

June 13, 1939.

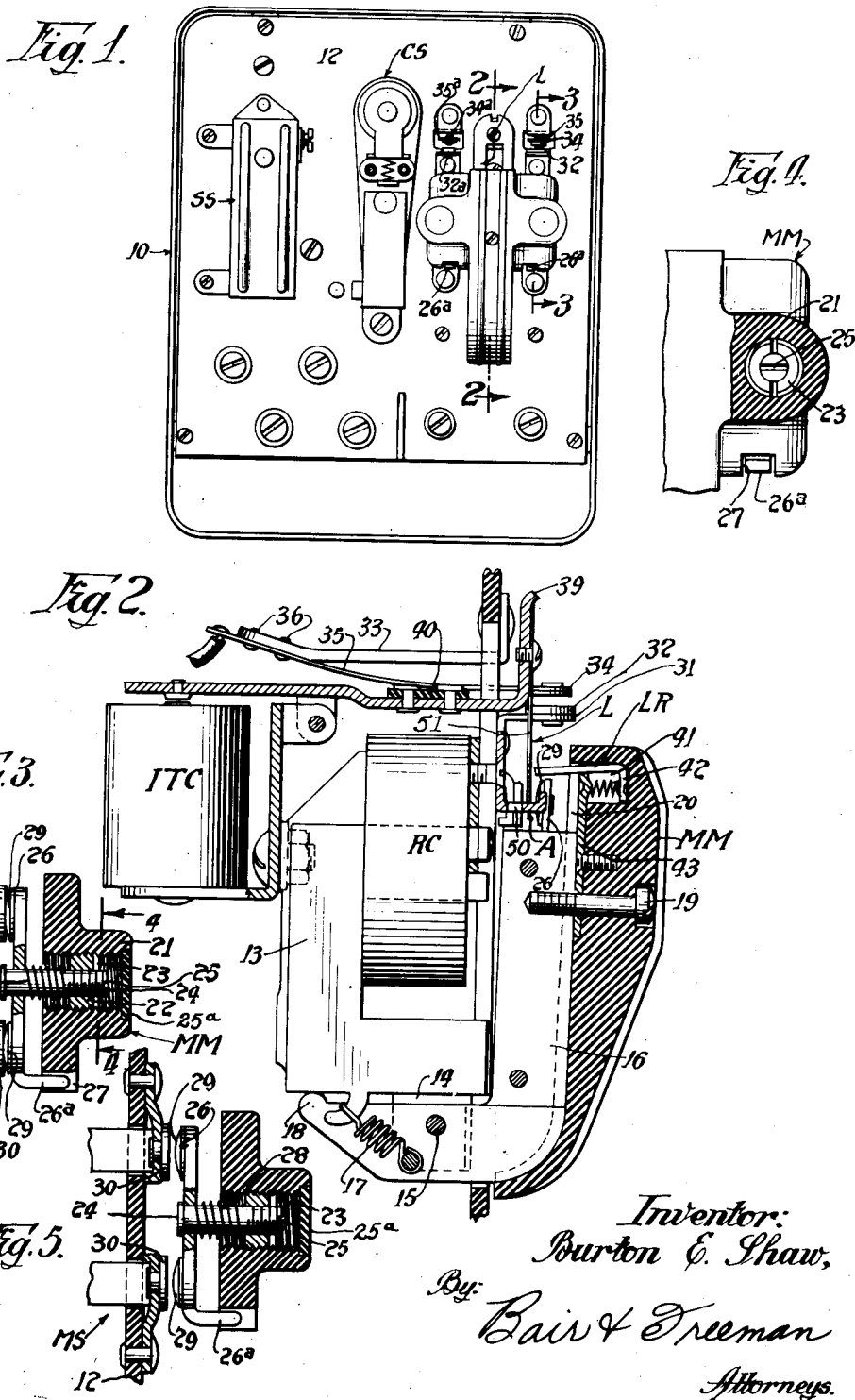
B. E. SHAW

2,162,126

BURNER CONTROL APPARATUS

Filed Dec. 14, 1937

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Fig. 6.

