Sept. 6, 1966 A. E. CHESNUT 3,271,546

PENDULUM ACTUATED TILT RESPONSIVE ELECTRIC SWITCH

Filed March 16, 1964

2 Sheets-Sheet 1

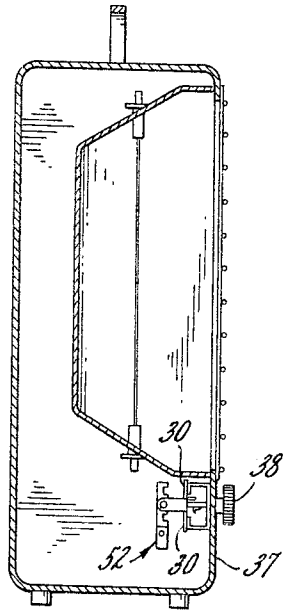


Fig. 1.

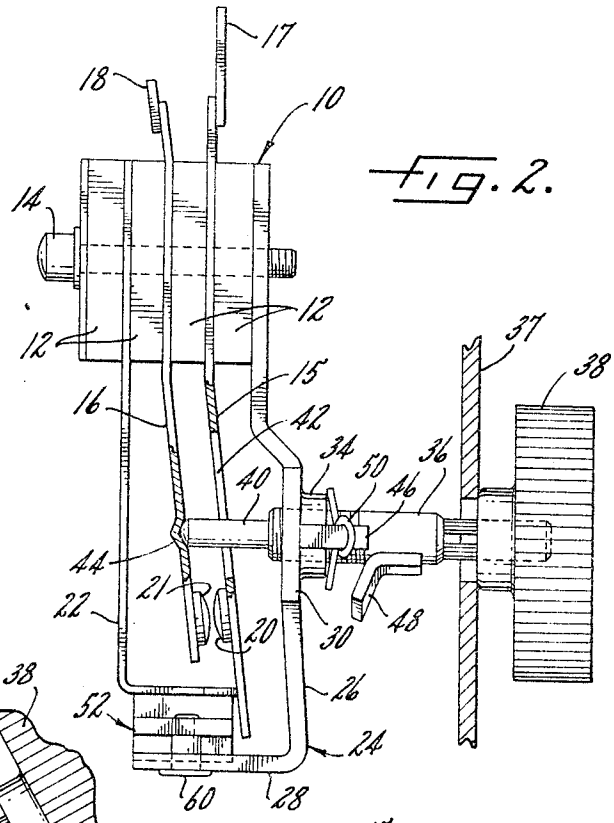


Fig. 2.

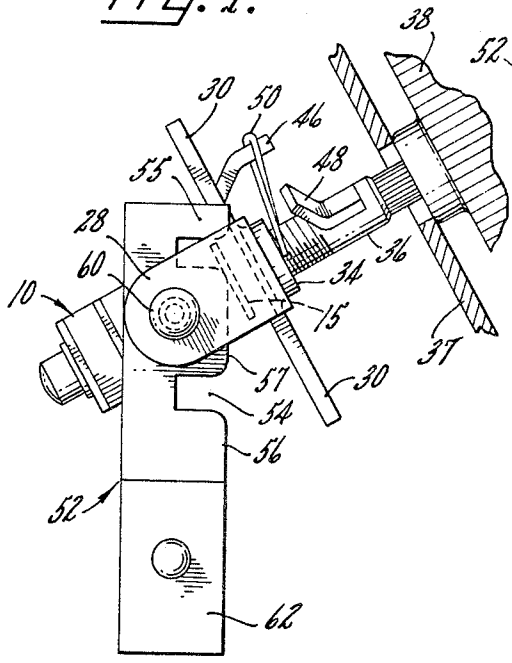


Fig. 3.

