

March 24, 1942.

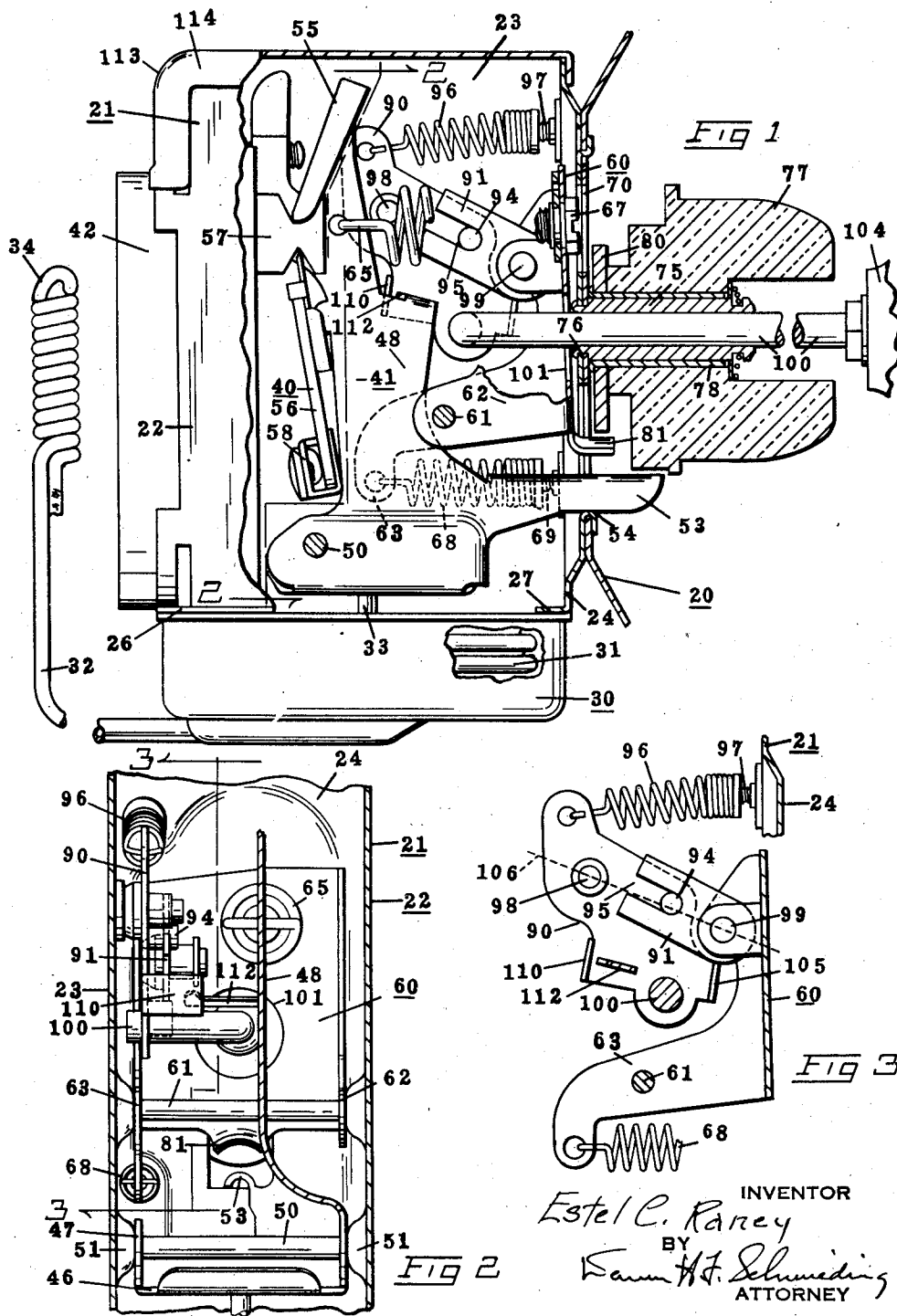
E. C. RANEY

2,277,560

CONTROL APPARATUS

Filed Aug. 3, 1940

2 Sheets-Sheet 1



March 24, 1942.