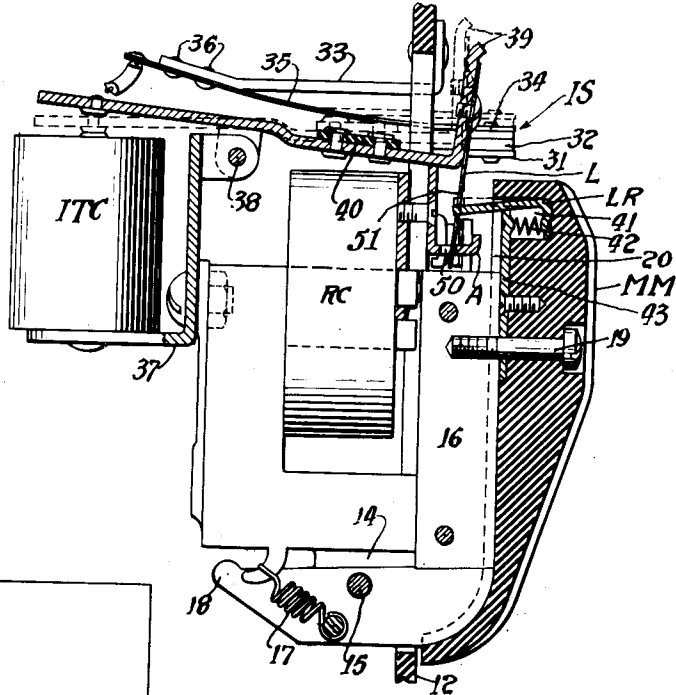
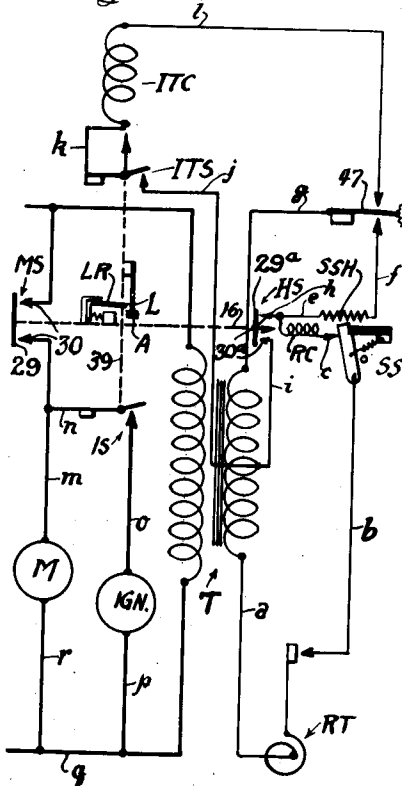
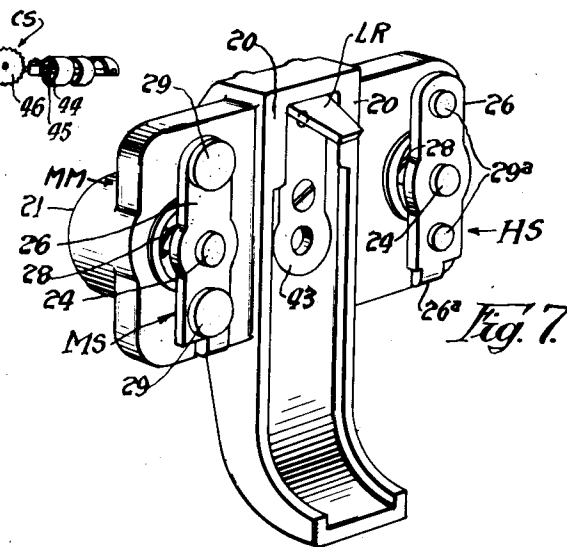


Fig. 8.



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UNITED STATES PATENT OFFICE

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BURNER CONTROL APPARATUS

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Application December 14, 1937, Serial No. 179,707

12 Claims. (Cl. 158—28)

An object of my invention is to provide burner control apparatus involving particularly a relay mechanism of simple construction including novel ignition control mechanism operated thereby.

5 A further object is to provide burner control apparatus including a relay and ignition control mechanism, the ignition control mechanism being so arranged and operable in such manner that the ignition switch remains open when the relay is off, thus preventing the motor of the burner, when coasting to a stop and thereby generating a current after the burner is shut down, being operable to energize the ignition mechanism and thereby ignite any gases which might remain in the furnace after the relay has been de-energized, my arrangement being thereby operable to permit such gases to be cleared from the furnace by the natural draft after shut down of the burner.

