J. F. CAVANAGH.

IGNITION SWITCH.

APPLICATION FILED OCT. 21, 1916.

**1,232,458.**

Patented July 3, 1917.

2 SHEETS—SHEET 1.

Fig 1

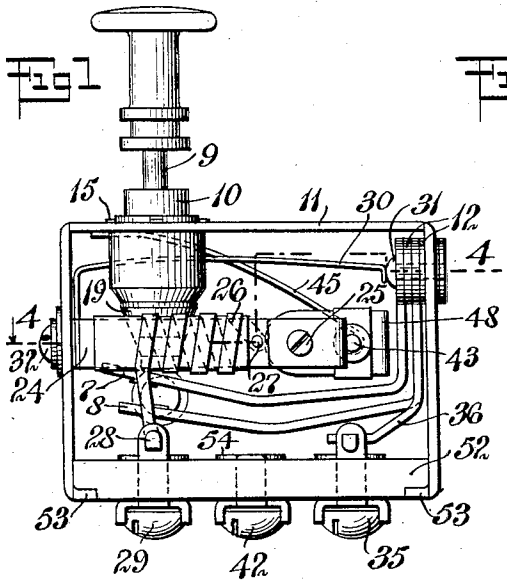



Fig 2

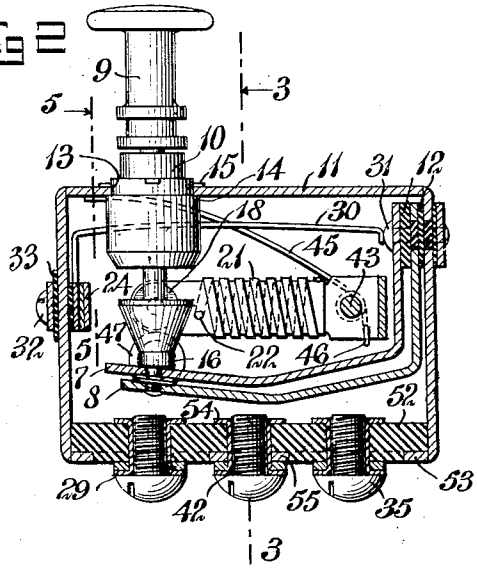



Fig 3

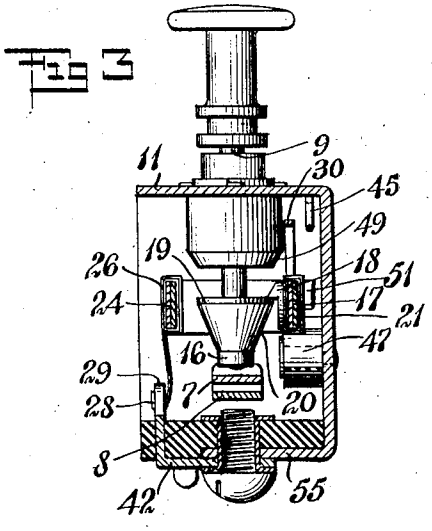
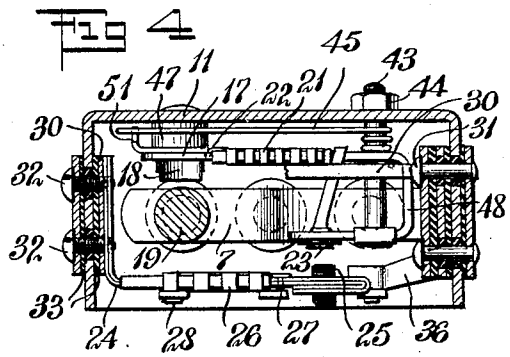



Fig 4




Inventor

*John F. Cavanagh*

By his Attorneys

*Whitlock & Allyn.*

J. F. CAVANAGH.

IGNITION SWITCH.

APPLICATION FILED OCT. 21, 1916.