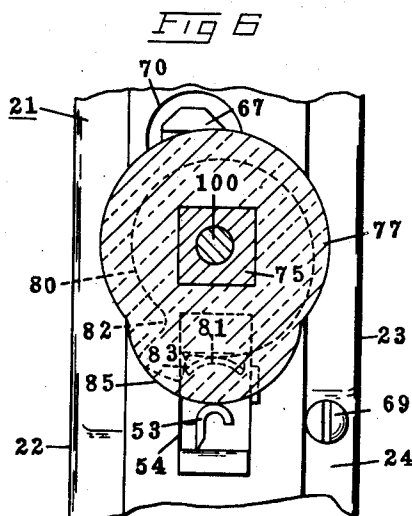
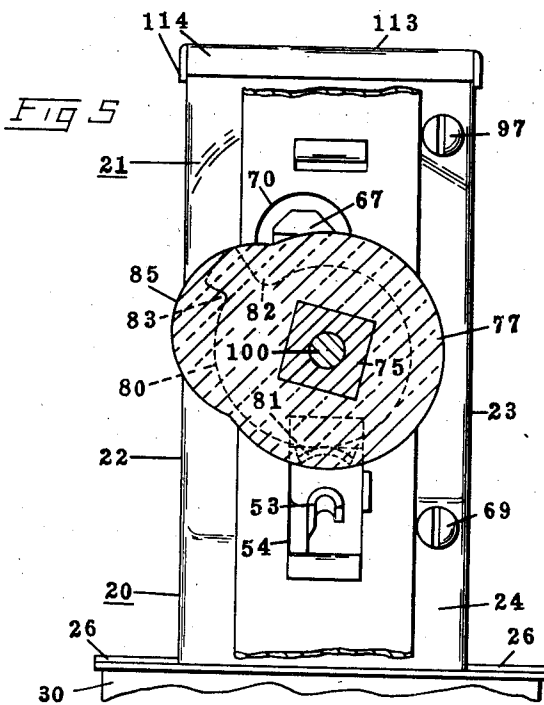
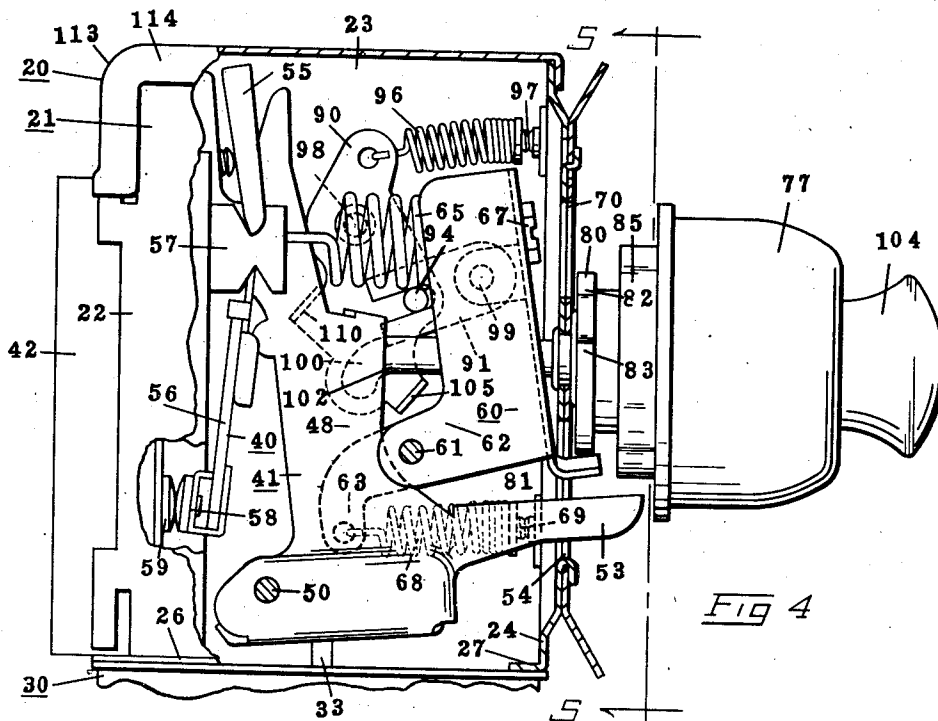
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2 Sheets-Sheet 2



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2,277,560

CONTROL APPARATUS

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10 Claims. (Cl. 200—83)

The present invention relates to improvements in control apparatus, and more particularly to control apparatus for household refrigerators.

