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CENTRIFUGAL ELECTRICAL CIRCUIT INTERRUPTING DEVICE

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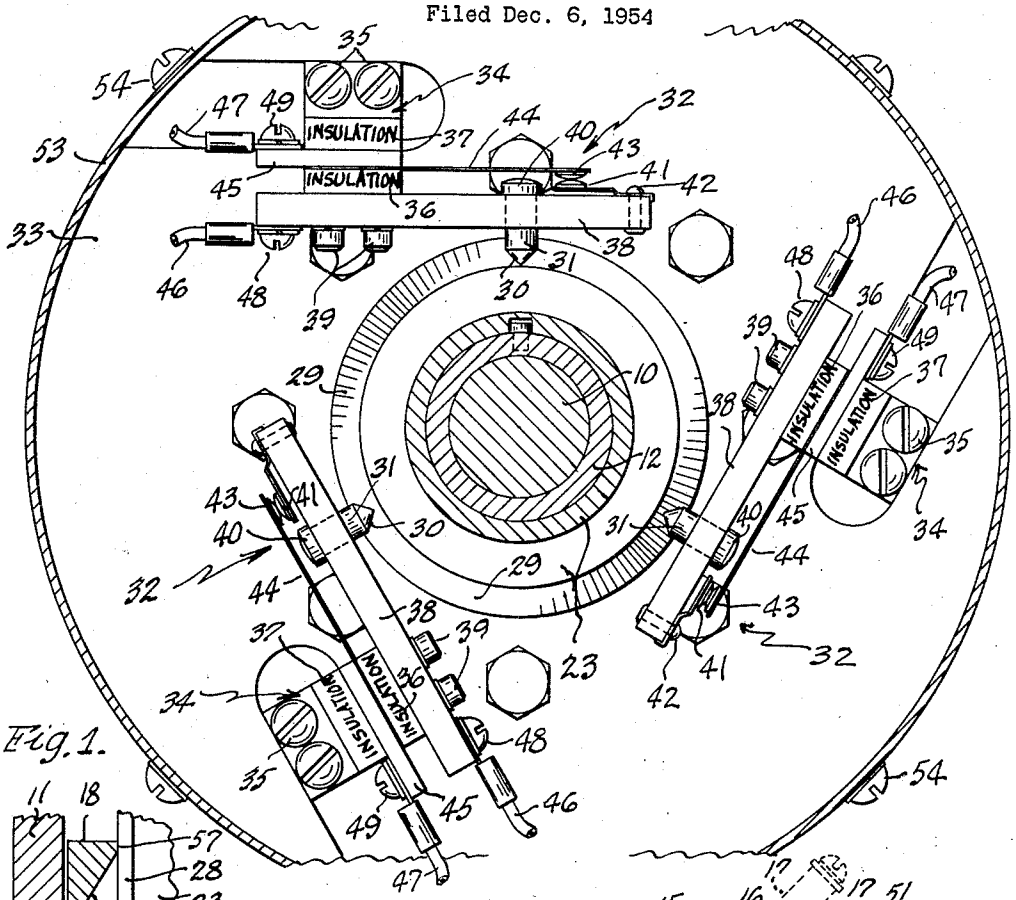


Fig. 1.

Fig. 4.

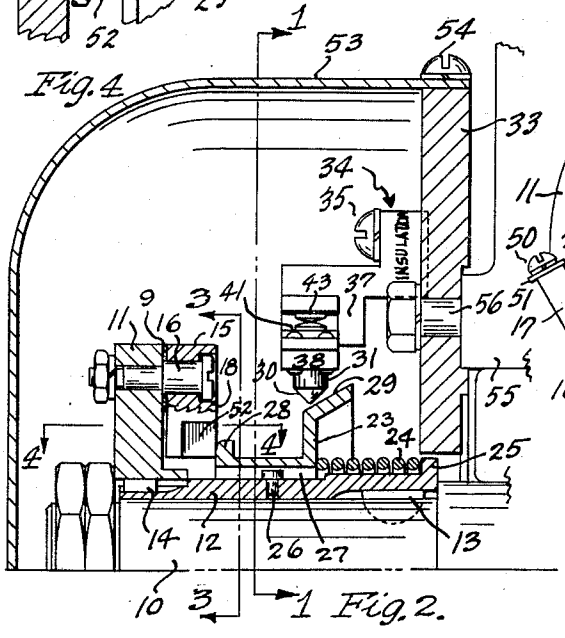


Fig. 2.