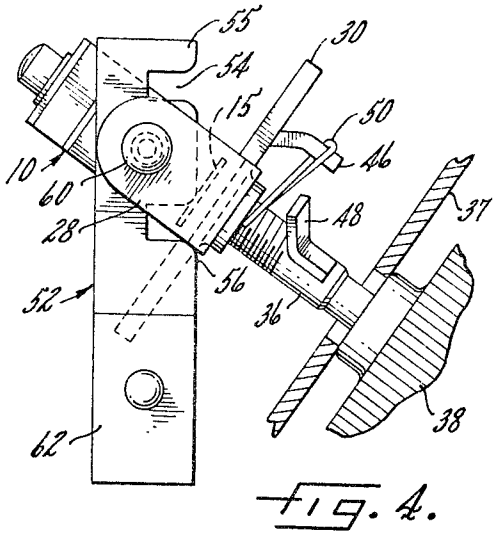


Fig. 4.

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PENDULUM ACTUATED TILT RESPONSIVE ELECTRIC SWITCH

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2 Sheets-Sheet 2

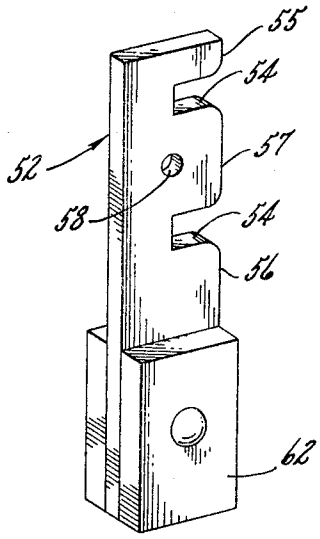


Fig. 5.

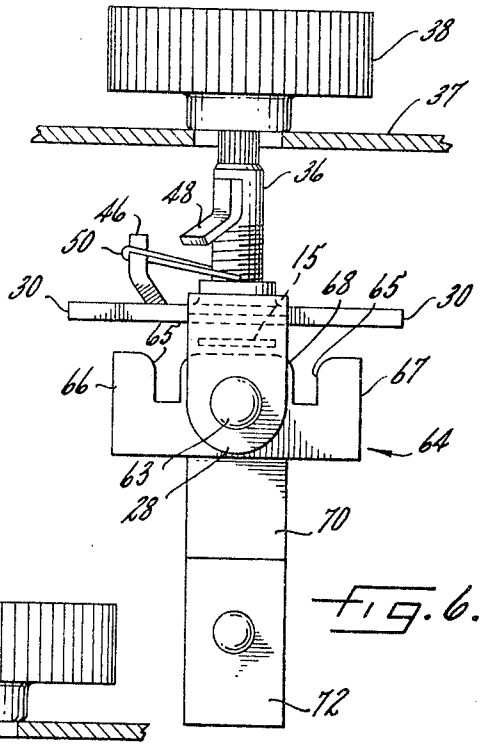


Fig. 6.

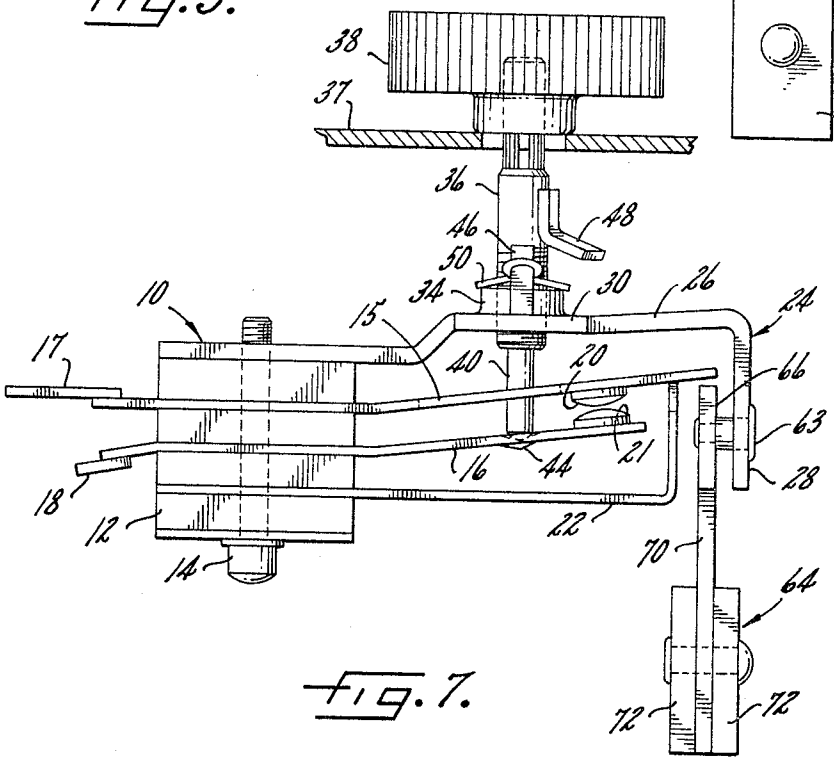


Fig. 7.