**1,232,458.**

Patented July 3, 1917.

2 SHEETS—SHEET 2.

Fig 5

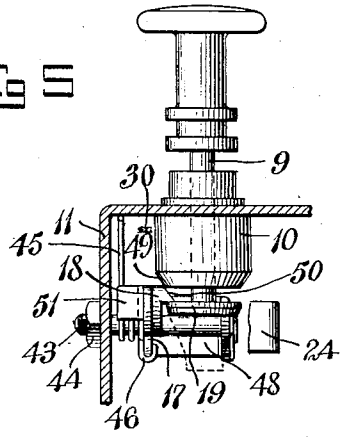
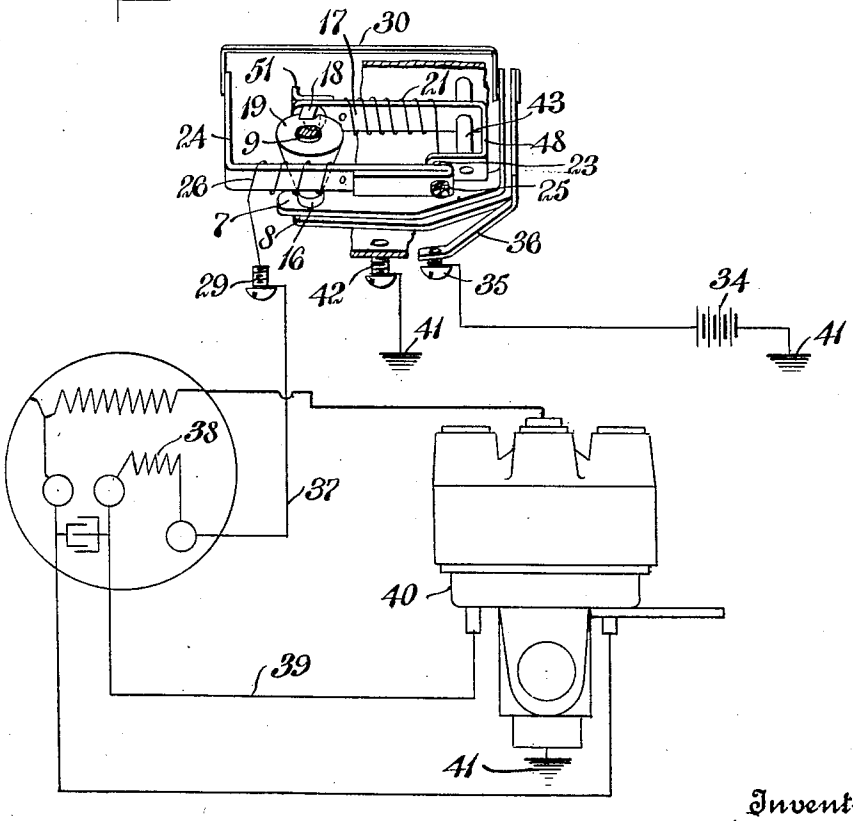



Fig 6




Inventor

John F. Cavanagh

By his Attorneys

Mitchell & Alley

# UNITED STATES PATENT OFFICE.

JOHN F. CAVANAGH, OF MERIDEN, CONNECTICUT, ASSIGNOR TO CONNECTICUT TELEPHONE & ELECTRIC COMPANY, OF MERIDEN, CONNECTICUT, A CORPORATION OF CONNECTICUT.

## IGNITION-SWITCH.

1,232,458. Specification of Letters Patent. **Patented July 3, 1917.**

Application filed October 21, 1916. Serial No. 126,965.

*To all whom it may concern:*

Be it known that I, JOHN F. CAVANAGH, a citizen of the United States of America, residing at Meriden, Connecticut, have invented a new and useful Ignition-Switch, of which the following is a specification.