20 Still a further object is to provide a relay having associated with it an ignition switch and control mechanism for the ignition switch which is partly operated by an ignition trip coil and partly operated by the armature of the relay, the mechanism including a latch which is latched by an armature of the ignition trip coil when the trip coil is energized for opening the ignition switch and a latch release device operated by the relay armature whenever the relay coil is energized.

30 Another object is to provide a relay in which a mounting member for the movable contacts is secured to the relay armature by a single screw whereby the mounting member may be readily removed from the armature for exposing both the movable contacts and the stationary contacts for inspection and cleaning purposes.

40 Still a further object is to provide burner control apparatus including a circuit in which there is an ignition switch so controlled that it may be closed by energization of the relay, opened by movement of a combustion switch to combustion establishment position and maintained open instead of closing when the relay coil is de-energized.

45 With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my burner control apparatus, whereby the objects contemplated are attained as hereinafter more fully set forth, pointed out in my claims and illustrated in the accompanying drawings, in which:

50 Figure 1 is a front elevation of a control apparatus embodying my invention and showing the cover therefor removed.

Figure 2 is an enlarged sectional view on the line 2—2 of Figure 1 showing the relay of the control apparatus in de-energized position.

Figure 3 is an enlarged sectional view on the line 3—3 of Figure 1 showing the contacts of the relay in closed position.

Figure 4 is a sectional view on the line 4—4 of Figure 3.

Figure 5 is a sectional view similar to Figure 3 showing the relay contacts open.

Figure 6 is a sectional view similar to Figure 2 showing the relay closed, and in dotted lines an ignition trip armature moved to the position it assumes as a result of energization of an ignition trip coil.

Figure 7 is a perspective view of a mounting member and the movable contacts carried thereby, the mounting member being a removable part of the relay; and

Figure 8 is an electro-diagrammatical view of a typical circuit in which my control apparatus may be used.

On the accompanying drawings I have used the reference numeral 10 to indicate a housing of a control apparatus. This apparatus is usually called a "stack switch". Within the housing 10, a panel 12 of insulation or the like is mounted. A safety switch SS and a combustion switch CS are mounted on the panel 10 but the details of these two switches form no part of my present invention. The mechanism of the safety switch and combustion switch are shown diagrammatically in Figure 8. Details of the combustion switch CS may be found in my co-pending application Serial No. 179,708, filed December 4, 1937.

In connection with my burner control apparatus I provide a relay including a relay coil RC. A core 13 is provided for the relay and the core is suitably supported in a frame work which includes perforated ears 14 pivoted on a pin 15. On the ears 14 is an L-shaped armature 16. A spring 17 normally retains the armature in the position of Figure 2 with an extension 18 of the armature engaging the core 13 to act as a stop.

A mounting member MM is secured to the armature 16 by a single screw 19. The mounting member has a pair of side flanges 20 which engage the sides of the armature 16 to prevent undesired rotation of the mounting member relative to the screw 19. The mounting member MM is preferably formed of insulating material and has a pair of threaded bores 21. Within each bore 21 a sleeve 22 is mounted and these sleeves are slotted as indicated at 23 so that a

forked screw driver may be utilized for adjusting them axially of the bores 21.

Each sleeve 21 has threaded in it, a headed element or screw 24. A contact carrier 26 is slidably mounted on each headed element 24 and rotation thereof is prevented by an L-shaped extension 26a mounted loosely in a slot 27 of the mounting member MM. Springs 28 are interposed between the contact carriers 26 and the sleeve 22.

One of the contact carriers has a pair of movable contacts 29 mounted thereon for cooperation with stationary contacts 30. The contacts 29 and 30 constitute a motor switch MS. The other contact carrier has similar movable contacts 29a co-operable with similar stationary contacts 30a (see Figure 8). The contacts 29a and 30a constitute a holding switch HS. An ignition switch IS is provided comprising a bracket 31 carrying a stationary contact 32 and a bracket 33 supporting a movable contact 34. The contact 34 is mounted on a leaf spring 35 which in turn is riveted as at 36 to the bracket 32.

