

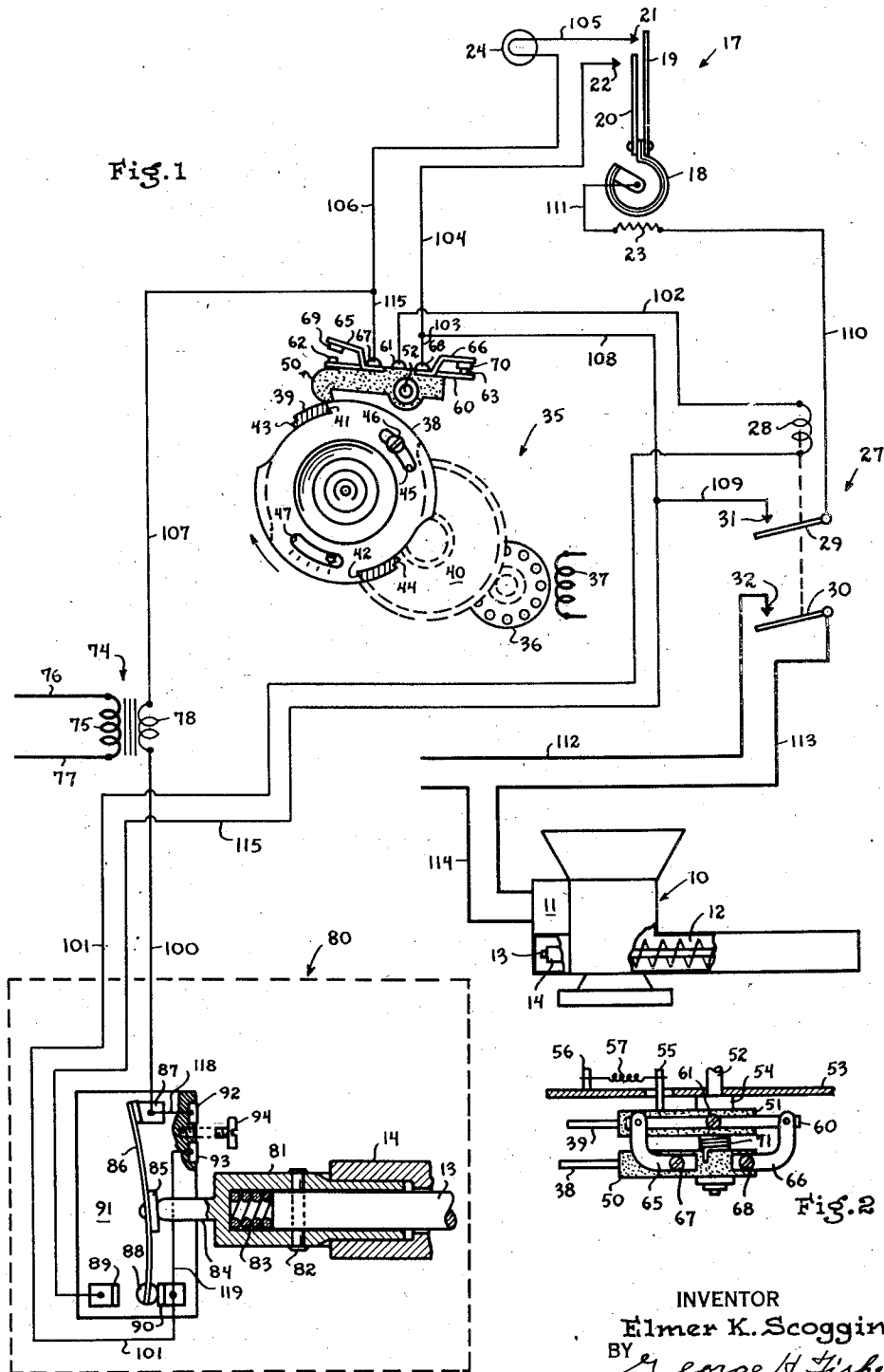
May 19, 1942.