My present invention aims primarily to provide simple and effective mechanism for automatically disrupting the ignition circuit when the engine has been stopped with the engine contacts in closed-circuit condition and to thereby protect the coil and other mechanism from injury.

A special object is to provide means for holding the circuit in closed condition, which will securely hold the parts in this relation without being affected by current fluctuations in the normal operation and which will operate quickly to break the circuit under abnormal conditions.

Another object is to combine with the automatic current interrupting mechanism manually operable means for controlling the circuit independent of the automatic control.

Further objects are to accomplish the foregoing in a simple compact construction, preferably in the nature of a single unit which can be easily wired and mounted in place and which will be relatively inexpensive to produce.

Other features of the invention and details of construction will appear as the specification proceeds.

In the accompanying drawings I have illustrated my invention embodied in practical commercial form but I would have it understood that the invention is susceptible of changes and modification without departure from the true spirit and scope of the invention.

In said drawings:

Figure 1, is an inside view of the switch unit with the switch in open-circuit condition.

Fig. 2, is a longitudinal sectional view of the same with the push button forced in to hold the switch closed.

Fig. 3, is a cross sectional view taken substantially on the plane of the line 3—3 of Fig. 2.

Fig. 4, is a horizontal sectional view taken substantially on the plane of the line 4—4 of Fig. 1.

Fig. 5, is a fragmentary sectional view taken substantially on the plane of the line 5—5 of Fig. 2 and illustrating the automatic releasing of the thermostatic holding member from the operating plunger.

Fig. 6, is a more or less diagrammatic view of the switch and circuits controlled thereby.

In the structure disclosed the ignition switch is made up of two spring contacts 7 and 8 which are forced into electrical engagement with each other by means of an operating member in the form of a plunger 9 which is guided for movement toward and away from the switch contacts in a bushing 10. These parts are supported in operative relation in the present disclosure by mounting them in a metallic casing 11, the switch contacts being disposed in the bottom portion of this casing and supported on suitable insulators 12 and the bushing being secured in the top of the casing as by seating it in an opening 13, said bushing having a shoulder portion 14 engaging the under side of the top and outwardly struck lugs 15 engaging the upper side of the top whereby said bushing is rigidly supported in place. The plunger is preferably insulated from the switch as by providing it with an insulating button 16 on its lower end where it engages with the upper contact.

The switch is normally held in the closed circuit condition illustrated in Figs. 2, 3 and 6 by means of a thermostatic holding device which here takes the form of a thermostatic bar 17 disposed at one side of the plunger and provided with a locking shoulder 18 to engage over a locking shoulder 19 on the plunger. The locking shoulder on the thermostat may be in the form of an outstanding lug on the inner face of the bar and the locking shoulder on the plunger may consist of an annular head or enlargement on the lower end of the plunger, which head is shown in the form of a truncated cone to provide the inclined face 20 for forcing the thermostat laterally to one side during the downward circuit closing movement of the plunger.

The holding action exerted by the thermostat when the plunger has been pushed in to the circuit closed position will be clear from Figs. 2 and 3 wherein it will be apparent that the plunger is held inward by the inter-engagement of the locking shoulders on the thermostat and plunger against the

tension of the spring contacts, the upper spring contact as clearly indicated in Fig. 1, serving when the plunger is free, to thrust the plunger outward to the open-circuit position. The upper contact arm thus serves both as a switch contact and a return spring for the switch operating plunger.

The holding thermostat is so constructed that under action of heat it will shift laterally or transversely away from the plunger and thereby carry the locking shoulder thereon out of engagement with the shoulder on the plunger, thus releasing the plunger and permitting the switch contacts to separate. The means for thus heating the thermostat is shown as a heating coil 21 mounted on the thermostatic bar, connected with the bar at one end at 22 and provided with a terminal contact 23 at the opposite end.