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3,271,546

PENDULUM ACTUATED TILT RESPONSIVE ELECTRIC SWITCH

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9 Claims. (Cl. 200—138)

This invention relates to an electric switch, and more particularly to a combined thermostat and tip-over switch for use in an electric appliance or the like.

It is an object of the invention to provide an electric switch which will be responsive to thermal actuation, which will be actuated by the relative movement of a gravity actuated safety control member, which will require the use of but one pair of contacts, which can be mounted in different orientations within an appliance, which can be simply and inexpensively manufactured from a relatively small number of parts, and which can be of a compact size.

In accordance with one form of the invention as it is embodied in a combined thermostat and safety switch, there is provided an insulating base. First and second metallic blades are fixedly mounted at one of their ends on said base and are provided adjacent their opposite ends with first and second contacts engageable with each other for completing a circuit through said blades. A bimetallic blade is also mounted on said base and is engageable with said first blade to thus vary the position of the contacts with respect to each other and in response to temperature changes.

A rigid generally L-shaped arm is mounted on the base and is provided with a pair of outwardly projecting wings which may conveniently serve as mounts for mounting the switch on an appliance. A screw is adjustably mounted in said arm and projects through an opening in said first blade to engage the second blade for varying the position of the blade contacts to provide calibrated adjustment of the temperature of actuation of said contacts.

A gravity actuated safety control member is mounted on said arm. The control member is in the form of a pendulum comprising a first portion of electrically insulating material swingably connected to said arm and a weighted second portion projecting downwardly from said first portion. The pendulum is gravity actuated and the switch is mounted at an attitude wherein the pendulum will hang vertically with its first portion out of engagement with said first and second blades. Upon tilting of the switch in either direction in a plane parallel to the plane of said first portion, said switch will move relative to the pendulum to cause said first portion to engage first blade and the arm to move the contacts out of engagement with each other to thus open the circuit through the switch. Upon movement of the switch into its normal orientation, said pendulum will again hang vertically in a position to dispose said first portion out of engagement with the first blade for restoring the contacts in their operative position.

Other objects and features of the invention will become apparent from the more detailed description which follows and from the accompanying drawings, in which:

FIG. 1 is a vertical section through an electric heater having a switch embodying the invention mounted therein;

FIG. 2 is an enlarged plan view of the switch shown in FIG. 1;

FIG. 3 is an end elevation of the switch shown in FIG. 2 and showing said switch in a tilted orientation;

FIG. 4 is an end elevation similar to FIG. 3, but showing the switch in a different tilted orientation;

FIG. 5 is a perspective view of the safety control pendulum shown in FIG. 2;

FIG. 6 is an end elevation of the switch shown in FIG. 2, but showing a modified form of the safety control pendulum; and

FIG. 7 is a side elevation of the switch shown in FIG. 6.

As shown in the drawings, the switch comprises a base **10** formed from a plurality of insulating blocks **12** retained in a stacked position by a bolt **14**. First and second resilient metallic blades **15** and **16** have one of their ends mounted on the base **10** and separated by one of the blocks **12** to electrically insulate said blades from each other. Desirably, said blades are provided with terminals **17** and **18** for connecting them to appropriate electrical leads. The blades project outwardly from the base **10** and contacts **20** and **21** are mounted on the blades **15** and **16**, respectively, adjacent their ends remote from said base. The blades **15** and **16**, due to their inherent resiliency, are urged toward each other toward a contact closing position. A bimetallic blade **22** electrically insulated from the blade **16** by one of the blocks **12** is also mounted on the base **10**. The outer end of the blade **22** is bent to engage the blade **15** for thus causing the contacts **20** and **21** to be moved into and out of engagement with each other in response to temperature changes.

