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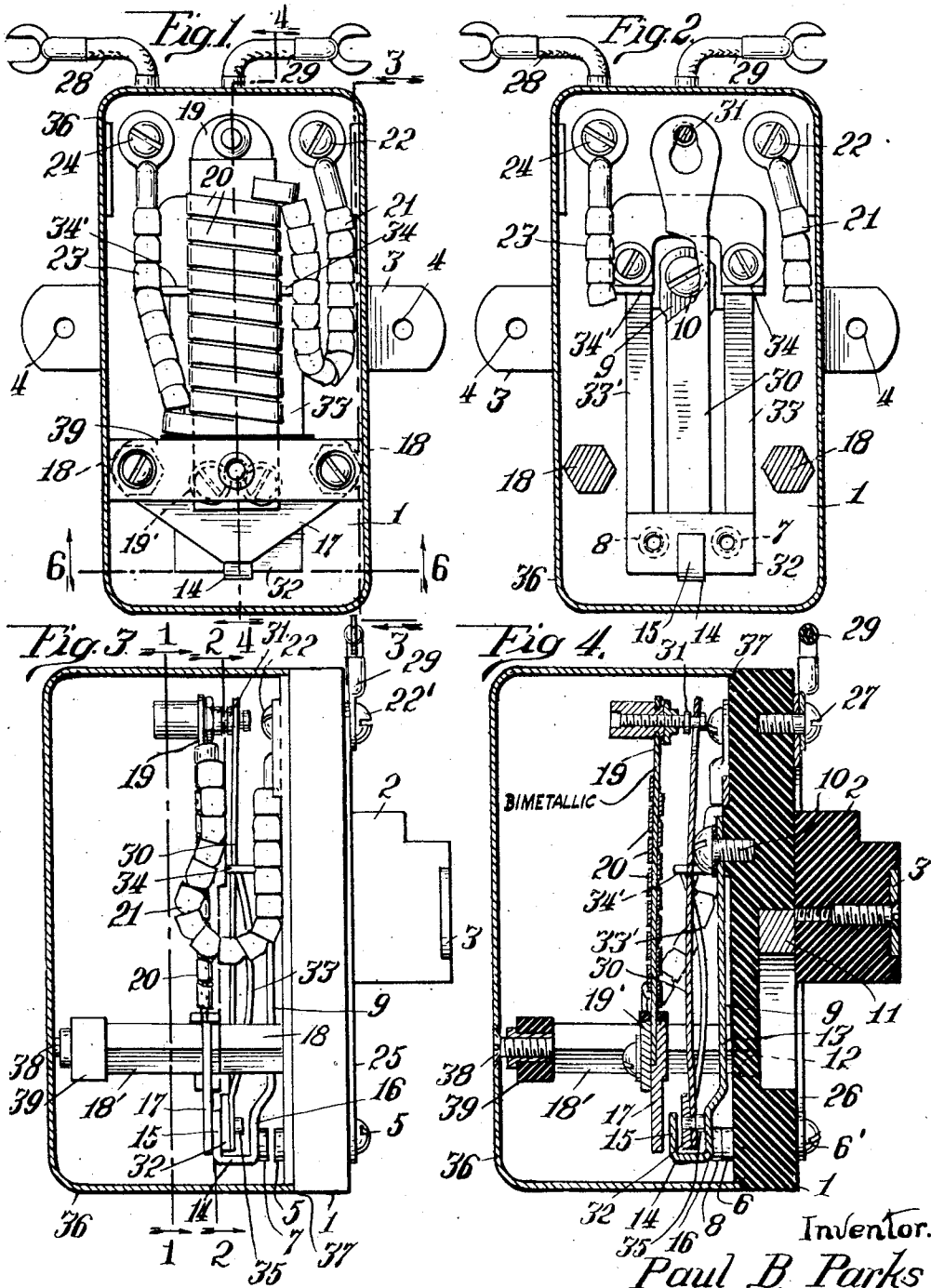
P. B. PARKS