In connection with the ignition switch IS I provide an ignition trip coil ITC. The coil ITC may be an electro-magnet and may be suitably mounted on the core 13 of the relay by a bracket 37. Pivoted on a pin 38 carried by the bracket 37 is an armature 39 adapted to be attracted by energization of the ignition trip coil ITC. The armature 39 carries a cross piece 40 of insulation adapted to contact with the spring 35 and thereby lift the ignition switch contact 34 off the contact 32 when the ignition trip coil is energized.

An ignition trip switch ITS is provided which is similar to the ignition switch IS and therefore it is not shown in detail although the leaf spring and contacts thereof are shown in Figures 1 and 8 at 35a, 32a and 34a.

A latch L is provided for the armature 39 in the form of a leaf spring carried by the armature. The latch L is normally in the position of Figure 2 with its lower end resting on an abutment bracket A. The mounting member MM has a socket 41 in which there is a latch release LR. The latch release consists of an L-shaped strip of metal located in the socket and constrained to the position in Figure 2 by a spring 42 interposed between the short arm of the latch release and a plate 43. Whenever the relay coil RC is energized, the armature 16 will be attracted as in Figure 6 resulting in the latch release LR pushing the leaf spring L off the abutment A and into a slot 50 thereof so that the leaf springs 35 and 35a bearing down on the cross bar 40 of the armature 39 will move it toward the full line position illustrated in Figure 6. As the contacts 34 and 34a engage the contacts 32 and 32a, the latch release LR will enter a slot 51 of the latch L and the armature 39 will move further and finally assume the position of Figure 6 due to the right end thereof being the heaviest. The armature is then stopped in such final position by engaging the upper end of the abutment bracket A as shown.

Subsequently when the ignition trip coil ITC is energized it will attract the armature 39 and move it to the dotted position in Figure 6 resulting in relatching of the latch L on the abutment A. During this operation, the latch release LR will be lifted by the lower edge of the slot 51 to the dotted position illustrated and will subsequently drop to the position of Figure 2 when the relay coil is de-energized.

Practical operation

Referring to Figure 8, a burner and its ignition mechanism are illustrated diagrammatically. The motor of the burner is indicated at M and its ignition mechanism at Ign. A power circuit for the motor and the ignition mechanism is illustrated which includes the motor switch MS and the ignition switch IS. A transformer T is illustrated which provides low voltage current for a room thermostat RT and its circuit including the relay coil RC, the holding switch HS, the combustion switch CS and the safety switch SS and its heater SSH.

When the room thermostat closes, a circuit will be established through the relay coil RC including the following wires and elements (the wires being indicated by lower case letters): a, RT, b, SS, c, RC, d, e, SSH, f, the cold contacts of the combustion switch CS and g. This energizes the relay coil so that the motor switch is closed, thereby energizing the burner motor M. The armature 16 of the relay is indicated by dotted line and the armature is operable to release the latch L by causing the latch release LR to engage it and move it out of engagement with the abutment A. This results in the ignition switch IS being closed for furnishing current from the power circuit to the ignition mechanism Ign and also the ignition trip switch ITS being closed so that the ignition trip coil ITC can be subsequently energized.

Attraction of the armature 16 by energization of the relay coil also closes the holding switch HS. This results in two circuits being established for the purpose fully described in my Patent No. 2,080,580 of May 18, 1937. One of these circuits includes the following wires and elements: a, RT, b, SS, c, RC, d, h, HS, i, this circuit being supplied by the lower half of the secondary coil of the transformer T. The other circuit is supplied with current from the upper half of the transformer secondary and includes the following wires and elements: i, HS, h, e, SSH, f, cold contacts of the combustion switch CS and g.

When combustion is successfully established the hot contacts of the combustion switch will close and the cold ones will open. This discontinues the second circuit just mentioned and in place thereof establishes a third one including the following wires and elements: j, ITS, k, ITC, e, hot contacts of the combustion switch and g. Energization of the coil ITC opens the ignition switch IS and latches the latch L on the abutment A as shown by dotted lines in Figure 6. Also the ignition trip switch ITS is thereby opened so that current will not continue to be supplied to the ignition trip coil ITC. The momentum of the armature 39 in opening the ignition switch will carry the latch L to its latched position after the ignition trip coil is de-energized by opening of the ignition trip switch ITS.