A rigid generally L-shaped arm **24** is mounted on the base **10** and comprises a first stretch **26** generally normal to a second stretch **28**. On end of the stretch **26** is connected to said base in an insulated position from the blade **15** by one of the blocks **12**. Said stretch extends outwardly from the base and is provided with a pair of outwardly projecting wings **30** which serve as mounts for mounting the switch on a heater or other appliance as is shown in FIG. 1. The arm stretch **26** is provided with a threaded boss **34** in which an adjusting screw **36** is carried. The switch shown in FIGS. 1–3 is adapted to be mounted in a heater or other appliance in a vertical orientation with the blades **15** and **16** lying in generally vertical planes. In such an orientation in a heater, the screw **36** projects outwardly through the forward heater face **37** shown in FIG. 1 and is connected to a control knob **38**. The opposite end of said screw comprises an insulator tip **40** which projects through an opening **42** in the blade **15** and bears against the blade **16**. Conveniently, the blade **16** may be dented, as at **44**, for locating the tip **40** against said blade. The knob **38** may be moved in front of indicia (not shown) on the heater face **37** to thus provide calibrated adjustment of the temperature of actuation of contacts **20** and **21**. Conveniently, a finger **46** is struck outwardly from one of the wings **30** in the path of rotation of a lug **48** mounted on the screw **36** to limit rotational movement of said screw and thus limit the positioning of contact **21** with respect to contact **20** upon rotation of said screw. The finger **46** also carries a loop spring **50** bindingly embracing the screw **36** for frictionally retarding rotation of said screw and thereby serving to hold the screw in the desired position of adjustment.

A safety member in form of a pendulum is swingably mounted on the arm stretch **28**. Said pendulum comprises an elongated first portion **52** of electrically insulating material having a pair of recesses **54** formed along one of its longitudinal edges inwardly from the ends thereof. The recesses **54** thus provide the portion **52** with a pair of end projections **55** and **56** and an intermediate third projection **57**. An opening **58** is formed in the region of the projection **57** for the reception of a pivot pin **60** mounted on the arm stretch for supporting the pendulum on the arm **24** for swinging movement relative to the switch in a plane generally normal to the plane of the blades **15** and **16**. The pendulum has a second portion in the form of a weight **62** mounted on one end of the portion **52** and projecting downwardly from the portion **52** in alignment therewith. When the switch

is mounted in an appliance with the blades **15**, **16**, and **22** in generally vertical planes, the pendulum will hang downwardly from its connection **60** to the arm **24**. With the appliance in its normal upright position, said pendulum will be disposed out of contact with the blades **15** and **16**, and opening and closing of the contacts **20** and **21** will be in response solely to movement of the bimetal blade **22** against the arm **15** and the adjustment provided by the screw tip **40** bearing against blade **16**. However, as shown in FIG. 3, when the appliance is tilted rearwardly, the switch will move from its normal upright position shown in FIG. 1 to a tilted position shown in FIG. 3, but the pendulum will maintain its vertical orientation due to the weight **62**. When the switch is so tilted, the projection **57** will bear against and move the blade **15** to open the contacts **20** and **21**, and the projection **55** will bear against the upper edge of the arm stretch **26** to thus limit movement of the blade **15** in a contact opening direction and prevent said blade from being permanently bent and distorted. Conversely, as shown in FIG. 4, when the appliance is tilted forwardly, the switch likewise tilts forwardly from its normal vertical orientation, and the projection **57** will again engage and move the blade **15** to move the contact **20** out of engagement with the contact **21**, and the projection **56** will engage the lower edge of the arm stretch **26** to limit the movement of blade **15** in its contact opening direction.

The switch shown in FIGS. 1–3 is adapted to be mounted in an appliance in a vertical orientation wherein the blades **15**, **16**, and **22** lie in generally vertical planes. However, in certain instances it is necessary that the switch be mounted in a horizontal orientation wherein the blades **15**, **16**, and **22** lie in generally horizontal planes. In order to permit my switch to be mounted in such a horizontal orientation, I employ the pendulum construction shown in FIGS. 6 and 7.