An object of the invention is to provide a manually operated adjusting mechanism for a control apparatus, which apparatus includes a frame having two opposed walls and an interconnecting wall and a movable control member mounted intermediate the opposed walls, which mechanism comprises a plate pivoted between the opposed walls and a spring interconnecting the plate and the control member, the plate being movable about its pivot by a manually movable device, mounted on the interconnecting wall, and a toggle mechanism for varying the tension of the spring on the control member. The plate is movable to a predetermined position by the toggle mechanism which comprises a link pivotally mounted on one of the opposed walls and a second link pivotally supported on the plate, the toggle being manually operated by a member extending through an opening in the interconnecting wall and an opening in the plate.

Another object of the invention is to provide an arm on the above mentioned plate for extending through an opening in the interconnecting wall and being engagable with a manually operated cam member supported on the interconnecting wall for engaging the arm to vary the position of the plate, and providing an opening through the cam member to receive and support the toggle operating member.

Other and further objects and advantages will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred form of embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a side view, partly in section, of a control apparatus, part of the apparatus being broken away;

Fig. 2 is a view taken on line 2—2 of Fig. 1;

Fig. 3 is a fragmentary view taken on line 3—3 of Fig. 2 and showing part of an adjusting mechanism for the apparatus;

Fig. 4 is a view similar to Fig. 1, but showing the apparatus in another control position;

Fig. 5 is a view taken on line 5—5 of Fig. 4, and

Fig. 6 is a fragmentary view similar to Fig. 5, but showing the adjusting device in a different position.

Referring to the drawings, a control apparatus embodying the invention is shown generally at 20. Mechanism of the apparatus is supported

by and enclosed in a U shaped frame 21, which in the present embodiment, is formed of a sheet metal stamping and includes two opposed walls 22 and 23 and an interconnecting wall 24. The lower edges of the walls 22 and 23 are turned to form flanges 26 and the lower edge of the wall 24 is turned inwardly to form a flange 27.

A thermostatic element 30 is suitably attached to the flanges 26 and 27. The element 30 includes a casing inclosing a bellows 31 and a tube 32 is connected to the bellows and the tube and bellows are charged with a volatile fluid, such as sulphur dioxide. The bellows 31 is adapted to raise and lower a rod 33 in response to changes in temperature at the coil 34 formed at the end of tube 32. The coil 34 is adapted to be connected in heat transfer relation with the evaporator of an electrically operated refrigerator.

The element 30 operates a toggle switch mechanism 40 through a control member 41. The switch mechanism 40 is mounted on an insulation block 42, which block is secured between the edges of the walls 22 and 23. The toggle switch 40 includes a U shaped flipper 55 and a snap acting member 56 pivoted on a bracket 57, which flipper and member 57 are interconnected by a tension spring, not shown. The member 56 carries a contact bar 58 and is snapped by the tension spring to and from two spaced fixed contacts 59 when the flipper 55 is moved about its pivot.

The control member 41 is formed having a yoke 46, an upturned part 47 at one end of the yoke and an arm 48, extending upwardly from the opposite side of the yoke. A pin 50 extends through the part 47 and arm 48 and the ends thereof are journaled in bearings 51 formed in the walls 22 and 23 to pivotally support the member 41. An arm 53 is formed on the member 41 and extends through an opening 54 in the wall 24, the purpose of which arm will be explained hereinafter. The upper end of the member 41 is forked and the yoke of the U shaped flipper 55 of the switch mechanism 40 is received between the prongs of the fork. When the control member 41 is moved counterclockwise, as viewed in Fig. 1, the flipper 55 is moved past its dead center position to cause snap movement of the switch member 56 to the switch closed position, shown in Fig. 4, and when the member 41 is rotated clockwise the flipper 55 is moved beyond its dead center position in the opposite direction to cause the member 56 to be snapped to the switch open position. The switch is adapted to be connected in the circuit of the

motor for operating the refrigerator apparatus to be controlled. It is to be understood, however, that the control apparatus could control the circuit of an electrically operated refrigerant valve.