2,144,120

THERMAL CONTACTOR

Filed June 19, 1936

2 Sheets-Sheet 1



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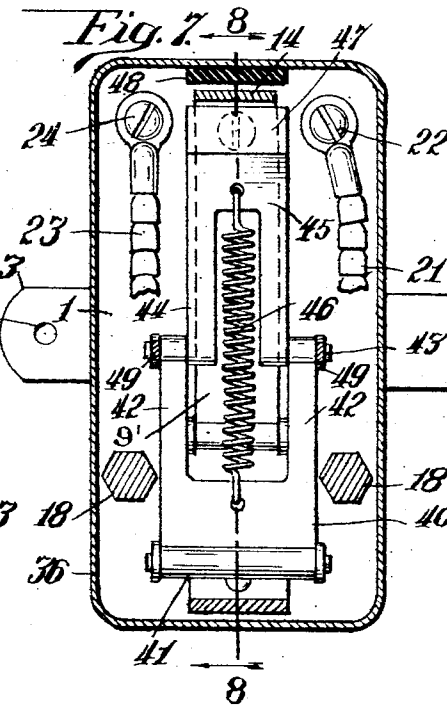
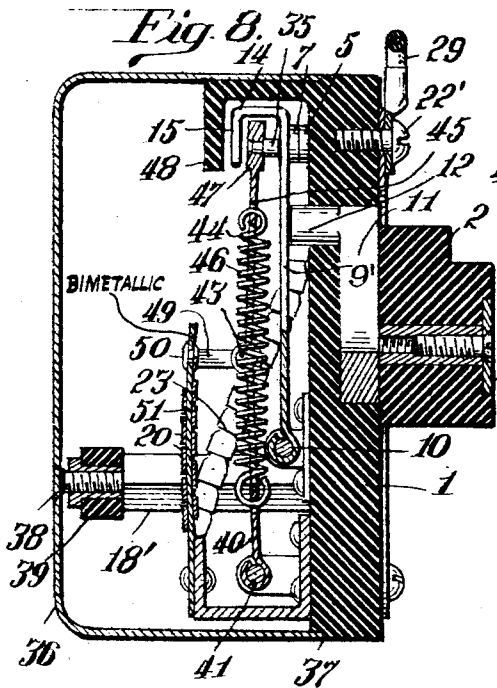
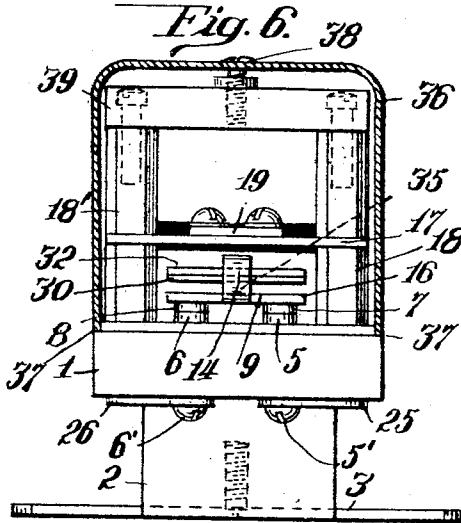
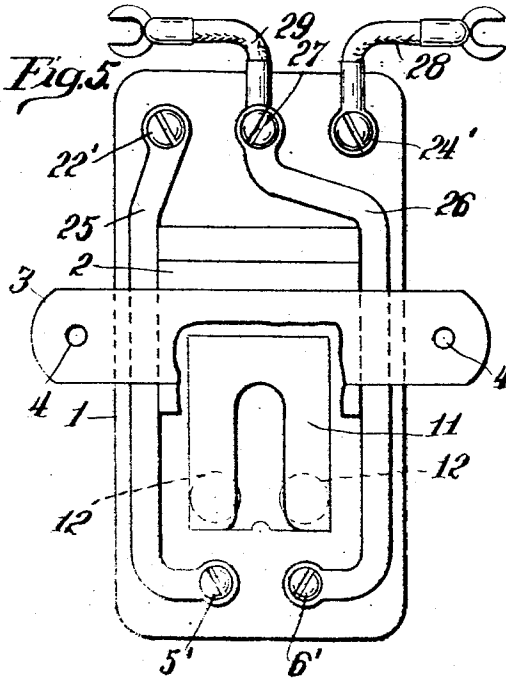
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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THERMAL CONTACTOR

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9 Claims. (Cl. 200—122)

This invention relates to certain new and useful improvements in a thermal contactor; more particularly to an improved re-closing circuit breaker adapted to be operated by a thermostatic element to temporarily break a circuit when the current flowing in this circuit becomes excessive, or flows for too long a period of time.