E. K. SCOGGIN

2,283,467

STOKER ALARM SYSTEM

Filed May 3, 1940



INVENTOR
Elmer K. Scoggin
BY *George A. Fisher*
ATTORNEY

UNITED STATES PATENT OFFICE

2,233,467

STOKER ALARM SYSTEM

Elmer K. Scoggin, Minneapolis, Minn., assignor to
Minneapolis-Honeywell Regulator Company,
Minneapolis, Minn., a corporation of Delaware

Application May 3, 1940, Serial No. 333,147

10 Claims. (Cl. 236—1)

My invention relates to an improved control and alarm system for automatic stokers employing a shear pin or equivalent device in the driving connections between the stoker and driving motor which disconnects the motor from the stoker when the stoker feed mechanism becomes jammed or otherwise obstructed so that its normal operation is prevented.

The object of my invention is to provide an improved arrangement for immediately stopping the stoker motor in the event it becomes overloaded and for providing a signal to indicate that the stoker has stopped.

Another object is to provide an alarm device for thermostatically controlled stokers employing a shear pin or the like wherein the alarm circuit includes part of the thermostat circuit and is effective when the shear pin fails.

Another object is to control the alarm circuit from the thermostat.

Other objects and advantages of the invention will become apparent from the following detailed description and annexed drawing, Figure 1 of which represents diagrammatically an automatic stoker system embodying my invention, and Figure 2 of which is a plan view of a detail portion of the control mechanism.

Referring to the drawing, numeral 10 designates generally a stoker which may be of a well known type, the stoker being driven by an electric motor having a terminal box 11. The stoker feed mechanism comprises a screw conveyor 12 having a shaft 13. The stoker motor drives the shaft 13 by means of a drive collar 14 which is connected to the shaft 13 in a manner which will be pointed out more in detail presently.

The stoker is controlled primarily from a thermostat 17 disposed in a space being heated by means of a furnace or the like to which fuel is fed by the stoker. The thermostat 17 comprises a bimetal element 18 to which are attached a pair of resilient blades 19 and 20 cooperating with fixed electrical contacts 21 and 22, respectively. The thermostat 17 is of a known type wherein the blade 19 engages its associated contact at a predetermined temperature and the blade 20 engages its associated contact at a predetermined temperature which may be 1° or 2° lower, for example. The thermostat 17 is of a heat actuated type including a heating element 23 which is energized after both blades have engaged their associated contacts and the blade 20 has disengaged from its associated contact as will be described more in detail presently.

Numeral 24 designates an incandescent lamp

connected in circuit with an electric wire leading to the thermostat 17.

The thermostat 17 controls a relay generally designated at 27, the relay comprising the usual winding 28 adapted to actuate an armature connected to movable switch blades 29 and 30, the blades 29 and 30 moving into engagement with fixed electrical contacts 31 and 32, respectively, when the winding 28 is energized.

The relay 27 which controls the stoker motor may also be controlled by a timing mechanism generally designated at 35. The timing mechanism is driven by an electric timing motor having an armature 36 and a winding 37. The motor drives a pair of spaced cams 38 and 39 concentrically mounted on a shaft which is driven at a relatively low speed through a gear train 40. The cams 38 and 39 are frictionally mounted on their shaft so that they may be rotated on the shaft and relatively to each other. The cam 38 is generally circular, having two diametrically opposed abrupt drop offs 41 and 42, there being a cam portion adjacent each of the drop offs of slightly smaller radius than the remaining portions of the cam. The cam 39 has a very similar shape, being generally circular but having diametrically opposed abrupt drop offs 43 and 44, these drop offs having an intermediate shoulder so as to form two small closely spaced drop offs. Adjacent the drop offs 43 and 44 of cam 39 the cam has portions of slightly smaller radius than the remaining portions of the cam, the shape of the cam being generally similar as mentioned above to the cam 38. The cam 38 has an arcuate slot 45, and an adjustable screw 46 extends through this slot and engages with the cam 39, the screw acting to firmly hold the cams in their relative positions when it is tightened. The cam 38 has a second arcuate slot 47 having graduations adjacent thereto, and there is a pointer attached to the cam 39, the end of which is positioned in the slot 47 adjacent to the graduations. The purpose of the pointer and graduations is to provide an index or indication of the relative positions of the cams.