The coil of the holding thermostat is normally out of circuit so that said member serves normally solely as a means for holding the circuit closed and is unaffected by fluctuations in current strength or other conditions in the ignition system. When however the circuit is left closed for a period of time that might injure the apparatus the heating coil of the holding thermostat is placed in circuit, in the present illustration by a second thermostat consisting of a thermostatic bar 24 carrying a contact 25 for engagement with the heating coil contact 23 and provided itself with a heating coil 26. The heating coil of this second thermostat is normally connected in the ignition circuit so as to be influenced by conditions therein and is shown connected at one end at 27 to the thermostatic bar and at its opposite end at 28 to a terminal 29.

The coil 26 is shown placed in series with the ignition contacts by a bar 30 extending from the base of the thermostat bar over to the upper switch contact 7, the actual contact being here made by the engagement of the end of the bar 30 with the head of the rivet 31 which holds the contact 7 in place. The base of the second thermostat is shown angled with respect to the body of the bar and secured by means of suitable fastenings 32 on insulators 33 at the opposite side of the casing from that side on which the switch contacts are mounted. Also for the sake of compactness the second thermostat bar is preferably disposed at the opposite side of the plunger from that side where the holding thermostat is located.

Fig. 6 illustrates a typical circuit arrangement wherein the current from a battery 34 is conducted to a terminal 35 connected with the lower switch contact as by means of an arm 36 integral with said contact and through said lower contact to the upper contact thence by cross connection 30 to the thermostat bar 24, through the coil 26 on said bar to the terminal 29 and thence by a conductor 37 through the primary 38 of an induction coil and conductor 39 to the distributer 40 which has one side grounded at 41 through which the current returns to the grounded side of the battery.

The circuit closer thermostat does not operate in the normal running of the engine and only becomes sufficiently heated to close the circuit when the engine is stopped with the primary circuit closed or when some such dangerous condition exists, the coil of such thermostat being for this purpose as illustrated of relatively heavy and coarse wire so as to carry the normal load without undue heating and to heat up sufficiently to operate the thermostat only by reason of an abnormal flow of current such as occurs when the engine stops with the breaker contacts in engagement.

When this occurs the circuit closer moves over and closes the circuit for the heating coil of the holding thermostat through the contacts 25—23. The current flow is then through the switch contacts and the heating coil of the circuit closer as before, and from the bar 24 of this thermostat through contacts 25—23 to the heating coil 21 of the holding thermostat and from the bar 17 of this thermostat to the metallic casing which supports it and by way of a terminal 42 which is connected with the metallic casing, to ground. Under these circuit conditions the holding thermostat becomes heated and the thermostat bar 17 is thereby caused to be moved laterally away from the plunger and to carry the holding lug 18 away from engagement with the locking shoulder on the plunger permitting the plunger to rise under pressure of the upper spring contact 7 which results in the breaking of the ignition circuit. The heating coil 21 of the holding thermostat is preferably made of relatively fine wire as indicated so as to heat up quickly and for the same reason a greater number of turns may be employed in this coil than in the coil of the circuit closer thermostat.

The push button plunger which serves for the closing of the switch is preferably also made manually operable for opening the ignition circuit, this being provided for in the present disclosure, by constructing the holding thermostat so as to yield and release the plunger when the plunger is pulled outward to open the switch.

This yielding mounting for the holding thermostat is provided in the illustration, by pivotally supporting the holding thermostat at the end farthest removed from the holding end on a supporting stud 43 which is suitably secured to the back of the metallic casing by means of a nut 44 and by providing a spring 45 which engages the top of the casing, which is coiled about the pivot-

stud and is hooked into engagement with the rearward end of the pivoted thermostat arm at 46. From Fig. 2 it will be clear that by these means the holding end of the thermostat will be yieldingly held downward, a suitable stop 47 being ordinarily provided to limit the downward movement of such thermostat. To provide a firm pivotal mounting for the thermostat, the thermostat bar is shown doubled back upon itself in U-shaped form as indicated at 48, Figs. 4 and 6, the pivot stud passing through both arms of this yoke formation and the outer arm being disposed relatively close to the free end of the circuit closer thermostat and supporting the contact 23 for engagement thereby.