As is well known, one of the principal requirements of any circuit breaker is to provide for a sudden, complete and decisive breaking of the circuit so as to minimize injurious sparking at the electric contacts when these contacts are separated. Usually some form of snap-spring mechanism is provided to suddenly separate the contacts. However, if this snap-mechanism is operated by a slowly moving thermostatic member there will usually be a dead-center position of the snap-spring mechanism, just before the quick actuating movement takes place, when substantially no pressure is exerted on the contact members with the result that these contacts may tend to slightly separate or chatter thereby producing injurious sparking. To avoid this it has been proposed to add a magnetic detent to hold the contacts together while the spring mechanism is being moved over dead-center, but even this device has not been entirely effective since there is a position where the holding power of the magnet is just offset by the weakened spring-action so that chattering may occur.

According to the present improvement the movable contact member is mounted on a carrier that is not directly connected with the snap-spring actuating mechanism. A magnetic detent is provided for holding the carrier in one extreme position with the contacts engaged. The snap-spring mechanism has freedom of movement with respect to the carrier, but after this spring-mechanism has passed its dead-center position in either direction it will forcibly engage a portion of the carrier so as to impact the same and move the carrier quickly to its other extreme position. As a result the electric contacts will be held firmly together by the magnetic detent until the snap-spring mechanism has started its movement in the contact-separating direction and has gained sufficient speed and momentum to effect a quick and decisive separation of the contacts.

The principal object of this invention is to provide a thermal contactor of the type briefly described hereinabove and disclosed more in detail in the specifications which follow.

Another object is to provide a circuit-breaker comprising a snap-spring mechanism having lost motion connection with the movable switch contact in combination with a magnetic detent for holding the contacts in engagement while the spring mechanism is reversing its direction of movement.

Another object is to provide an improved form

of thermally actuated re-closing circuit breaker.

Other objects and advantages of this invention will be more apparent from the following detailed description of certain approved forms of mechanism constructed and operating according to the principles of this invention.

In the accompanying drawings:

Fig. 1 is a vertical section taken substantially on the line 1—1 of Fig. 3, and showing the internal mechanism in top plan view.

Fig. 2 is a vertical section taken substantially on the line 2—2 of Fig. 3.

Fig. 3 is a vertical section taken substantially on the line 3—3 of Fig. 1 and showing the internal mechanism in side elevation with the contacts separated.

Fig. 4 is a central vertical section taken substantially on the line 4—4 of Fig. 1, and showing the contacts engaged or in circuit-closing position.

Fig. 5 is a rear elevation partially broken away.

Fig. 6 is a transverse section taken substantially on the line 6—6 of Fig. 1 and showing the internal mechanism in end elevation as looking from below at Fig. 1.

Fig. 7 is a vertical section, similar to Fig. 2, but showing a modified form of snap-spring operating mechanism.

Fig. 8 is a vertical section taken substantially on the line 8—8 of Fig. 7.

Referring first to the form of the invention shown in Figs. 1 to 6 inclusive, the operating parts of this device are carried by a base block 1 of insulating material, which in turn is carried through an insulating block 2 by a metallic cross bar 3 adapted to be secured against a wall or panel by screws or other devices inserted through the holes 4.