Numerals 50 and 51 (see Figure 2) designate a pair of cam followers for the cams 38 and 39, respectively, the cam followers being mounted on a shaft or arbor 52 which may be carried by a panel member 53. The cam followers are made of suitable composition material, each having an end suitably formed to engage its respective cam as shown. The cam follower 51 is spaced from the panel 53 by a collar 54 and carries a pin 55 extending through an opening

in the panel 53, the pin 55 being connected to a fixed pin 56 on the panel 53 by a coil spring 57, the coil spring 57 urging the cam follower 51 in a counter-clockwise direction about the arbor 52 against the cam 39. Fastened to the cam follower 51 is a metal contact strip 60 attached to the cam follower by means of a screw 61. The contact strip 60 carries contacts 62 and 63 at its opposite ends. Attached to the cam follower 50 are contact brackets 65 and 66, the bracket 65 being attached by a screw 67 and the bracket 66 being attached by a screw 68. The bracket 65 carries a contact 69 at its end and it is so shaped that this contact is adjacent to and engageable with the contact 62. The bracket 67 carries a contact 70 at its end and it is so shaped that the contact 70 is adjacent to and engageable with the contact 60. Encircling the arbor 52 between the cam followers 50 and 51 is a coil spring 71 one end of which engages the cam follower 50 urging it in a counter-clockwise direction about the arbor 52. When both the cam followers are engaging the portions of their respective cams of larger diameter they are in their relative positions as shown in Figure 1. In this position as shown, the contacts 63 and 70 are in engagement and the contacts 62 and 69 are separated. As will be apparent from Figures 1 and 2 if the cam follower 50 were rotated in a counter-clockwise direction relative to the cam follower 51 the contacts 63 and 70 would be separated and the contacts 62 and 69 could be brought into engagement. The operation of the contacting mechanism will be described more in detail hereinafter.

Power for operation of the relay is supplied by a transformer generally designated at 74, the transformer comprising a primary winding 75 to which power is supplied from any suitable source by wires 76 and 77. The transformer also includes a secondary winding 78 having a fewer number of turns than the primary winding.

Numeral 80 designates the mechanism enclosed within the broken lines, this mechanism representing the details of the mechanical connection between the stoker driving motor and the shaft 13 previously referred to. As will now be described this connection embodies a shear pin and a switch device operable in response to failure of the shear pin. It will be noted that the drive collar 14 which is driven by the stoker motor is counter-bored, and splined into the counter-bore is a cap member 81, the end of the shaft 13 being received within the cap member 81. The end of the shaft 13 has a transverse opening coaxial with corresponding openings in the cap 81, and received in these openings is a shear pin 82. Obviously the drive collar 14 drives the cap 81 by reason of the splined engagement therewith and the cap 81 drives the shaft 13 through the shear pin 82. The shear pin 82 is of such size and is made of a material having such a strength that when the shaft 13 meets a given resistance to rotation the shear pin 82 will shear so as to disconnect the drive collar 14 from the shaft 13 in order to prevent an undue load from being imposed upon the driving motor. Numeral 83 designates a coiled compression spring disposed within the cap 81, one end of the spring bearing on the shaft 13 so that the spring tends to urge the cap 81 away from the end of the shaft 13. On the left end of the cap 81 is a finger or prong 84 which bears against a plate 85 on a resilient snap acting switch arm 86. The switch arm 86 has one end

secured to an electrical terminal 87 and at its other end carries a contact member 88 movable with a snap action between two electrical contacts 89 and 90 carried on suitable electrical terminals. Normally when the shear pin has not sheared the parts are in the position as shown with the contact 88 in engagement with the contact 90. The various terminals of the switching mechanism just described are mounted on a suitable panel 91 and this panel has a pair of adjacent terminal members 92 and 93 which may be bridged by a screw 94 insertible between the terminal members 92 and 93.

