March 10, 1942. B. A. PEARSON 2,276,085

THERMALLY RESPONSIVE ELECTRIC CONTACTOR

Filed Jan. 13, 1939 2 Sheets-Sheet 1

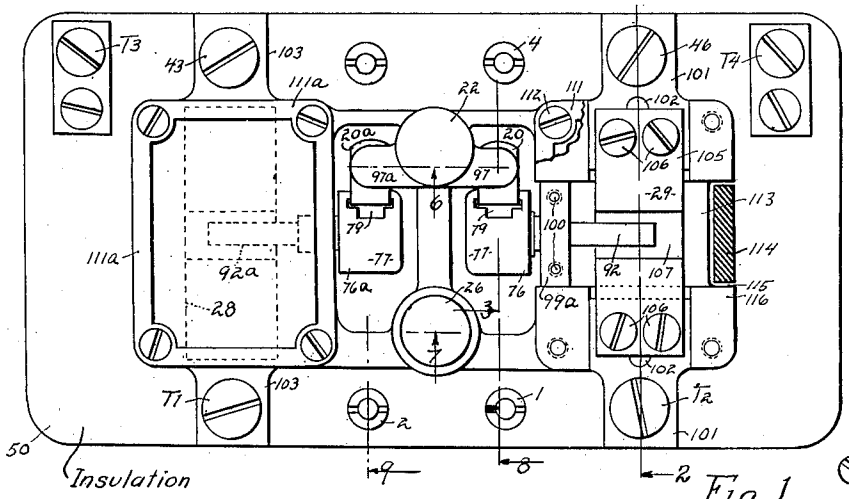


Fig. 1

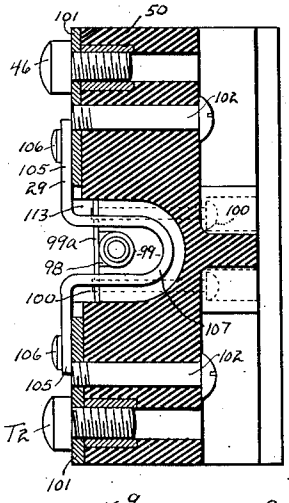


Fig. 2

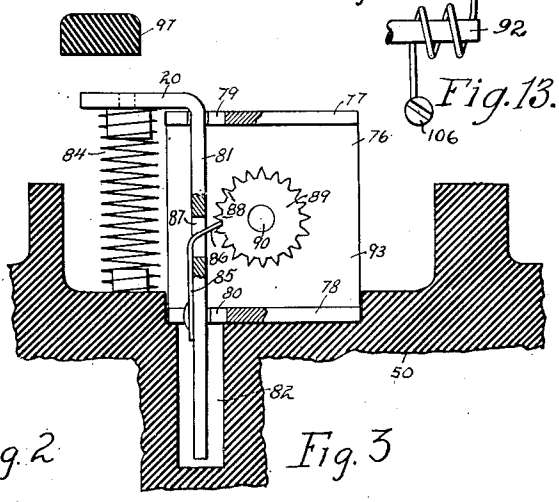


Fig. 3

Fig. 13.

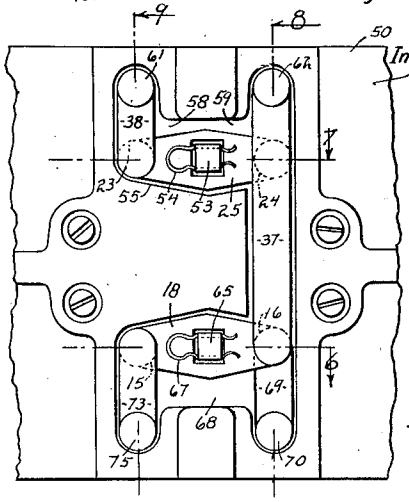


Fig. 5

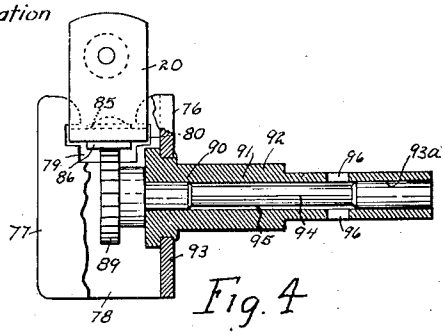


Fig. 4

BY

INVENTOR.
Bernhard A. Pearson
Harry P. Canfield
ATTORNEY.