The switch shown in FIGS. 6 and 7 differs from the switch in FIGS. 1–3 only in the construction of the pendulum. To this end, said switch comprises first and second resilient metallic blades **15** and **16** mounted on an insulating base **10** and carrying contacts **20** and **21**. A bimetallic blade **22** is also mounted on the base **10** and is engageable with the blade **15** for opening and closing the contacts **20** and **21** in response to temperature changes. The switch is mountable in an appliance by a rigid generally L-shaped arm **24** comprising a first stretch **26** connected to the base **10** and integral with a second stretch **28**. The stretch **26** carries an adjusting screw **36** having a control knob **38** at one of its ends and an insulator tip **40** at its opposite end engageable with the blade **16** for adjusting the relative positioning of the contacts **20** and **21**.

The switch shown in FIGS. 6 and 7 is mounted in a horizontal orientation with the arm stretch **28** projecting downwardly. Said stretch is connected by a pin **63** to a generally T-shaped pendulum comprising an elongated first portion **64** formed from electrically insulating material. The upper edge of the first portion **64** has a pair of recesses **65** spaced inwardly from the ends thereof to define a pair of end projections **66** and **67** and an elongated third projection **68** intermediate the projections **66** and **67** and swingably connected to the pin **63**. A shank **70** projects downwardly from the first portion **64** intermediate to the length thereof and is connected to a weight **72** to thus cause the first portion **64** to be suspended in a generally horizontal orientation.

Should the switch and the appliance to which it is connected be tilted to the left as viewed in FIG. 6, the projection **68** will bear against the blade **15** to move the contact **20** out of engagement with the contact **21** and the projection **67** will bear against the right edge of the arm stretch **26** to limit such movement of blade **15**. Conversely, should the switch be tipped to the right as viewed in FIG. 6, the projection **68** will bear against the blade **15** to move the contact **20** out of engagement with

the contact **21**, and the projection **66** will bear against the left edge of the arm stretch **26** to limit such blade movement.

With the blade **15** in each embodiment projecting outwardly beyond the blade **22** for engagement with the pendulum **52** or **64** when the switch is tilted, said pendulums further serve to provide a positive "off" for the switch when it is in its normal upright position. When the thermostat is in its fully off position, the blade **16** is in a position to cause the contacts **20** and **21** to be spaced from each other, but the end of the bimetal blade **22** will still contact the blade **15**. However, should the ambient temperature drop below the temperature for which the thermostat is set in its fully off position and thus move the blade **22** to permit the blade **15** to spring toward a contact closing position, the end of the blade **15** will engage the pendulum projection **57** or **60** to prevent the blade **15** from moving all the way into a position to permit the contacts to close.

I claim:

1. An electric switch, comprising a base, first and second blades fixedly mounted at one of their ends on said base and respectively having first and second contacts adjacent their opposite ends, a bimetallic blade mounted on said base and engageable with one of said first and second blades to vary the position of said contacts with respect to each other, a rigid generally L-shaped arm mounted on said base, a screw adjustably mounted on said arm and engageable with one of said first and second blades to vary the position of said contacts relative to each other, and a pendulum having a first portion of electrically insulating material swingably connected to said arm, and a weighted second portion, said pendulum being gravity actuated and said switch being mounted in an attitude wherein said pendulum will hang vertically with said first portion out of engagement with said first and second blades, said first portion being engageable with one of said first and second blades upon tipping of the switch in either direction in a plane generally parallel to the plane of said first portion to cause said first portion to move one of said first and second blades relative to the other to move said contacts into spaced relation to each other.

2. The invention as set forth in claim **1** in which said pendulum is swingable relative to said arm in a plane generally normal to the planes of said first and second blades.