From the foregoing description of the mechanism 80 it will be understood that when the shear pin 82 shears, for example as a result of a rock or the like getting into the stoker feeding mechanism and obstructing the rotation of the screw 12, the coil spring 83 will urge the cap 81 to the left whereby the finger 84 acting against the switch blade 86 will cause it to bow to the left moving contact member 88 away from contact 90 and into engagement with contact 89 with a snap action. When the shear pin shears there is of course no further rotation of the shaft 13.

In normal operation of the system the relay 27 is energized in response to the thermostat 17 when the temperature has fallen to a predetermined value causing the blades 19 and 20 to engage their respective contacts. The circuit so formed for the relay winding 28 is as follows: from secondary 78 of the transformer 74 through a wire 100, terminal 87, switch blade 86, contact 88, contact 90, wire 101, relay winding 28, wire 102, screw 61, contact strip 60, contact 63, contact 70, contact bracket 66, screw 68, wire 103, wire 104, contact 22, blade 20 of the thermostat, blade 19, contact 21, wire 105, lamp 24, wire 106, and wire 107 back to the secondary 78. (It will be understood at this time the timing mechanism 35 is in a position as shown in Figure 1). Upon energization of the relay 27 the blades 29 and 30 are moved into engagement with their respective contacts, engagement of blade 29 with contact 31 completing a maintaining circuit for the relay winding 28 which is independent of the contact 22 as follows: from secondary 78 through wire 100, terminal 87, switch blade 86, contact 88, contact 90, wire 101, winding 28, wire 102, screw 61, contact strip 60, contact 63, contact 70, contact bracket 66, screw 68, wire 103, wire 108, wire 109, contact 31, switch blade 29, wire 110, heating element 23, wire 111, thermostatic element 18, blade 19, contact 21, wire 105, the lamp 24, wire 106 and wire 107 back to the secondary 78. As is apparent both of the circuits described above include the lamp 24 and the relay winding 28 in series. The current which these circuits carry is sufficient to energize the relay 27 but is only sufficient to make the lamp 24 glow very dimly. As long as the blade 20 engages the contact 22 there is no current in the maintaining circuit just described inasmuch as this circuit is shunted by the one through the blade 20 and contact 22 and thus there is no current flowing through the heating element 23 until the maintaining circuit becomes effective when blade 20 disengages from contact 22.

When switch blade 30 engages contact 32 a circuit is completed for the stoker motor as follows: from wire 112 to contact 32, blade 30, wire 113, terminal box 11 to wire 114, the wires 112 and 114 being connected to any suitable source

of power. When the stoker motor has been energized as just described, operation of the stoking mechanism commences and it continues as long as the relay 27 is energized or until the shear pin of the shear pin mechanism fails. When the temperature in the space being heated rises to a high enough value to move blade 20 away from the contact 22 the current for maintaining the relay 27 energized passes through the maintaining circuit as above described whereby the heating element 23 is energized and it then emits a small amount of heat to affect the thermostat 17. This small amount of heat raises the temperature surrounding the thermostat 17 slightly so that the blade 19 separates from the contact 21 slightly sooner than it would if the thermostat 17 were subjected only to room or space temperature. Whenever the blade 19 disengages from contact 21 the maintaining circuit is interrupted and the relay 27 is deenergized to stop the stoker.