A pair of similar spaced apart electric contacts 5 and 6 are mounted in the lower portion of block 1, these contact members extending through the block so that the rear portions thereof may serve as binding posts at the back of the block as indicated at 5' and 6' in Fig. 5. A pair of movable contacts 7 and 8, adapted to engage respectively with the fixed contacts 5 and 6, are mounted on a metallic carrier 9 which serves to electrically connect the contacts 7 and 8. As a consequence, when the contacts 7 and 8 are moved into engagement respectively with the contacts 5 and 6, the carrier and movable contacts will serve to bridge or complete a circuit between the fixed contacts 5 and 6. The carrier 9 is mounted loosely at its upper end as indicated at 10 on the supporting block 1 so that the contacts 7 and 8 will be held in proper alignment with the fixed contacts 5 and 6 but the carrier is free to move toward or from the supporting block 1 in a pendulum-like manner so as to make or break the connections between the contact members. A permanent horse-

shoe magnet 11 is mounted in a suitable recess formed in the back of block 1, and post extensions 12 project forwardly through the block 1 from the respective poles of the magnet so as to attract an intermediate portion 13 of carrier 9 which serves as an armature for the magnet. When the parts are moved to the circuit making position shown in Fig. 4 the armature 13 is brought adjacent the poles 12 of the magnet so that the magnet tends to strongly attract the carrier and hold the respective pairs of contacts 5, 7 and 6, 8 in firm engagement with one another. However, this magnetic attraction is not so strong but what it may be broken by a sufficient force applied to carrier 9 in the opposite direction, as hereinafter described. The lower end of carrier 9 is extended outwardly at 14 and then upwardly at 15 so as to provide a suitable space or gap between the member 15 and the opposing portion 16 of the carrier on which the contacts 7 and 8 are mounted. The free end portion of the snap-spring mechanism operates within this gap as will be hereinafter described.

In order to limit movement of the carrier 9 in the contact-separating or circuit-opening direction, the portion 15 of the carrier is adapted to engage a stop plate 17 carried by a pair of posts 18 projecting forwardly from base block 1. The lower end of a thermostatic bar 19 is anchored at 19' on this same stop plate 17. This thermostatic member 19 is preferably in the form of a bi-metallic bar adapted to warp or bend in one direction when heated. The bar 19 is wrapped with a heating coil 20 of high resistance material. One end of this heating coil 20 is connected through flexible conductor 21 with a binding post 22, and the other end of the coil is connected through flexible conductor 23 with a second binding post 24. These binding posts 22 and 24 extend through to the back of the supporting block 1 as indicated in Fig. 5 at 22' and 24'. Binding post 22' is connected through the conductor bar 25 with the fixed contact member 5'. The other fixed contact member 6' is connected at the back of the assembly by conductor bar 26 with a third binding post 27. The outside circuit wires 28 and 29 are connected respectively with the binding posts 24' and 27. It will thus be seen that when the assembly is in circuit-closing position, a circuit will be completed through the contactor as follows: From circuit wire 28 through binding post 24, conductor 23, heating coil 20, conductor 21, binding post 22, conductor bar 25, fixed contact 5, movable contact 7, carrier 9, movable contact 8, fixed contact 6, conductor bar 26, binding post 27 and the other circuit wire 29.

The thermostatic bar 19 is adapted to operate the snap-spring mechanism which in turn moves the contact carrier 9. In the forms shown in Figs. 1 to 6, this snap-spring assembly comprises a long flat leaf-spring 30 the upper end of which is connected at 31 with the free or movable end of thermostatic bar 19. The lower end of leaf-spring 30 is connected through cross-bar 32 with the lower ends of a pair of similar bowed springs 33 and 33' which are shorter than the main leaf-spring 30. If desired, the springs 30, 33 and 33' may all be stamped from the same sheet of spring metal, that is they may all be integrally connected at their lower ends. The upper ends of the springs 33 and 33' bear against a pair of similar fulcrum posts or bars 34 and 34' which are mounted on base block 1. The bowed springs 33 and 33' are under longitudinal

compression, that is tend to force the spring assembly downwardly. As a result, if the main central leaf-spring 30 is moved rearwardly or forwardly beyond the fulcrum point or dead-center position, the tendency of the springs 33 and 33' to expand or straighten out will tend to swing or snap the lower end of leaf-spring 30 further in that same direction. When the spring assembly is snapped toward the base plate 1, as shown in Figs. 4 and 6, the stud 35 positioned centrally on the rear face of cross bar 32 engages the central lower portion of member 16 of carrier 9 and forces the contacts 7 and 8 into engagement with the fixed contacts 5 and 6. This central stud 35 serves as an equalizing member to distribute the pressure between the two movable contacts 7 and 8. When the spring assembly is snapped to the other side of its dead-center position, the cross-bar 32 will swing across the gap between members 16 and 15 and forcibly strike the portion 15 of the carrier and continued movement of the lower end of the spring assembly will swing the carrier in this outward direction until member 15 engages the stop plate 17. This position of the parts is shown in Fig. 3.

