July 8, 1952 R. G. HUGHES 2,602,333

FURNACE DRAFT AUTOMATIC RELEASE

Filed May 10, 1949 2 SHEETS—SHEET 1

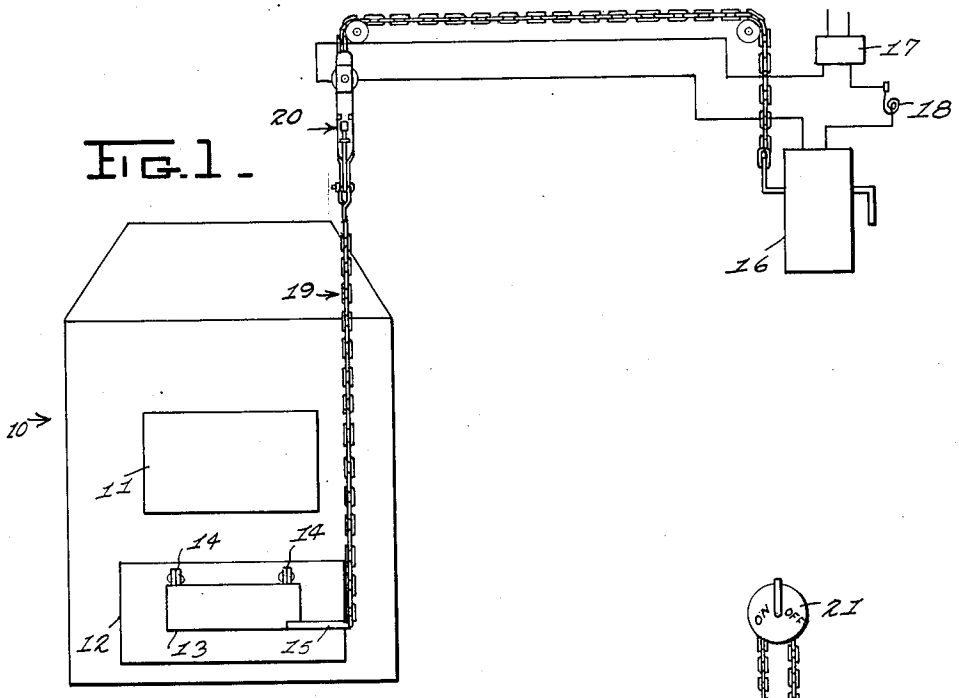


FIG. 1.

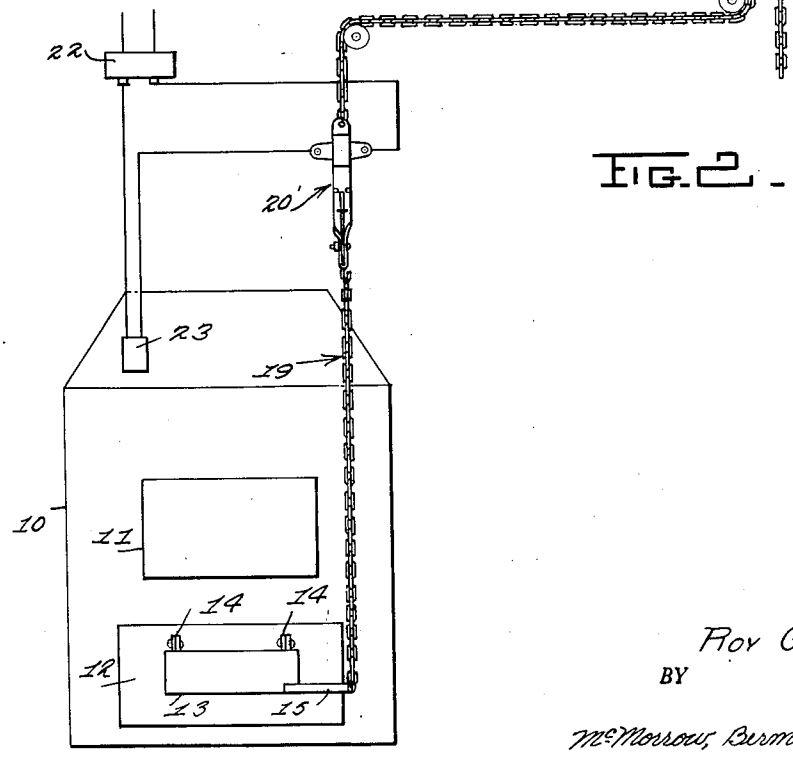


FIG. 2.