The cams 38 and 39 are rotated in a clockwise direction so as to complete one revolution per hour, for example, and the relay 27 may be energized in response to the timing mechanism at periodic intervals, for example, half-hourly intervals, for purposes of operating the stoker to maintain the fire alive. With the parts of the timing mechanism in the position shown the cam follower is just about to drop off the drop off 4 of cam 38. When the drop off 41 permits the left end of cam follower 50 to drop and thereby move in a counter-clockwise direction the contacts 63 and 70 are immediately separated and the contacts 62 and 69 are brought into engagement, the cam follower 51 remaining in the same angular position. When the contacts 62 and 69 are brought into engagement a circuit for the relay winding 28 is completed as follows: from secondary 78 through wire 100, terminal 37, switch blade 86, contact 88, contact 90, wire 101, winding 28, wire 102, screw 61, contact strip 60, contact 62, contact 69, contact bracket 65, screw 61, wire 115, and wire 107 back to secondary 78. Upon energization of the relay 27 the stoker will be operated for a short interval of a few minutes, for example 5 or 6 minutes depending upon the angular spacing of drop offs 41 and 43 upon the cams 38 and 39, the angular spacing of the drop offs corresponding to the number of minutes indicated by the pointer adjacent the graduations on cam 38. When the cams have rotated until the cam follower 51 drops on to the intermediate drop off 43, the cam follower 51 will be rotated slightly in a counter-clockwise direction so that contacts 62 and 69 will be separated but contacts 63 and 70 will not be brought into engagement inasmuch as the cam followers, as is apparent from Figure 1, must be in engagement with portions of their respective cams of the same radius in order for contacts 63 and 70 to be in engagement. When the contacts 62 and 69 are separated as just described the circuit for the winding of relay 27 is interrupted and operation of the stoker is stopped. After a further slight rotation of the cams the cam follower 51 drops off the second portion of the drop off 43 whereby it rotates slightly in a counter-clockwise direction so as to bring the contacts 63 and 70 into engagement. From the foregoing it will be understood that for a brief interval when the cam follower 51 has dropped on to the intermediate shoulder of drop off 43, both pairs of contacts actuated by the timing mechanism are separated. The

purpose of this sequence of operation of the contacts is to prevent the relay 27 being maintained energized by the maintaining circuit previously described when the relay has been energized by the timing mechanism, that is, after the relay has been energized by the timing mechanism blade 19 of the thermostat may engage the contact 21 and when the relay is to be deenergized by the timing mechanism if the contacts 63 and 70 are not separated at least momentarily the relay 27 will remain energized through the maintaining circuit as above described. The purpose of separating the contacts 63 and 70 is to interrupt the maintaining circuit at the end of each firing interval controlled by the timed mechanism.

With the parts in the position shown the screw 94 is not in place. If the shear pin 82 should now shear during operation of the stoker the contact 88 will be moved away from contact 90 and into engagement with contact 89. Movement of contact 89 away from contact 90 will interrupt the above described relay circuits causing the relay to be deenergized stopping the stoker motor. The stoker itself will of course stop as soon as the shear pin shears. Engagement of contact 88 with contact 89 will complete a circuit connecting the thermostat 17 directly across the secondary 78 of the transformer through the lamp 24, this circuit being as follows: from secondary 78 through wire 100, terminal 37, switch blade 86, contact 88, contact 89, wire 115, wire 109, wire 104, contact 22, thermostat blades 20 and 19, contact 21, wire 105, lamp 24, wire 106, and wire 107 back to secondary 78. This circuit obviously does not include the relay winding and therefore due to the reduced amount of resistance in it, it carries a greater amount of current and the lamp 24 will now glow brightly and will act as a signal indicating that the shear pin has sheared and that the stoker has stopped. The lamp 24 is located relatively close to the thermostat 17 and when the last mentioned circuit is completed causing the lamp to glow brightly, the lamp will give off a considerable amount of heat causing the thermostatic blades to be moved away from their respective contacts. As soon as blade 20 moves away from contact 22 the last described lamp circuit will be interrupted deenergizing the lamp. The thermostat will then have an opportunity to cool again causing the blade 20 to re-engage the contact 22 and in this manner the lamp 24 will be intermittently energized so as to glow brightly at intervals or in other words, provide a flasher type of signal indicating that the stoker has been stopped due to shear pin failure.

If desired, the lamp 24 may be connected in wire 104 leading to the contact 22.