March 10, 1942. B. A. PEARSON 2,276,085

THERMALLY RESPONSIVE ELECTRIC CONTACTOR

Filed Jan. 13, 1939 2 Sheets-Sheet 2

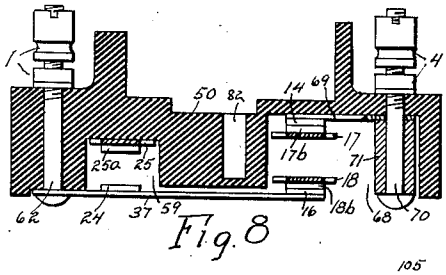


Fig. 8

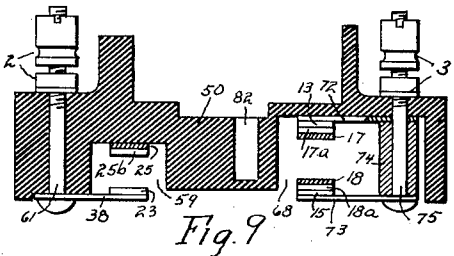


Fig. 9

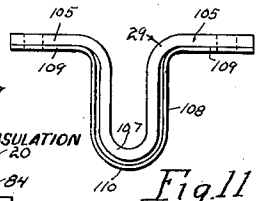


Fig. 11

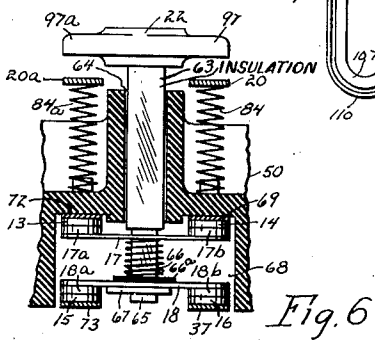


Fig. 6

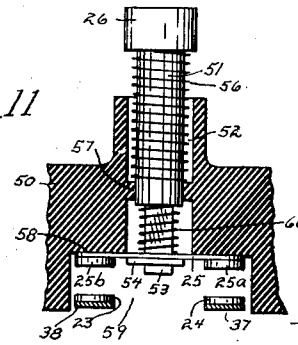


Fig. 7

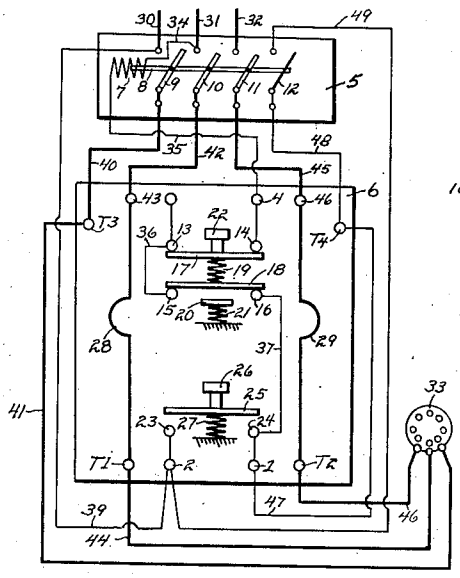


Fig. 12

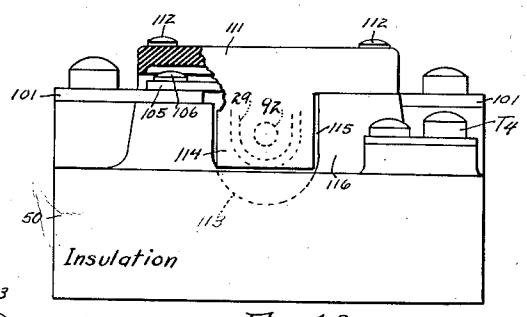


Fig. 10

INVENTOR.
Bernhard A. Pearson
BY Harry P. Canfield
ATTORNEY.