The rod 33 engages the yoke 46 of the control member 41 for connecting the power element 30 with the member 41. The fluid pressure in the element 30 tends to rotate the control member 41 counterclockwise to the switch closing position.

The frame 21, thermostatic element 30, switch mechanism and control member 41 as described thus far are similar in form and operation to the corresponding elements described in my co-pending application Serial No. 193,324, filed March 1, 1938, for Control apparatus.

A plate 60 is pivotally supported between the walls 22 and 23 by a pin 61 that interconnects two parallel arms 62 and 63 extending from plate 60, and the ends of the pin extend through the arms 62 and 63 and are supported in suitable bearings formed in the walls 22 and 23. A relatively heavy spring 65 is connected at one end to the member 41 by hooking the end of the spring through an eyelet in the member and the other end of the spring, not shown, is suitably threaded on a screw 66 rotatably supported in an opening in the plate 60. The screw 66 is provided with a slotted head 67 which is in alignment with an opening 70 formed in the wall 24 so that the screw may be rotated to adjust the tension of the spring to obtain the proper range of adjustment. This adjustment is generally made at the factory. The spring 65 tends to rotate the member 41 clockwise, or to the switch opening position, and opposes the movement of the member by the thermostatic element 30 to the switch closing position. It will be apparent that as the spring tension is increased the pressure within the thermostatic element 30 correspondingly increases to cause closing of the switch mechanism, and conversely, a reduction in spring tension will permit the switch to be closed by a reduced pressure in the element 30. As is well understood in the art the pressure in the bellows increases and decreases with increase and decrease in the temperature of the fluid in the coil 34, respectively. Thus by adjusting the tension of the spring 65, the temperatures at which the switch is operated may be regulated.

A spring 68 is connected at one end of the arm 63 of the plate 60 and the other end is threaded on a screw 69, which screw is rotatably mounted on the wall 24 similar to the manner in which screw 66 is mounted to member 60, and by rotating the screw 69 the tension of the spring 68 may be adjusted. The function of spring 68 will be set forth hereinafter.

The tension of the spring 65 is adjusted by an adjusting device that rotates the plate 60 about its pivot to various positions to change the length of the spring 65. The adjusting device comprises a tubular shaft 75 that is suitably attached to the wall 24 in an opening 76 formed in the wall, and a knob 77 that is rotatably mounted on the shaft 75, by a bushing 78, which knob is connected with a cam 80 also rotatably mounted on the shaft 75. The plate 60 is provided with a finger 81 that extends through the opening 54 in the wall 24, and during normal operation of the switch, the spring 65 biases the plate 60 counterclockwise, as viewed in Fig. 4, and maintains the finger 81 against the periphery of the cam 80. As the cam is rotated the plate 60 is moved toward or away from the control member 41, thus vary-

ing the tension of the spring 65. The cam is provided with shoulders 82 and 83 for engaging the finger 81 to limit rotation of the knob 77 and the shape of the cam intermediate the shoulders determine the tension of the spring during the range of movement of the cam. Preferably the apparatus is adjusted so that the switch operating temperatures are below the melting point of ice during the major portion of the cam adjustment.

The knob 75 is formed with a cam surface 85 that engages the arm 53 of the control member 45 when the knob 77 is rotated to the stop formed by shoulder 83, and tilts the control member 41 clockwise against the pressure in the thermostatic element 30 to force the control member to the switch opening position. Thus by manipulation of the knob 77 the normal temperature range of operation of the switch may be adjusted or the switch 40 may be moved to the open position for an indefinite period.