The entire operating assembly is housed within a sheet metal casing 36 which engages at its inner edge in a groove 37 formed around the outer edge of base plate 1. The casing 36 is held in place by a screw 38 engaging in an insulating bar 39 secured across the outer ends of the post extensions 18'.

In describing the operation of this device, let us assume that it is to be used in a circuit that is normally closed only for short intervals of time. The current in this circuit is of such strength that if it should continue to flow for an abnormally long time it might burn out parts of the apparatus in this circuit. Normally the circuit will be closed through the contactor as indicated in Fig. 4. That is the movable contacts 7 and 8 are closed against the fixed contacts 5 and 6. Now when the circuit is completed at some other point, a rather heavy current will flow through the heating coil 20 so as to raise the temperature of the thermostatic bar 19 which will start to warp outwardly, that is away from base plate 1. If the flow of this current persists for a longer time than is normally desirable, the thermostatic bar 19 will warp outwardly sufficient to move the upper end of a leaf spring 30 past the dead-center position. As the spring assembly reaches dead-center, it will be apparent that the lower end of the spring assembly no longer exerts any pressure against the contact carrier 9, but the carrier will still be drawn toward the supporting block 1 by the attraction of magnet 11 so that the movable contacts will still be held firmly against the fixed contacts. This contact engagement will still be maintained after the spring assembly starts to move in an outward direction. However, as the lower end of the spring assembly gains momentum and is snapped forcibly outward or away from the supporting plate 1, the cross bar 32 will hit the portion 15 of the carrier with a hammer-blow and suddenly move the carrier outwardly against the fixed stop 17. The fixed and movable contacts will thus be suddenly and decisively separated, and sparking therebetween will be reduced to a minimum.

It will now be seen that if the movable contacts were carried directly by the snap-spring mechanism, or the snap-spring mechanism were connected directly with the contact carrier 9 there

would be a point where the forces tending to hold the fixed and movable contacts in engagement would be substantially neutralized by opposing forces and the contacts would have a tendency to chatter. However, with the present construction the contacts are held firmly together by the magnetic detent until separated by a quick hammer-blow as the movable end of the snap-switch mechanism moves suddenly into engagement with a portion of the carrier.

While one particular form of snap-spring mechanism has been described, it is to be understood that there are numerous forms of such spring mechanism that might be used, the only essential being that this mechanism be adapted for slow movement to and slightly past dead-center position whereupon it will snap suddenly to an extreme position in this direction. Another form of spring-mechanism is shown, by way of example, in Figs. 7 and 8. A U-shaped swinging plate 40 is pivoted at its lower end 41 on a fixed support, and the upwardly projecting arms 42 are pivotally connected at 43 with the downwardly projecting arms 44 of another U-shaped plate 45. A spring 46 is connected under tension in the space between the pairs of arms 42 and 44 so that when this assembly is buckled in one direction or the other from a straight alignment of the two plates 42 and 45, the tendency of the spring will be to snap the two plates toward one another. The upper end of plate 45 carries the cross bar 47 on which is mounted the central stud 35 which is adapted to engage pendulum-like carrier 9' pivoted at its lower end on which carrier are mounted the movable contacts 7 and 8, all as in the first described form of the invention. When the snap-spring mechanism is buckled in the opposite direction, the bar 47 will swing into engagement with portion 15 of the contact-carrier and move the carrier into engagement with a fixed stop 48. The pivotal connections 43 between the two plates 42 and 45 are connected by a yoke member 49 with the upper movable end 50 of the thermostatic bar 51, which may be similar in all respects to the thermostatic bar 19 described in connection with the first form of the invention. Other parts not here referred to may be assumed to be essentially the same as those already described. As shown in Fig. 8, the snap-spring mechanism has been centrally buckled or bowed away from the supporting block 1 so that the contraction of the spring 46 has swung the upper end of plate 45 toward the supporting block so as to engage the carrier and move the contacts 7 and 8 into engagement with the fixed contacts 5 and 6. As current flows through the circuit of heating coil 20 the thermostatic bar 51 will be warped toward the supporting block 1 so as to straighten out or align the two swinging plates 42 and 45. As the assembly reaches a dead-center position the pressure of stud 35 on the contact carrier 9' will be released but magnet 11 will act to hold the carrier toward the supporting block 1 and hold the movable contacts in engagement with the fixed contacts. As the swinging plates 42 and 45 pass a dead-center position, the upper end of plate 45 will be suddenly snapped outwardly so that bar 47 will engage with portion 15 of the contact carrier 9' and suddenly swing the carrier outwardly against fixed stop 48 and thus break the circuit. This action need not be further described since it is essentially the same in all respects as that of the first described form of the invention.