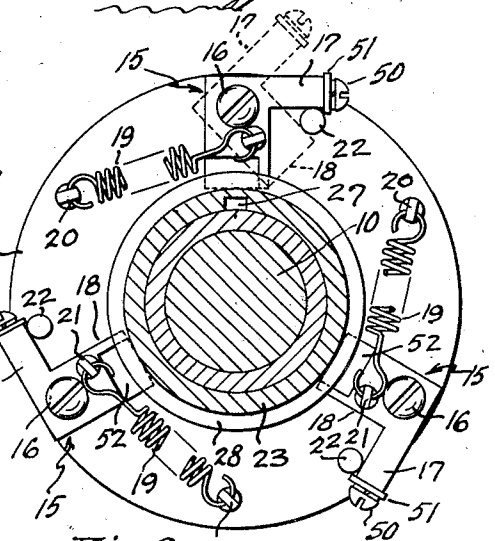


Fig. 3.

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CENTRIFUGAL ELECTRICAL CIRCUIT INTERRUPTING DEVICE

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8 Claims. (Cl. 200—80)

This invention relates to a centrifugal electrical circuit-interrupting device, and has for an object to provide a simple and effective means to interrupt an electrical circuit at a predetermined speed of a rotating member, such, for example, as a shaft or other member.

A further object is to provide a device of this character in which the circuit is automatically restored and the various elements are returned to their normal or retracted positions when the speed of the rotating shaft, for example, is reduced below a certain limit.

With the foregoing and other objects in view, I have devised the construction illustrated in the accompanying drawing forming a part of this specification. It is, however, to be understood the invention is not limited to the specific details of construction and arrangement shown, but may embody various changes and modifications within the scope of the invention.

In this drawing:

Fig. 1 is a transverse section substantially on line 1—1 of Fig. 2;

Fig. 2 is a longitudinal section of one half of the device;

Fig. 3 is a transverse section substantially on line 3—3 of Fig. 2, and

Fig. 4 is a detail section substantially on line 4—4 of Fig. 2.

The device comprises a rotating element construction including in the construction shown a shaft **10** which may be the shaft of a motor or other machine, and a supporting element or plate **11** mounted to rotate with the shaft. In the arrangement shown it is mounted on a sleeve **12** keyed to the shaft to rotate therewith, as indicated at **13**, and the supporting element **11** is keyed to the sleeve as indicated at **14**. Mounted on the plate or supporting element **11** is a plurality of spring-loaded flyweights **15**. In the present case there are three of these weights equally positioned about the axis of the shaft **10** and each pivoted to the plate **11** by any suitable means, such, for example, as the stud or bolt **16**, and held spaced from the support **11** by a washer **9** for clearance. Each flyweight is an angular shaped member comprising an outer arm **17** and an inner radially extending arm **18**, and they are each normally held in the retracted position as shown in Figs. 2 and 3, by a spring **19** secured at one end to the plate **11**, as indicated at **20**, and at its other end, as indicated at **21**, to the arm **18**. This spring is a tension spring normally stressed to tend to swing the associated flyweight in a clockwise direction as viewed in Fig. 3 about its pivot **16**, which movement is limited by a suitable stop **22** on the member **11** against which the arm **17** may rest.