This construction provides for the thermostat holding the plunger in the circuit-closed position and at the same time enables the thermostat to yield when the plunger is manually operated for the purpose of breaking the ignition circuits.

To insure a positive disengagement of the before described locking shoulders when the plunger is withdrawn to break the circuit I have provided means operable under such conditions to positively shift the thermostat out of holding engagement with the plunger, such means comprising a beveled face 49 at the lower end of the guide or bushing 10 for the plunger (Fig. 5) which is engaged by a similarly inclined face 50 on the holding lug 18 in the upward yielding movement of the thermostat and which acts to wedge or force the thermostat bar laterally and thereby release the lug 18 on the bar from the shoulder 19 on the plunger.

Means are preferably provided for rapidly cooling the holding thermostat after it is automatically operated so as to quickly place the same in condition for holding the plunger in circuit-closed condition, in case it is desired to start the engine again soon after the switch has been automatically released. This cooling means here takes the form of a laterally extending cooling lug 51 of good thermal conductivity on the end of the holding thermostat which, in the expansion of the thermostat comes into engagement with the wall of the metallic casing 11 thereby enabling the thermostat to quickly rid itself of heat by the communication of said heat to the walls of the supporting casing.

The terminals 29 and 35 may be mounted on an insulating base 52 which, as indicated in Figs. 1, 2 and 3, forms a closure to the otherwise open lower side or bottom of the casing, said base resting on the lugs 53 turned inward at the edges of such open side. This insulating terminal base may be secured in place by the middle grounded terminal 42 which is shown in the form of a tubular eyelet 54 extending through the insulating base and through a lug 55 extending forwardly from the back of the casing. The other two terminals may also be in the form of tubular eyelets passed through the insulating base and internally screw threaded to receive the terminal screws shown.

I have used the term "thermostat" herein to designate a suitable thermo electric element or device and similarly the terms employed throughout have been used in a descriptive rather than in a limiting sense, except so far as may be required by the prior art.

What I claim is:

1. In an ignition system, the combination with ignition circuit contacts, a device for closing the circuit through said contacts, a thermostatic element for holding said device in the circuit-closed position, a thermostatic circuit controller included in the ignition circuit, and a heating circuit for the thermostatic holding member controlled by said thermostatic circuit controller.

2. In an ignition system, an ignition circuit contact, a spring arm supporting said contact, an operating plunger for said spring arm, a thermostatic holding member engaging said plunger to hold the same against the tension of the spring contact arm, a thermostatic circuit controller included in the ignition circuit and a heating circuit for the thermostatic holding member controlled by said thermostatic circuit controller.

3. In an ignition switch, switch contacts, a push button for engaging said switch contacts, a thermostatic member engaging said push button to hold the same in the circuit-closed position and adapted when heated to release it from such circuit-closed position, a thermostatic circuit controller and a heating circuit for the thermostatic holding member controlled by said thermostatic circuit controller.

4. In a switch of the character described, switch contacts, an operating plunger for forcing said contacts into engagement, a thermostatic member engaging said operating plunger to hold the same in the circuit-closed position and movable under heat conditions out of holding engagement with said plunger and means yieldingly supporting said thermostatic holding member for enabling the same to yield and release the plunger when said plunger is moved to the circuit open position.

5. In a switch of the character described, switch contacts, an operating plunger for forcing said contacts into engagement, a thermostatic member engaging said operating plunger to hold the same in the circuit-closed position and movable under heat conditions out of holding engagement with said plunger, means yieldingly supporting said thermostatic holding member for enabling the same to yield and release the plunger when said plunger is moved to the circuit

open position, electric heating means for said thermostatic holding member and a thermostatic circuit closer for establishing a heating circuit through said electric heating means.