Patented Mar. 10, 1942 2,276,085

UNITED STATES PATENT OFFICE

2,276,085

THERMALLY RESPONSIVE ELECTRIC CONTACTOR

Bernhard A. Pearson, Cleveland, Ohio, assignor to The Clark Controller Company, Cleveland, Ohio, a corporation of Ohio

Application January 13, 1939, Serial No. 250,803

8 Claims. (Cl. 200—124)

This invention relates to electric contactors and particularly to electric contactors having contacts under the control of thermally responsive means.

Electric contactors are known comprising contacts arranged to be held closed by mechanical means comprising parts connected together by fusible metal; the metal being heated by electric current, and the contacts being released upon the attainment of the fusing temperature of the metal caused by excessive current; and the contacts being arranged to be then opened by stored mechanical energy, such for example, as that in a spring.

It is among the objects of this invention to provide generally an improved contactor of this class.

Other objects are:

To provide a contactor of the class referred to having contacts through the agency of which, the flow of electric current in a plurality of electric circuits is controlled, and being thermally responsive in an improved manner to the electric current in the circuits jointly or severally;

To provide a contactor of the class referred to having thermally responsive electric contacts and having improved means for manually operating the contacts to open and close an electric circuit connected thereto;

To provide an improved thermally responsive contact construction for thermally responsive contactors;

To provide an improved construction of thermally responsive contact and electric heating means therefor;

To provide a thermally responsive contactor construction comprising parts connected together by fusible metal and arranged to be heated by an electric heater and having improved means for shielding the fusible metal and heater from ambient air currents to thereby render them more accurately responsive to the heating current;

To provide an electric contactor construction of the class employing fusible metal and having improved means for retaining the fusible metal in the construction when melted;

To provide an electric contactor construction of the type employing parts connected together by fusible metal and having an improved chamber construction for enclosing the said parts;

To provide in a thermally responsive electric contactor of the class referred to, an improved electric heater and improved means for detachably assembling it with a thermally responsive element of the construction;

To provide for electric contactors of the thermally responsive type, an improved construction of electric heater;

To provide an improved contactor construction comprising manually operable means for closing and opening an electric circuit and thermally responsive means for opening the circuit.

Other objects will be apparent to those skilled in the art to which my invention appertains.

My invention is fully disclosed in the following description taken in connection with the accompanying drawings, in which;

Fig. 1 is a top plan view of an embodiment of my invention;

Fig. 2 is a sectional view taken from the plane 2 of Fig. 1;

Fig. 3 is a fragmentary sectional view to enlarged scale taken from the plane 3 of Fig. 1;

Fig. 4 is a view partly in section of a part of the embodiment of Fig. 1, and to an enlarged scale;

Fig. 5 is a fragmentary bottom plan view of a part of the embodiment of Fig. 1;

Fig. 6 is a fragmentary sectional view taken from the plane 6 of Fig. 1;

Fig. 7 is a fragmentary sectional view taken from the plane 7 of Fig. 1;

Fig. 8 is a cross-sectional view taken from the plane 8 of Fig. 1, with parts behind the section plane omitted;

Fig. 9 is a cross-sectional view similar to Fig. 8 taken from the plane 9 of Fig. 1;

Figs. 6, 7, 8 and 9 may also be referred to the planes 6, 7, 8, and 9 of Fig. 5;

Fig. 10 is an end elevational view of the embodiment of Fig. 1;

Fig. 11 is a view illustrating a modification of a heating element shown in a simpler form in Figs. 1 and 2;

Fig. 12 is a diagrammatic view of the embodiment of my invention of Fig. 1 in connection with a diagrammatically illustrated electro-magnetic contactor and illustrating a practical use for my invention;

Fig. 13 is a view illustrating another modification of a heating element shown in simpler form in Figs. 1 and 2.