INVENTOR.
ROY G. HUGHES
BY
McMorrow, Berman & Davidson
ATTORNEYS

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FIG. 3

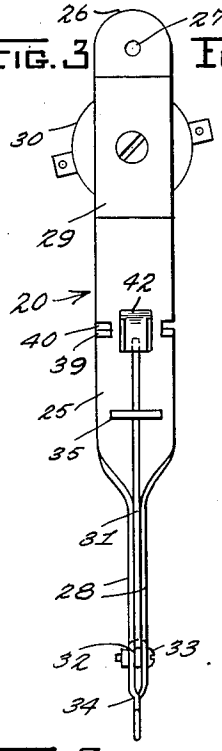


FIG. 4

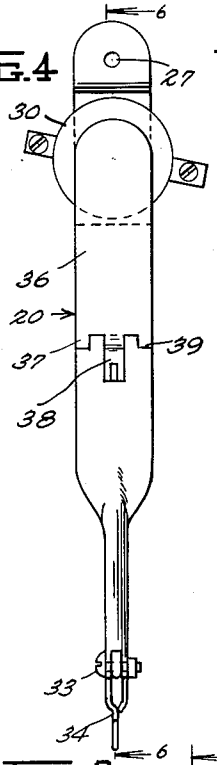


FIG. 5

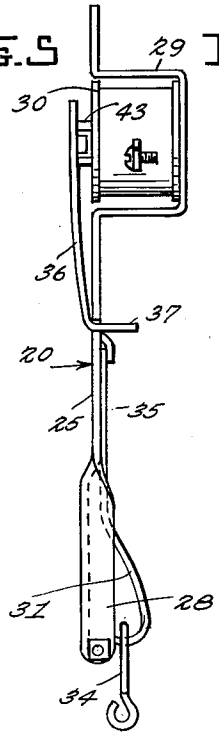


FIG. 6

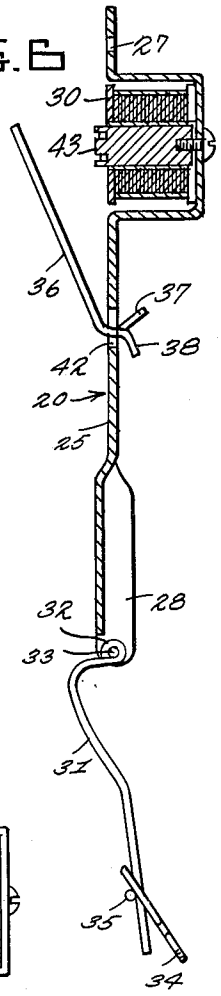


FIG. 7

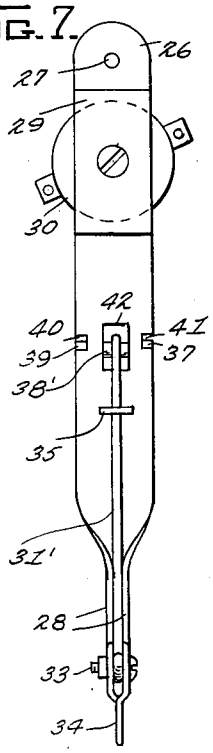


FIG. 8

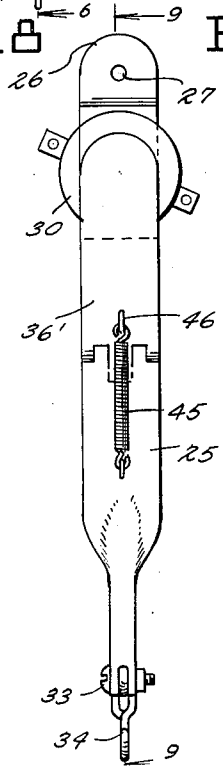
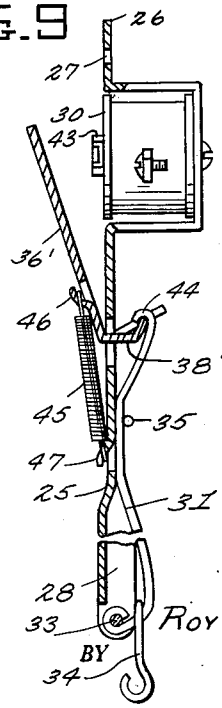


FIG. 9



INVENTOR.
ROY G. HUGHES
BY
McMorrow, Berman & Davidson
ATTORNEYS

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FURNACE DRAFT AUTOMATIC RELEASE

Roy G. Hughes, Warren, Ohio

Application May 10, 1949, Serial No. 92,439

2 Claims. (Cl. 74—2)

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This invention relates to an automatic release device, and more particularly to an electrically-operated, automatic release for a furnace draft.