6. In a switch of the character described, a switch contact, a spring pressed contact for engagement therewith, a movable plunger for forcing said spring contact into engagement with the first contact, a locking shoulder on said plunger, a thermostatic holding member engaging said locking shoulder, and means yieldingly supporting said thermostatic holding member.

7. In a switch of the character described, a spring pressed contact, a plunger for operating said contact, a locking shoulder on said plunger, and a thermostatic holding member engaging said locking shoulder movable under heat conditions laterally out of engagement with said locking shoulder and yieldable longitudinally in the direction of retractive movement of the plunger to permit manual retraction of said plunger.

8. In a switch of the character set forth, a switch operating plunger, a thermostatic member for holding said plunger in one position, means for yieldingly supporting said thermostatic member to permit the same to yield as the plunger is moved into a different position, and means for shifting the thermostatic member out of holding engagement with the plunger as said plunger is moved to said last position.

9. In a switch of the character set forth, a switch operating plunger, a thermostatic member for holding said plunger in one position, means yieldingly supporting said thermostatic member to permit said member to yield as the plunger is shifted to a different position and a relatively stationary abutment engaged by the thermostatic member during the yielding movement thereof arranged to force said member out of holding engagement with the plunger.

10. In a switch of the character set forth, a switch operating plunger, a thermostatic member pivotally supported at one end and engaging the plunger at its opposite end to hold said plunger in one position, a spring yieldingly holding said thermostatic member in such holding position, and means for disengaging the thermostatic member from holding engagement with the plunger as the plunger is moved to a different position.

11. In a switch of the character set forth, a switch operating plunger provided with a locking shoulder on the side thereof, a thermostatic member disposed alongside said plunger and having a locking shoulder engaging the locking shoulder on the plunger, electrical means for shifting said thermostatic member out of holding engagement with the plunger and manually operable means for releasing the thermostatic member from holding engagement with the plunger.

12. In combination, a switch operating member provided with a locking shoulder and movable in one direction to close a switch and in the opposite direction to open the switch, a thermostatic member engaging said locking shoulder and movable under heat conditions laterally out of engagement with said locking shoulder, means for heating said thermostatic member, said member being mounted to yield in the direction of retractive movement of the switch operating member and means operable in said retractive movement of the switch operating member to shift the thermostatic member laterally out of holding engagement with the locking shoulder.

13. In combination a switch operating plunger provided with a locking shoulder, a thermostatic holding member pivotally supported at one end and engaging said locking shoulder at its opposite end, and a spring acting on said pivoted thermostatic member to cause the same to hold the plunger yieldingly in a predetermined position.

14. In combination, a switch operating plunger provided with a locking shoulder, a thermostatic holding member pivotally supported at one end and engaging said locking shoulder at its opposite end, a spring acting on said pivoted thermostatic member to cause the same to hold the plunger yieldingly in a predetermined position and means for shifting the thermostatic member out of holding engagement with the locking shoulder when the plunger is shifted to a different position.

15. In combination, a switch operating plunger provided with a locking shoulder, a guide for said plunger and a yieldingly supported thermostatic member engaging the locking shoulder on the plunger and adapted to be carried into engagement with the plunger guide in the longitudinal shifting movement of the plunger.

16. In combination, a switch operating plunger provided with a locking shoulder, a thermostatic member yieldable in the direction of retractive movement of said plunger and provided with a locking shoulder engaging over the locking shoulder on the plunger and having an exposed inclined face and a relatively stationary member disposed in the path of said inclined face in the retractive movement of the plunger.

17. In combination, a switch operating plunger provided with a locking shoulder, a thermostatic member yieldable in the direction of the retractive movement of the plunger and provided with a locking shoulder engaging over the locking shoulder on the plunger and a relatively stationary mem-

ber having an inclined wedging face engaged by the thermostatic member in the retractive movement of the plunger.