According to description just made, ignition is discontinued by opening of the ignition switch as soon as combustion has been established sufficiently long enough to cause the heat of combustion to effect movement of the bi-metal coil 44 of the combustion switch CS and thereby rotate the rod 45 and the notched disk 46 to a position swinging the leaf spring 47 from cold to hot position.

When the room thermostat opens or power fails, thereby de-energizing the relay coil RC, the relay coil will not close the ignition switch, but the ignition switch will remain latched in open position by the latch L. This provides a safety feature which cannot be overlooked. In certain

types of stack switches the ignition switch is closed by de-energization of the relay coil which would result in a closed circuit indicated by the following wires and elements: from the motor M thru *m*, *n*, IS, *o*, IGN, *p*, and *r* back to the motor.

Accordingly as the motor coasts to a stop and acts as a generator it supplies current to the ignition mechanism which causes a spark in the furnace that ignites any gas remaining therein. By having the ignition switch remain latched in opened position, this circuit is open in my control apparatus, thus preventing any possibility of such ignition and any explosion which would result therefrom. When the relay coil is re-energized, however, the latch is promptly unlatched so that the ignition switch closes and current is then supplied through the motor switch and the ignition switch to the ignition mechanism until such time as the combustion switch moves to hot stack position.

The mounting member MM being mounted on the armature 16 so that it can be conveniently removed therefrom by the simple expedient of removing the single screw 19, makes it possible to remove the movable contacts 29 and 29a of the motor and holding switches as shown in Figure 7 so that they can be readily inspected and cleaned. Removal of these contacts exposes the stationary contacts 30 and 30a so that they can likewise be inspected and cleaned.

The particular mounting of the movable contact relative to the mounting member and thereby the armature 16 as shown in Figures 3 and 4 permits a double adjustment that takes care of manufacturing tolerances as well as the drop out voltage of the relay. The sleeve 22 being threaded in the bore 21 and the screw 24 being threaded in the sleeve 22 permits both adjustment of the head 24 relative to the armature 16 and adjustment of the tension of the spring 28. The screw 24 can be adjusted so that the final position of its head as determined by the armature 16 engaging the core 13 of the relay is either close to or relatively far away from the contact carrier 26. Accordingly the desired distance of travel of the armature toward open switch position may be adjusted so that the pick-up of the contact carrier occurs after the desired travel of the armature from closed switch toward open switch position. The tension of the spring 28 may be increased or decreased as desired. An increase thereof results in the spring exerting greater pressure to open the relay switch and thereby causes the relay to operate at a higher drop out voltage. Similarly a decrease in the spring tension will cause opening of the relay at a lower drop out voltage.

The foregoing adjustments of the sleeve 22 and the screw 24 may be made by the use of a forked screw driver cooperating with the slot 23 and an ordinary screw driver cooperating with a slot 25 of the sleeve 22 and screw 24 respectively. These adjustments are made at the factory after which a plug 25a may be inserted in the mounting member M over the open end of the bore 21 to seal the same against tampering with the adjustment thereafter.

Some changes may be made in the construction and arrangement of the parts of my burner control apparatus without, however, departing from the real spirit and purpose thereof. It is accordingly my intention to cover by my claims any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

I claim as my invention:

1. In burner control apparatus for a burner and its ignition mechanism, a relay to initiate and maintain operation of the burner, a room thermostat for causing energization of said relay, an ignition switch for the ignition mechanism, a latch for normally retaining said ignition switch open, a latch release operable by said relay when energized to release said latch and thereby permit said ignition switch to close and means operable upon combustion establishment to open said ignition switch and relatch said latch.

2. In burner control apparatus for a burner and its ignition mechanism, a relay to initiate and maintain operation of the burner, a room thermostat for energizing said relay, an ignition switch for the ignition mechanism, a latch, a latch means operable upon combustion establishment to open said ignition switch and latch said latch for normally retaining said ignition switch open, and means operable by said relay when energized to release said latch and thereby permit said ignition switch to close.

3. In burner control apparatus for a burner and its ignition mechanism, means to initiate and maintain operation of the burner, an ignition switch for the ignition mechanism, a latch for normally retaining said ignition switch open, a latch release operable by said first means when it initiates operation of the burner to release said latch and thereby permit said ignition switch to close and means operable upon combustion establishment to open said ignition switch and relatch said latch.