It is among the objects of the invention to provide an improved automatic release device of small size and light weight which can be directly connected into a tension strand, such as a furnace draft-control chain or cable, which is automatically actuated upon failure of power to the draft-controlling motor or upon overheating of the furnace, to immediately release the chain or cable and permit the draft to close, which is simple and durable in construction and extremely economical to manufacture, so that it can be sold at a nominal cost either as standard equipment with new furnace-control systems, or as an accessory to be added to an existing system, and which is easy to install, requires to material modification of a control system in which it is incorporated, is not subject to malfunctioning in use, and provides a positive safety control for preventing furnace overheating, and for similar purposes.

Other objects and advantages will become apparent from a consideration of the following description and the appended claims in conjunction with the accompanying drawings, wherein:

Figure 1 is a diagrammatic illustration of a furnace-control system showing the application thereto of an automatic release illustrative of the invention;

Figure 2 is a diagrammatic view of a furnace-control system different from that illustrated in Figure 1, and showing the application thereto of an automatic draft release illustrative of the invention;

Figure 3 is a rear elevation of the automatic draft-release device of the invention;

Figure 4 is a front elevation of the draft-release device illustrated in Figure 3;

Figure 5 is a side elevation of the draft-release device shown in Figures 3 and 4;

Figure 6 is a longitudinal cross-section on the line 6—6 of Figure 4;

Figure 7 is a rear elevation of a somewhat modified form of automatic release device;

Figure 8 is a front elevation of the device illustrated in Figure 7;

Figure 9 is a longitudinal cross-section on the line 9—9 of Figure 8.

With continued reference to the drawings, and particularly to Figures 1 and 2, the numeral 10 generally indicates a furnace cover or housing having therein a fuel-receiving door 11 and an ash pit or clean-out door 12 provided with a draft opening therein controlled by a draft door

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13 pivotally connected at its upper edge to the clean-out door 12 by suitable hinges 14. The draft door 13 has an arm 15 projecting from one end thereof at its lower edge for opening and closing the draft door.

As the furnace may be of entirely conventional construction, a further description is considered unnecessary for the purposes of the present disclosure. Opening of the draft door 15 will permit a draft of air into the furnace under the furnace grates to promote the combustion of fuel in the furnace, and closing of the draft door will cut off this flow of air retarding combustion of fuel in the furnace and causing the furnace to cool. The amount of heat supplied by the furnace may thus be controlled by variably opening the draft door 13, the furnace generating its maximum heat output when the draft door is side open and generating a minimum amount of heat when the draft door is fully closed.

In the arrangement shown in Figure 1, the draft-regulating door 13 is controlled by a conventional draft-regulating, electric motor 16 operated from a step-down transformer 17 under the control of a room thermostat 18.

This system operates entirely satisfactorily as long as there is no interruption to the electric power supplied to the motor 16 through the transformer 17 and thermostat 18. If the power should accidentally fail, however, while the furnace is in operation, the motor 16 may stop in a position in which the draft-regulating door 13 is left open. With this door open, the furnace will continue to heat and frequently under these conditions, the furnace reaches such a high temperature as to damage the furnace, or cause a fire in the building in which the furnace is installed. The motor 16 is connected to the draft-regulating door 13 through the intermediacy of a flexible strand, such as the chain generally indicated at 19, and to avoid the contingency of the furnace overheating in the event of power failure to the motor 16, the present invention contemplates the interposition of the automatic release device, generally indicated at 20, in the chain 19 to release the tension on the chain and permit the draft-regulating door to close upon failure of the supply of power to the furnace draft-regulating system.

In the arrangement shown in Figure 2, the furnace is provided with a manually-operated draft control. In this case, the chain 19 is led over suitable pulleys to a manually-rotatable drum 21 by means of which the draft-regulating door 13 may be opened and closed from a con-

venient position in the house above the location at which the furnace is installed. With such a manually-operated control the draft regulation may be forgotten and the draft-regulating door left open, particularly during the absence of the occupants from the house, in which case the furnace may seriously overheat, damaging the furnace, or even causing a fire in the building. The invention contemplates the interconnection of an automatic release device, generally indicated at 20', in the chain 19 to obviate such a contingency. The device 20' is substantially the same as the device 20, but operates in a slightly different manner because of the lack of a normal supply of electric current to the draft-regulating system, no current supply being necessary in the case of the manually-operated control system.