18. In combination, a movable switch operating member, a thermostatic holding member for said switch operating member, electric heating means on said thermostatic member, a contact on said thermostatic member for the electric heating means and a circuit controlling device engageable with said contact.

19. In combination, a movable switch operating member, a thermostatic holding member for said switch operating member, electric heating means on said thermostatic member, a contact on said thermostatic member for the electric heating means, a circuit controlling device engageable with said contact and a thermostatic circuit closer engagable with said contact.

20. In combination with an ignition circuit including switch contacts, operating means for normally holding the circuit closed through said ignition switch contacts and an electrically operated thermostatic holding member for said operating member entirely out of circuit during the normal operation of the system.

21. In combination with an ignition circuit including switch contacts, operating means for holding the circuit closed through said contacts, an electrically operated thermostatic holding member for the operating member arranged on open circuit condition during the normal operation of the system and a thermostatic circuit closer for closing the circuit through the electrical holding member under abnormal conditions.

22. In combination with a switch operating member, a thermostatic member for holding said switch operating member in a predetermined position, means for shifting said thermostatic member out of holding engagement with the switch operating member and thermal conducting means for carrying off heat from the thermostatic member.

23. In combination with a movable switch operating member, a thermostatic holding member for said switch operating member, a metallic support of good thermal conductivity and a thermostatic conductor on the thermostatic member for engagement with the metallic support.

24. The combination with a movable switch operating member, a thermostatic holding member for said movable switch operating member yieldable in the direction of retractive movement of the switch operating member and a stop limiting the movement of the yieldable thermostatic member in the opposite direction.

25. In a switch of the character described, switch contacts, an operating plunger therefor, a thermostatic holding member for said plunger disposed at one side of the plunger and a thermostatic circuit controller for said holding member disposed at the opposite side of the plunger.

26. In combination, a casing, switch contacts in the bottom of said casing, a switch operating plunger projecting from the top of the casing, a thermostatic holding member for said plunger disposed at one side of the casing at the side of the plunger and a thermostatic circuit controller for said holding member disposed at the opposite side of the casing at the opposite side of the plunger.

27. In combination, switch contacts, a thermostatic circuit controller electrically connected with one of said switch contacts, a thermostatic holding member provided with a contact engaged by the thermostatic circuit controller and a switch operating member engaged by the thermostatic holding member.

28. In a switch of the character described, switch contacts, a terminal for one of said contacts, a thermostatic circuit controller electrically connected with the other switch contact, a terminal for said circuit controller, a switch operating member, a thermostatic holding member for the switch operating member provided with a contact for engagement by the circuit closer and a terminal for the thermostatic holding member.

29. In a switch of the character described, a metallic support, an insulating terminal base carried by said support, insulated switch contacts mounted on the support, a terminal for one of said switch contacts mounted on the insulating base, a thermostatic circuit controller electrically connected with the other switch contact, a terminal for said circuit controller mounted on the insulating base, a movable switch operating member, a thermostatic holding member for the switch operating member electrically connected with the metallic support and provided with a contact for engagement by the circuit controller and a circuit terminal on the metallic support.

30. In a switch of the character described, a metallic casing having an opening in one side and a tongue projecting in the opening, an insulating base closing said opening and resting on the tongue aforesaid and a tubular circuit terminal securing the insulating base to the tongue.

31. In combination with a switch operating member, a quickly responsive holding thermostat for the same provided with a heating coil of relatively fine wire and a thermostatic circuit closer for the heating circuit of the holding thermostat provided with a heating coil of relatively heavier wire.

32. In combination with a switch operating member, a holding thermostat for the same provided with a U-shaped base and a pivotal support for said thermostat extending through the side arms of said U-shaped base.

33. In combination with a switch operating plunger, a holding thermostat for the same and a locking shoulder on the plunger engaged by the thermostat and provided with an inclined surface for wedging engagement with the thermostat.

JOHN F. CAVANAGH.