The contactor construction embodying my invention and illustrated in the drawings has for its primary use the opening and closing of a control circuit by which the winding of an electro-magnetic contactor may be energized and de-energized, the contacts of the electro-mag-

netic contactor controlling the electric current in a main electric circuit such as an energizing circuit of an electric motor. The contactor comprises manually operable contacts to effect closing of the control circuit, manually operable contacts to effect opening of the control circuit, and thermally responsive contacts to open the control circuit upon the occurrence of excess current in the main circuit.

As will become apparent hereinafter, the said manually operable and thermally responsive contacts may be variously connected in the control circuit, and one illustrative arrangement is indicated diagrammatically in Fig. 12; and this will now be described, followed by a description of the actual contactor illustrated in the other figures.

Referring to Fig. 12, I have shown generally at 5, in diagrammatic form, an electro-magnetic contactor; and at 6, the control contactor more particularly embodying my invention.

The contactor 5 comprises an electro-magnetic winding 7 which, when energized, pulls toward the left a plunger 8 thereby moving main contactor arms 9, 10, and 11 and an auxiliary contact arm 12 from the circuit-open positions illustrated, to the circuit closing positions to be described. The control contactor 6 comprises a pair of contacts 13 and 14 and a pair of contacts 15 and 16, the said pairs being respectively bridged by bars 17 and 18 and held bridged by a spring 19 reacting thereon. The bridging bar 18 is arranged to be raised against the tension of the spring 19 to disconnect the contacts 15 and 16 by a finger 20 movable upwardly by a spring 21, upon the occurrence of certain thermal conditions to be described. The bar 17 is arranged to be depressed to disconnect the contacts 13 and 14 by an operator's push-button 22.

Another pair of contacts 23 and 24, normally unbridged, are arranged to be bridged by a bridging bar 25, which may be moved downwardly by a manual push-button 26 against the tension of a spring 27, which normally holds the bar 25 in unbridging position.

At 28 and 29 are heating elements to be more fully described in an actual construction thereof, and means is provided by which, if current in either of the elements 28 or 29 exceeds a predetermined amount, the heat thereof will cause the finger 20 to be released to move upwardly and move the bar 18 to unbridge the contacts 15 and 16 as referred to.

Electric current is supplied by supply mains 30, 31 and 32, which in the illustrative embodiment under consideration, are the mains of a three-phase alternating electric current system, and at 33 is an electric motor of the three-phase induction type, the operation of which is under the control of the contactor 6.

Description of the other parts of Fig. 12, including the electric circuits thereof will now be given in connection with the description of its operation as a whole.

To start the motor 33, the operator depresses the manual push-button 26, thereby bridging the contacts 23 and 24 and current flows from the supply main 31 by a wire 34, through the winding 7 of the magnetic contactor 5, by wire 35 to a terminal 4 on the contactor 6, and thence to the contact 14.

Thence the current flows through the bridging bar 17 to the contact 13 and by a connector 36 to the contact 15, through the bar 18 to the contact 16, by a connector 37 to the contact 24, through the bar 25 to the contact 23, thence to a terminal 2, and by wire 39 to the main 30.

The contactor 5 is thereby operated and main current flows from the mains 30, 31 and 32 to the motor 33 as follows. From the main 30 through the contactor arm 9, by a wire 40 to a terminal T3, and by wire 41 to the motor 33. Current from the main 31 flows through the main contactor arm 10, by a wire 42 to a terminal 43, through the heating element 28 to a terminal T1, and thence by wire 44 to the motor 33. Current flows from the main 32 through the main contactor arm 11, by a wire 45 to a terminal 46, through the heating element 29 to a terminal T2, and thence by wire 46 to the motor 33.

A maintaining circuit is made for the contactor 5 as follows. From the main 31, through the winding 7 and to the contact 24, as above described, and thence to a terminal 1, and by a wire 47 to a terminal T4, thence by wire 48 to and through the auxiliary contact arm 12, thence by wire 49 to the said terminal 2, and back to the main 30, by wire 39 whereby when the operator's push-button 26 is released, the contactor 5 will remain operated.