3. An electric switch, comprising a base, first and second blades fixedly mounted at one of their ends on said base and respectively having first and second contacts adjacent their opposite ends, a bimetallic blade mounted on said base and engageable with one of said first and second blades to vary the position of said contacts with respect to each other, a rigid arm having a first stretch mounted on said base and a second stretch normal to said first stretch, a screw adjustably mounted in said first stretch and engageable with one of said first and second blades to vary the position of said contacts relative to each other, and a pendulum having a first portion of electrically insulating material swingably connected to said second stretch and a weighted second portion, said pendulum being gravity actuated and said switch being mounted in an attitude wherein said pendulum will hang vertically with said first portion out of engagement with said first and second blades, said first portion being engageable with one of said first and second blades upon tipping of the switch in either direction in a plane generally parallel to the plane of said first portion to cause said first portion to move one of said first and second blades relative to the other to move said contacts into spaced relation to each other.

4. An electric switch, comprising a base, first and second blades fixedly mounted at one of their ends on said base and respectively having first and second contacts adjacent their opposite ends, a rigid arm mounted on said

base, and a pendulum having a first portion of electrically insulating material having first and second sets of cam elements swingably connected to said arm and a weighted second portion, said pendulum being gravity actuated and said switch being mounted in an attitude wherein said pendulum will hang vertically with said first portion out of engagement with said first and second blades, the first set of cam elements on said first portion being engageable with one of said first and second blades upon tipping of the switch in either direction in a plane generally parallel to the plane of said first portion to cause said first portion to move one of said first and second blades relative to the other to move said contacts into spaced apart relation to each other and said second set of cam elements limiting the movements of said blades relative to each other upon said tipping.

5. The invention as set forth in claim 4 in which said first portion of said pendulum has a pair of recesses spaced inwardly from its ends along one side thereof to define a pair of projections at its opposite ends constituting said second set of cam elements and a third projection intermediate its length areas of which constitute said first set of cam elements, said first portion being swingably connected to said arm in the region of said third projection whereby one cam element in said first set of cam elements and one cam element in said second set of cam elements engage said first blade and arm, respectively, when the switch is tilted in one direction and the other cam element in said first set of cam elements and the other cam element in said second set of cam elements engage said first blade and arm, respectively, when the switch is tilted in an opposite direction.

6. The invention as set forth in claim 5 in which said weighted second portion of the pendulum extends downwardly from one end of said first portion in longitudinal alignment with said first portion.

7. The invention as set forth in claim 5 in which said weighted second portion of the pendulum extends downwardly from said first portion intermediate the length of said first portion and said pendulum is generally T-shaped.

8. An electric switch, comprising a base, first and second blades fixedly mounted at one of their ends on said base and having their opposite ends biased toward each other and provided with first and second contacts, respectively, a bimetallic blade mounted on said base and engageable with said first blade to vary the position of said contacts with respect to each other, a rigid generally L-shaped arm mounted on said base, a screw adjustably mounted on said arm and engageable with said second blade to vary the position of said contacts relative to each other, and a pendulum having a first portion of electrically insulating material swingably connected to said arm,

and a weighted second portion, said pendulum being gravity actuated and said switch being mounted in an attitude wherein said pendulum will hang vertically with said first portion out of engagement with said first and second blades, said first portion being engageable with said first blade and arm upon tipping of the switch in either direction in a plane generally parallel to the plane of said first portion to cause said first portion to move said first blade relative to said second blade to move said contacts into spaced relation to each other, said pendulum being spaced relative to said first blade when the switch is in its upright position and said screw has moved the second blade into a position to provide maximum spacing between the contacts to prevent said first blade from moving said first contact into engagement with the second contact irrespective of the movement of said bimetallic blade.

9. An electric switch, comprising a base, first and second blades fixedly mounted at one of their ends on said base and respectively having first and second contacts adjacent their opposite ends, a rigid arm mounted on said base, and a pendulum having a first portion of electrically insulating material swingably connected to said arm and a weighted second portion, said pendulum being gravity actuated and said switch being mounted in an attitude wherein said pendulum will hang vertically without said first portion effecting movement of either of said blades, said first portion being engageable with one of said first and second blades and arm upon tipping of the switch in either direction in a plane generally parallel to the plane of said first portion to cause said first portion to move one of said first and second blades relative to the other to move said contacts into spaced relation to each other, said arm and pendulum having co-operating means for limiting the relative movement between said arm and pendulum.

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