I claim:

1. In an electric contactor, fixed and movable contacts, a carrier on which the movable contact is mounted, the carrier being movable between two extreme positions in one of which the contacts are engaged to complete a circuit and in the other of which the contacts are separated to break the circuit, a portion of the carrier serving as an armature, a magnet positioned to attract the armature and tend to hold the contacts in engagement with one another, a snap-spring mechanism having two opposite movable end portions and an intermediate fulcrumed portion, a fixed fulcrum member engaged by this intermediate portion of the snap-spring mechanism, one movable end portion being adapted to snap to one or the other of two opposite positions when the spring mechanism is moved over a dead-center position and having limited freedom of movement with respect to the carrier but adapted to engage the carrier after the snap-spring mechanism has passed a substantial distance beyond its dead-center position in either direction and thereafter shift the carrier from one to the other of its extreme positions, a thermostatic member operatively connected with the other movable end portion of the snap-spring mechanism and adapted to move this mechanism past its dead-center position, and an electric heater for the thermostatic member, said heater being connected in the circuit controlled by the contacts.

2. In an electric contactor, fixed and movable contacts, a carrier on which the movable contact is mounted, the carrier being movable between two extreme positions in one of which the contacts are engaged to complete a circuit and in the other of which the contacts are separated to break the circuit, a portion of the carrier serving as an armature, a magnet positioned to attract the armature and tend to hold the contacts in engagement with one another, a snap-spring mechanism having two opposite movable end portions and an intermediate fulcrumed portion, a fixed fulcrum member engaged by this intermediate portion of the snap-spring mechanism, one movable end portion being adapted to snap to one or the other of two opposite positions when the spring mechanism is moved over a dead-center position and having limited freedom of movement with respect to the carrier but adapted to engage the carrier after the snap-spring mechanism has passed a substantial distance beyond its dead-center position in either direction and thereafter shift the carrier from one to the other of its extreme positions, a thermostatic bar fixed at one end and having its free end portion connected with the other movable end portion of the snap switch mechanism so as to move this mechanism past its dead-center position as the bar is warped in one direction or the other, and an electric heating coil associated with the bar and connected in the circuit controlled by the contacts.

3. In an electric contactor, fixed and movable contacts, a carrier on which the movable contact is mounted, the carrier being movable between two extreme positions in one of which the contacts are engaged to complete a circuit and in the other of which the contacts are separated to break the circuit, means normally tending to hold the carrier in the first extreme position with the contacts in engagement with one another, a snap-spring mechanism having two opposite movable end portions and an intermediate fulcrumed por-

tion, a fixed fulcrum member engaged by this intermediate portion of the snap-spring mechanism, one movable end portion being adapted to snap to one or the other of two opposite positions when the spring mechanism is moved over a dead-center position and having limited freedom of movement with respect to the carrier but adapted to engage the carrier after the snap-spring mechanism has passed a substantial distance beyond its dead-center position in either direction and thereafter shift the carrier from one to the other of its extreme positions, a thermostatic member operatively connected with the other movable end portion of the snap-spring mechanism and adapted to move this mechanism past its dead-center position, and an electric heater for the thermostatic member said heater being connected in the circuit controlled by the contacts.