It is well known that ice, during normal operation of the well known household refrigerators, collects on the evaporator and it is desirable to discontinue operation of the refrigerating system from time to time to permit this ice to melt. It is also desirable to cause the refrigeration cycles to be resumed automatically after the ice has melted. It is the practice to provide, in refrigerator control apparatus, a device for increasing the tension of the range spring considerably in excess of its normal tension so that the temperature of the thermostatic element 30 rises well above the melting point of ice before the refrigeration cycle is resumed, and after the switch is closed to cause the tension of the spring to return to normal. In the present control apparatus, this device comprises a toggle formed by links 90 and 91 and a manually operated member for moving the toggle. The link 90 is pivotally mounted on the wall 23 at 98 and the link 91 is pivotally mounted on the plate 60 at 99. The link 90 is provided with a laterally extending pin 94 that extends into a slot 95 formed in the link 91 for forming a sliding connection between the links. The link 90 is biased clockwise by a relatively light spring 96 connected at one end to the link and having the other end threaded on a screw 97 rotatably supported on the wall 24, which screw 97 adjusts the tension of the spring 96.

While the control apparatus is operating the toggle link is normally maintained in the "broken" position by the spring 96, as is illustrated in Fig. 4. When the toggle is in this position the plate 60 may be rotated about its pivot by the cam 80 without interference with the toggle links because the pin 94 slides freely in the slot 95. A rod 100 is slidably mounted in the shaft 75 and extends through the opening 76 in the wall 24 and through an opening 101 formed in the plate 60. The inner end of the rod 100 is turned at right angles at 102 and is pivotally connected to the link 90. A knob 104 is attached to the end of the rod 100 to enable the rod to be reciprocated by the user of the refrigerator. The toggle link 90 has a laterally extending lug 105 formed thereon, which lug strikes the toggle link 91 to limit counterclockwise rotation of the member 90 by the rod 100 when the rod is pulled outwardly, as is illustrated in Fig. 3. The lug 105 is positioned to engage the link 91 when the toggle is moved to what may be called an over center position, that is, the joint between the toggle links will be slightly above the center of the piv-

ots 98 and 99 of the links 90 and 91, as is illustrated by the dotted line 106. When the toggle is in this position the links are relatively extended and the plate 60 is forced toward the wall 24 to extend the spring 65. It will be apparent that in this position of the toggle links the tension of the spring 65 maintains the toggle in the over center position. Also, when the plate 60 is moved by the toggle, the finger 81 thereof is moved from the cam 80.

A shoulder 110 is formed on the link 90 and when the toggle is in the over center position the shoulder 110 lies in the path of a laterally extending shoulder 112 formed on the control member 41, or if the control member 41 is in the switch closed position when the rod 100 is pulled, the shoulder 110 engages the shoulder 112 to move the member 41 to the switch opening position. The increased tension of spring 65 maintains the member 41 in this position until the refrigerator evaporator warms sufficiently to cause the element 30 to rotate the member toward the switch closed position. As the control member 41 is moved to the switch closed position by the thermostatic element 30, the shoulder 112 engaging the shoulder 110, rotates the link 90 clockwise to break the toggle. As the toggle is broken the plate 60 is returned to its normal position as determined by the cam 80 and the switch is closed by the member 41. The rod 100 is also returned to its normal position by the link 90.

The temperature at which the thermostatic element 30 operates to break the toggle is adjusted by adjusting the spring 68, which adjustment is preferably made at the factory. The spring 68 counteracts the spring 65, through the pivoted plate 60, only when the finger 81 of the plate 60 is free of the cam 80, i. e., when the toggle is in the over center position. Thus by adjusting the tension of the spring 68, the effective tension of the spring 65 on the control member may be adjusted. This causes the "defrosting" cycle of the refrigerator to be terminated at a fixed temperature.

The top of the frame 21 is covered by a sheet metal cover 113 that is provided with overlapping flanges 114 having detents, not shown, frictionally engageable with protrusions formed in the walls 22 and 23.

The control apparatus may be mounted in the refrigerator by a bracket 114 secured to the wall 24 by suitable tabs 115 formed of the sheet metal of the wall and turned over edges of openings in the bracket.

The novel arrangement and cooperation of the adjusting mechanism for the spring 65 permits the control apparatus to be formed of relatively few parts made of stampings and arranged in a compact structure.

