 21 are in the form of pins and extend between and are secured to the side walls 13 of the bracket 7. They are arranged in straddled relation with the lower end of the arm 19 and coact with the latter to limit swinging or tilting movement of the holder and tube. The holder 8 because it is pivotally supported at one end tends to swing downwards in response to the action of gravity. The tube is so arranged with respect to the holder that when the holder swings downwards by gravity the mercury bridges the contacts 9 and 10 and effects closing of the switch. The stop 20 coacts with the arm 19 to limit downward swinging of the holder and tube and is so arranged that when the arm strikes against it, it arrests the holder in the proper angular positions for closing of the switch. The stop 21 coacts with the arm 19 to limit upward swinging movement of the holder and tube and is so arranged that it arrests the holder and tube after the latter have been tilted upwards into a position wherein the mercury is at one end of the tube and the switch is thus in its open position. The action of gravity on the holder and tube serves to shift the

switch into its normal or closed position and to retain the switch in such position. When the arm 19 is swung towards the stop 21 the holder and tube swing upwards and effect closing of the switch. When the arm is released the holder and tube swing downwards until the arm 19 strikes against and is arrested by the stop 20 and the switch is thus in its closed position.

The governor 5 is disposed between the motor M and the switch 4 and comprises as the main elements thereof a cylindrical or disk-like housing 22, a switch actuating shaft 23, and a pair of ball type weights 24. The housing 5 embodies a centrally disposed laterally projecting elongated hub 25 and has a central axially extending bore 26 and a pair of guide-ways 27. The hub 25 is formed integrally with the housing and embodies a centrally disposed socket 28 through which extends the projecting end of the armature shaft *m*. A set screw 29 extends transversely through the hub and serves to secure the housing for conjoint rotation with the armature shaft. The bore 26 communicates with and is coaxial with the socket 28 and extends through the end face of the housing which faces the bracket 7 of the switch. It is larger in diameter than the socket and is closed as far as its outer end is concerned by an end cap 30. The latter is removably secured in place by means of a screw thread connection 31 and embodies a cross-wall 32 and a socket 33. The guide-ways 27 communicate with and extend radially from the bore 26 and have the ball-type weights 24 mounted therein for sliding movement to and from the shaft 23. The outer ends of the guide-ways extend through the periphery of the housing 22 and are closed by a pair of plugs 34. The latter, as shown in Figure 2 of the drawing, are secured in place by means of screw thread connections 35 and have comparatively deep diametrically extending kerfs 36 whereby they may be turned by a screw driver or like tool into and out of their operative position or adjusted longitudinally of the guide-ways. Cotter pins 37 extend through aligned holes in the peripheral or outer marginal portion of the housing and the kerfs 36 in the plugs and serve to lock the plugs in place. When it is desired to remove the plugs the cotter pins are removed from the governor housing by pulling them axially through the holes. Thereafter by way of a screw driver the plugs are turned or rotated until they are free from the housing. In the event that it is desired to adjust the plugs axially the cotter pins are removed and then the plugs are turned in the desired direction.

The switch actuating shaft 23 is coaxially positioned with respect to the armature shaft *m* of the electric motor M. It extends across the central portion of the bore 26 and embodies an integral tapered element 38. One end of the switch actuating shaft fits in an elongated bore 39 in the end of the armature shaft which extends through and fits in the socket 28 in the hub 25 and the other end of said shaft extends through a hole 40 in the cross-wall 32 of the cap 30. The bore 39 and the hole 40 support the switch actuating shaft so that it is slidable axially. The end of the shaft 23 which extends through the hole in the cross-wall of the cap 30 is aligned with the depending arm 19 of the switch holder 8 and is adapted when said shaft 23 is shifted away from the armature shaft to engage the arm 19 and swing the holder and tube upwards into their switch opening position. When the shaft 23 is

shifted in the opposite direction, that is, towards the armature shaft, the end which projects through the cap moves away from the arm 19 and permits the holder and tube to swing downwards by gravity into their so-called switch closed position. The tapered member 38 is disposed in the bore 26 and is arranged so that the large end thereof faces the cap 30 and its small end faces the inner end of the socket 28 of the hub 25.