4. In burner control apparatus for a burner and its ignition mechanism, means to initiate and maintain operation of the burner, an ignition switch for the ignition mechanism, said ignition switch being biased to close, a latch for normally retaining said ignition switch open against its bias, a latch release operable by said first means when it initiates operation of the burner to release said latch and thereby permit said ignition switch to close and means operable prior to re-energization of said relay, to open said ignition switch and relatch said latch.

5. In burner control apparatus for a burner and its ignition mechanism, a relay to initiate and maintain operation of the burner, a room thermostat for causing energization of said relay, an ignition switch for the ignition mechanism, a latch for normally retaining said ignition switch open, a latch release operable by said relay when energized to release said latch and thereby permit said ignition switch to close, an ignition trip coil operable when energized to open said ignition switch and relatch said latch, a combustion switch operable upon combustion establishment to energize said ignition trip coil and an ignition trip switch in the circuit of said ignition trip coil and opened by energization of the ignition trip coil to discontinue the circuit therethrough after the ignition switch has been latched in open position.

6. In burner control apparatus for a burner and its ignition mechanism, a relay to initiate and maintain operation of the burner, an ignition switch for the ignition mechanism, a latch for normally retaining said ignition switch open, a means operable by said relay when energized to release said latch and thereby permit said ignition switch to close, an ignition trip coil operable when energized to open said ignition switch and relatch said latch and combustion responsive means to energize said ignition trip coil.

7. In burner control apparatus for a burner and its ignition mechanism, means to initiate and

maintain operation of the burner, an ignition switch for the ignition mechanism, a latch for normally retaining said ignition switch open, a latch release operable by said first means when it initiates burner operation, said latch release being thereby operable to release said latch to permit said ignition switch to close, an ignition trip coil operable when energized to open said ignition switch and relatch said latch and a combustion switch operable upon combustion establishment to energize said ignition trip coil.

8. In burner control apparatus for a burner and its ignition mechanism, a relay comprising a relay coil, an armature to be attracted thereby, an ignition switch biased to closed position, an ignition trip coil operable when energized to open said ignition switch, a latch movable by energization of said ignition trip coil to latched position for thereafter retaining said ignition switch open against its bias and a latch release carried by the armature of said relay and operable to release said latch when said relay coil is energized.

9. Control apparatus for a burner and its ignition mechanism comprising a relay coil, an armature to be attracted thereby, an ignition switch, means tending to retain it closed, an ignition trip coil, a second armature to be attracted thereby, said second armature being associated with said ignition switch to open it when said second armature is so attracted, a latch carried by said second armature and movable thereby to latched position upon energization of the ignition trip coil to retain the ignition switch in open position and a latch release carried by said first armature and operable to release said latch when said relay coil is subsequently energized.

10. In burner and ignition control apparatus, a relay coil, an armature to be attracted thereby, an ignition switch biased to close, an ignition

trip coil operable when energized to open said ignition switch, means movable by energization of said ignition trip coil to retain said ignition switch open and means movable by the armature of said relay when energized and operable to release said first means from its position retaining said ignition switch open and thereby permitting said ignition switch to close.

11. In burner and ignition control apparatus, a relay coil, an armature to be attracted thereby, an ignition switch, an ignition trip coil, a second armature to be attracted thereby, said second armature being connected with said ignition switch to open it when said second armature is attracted by energization of said ignition trip coil, a latch carried by said second armature and movable thereby to latched position upon energization of said ignition trip coil, said latch retaining said ignition switch in open position and a latch release carried by said first armature and operable to release said latch when said relay coil is subsequently energized.

12. In apparatus of the class described, a relay comprising a relay coil, an armature to be attracted thereby upon energization thereof, an ignition switch biased to close, an ignition trip coil, a second armature to be attracted thereby, said second armature being associated with said ignition switch to open it when said ignition trip coil is energized, a latch carried by said second armature, an abutment for said latch, said second armature, when said ignition trip is energized, moving said latch to a position engaging said abutment, said abutment and latch thereupon retaining said ignition switch in open position and a latch release carried by said first armature and operable to release said latch from said abutment when said relay coil is subsequently energized.

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