Also mounted on the sleeve **12** and therefore on the shaft **10** is a switch-actuating collar or operating member **23**. This collar is also spring-loaded by a coil spring **24** on the sleeve resting at one end against the flange **25** of the sleeve and at its other end against the collar **23**. This collar is free to slide on the sleeve longitudinally of the shaft toward and from the flyweight

support **11** and therefore the flyweights thereon, but is secured to rotate with the shaft and sleeve **12** by any suitable means, such, for example, as a pin **26** carried by the sleeve with its head in a longitudinal channel or slot **27** in the sleeve. The outer end of the collar is flanged as shown at **28** to engage the inner ends of the arms **18** of the flyweights, and at its opposite end has a tapered or inclined flange **29** adapted to engage the tapered inner ends **30** of a series of operating buttons **31** for a series of switches **32**.

In the arrangement shown these switches are mounted on a stationary support or plate **33** which may be mounted on the housing or frame of the machine **55** by screws **56**, or be held in the position shown by other means, each switch being mounted on an insulating support or bracket **34** secured to the plate by any suitable means, such, for example, as the screws **35**. This bracket has an arm **37** and on the arm is mounted a supporting conductor bar **38** by any suitable means, such, for example, as the screws **39**. The switch operating button **31** is mounted to slide in this bar **38** and has an enlarged head **40** to limit its inward movement. This button is made of insulating material, such, for example, as nylon. At the free end of the bar **38** is mounted a yieldable spring stationary switch contact **41** by any suitable means such as the rivets **42**. This yieldable contact spring is an important feature in this device, particularly for certain applications where the unit is subject to high shock. Associated with this contact **41** is a movable spring contact **43** mounted on a flat spring arm or conductor strip **44** secured to arm **37** on the insulating block **34** with a conductor bar **45** so that the spring **44** and bar **45** are electrically connected. They are insulated from bar **38** by the insulating strip **36** held between them by pressure of screws **39**. Means is provided for connecting conductor wires of an electric circuit to be controlled to the bars **38** and **45** and thus to the switch contacts **41** and **43**. They are shown in Fig. 1 at **46** and **47** connected by binding screws **48** and **49** to the bars **38** and **45** respectively.

The outer arms **17** of the flyweights are provided with means for securing one or more small weights to these arms to determine the speed of the member **11** which will cause centrifugal action and throw them outwardly to the released or dotted line position shown at the top of Fig. 3. This may be a screw **50** securing one or more weights **51** to the arm, or if preferred some means could be provided for adjusting the tension of the springs **19**, or springs **19** of different tensions could be used. The free end of the other arm **18** of each flyweight is provided with an inclined cam surface **52** on its inner side in position to cooperate with flange **28** on the end of the sleeve **23**.

In operation, when the rotating shaft and elements **11** and **12**, together with the flyweights, reach a predetermined speed, which may be determined or adjusted either by varying the strength of the springs **19** or by the addition or removal of weights **51** held by the screws **50**, centrifugal force will overcome the retarding effect or force of the springs **19**, together with friction on mountings of the flyweights and the pressure of the sleeve **23** against them, and these flyweights will then throw out suddenly to the dotted line position shown at the top of Fig. 3 (only one of these elements being shown in this position to simplify the drawing), allowing the switch-actuating collar **23** to be shifted forwardly (or to the left as viewed in Fig. 2) by spring **24** toward the flyweight frame or support **11**. As this collar travels forwardly its inclined flange **29** will engage the inner ends **30** of the contact spring actuating buttons **31**, shifting them axially or outwardly, and each button will shift the associated movable contact **43** outwardly to separate

it from the contact 41 and open the circuit in which these contacts are located, this action being effected by the head 40 of the button 31 engaging the flexible spring strip 44 and forcing it outwardly.

When the speed of the shaft and the member 11 with the flyweights has dropped sufficiently, the force of the springs 19 upon the flyweights causes them to retract or move to the full line position of Fig. 3, this movement being limited by the arms 17 engaging the stops 22. During this movement the inclined cam surfaces 52 on the arms 18 of the flyweights engage the outer flanged end 28 of the collar 23 and push the collar 23 backwardly to its retracted position, or that is, to the right as viewed in Fig. 2, against the action of the spring 24. This movement of the collar releases the pressure on the switch operating buttons 31 and permits them to be forced inwardly by the spring action of the spring strips 44 carrying the movable contacts 43, permitting the contacts 43 to again engage the contacts 41 and close their respective circuits.