Under some circumstances it may not be necessary to completely interrupt the circuit of the relay winding when it is desired to stop the stoker motor in the event of shear pin failure. That is, the relay winding 28 may be merely shunted so as to reduce the amount of current flowing therethrough to such a low value that it will not be energized. In order to shunt the relay winding in this manner a single pole single throw switch actuated by the shear pin may be used thus eliminating the use of contact 90. To produce such an arrangement the screw 94 may be inserted in place bridging the terminal members 92 and 93 so that the above described circuits for the relay which pass through the switch member 86 and contact 90 would by-pass the

switch through the wire 118, terminal member 82, screw 94, terminal 93 and wire 119 to wire 101. Thus upon movement of the switch blade to the left bringing contact 88 into engagement with contact 89, the relay circuit through relay winding 28 would not be interrupted but the winding 28 would be shunted by the above described circuit for the lamp 24.

From the foregoing those skilled in the art will appreciate that I have provided a very efficient and economical arrangement for stopping a stoker in the event of the stoker mechanism placing an overload upon the driving motor, and for providing a signal to indicate that the stoker has been stopped. The signal which I employ is located near the thermostat where it will be visible to the occupants of the space being heated and inasmuch as it is connected in the control wiring of the thermostat no additional wiring is required for the signal. By reason of my particular arrangement the signal is of the intermittent flashing type making it more noticeable, the intermittent action being produced by the thermostat itself rather than by additional mechanism.

The embodiments of my invention which I have disclosed are exemplary forms and while they are preferred forms which the invention may take, other forms and various modifications may be made in it. The invention is therefore not to be limited by the disclosure which is illustrative but only in accordance with the appended claims.

I claim as my invention:

1. In apparatus of the character described, in combination, an automatic stoker having fuel feed mechanism and motor driving means therefor, a thermostat for controlling the stoker having a control circuit connected thereto, a signal device included in said circuit, said circuit normally carrying insufficient current to properly operate the signal device, means responsive to excessive load on the motor driving means for stopping the fuel feed mechanism, said last means including a switch actuable thereby for connecting said circuit directly to a power source whereby said signal device carries sufficient current to properly operate it.

2. In apparatus of the character described, in combination, an automatic stoker having fuel feed mechanism and motor driving means therefor, a thermostat for controlling the stoker having a control circuit connected thereto, a relay controlled by said circuit controlling said motor driving means, a signal device included in said circuit, said device being in series with the winding of said relay when the circuit is completed, said circuit normally carrying insufficient current to properly operate the signal device, means responsive to excessive load on the motor driving means for stopping the fuel feed mechanism, said last means including a switch actuable thereby for shorting said relay winding whereby said signal device carries sufficient current to properly operate it and the relay is deenergized to stop the driving means.

3. In apparatus of the character described, in combination, an automatic stoker having fuel feed mechanism and motor driving means therefor, a thermostat for controlling the stoker having a control circuit connected thereto, a relay controlled by said circuit controlling said motor driving means, a signal device included in said circuit, said device being in series with the winding of said relay when the circuit is completed,

said circuit normally carrying insufficient current to properly operate the signal device, means responsive to excessive load on the motor driving means for stopping the fuel feed mechanism, said last means including mechanism actuable thereby for interrupting the passage of current through the relay winding and by-passing the winding whereby the circuit through said signal device carries sufficient current to operate it.

4. In apparatus of the character described, in combination, an automatic stoker having fuel feed mechanism and motor driving means therefor, control means for the stoker comprising a thermostat located remotely from the stoker and having a control circuit connected thereto, a normally closed switch in said circuit, and a signal device included in said circuit, said circuit normally carrying insufficient current to properly operate said signal device, means responsive to excessive load on the motor driving means for opening said switch to stop the stoker, and a normally open switch operable to closed position by said load responsive means, means forming a circuit controlled by said normally open switch connecting said signal device directly across a power source whereby said signal device carries sufficient current to properly operate it.