While the form of embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

I claim:

1. In a control apparatus, means forming a frame having two opposed walls and an interconnecting wall, said interconnecting wall having an opening; a control member movable between said opposed walls; a plate; means for pivoting the plate intermediate the opposed walls, said plate having an opening; a spring interconnecting the plate and control member; a toggle comprising two connected links, one of said links being pivoted on one of the said opposed walls

and extending forwardly toward the interconnecting wall and the other of said links being pivoted on the plate and extending rearwardly; a manually operable member extending from the exterior of the frame through said openings in the interconnecting wall and plate and connected to one of said links for moving the toggle links; and means for limiting movement of the toggle links by the last mentioned member whereby the toggle moves the plate to a predetermined spring adjusting position when actuated by said last mentioned member.

2. In a control apparatus, means forming a frame having two opposed walls and an interconnecting wall, said interconnecting wall having an opening; a control member movable between said opposed walls; a plate; means for pivoting the plate intermediate the opposed walls, said plate having an opening; a spring interconnecting the plate and control member; a toggle comprising two connected links, one of said links being pivoted on one of the said opposed walls and extending forwardly toward the interconnecting wall and the other of said links being pivoted on the plate and extending rearwardly; a manually operable member extending from the exterior of the frame through said openings in the interconnecting wall and plate and connected to the first mentioned link for moving the toggle links; and means for limiting movement of the toggle links by the last mentioned member whereby the toggle moves the plate to a predetermined spring adjusting position when actuated by said last mentioned member.

3. In a control apparatus, means forming a frame having two opposed walls and an interconnecting wall, said interconnecting wall having an opening; a control member movable between said opposed walls; a plate; means for pivoting the plate intermediate the opposed walls, said plate having an opening; a spring interconnecting the plate and control member; means for selectively positioning the plate about its pivot for adjusting the spring, said means including a rotatable member mounted on said interconnecting wall, said rotatable member having an opening therethrough in alignment with the opening in said interconnecting wall; a toggle comprising two connected links, one of said links being pivoted on one of the said walls and the other of said links being pivoted on the plate; a manually operable member extending from the exterior of the frame, through the openings in the rotatable member, plate and the interconnecting wall and connected to one of said links; and means for limiting movement of the toggle links by the third mentioned member whereby the toggle moves the plate to a predetermined spring adjusting position when actuated by the third mentioned member.

4. In a control apparatus, means forming a frame having two opposed walls and an interconnecting wall, said interconnecting wall having an opening; a control member movable between said opposed walls; a plate; means for pivoting the plate intermediate the opposed walls, said plate having an opening; a spring interconnecting the plate and control member; means for selectively positioning the plate about its pivot for adjusting the spring, said means including a rotatable member mounted on said interconnecting wall, said rotatable member having an opening therethrough in alignment with the opening in said interconnecting wall; a toggle comprising two connected links, one of

said links being pivoted on one of the said walls and the other of said links being pivoted on the plate; a manually operable member extending from the exterior of the frame, through the openings in the rotatable member, plate and the interconnecting wall and connected to the first mentioned link; and means for limiting movement of the toggle links by the third mentioned member whereby the toggle moves the plate to a predetermined spring adjusting position when actuated by said third mentioned member.

5. In a control apparatus, means forming a frame having two opposed walls and an interconnecting wall, said interconnecting wall having an opening; a movable control member mounted between the opposed walls; a plate pivotally supported between the two walls and movable toward and away from the control member, said plate having an opening therein and a part extending therefrom and through an opening in the interconnecting wall; a spring interconnecting the control member and the plate; a manually operated adjusting device including, a cam mounted on the interconnecting wall, said cam engaging said part for varying the position of the plate about its pivot, said adjusting device having an opening therethrough in alignment with the opening in the interconnecting plate; a toggle comprising a toggle link pivotally supported on one of said walls and a second toggle link connected with the first mentioned link and pivotally supported on the plate; a member extending through the openings in the adjusting device, interconnecting wall and plate and connected with one of the toggle links for moving the toggle; and means for limiting movement of the toggle links by the last mentioned member whereby the toggle moves the plate to a predetermined spring adjusting position when actuated by the last mentioned member.