In the arrangement illustrated in Figure 2, a step-down transformer 22 is provided, and one end of the low-voltage side of this transformer is connected to one side of a temperature-responsive switch 23 mounted on the furnace 10. The opposite side of the switch is connected to one side of the automatic release device 20', and the other side of this device is connected to the other end of the low-voltage side of the transformer, so that, when the temperature of the furnace exceeds a predetermined value and the temperature-responsive switch 23 closes, the device 20' will be actuated to lengthen the chain 19 sufficiently to close the draft-regulating door 13.

Obviously, this device could be operated just as well by having the switch 23 normally closed and arranged to open when the furnace temperature reaches a predetermined degree, thereby interrupting the supply of electrical energy to the device 20, and thus causing the device to operate and lengthen the chain to close the furnace draft-regulating door.

The automatic release device generally designated at 20 in Figure 1 is illustrated in detail in Figures 3 to 6, inclusive, to which reference may now be had for a detailed description of the device.

The device 20 comprises an elongated, metal plate or strap 25 provided with an arcuately-rounded end 26 and an aperture 27 near such rounded end to receive one end of the chain 19, or other flexible strand, into which the device is connected. Near its opposite end the plate 25 is folded along its longitudinal center line to provide a pair of spaced-apart, substantially parallel ears 28, which ears are provided with registering apertures near the corresponding end of the plate.

Near the rounded end 26, the plate is provided with a U-shaped bend 29 forming a magnet-receiving recess and an electromagnet 30 is positioned in this recess and secured at one end to the bight of the U-shaped bend 29, the opposite end of the magnet being substantially flush with the portions of the plate at opposite sides of the bend.

The magnet 30 is of conventional construction, and of low-voltage requirements, and is electrically connected with the transformer 17 of Figure 1, or the transformer 22 of Figure 2 in a manner to be energized by the current output of the particular transformer.

A lever 31 in the form of an elongated, bent wire having an eye 32 at one end is pivotally connected to the plate 25 by means of a suitable pivot pin or bolt 33 extending through the apertures in the lugs 28 and through the eye 32 of the lever. This lever is swingable between a position in which it is superposed relative to the plate 25 and a position at which it extends outwardly from the end of the plate to which it is pivotally connected.

A link 34 is slidably mounted on the lever 31 for connection to an end of the chain 19 opposite the end connected to the plate 25 by the aperture 27.

When the lever is held to its position superposed upon the plate 25, as illustrated in Figures 3, 4 and 5, the chain 19 is of normal length and held under tension, but when the lever is released and swings to the position illustrated in Figure 6, the chain is lengthened sufficiently to permit the draft-regulating door of the furnace to close. A ring stop 35 is secured on the lever near the free end of the latter to limit movement of the ring outwardly of the lever when the lever swings to its position extending outwardly from the end of plate 25 to which it is pivotally connected, as illustrated in Figure 6. This stop 35 may conveniently comprise a cross-pin welded or otherwise suitably secured substantially at its mid-length location to the lever 31 adjacent the free end of the latter.

A trigger 36 is pivotally connected near one end to the plate 25 intermediate the length of the latter for cooperation with the electromagnet 30 to releasably hold the lever 31 in position superposed on the plate 25. This trigger 36 comprises a flat plate notched at one end to provide three spaced-apart tines 37, 38 and 39. The two outside tines 37 and 39 are bent substantially at right angles to the remainder of the trigger plate and are pivotally received in respective notches 40 and 41 provided in the side edges of the plate 25 to pivotally mount the trigger on the plate. The metal tine or tongue 38 is bent first substantially to the direction of the outside tines 37 and 39 and is then re-curved to extend substantially parallel to the major portion of the trigger plate. This tongue extends through a rectangular aperture 42 provided in the plate 25 between the notches 40 and 41 and is so positioned that its outer end overlies the adjacent end of the lever 31, as clearly illustrated in Figure 5, when the trigger plate is in contact near its end opposite the tines with the core 43 of the electromagnet.

With this arrangement, as long as the electromagnet 30 is energized and holds the trigger member 36 against its core, as illustrated in Figure 5, the lever 31 will be locked in position superposed relative to the plate 25, and the length of the chain 19 will be maintained at a value to operate the draft-regulating door 13.