5. In apparatus of the character described, in combination, an automatic stoker having fuel feed mechanism and motor driving means therefor, a thermostat for controlling the driving means having control wires connected thereto, a signal device adjacent the thermostat, means responsive to excessive load on the driving means for stopping the fuel feed mechanism, and a switch operable by said load responsive means for completing a circuit to said signal device, said circuit including a portion of at least one of said control wires connected to the thermostat and extending through the thermostat, and said device being arranged to influence the thermostat to open said circuit to deenergize the device, the thermostat then acting normally to reclose the circuit whereby the device is intermittently energized and deenergized.

6. In apparatus of the character described, in combination, an automatic stoker having fuel feed mechanism and motor driving means therefor, a thermostat having switch contacts for controlling the driving means, said thermostat having control wiring connected thereto, a signal device adjacent the thermostat, means responsive to excessive load on the driving means for stopping the fuel feed mechanism, and a switch operable by said load responsive means for completing a circuit to said signal device, said circuit including portions of said wiring and said switch contacts, said signal device emitting heat when energized for influencing the thermostat to open said contacts to deenergize the device, said thermostat then acting normally to reclose the contacts whereby the device is intermittently energized and deenergized.

7. In apparatus of the character described, in combination, an automatic stoker having fuel feed mechanism and motor driving means therefor, control means for the stoker comprising a thermostat for controlling the driving means having control wiring connected thereto, a relay controlled by the thermostat, a signal device adjacent the thermostat, means responsive to excessive load on the motor driving means for stopping the stoker comprising a normally closed switch in the circuit of the winding of said relay, and a normally open switch operable to closed

position by said load responsive means for completing a circuit to said signal device, said circuit including portions of said control wiring connected to the thermostat and extending through the thermostat, said device being arranged to influence the thermostat when energized to open the circuit to deenergize the device, the thermostat then acting normally to reclose the circuit whereby the device is intermittently energized and deenergized.

8. In apparatus of the character described, in combination, an automatic stoker having fuel feed mechanism and motor driving means therefor, a thermostat for controlling the stoker having a control circuit connected thereto, a signal device included in said circuit near the thermostat, said circuit normally carrying insufficient current to properly operate the signal device, means responsive to excessive load on the motor driving means for stopping the fuel feed mechanism, said last means including a switch actuatable thereby for connecting said circuit directly to a power source whereby said signal device carries sufficient current to properly operate it, said device emitting heat influencing the thermostat to open the circuit through the device whereby the thermostat then acts normally to reclose the circuit and thereby intermittently energizing and deenergizing the device.

9. In apparatus of the character described, in combination, an automatic stoker having fuel feed mechanism and motor driving means therefor, a thermostat for controlling the stoker having control wires connected thereto, a relay controlled by said wires controlling said motor driving means, said thermostat embodying an

electric signal device, the circuit arrangements comprising means whereby two circuits may be formed, the first of which operatively energizes said relay and the second of which operatively energizes said signal device, one of said circuits including said signal device and the winding of said relay in series, means responsive to excessive load on the motor driving means, said responsive means comprising a normally open and a normally closed switch actuatable thereby, said normally closed switch controlling said first circuit and arranged to operatively deenergize the relay upon excessive load and said normally open switch controlling said second circuit and arranged to operatively energize said signal device upon excessive load.

10. In apparatus of the character described, in combination, an automatic stoker having fuel feed mechanism and motor driving means therefor, control means for the stoker including a thermostat and a relay device controlled by the thermostat, an electric signal device at the thermostat, circuit means whereby the winding of the relay device and signal device may be connected to form a series circuit, means forming a shunt circuit associated with said series circuit for shunting one of said devices, whereby opening and closing of the shunt circuit varies the energization of the winding of the relay device and the signal device, and switch means responsive to excessive load on the motor driving means controlling the shunt circuit whereby upon excessive load the relay is rendered ineffective to start the stoker and the signal device is operatively energized.

ELMER K. SCOGGIN.