The periphery of the member 38 is curved correspondingly to the periphery of the weights 24 and coacts with said weights in such manner that when the weights are shifted inwards against the member 38 the shaft 23 is shifted away from the armature shaft and effects closing of the switch 4. A light compression spring 41 serves to shift the shaft 23 towards the armature shaft for switch opening purposes when the weights 24 are flung outwards by centrifugal force toward the outer ends of the guide-ways 27. This spring is disposed in the socket 33 in the cap 30 and surrounds the shaft 23. One end of the spring abuts against the cross-wall 32 of the cap and the other end of the spring abuts against the large end of the tapered member 38. The ball type weights 24 are adapted to move outwards in the guide-ways in response to the action of centrifugal force when the governor is rotated. They are slightly smaller in diameter than the guide-ways and are urged inwards toward the tapered member 38 by way of a pair of compression springs 42. These springs are of the coil variety and extend between the outer portions of the weights 24 and the plugs 34. The outer ends of the springs are confined in sockets 43 in the inner portions of the plugs. The springs 42 are stronger than the spring 41 and hence when the armature shaft *m* is at rest or its speed is so slow that outward thrust of the balls due to centrifugal force is overcome, said springs 42 force the weights inwards against the action of the spring 41 and cause the shaft 23 to move towards the bracket 7 and close the switch 4. When the speed of the armature shaft *m* is such that the weights 24 in response to centrifugal force move outwards in the guide-ways against the force of the compression springs 42 the tapered member 38 becomes free with the result that the light compression spring 41 operates to shift the shaft 23 towards the armature shaft and thus effects closing of the switch. The stop 20 is so arranged and the shaft 23 is of such length that when the shaft is shifted towards the armature shaft by the action of the spring 41 there is no contact or engagement of the shaft with the arm 19. As a result of this, the governor when operative does not contact or wear away any part of the switch.

The operation of the device is as follows: When the motor *M* is stopped, that is, when the armature shaft *m* is at rest, the switch actuating shaft 23 is shifted away from the armature shaft as the result of the ball type weights being forced inwards against the tapered member 38 by the compression springs 42, and operates to hold the switch in its open position. When the motor *M* is started the armature shaft *m* first turns slowly. As the speed of the shaft increases to the point where centrifugal action as far as the weights 24 are concerned is sufficient to overcome the inward force of the compression springs 42, the weights move outwards in the guide-ways 27 away from the tapered member 38 and compress the springs 42. As soon as the tapered member is free as a result of outward movement of the ball type weights, the light compression spring

41 in the socket 33 in the cap 30 shifts the switch actuating shaft 23 towards the armature shaft *m* and thus releases the switch so that in response to the action of gravity the holder and tube swing downwards into their closed position. If during drive of the motor, the speed of the shaft should for any reason whatsoever drop to the point where the springs 42 are able to overcome the centrifugal force or action of the weights 24 the springs force the weights inwards into contact with the periphery of the member 38. Because such periphery is tapered the weights set up a wedge action which overcomes the force of the spring 41 and causes the shaft 23 to move away from the armature shaft and effect opening of the switch 4. The governor serves to control the switch so that the latter is closed when the shaft *m* reaches a predetermined speed and is opened when the speed of the shaft drops below such speed. If it is desired to adjust the governor so that the latter effects closing of the switch at a higher or lower speed of the shaft *m*, it is only necessary to adjust the plugs 34 in the guide-ways so as to increase or decrease the force of the compression springs 42 or upon removal of the plugs to substitute lighter or heavier ball-type elements for the elements 24 or heavier or lighter compression springs for the springs 42.

The herein described circuit controlling device is extremely efficient in operation and due to the simplicity of design or construction may be manufactured at a low and reasonable cost. It has more or less general application although it is particularly adapted for use in a combustion system wherein a motor driven blower is used to supply air under pressure to a burner to which gaseous fuel is supplied under control of an electrically operated valve, and it is desired to control the supply of current to the valve in such manner that the valve is maintained closed except when the blower is operating to supply the desired or proper amount of air to the burner.

The invention is not to be understood as restricted to the details set forth, since these may be modified within the scope of the appended claims, without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent is:

1. A circuit controlling device comprising in combination a switch for the circuit, a power driven rotary element, and a governor connected to rotate with the element and embodying a housing with a bore in the central portion thereof and guide-ways communicating with and radiating from the bore, an axially slidable shaft in the bore adapted when slid in one direction to shift the switch into one of its positions and when shifted in the opposite direction to control the switch so that the latter is shifted into its other position and provided with a tapered member, weights movably mounted in the guide-ways and adapted when the element is driven at a certain speed to move outwards in response to centrifugal force, springs in the outer ends of the guide-ways for forcing the weights inwards when the element is driven at a lower speed and causing them to engage the member and by way of a wedging action force the member and shaft in said one direction, and means for automatically shifting the shaft in the other direction upon outward movement of the weights in the guide-ways.

2. A circuit controlling device comprising in

combination a switch for the circuit, a power driven rotary element, and a governor connected to rotate with the element and embodying a housing with a bore in the central portion thereof
5 and guide-ways communicating with and radiating from the bore, an axially slidable shaft in the bore adapted when slid in one direction to shift the switch into one of its positions and when shifted in the opposite direction to control the
10 switch so that the latter is shifted into its other position and provided with a tapered member, weights movably mounted in the guide-ways and adapted when the element is driven at a certain speed to move outwards in response to centrifugal force, springs in the outer ends of the guide-ways for forcing the weights inwards when the element is driven at a lower speed and causing them to engage the member and by way of a wedging
5 action force the member and shaft in said one direction, and a compression spring of less strength than the springs in the guide-ways extending around the shaft and adapted upon outward movement of the weights to shift the shaft
10 in said other direction.

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