4. In an electric contactor, fixed and movable contacts, a magnetic detent normally tending to hold the contacts in engagement to complete a circuit, a snap-spring mechanism having two opposite movable end portions and an intermediate fulcrumed portion, a fixed fulcrum member engaged by this intermediate portion of the snap-spring mechanism, one movable end portion being adapted to snap to one or the other of two opposite positions when the spring mechanism is moved over a dead-center position and having a lost-motion connection with one of the contacts whereby the snap-spring mechanism may be moved a substantial distance beyond its dead-center position and will thereafter engage and move the movable contact to break the circuit, a thermostatic member operatively connected with the other movable end portion of the snap-spring mechanism and adapted to move this mechanism past its dead-center position, and an electric heater for the thermostatic member said heater being connected in the circuit controlled by the contacts.

5. A snap switch comprising in combination a tension member and an adjacent compression member each operatively mounted at one end and connected together at their opposite ends which are free to move, a loosely mounted pendulum-like member having a U-shaped end portion forming a pair of stops between which said connected end part moves, at least one of said first two members comprising spring means, said compression member being mounted operatively at a point whereby it has a different radius of action than said tension member, said stops being movable with said connected end part when said connected end part strikes a stop after leaving the opposite stop, at least one of said stops having electrical contact means thereon associated with stationary electrical contact means, the arrangement being such that electrical contact at said stationary electrical contact means is made or broken as said end portion snaps from one stop to the other.

6. A snap switch comprising in combination an elongated member operatively mounted at one end with the opposite end free to move, a loosely mounted movable member, stops formed by spaced apart portions of said loosely mounted member between which said free end moves, said switch being so constructed that said free end moves from one stop to the other with a snap

action, said stops being movable with said free end when said free end strikes a stop after leaving the opposite stop, at least one of said stops having electrical contact means thereon associated with stationary electrical contact means, the arrangement being such that the electrical contact at said stationary electrical contact means is made or broken as said free end portion snaps from one stop to the other.

7. A snap switch comprising, in combination, a member which moves with a snap action, a pendulum-like member comprising movable stops between which said snap action member moves, said switch being so constructed and arranged that said stops move with said snap action member when said member strikes a stop after leaving the opposite stop, at least one of said stops having electrical contact means thereon associated with stationary electrical contact means, the arrangement being such that the electrical contact at said stationary electrical contact means is made or broken as said free end portion snaps from one stop to the other.

8. A snap switch comprising, in combination, an elongated member operatively mounted at one end with the opposite end free to move, a loosely mounted magnetic pendulum-like member having a U-shaped portion, stops formed by the inner surfaces of said U-shaped portion between which the free end of said first member moves, said switch being so constructed that said free end moves from one stop to the other with a snap action, an electrical contact on the exterior side of one leg of said U-shaped end portion and pressing against a stationary electrical contact, a magnet contiguous to and in such relation to said pendulum-like member as to tend to hold said two contacts together, said free end portion pressing against the electrical contact leg of said U-shaped part when said two contacts are in contact, said switch being so constructed and arranged that when said free end strikes the opposite leg or stop the pull of said magnet on said pendulum-like member is overcome and said contacts are separated, thereby breaking the electrical circuit controlled thereby.

9. A snap switch comprising, in combination, an elongated member operatively mounted at one end with the opposite end free to move, a loosely mounted magnetic pendulum-like member having spaced apart portions, stops formed by the spaced apart portions of said pendulum-like member between which the free end of said first member moves, said switch being so constructed that said free end moves from one stop to the other with a snap action, an electrical contact on the exterior side of one part of said spaced-apart portion and pressing against a stationary electrical contact, magnetic means tending to hold said two contacts together, said free end portion pressing against the electrical contact portion of said pendulum-like part when said two contacts are in contact, said switch being so constructed and arranged that when said free end strikes the opposite stop or the opposite portion of said spaced-apart section said magnetic attraction is overcome and said contacts are separated, thereby breaking the electrical circuit controlled thereby.

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