In the event of power failure to the electromagnet 30, the trigger 36 is released to swing downwardly by gravity, from the position illustrated in Figure 5 to the position illustrated in Figure 6, thereby releasing the free end of the lever 31 so that the lever can swing away from the plate 25 to lengthen the chain 19 in the manner described above.

In the arrangement illustrated in Figures 7, 8 and 9, the construction is the same as that illustrated in Figures 3 to 6, inclusive, and described above, except that in the form illustrated in Figures 7, 8 and 9, a slightly modified lever 31' and a slightly modified trigger 36' are used so that the device will trip when the solenoid 30 is energized rather than when the solenoid is de-energized, as described above in connection with Figures 3 to 6, inclusive.

In this arrangement the lever 31' is provided on its free end with a re-curved hook 44 and the metal tine or tongue 38' of the trigger is

curved near its outer end in a direction toward instead of away from the major portion of the trigger, so that the outer end of this tongue engages in the hook 44 to latch the lever 31' in position superposed relative to the plate 25 when the trigger is disposed at its maximum distance away from the core 43 of the solenoid. When the solenoid is energized and attracts the free end of the trigger, the tongue 38' is released from the hook 44 of the lever 31' to free the lever so that the lever will swing downwardly to a position in which it extends outwardly from the end of the plate 25 to which it is pivotally connected, thereby lengthening the chain 19 to close the draft-regulating door of the furnace.

If desired, a tension spring 45 may be connected at one end to a tongue 46 struck out from the trigger 36', and at its opposite end to a tongue 47 struck out from the plate 25 to assist the force of gravity in holding the trigger 36' away from the core of the electromagnet 30.

As explained above, the form of the device shown in Figures 3 to 6, inclusive, may be used in either of the arrangements shown in Figures 1 and 2, provided that in the arrangement shown in Figure 2, the switch 23 remains closed during normal operation and opens only in response to furnace temperature above a predetermined value. The slightly modified form of device shown in Figures 7, 8 and 9 is designed to save electrical energy in that it operates with the switch 23 normally open and closing upon being subjected to furnace temperature above the predetermined value.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are, therefore, intended to be embraced therein.

I claim:

1. An automatic release device comprising an elongated, flat plate having near one end an aperture for attaching one end of a tension strand thereto, an electromagnet carried by said plate adjacent said one end, said plate having at its opposite end a formation providing a pair of spaced-apart, apertured ears, a lever pivotally connected at one end to said ears, a ring slidable on said lever for attaching an end of a tension strand to the latter, and a trigger pivotally mounted near one end on said plate intermediate the length of the latter and engageable with the free end of said lever to releasably hold the latter in superposed relationship to said plate, said

trigger being movable in response to a change in the energization of said electromagnet to release said lever for swinging movement to a position in which it extends outwardly from the end of said plate to which it is pivotally connected, to thereby increase the length of a strand connected to said plate and said ring, said lever comprising an elongated member having a pivot-pin-receiving eye at its end pivotally connected to said ears, and said trigger comprising an elongated plate structure having on its end pivoted to said plate a tongue engageable with the free end of said lever, said lever and said trigger being disposed at respectively opposite sides of said plate and said plate having an aperture for the projection of said trigger tongue therethrough to engage said lever.

2. An automatic release device comprising an elongated flat plate having near one end an aperture for attaching one end of a tension strand thereto, an electromagnet carried by said plate adjacent said one end, said plate having at its opposite end a formation for the pivotal attachment of a lever to said plate, a lever pivotally connected to one end to said formation, a ring slidable on said lever for attaching an end of a tension strand to the latter, and a trigger pivotally mounted near one end on said plate intermediate the length of the latter and engageable with the free end of said lever to releasably hold the latter in superposed relationship to said plate as long as said electromagnet is energized, said trigger being movable in response to de-energization of said electromagnet to release said lever for swinging movement to a position in which it extends outwardly from the end of said plate to which it is pivotally connected to thereby increase the length of a strand connected to said plate and said ring, said lever comprising an elongated member pivotally connected at one end to said formation and said trigger comprising an elongated plate structure having on its end pivoted to said plate a tongue engageable with the free end of said lever, said lever and said trigger being disposed at respectively opposite sides of said plate and said plate having an aperture for the projection of said trigger tongue therethrough to engage said lever, and a ring stop on said lever near the free end of the latter.

ROY G. HUGHES.

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The following references are of record in the file of this patent:

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