6. In a control apparatus, means forming a frame having two opposed walls and an interconnecting wall, said interconnecting wall having an opening; a movable control member mounted between the opposed walls; a plate pivotally supported between the two walls and movable toward and away from the control member, said plate having an opening therein and a part extending therefrom and through an opening in the interconnecting wall; a spring interconnecting the control member and the plate; a manually operated adjusting device including, a cam mounted on the interconnecting wall, said cam engaging said part for varying the position of the plate about its pivot, said adjusting device having an opening therethrough in alignment with the opening in the interconnecting plate; a toggle comprising a toggle link pivotally supported on one of said walls and a second toggle link connected with the first mentioned link and pivotally supported on the plate; a member extending through the openings in the adjusting device, interconnecting wall and plate and connected with the last mentioned link for moving the toggle; and means for limiting movement of the toggle links by the last mentioned member whereby the toggle moves the plate to a predetermined spring adjusting position when actuated by the last mentioned member.

7. In a control apparatus, means forming a frame having two opposed walls and an interconnecting wall, said interconnecting wall having an opening; a movable control member mounted between said opposed walls, said member having an arm; a plate pivotally mounted

between the opposed walls, said plate having an opening therethrough and an extending part, said interconnecting wall being open to receive the arm of the control member and the extending part of the plate; a spring interconnecting the control member and the plate; cam means mounted on the interconnecting wall and engageable with said extending part over a range of movement of said means for varying the position of the plate, and engageable with said arm during a portion of the range of movement of said cam means for moving the control member to one of its positions, said cam means having an opening therethrough in alignment with the opening in the plate; a toggle including a toggle link pivotally supported on one of the said opposed walls and a second toggle link connected with the first mentioned link and pivotally supported on the plate; a member extending in the opening in the cam means and through the opening in the interconnecting wall and the opening in said plate and connected with one of the said toggle links for actuating the toggle; and means for limiting movement of the toggle links by the last mentioned member whereby the toggle moves the plate to a predetermined spring adjusting position when actuated by the last mentioned member.

8. In a control apparatus, means forming a frame having two opposed walls and an interconnecting wall, said interconnecting wall having an opening; a movable control member mounted between said opposed walls, said member having an arm; a plate pivotally mounted between the opposed walls, said plate having an opening therethrough and an extending part, said interconnecting wall being open to receive the arm of the control member and the extending part of the plate; a spring interconnecting the control member and the plate; cam means mounted on the interconnecting wall and engageable with said extending part over a range of movement of said means for varying the position of the plate, and engageable with said arm during a portion of the range of movement of said cam means for moving the control member to one of its positions, said cam means having an opening therethrough in alignment with the opening in the plate; a toggle including a toggle link pivotally supported on one of the said opposed walls and a second toggle link connected with the first mentioned link and pivotally supported on the plate; a member extending in the opening in the cam means and through the opening in said plate and connected with said second toggle link for actuating the toggle.

9. In a control apparatus, means forming a frame having a wall and two confronting walls extending rearwardly from said wall, said wall having an opening therethrough; a control member movable between said confronting walls; a lever pivoted on one of said walls; a spring interconnecting the lever and control member; a toggle comprising two rearwardly extending interconnected links, one of said links being pivoted on the lever and the other of said links being pivoted on one of said confronting walls; and a member connected with one of said links and extending forwardly through the opening in said wall.

10. In a control apparatus, means forming a frame having two opposed walls and an interconnecting wall, said interconnecting wall having an opening; a control member movable be-

tween said opposed walls; a lever; means for pivoting the lever intermediate the opposed walls; a spring interconnecting the lever and control means; means for selectively positioning the lever about its pivot for adjusting the spring, 5 said means including a rotatable member mounted on said interconnecting wall, said rotatable member having an opening therethrough in alignment with the opening in said interconnecting wall; a toggle comprising two inter- 10 connected links, one of said links being pivoted on one of said walls and the other of said links being pivoted on the lever; a manually operable member extending from the exterior of the frame through the openings in the rotatable member and the interconnecting wall, said manually operable member being connected to one of said links; and means for limiting movement of the toggle links by the third mentioned member whereby the toggle moves the lever to a predetermined spring adjusting position when actuated by said third mentioned member.

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