The operating parts may be enclosed in and protected by a suitable cover 53 secured to member 33 by any suitable means such as screws 54.

It will be seen the flyweights all act independently and thus all of them must throw outwardly in order that the collar 23 may be shifted from its retracted position of Fig. 2 by the spring 24. The switches may be connected in different arangements, but they are normally connected in parallel in the circuit to be controlled and therefore all of them must open to break this circuit. That is, as long as one switch remains closed the circuit will not be interrupted. The collar 23 is held in its retracted position by engagement of its outer end or flange 28 against the flat surfaces 57 (Fig. 4) on the rear side of the flyweights.

It will be seen that this is a very simple and effective means and arrangement for automatically opening or interrupting an electric circuit when the speed of a rotating element, such as a shaft, for example, reaches a certain limit, and that the elements are all automatically returned to their normal or retracted positions to close or restore the circuit when the speed drops below a certain predetermined limit. Although this unit is shown and described, by way of example and disclosure purposes, as mounted on the housing or frame and shaft of a machine, it will be understood it may be mounted by different means. For example, it may be furnished as a self-contained unit between its own bearings and coupled to another machine. An important use for this device is on equipment supplied to the Navy where this equipment is subjected to Class HI shock test.

It is also to be understood that, although this unit has been shown and described as an interrupter for an electric circuit, it can be used as a circuit closing device. For this purpose the contacts 41 and 43 could be normally separated and the movable contact shifted to engagement with the other by the button 31.

Having thus set forth the nature of my invention, I claim:

1. In a circuit controlling device of the character described, a rotatable shaft, a support secured on the shaft, a spring loaded flyweight pivotally mounted on the support adapted to shift outwardly from a normally retracted position by centrifugal action as the speed of the shaft reaches a given limit, a spring loaded collar mounted to slide longitudinally of the shaft toward and from the said support and normally held in the retracted position by the flyweight when it is in the retracted position, a stationary support, at least one electric switch mounted on the stationary support including a movable contact, a shiftable operating member for shifting the contact, cam means carried by the collar for shifting said operating member by movement of the collar from its retracted toward the advanced position upon its release by outward movement of the flyweight, and cam means on the flyweight to shift the collar to the retracted position by movement of the flyweight from its outward to its retracted position.

2. In a circuit controlling device of the character described, a rotatable shaft, a support mounted on and secured to the shaft, spring loaded flyweights pivotally mounted on the support adapted to shift outwardly from normally retracted positions by centrifugal force as the speed of the shaft reaches a certain limit, a stationary support, electric switches mounted on the stationary support including movable contacts, movable operating members for shifting the contacts, an operating collar mounted to slide longitudinally of the shaft and held in a normally retracted position by the flyweights while in their retracted positions, a spring tending to move the collar forwardly from its retracted position toward the flyweights, said collar provided with an inclined cam surface to shift said operating members to operate the switch contacts by forward movement of the collar upon its release by outward movement of the flyweights, and cam means on the flyweights to shift the collar backwardly to its retracted position by movement of the flyweights to their retracted positions upon reduction of the speed of the shaft below a given limit.

3. In a circuit controlling device of the character described, a rotatable shaft, a support mounted on and secured to the shaft, a spring loaded flyweight pivotally mounted on the support adapted to shift outwardly from a normally retracted position by centrifugal force as the speed of the shaft reaches a certain limit, a stationary support, an electric switch mounted on the stationary support including a conductor bar, a stationary contact mounted on the bar, a movable spring contact movable to and from engagement with the first contact, an operating button carried by the bar and movable to shift the movable contact, an operating collar mounted to slide longitudinally of the shaft and normally held in a retracted position by the flyweight when in its retracted position, a spring tending to shift the collar forwardly from its retracted position, and said collar provided with an inclined cam surface to shift the operating button to operate the movable contact on release of the collar by the flyweight.

4. In a circuit controlling device of the character described, a rotatable shaft, a support mounted on and secured to the shaft, a spring loaded flyweight pivotally mounted on the support adapted to shift outwardly from a normally retracted position by centrifugal force as the speed of the shaft reaches a certain limit, a stationary support, an electric switch mounted on the stationary support including a conductor bar, a stationary contact mounted on the bar including a spring conductor strip and a contact element carried by said strip spaced from the bar, a movable spring contact movable to and from engagement with the first contact, operable means carried by the bar to shift the movable contact, an operating collar mounted to slide longitudinally of the shaft and normally held in retracted position by the flyweight, a spring tending to shift the collar forwardly from its retracted position, and said collar provided with means to operate said operable means to shift the movable contact.

5. In a circuit controlling device of the character described, a rotatable shaft, a supporting member mounted on the shaft to rotate therewith, a plurality of spring loaded flyweights mounted on the supporting member adapted to swing outwardly under centrifugal force when the speed of the member reaches a given limit, said flyweights mounted to act independently of each other with separate retracting springs, a spring loaded collar slidable longitudinally of the shaft held in a retracted position against action of its spring by the flyweights in their retracted positions and releasable by outward movement of the flyweights, a stationary support, cooperating stationary and movable switch contacts mounted on said support, means operable by movement of the collar from

its retracted position upon its release by outward movement of the flyweights to shift the movable contacts relative to the stationary contacts, and cooperating means on the flyweights and collar to shift the collar to its retracted position against action of its spring as the flyweights are retracted by their springs when the speed of the shaft drops to a given limit comprising inclined cam surfaces on the flyweights engaging the collar.

6. In a circuit controlling device of the character described, a rotatable support, a plurality of spring loaded flyweights pivotally mounted on the support adapted to swing outwardly under centrifugal force against action of their springs when the speed of the support reaches a given limit, said flyweights mounted to act independently of each other against separate retracting springs, a spring loaded collar movable toward the support under action of its spring normally held in retracted position by the flyweights in their retracted positions and releasable by outward movement of the flyweights, a stationary support, electrical switches mounted on the stationary support each including relatively movable contacts, means operable by movement of the collar from its retracted position by action of its spring to shift said contacts comprising an inclined cam surface on the collar and switch shifting means operable thereby, and cooperating means on the flyweights and collar to shift the collar to its retracted position against action of its spring by movement of the flyweights under action of their springs to their retracted positions.

7. In a circuit controlling device of the character described, a rotatable support, a plurality of spring loaded flyweights pivotally mounted on the support adapted to swing outwardly independently of each other under centrifugal force against action of separate springs when the speed of the support reaches a given limit, a spring loaded collar movable toward the support under action of its spring normally held in retracted position against action of its spring by the flyweights in their retracted positions and releasable by outward movement of the flyweights, a stationary support, electrical switches mounted on the stationary support each including movable contacts, and

shiftable means operable by movement of the collar from its retracted position under action of its spring upon release by the flyweights to shift said contacts comprising an inclined cam surface on the collar engaging said shiftable means.

8. In a circuit controlling device of the character described, a rotatable shaft, a support mounted on the shaft to rotate therewith, three flyweights mounted equally spaced about the shaft on the support, means mounting the flyweights to shift outwardly away from the shaft under centrifugal force when the speed of the shaft reaches a given limit, a separate spring for each flyweight tending to shift it to a retracted position, a collar slidable longitudinally of the shaft between a retracted and a forward position, a spring tending to shift the collar from the retracted to the forward position, the flyweights positioned when in their retracted positions to retain the collar in its retracted position and each provided with an inclined cam surface to engage the collar and shift it longitudinally of the shaft to its retracted position as the flyweights move at right angles to the shaft to their retracted positions under action of their spring, a stationary support, a plurality of switches on said latter support one for each flyweight, an actuating member for each switch movable in a direction perpendicular to the shaft, and said collar provided with an inclined cam surface to shift the switch actuating members outwardly away from the shaft by forward movement of the collar under action of its spring when the collar is released by outward movement of the flyweights under centrifugal action.

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