The motor is thereby started and operates, and it may be stopped at any time by the operator upon pressing the push-button 22, which as will be understood, opens the circuit through the winding 7 of the contactor 5, which then opens its contacts and cuts off the motor current from the supply mains. Also, as will be noticed, the main current to the motor 33 flows through the heating elements 28 and 29 in two of the phases thereof, and if either phase of the motor should take too much current, the heat developed in these heating elements will cause the finger 20 to raise the bridging bar 18, as referred to which, as will be understood opens the circuit through the winding 7, causing the contactor 5 to open and cut off the current to the motor 33, as well as open the control circuit at the auxiliary contact arm 12.

An actual embodiment of the contactor 6 is illustrated in Figs. 1 to 10 of the drawings and will now be described. In the several figures, parts corresponding to the parts of Fig. 12 are given the same reference characters as in that figure.

Referring now to Figs. 1 to 10 inclusive, I have shown at 50, a main base or support, which, in the preferred embodiment of my invention is formed from moulded plastic material. A "Start" push-button 26 is provided, Figs. 1 and 7, having a shank 51 reciprocable in a bore 52 in the main frame, the inner end 53 of which is of reduced diameter and preferably rectangular or square in cross-section, and has telescoped thereon a bridging bar 25 retained by a cotter-key 54, see also Fig. 5, the bar carrying contacts 25*a* and 25*b* on the opposite ends thereof. The bar 25, and therefore the shank 51, of the push-button 26 are prevented from rotation to prevent rotary displacement of the bar and the contacts, by a shoulder 55 of the main frame, see Fig. 5, disposed adjacent to, but slightly spaced from and conforming generally to the shape of the bar 25.

A spring 56 around the upper portion of the stem 51 abuts at its upper end upon the push-button 26, and at its lower end upon a wall 57 at the inner end of the bore 52 to normally hold the push-button 26 in an upper position and to hold the bar 25 against the bottom 53 of a recess 59 in which the bar is disposed, and of which recess the said shoulder 55 constitutes a side wall.

A spring 60 surrounds the reduced diameter rectangular lower end portion 53 of the stem, and abuts at its upper end upon the stem proper, 51, and at its lower end upon the bar 25.

By this construction the push-button 26 is normally held in its upper position illustrated, but may be pushed downwardly against the tension of the spring 56 and carries therewith the bar 25 and contacts 25*a* and 25*b*, moving them into engagement with contacts 24 and 23, bridging the same.

Referring to Figs. 5, 7, 8 and 9, the contact 23 is mounted on the end of an electrical connector 38, the outer end of which is clamped upon the underside of the frame 50 by the head of a bolt 61, having on the top side of the base, terminal nuts 2—2; and as shown in Figs. 7 and 9, the contact 23 is aligned with contact 25*b*.

The contact 24 is mounted upon an intermediate portion of an electrical connector 37, one end of which is clamped upon the frame 50, under the head of a bolt 62, projected through a bore in the base, and having on the other end terminal nuts 1—1. The contact 24 as shown in Fig. 8, being aligned with the said contact 25*a* on the bar 25.

At 22 is a stop and reset push button, having a rectangular, preferably square stem 63 reciprocable in a bore 64 in the main frame 50, whereby it is prevented from rotating, the lower end portion 65 thereof being of reduced cross-sectional area and having a spring 66 telescoped thereon and abutting at one end upon the bridging bar 17 and at the other end abutting upon an insulating washer 66*a* on the bridging bar 18, Figs. 5, 6, 8 and 9, a cotter key 67 retaining the bar 18 on the stem 65.

The bar 17 at opposite ends thereof carries contacts 17*a* and 17*b* held normally in engagement by the spring 66 with contacts 13 and 14, to be more fully described. The bar 18 carries contacts 18*a* and 18*b* held normally by the spring 66 in engagement with contacts 15 and 16 to be more fully described. The bars 17 and 18, and hence their said contacts, being disposed in a recess 68 in the main frame.

As shown in Figs. 5, 6, 8 and 9 the contact 14 is mounted on the end of an electrical connector 69, clamped upon the main frame in the bottom of the recess 68 and under the head of a bolt 70 by a thick washer 71, the bolt 70 having terminal nuts at 4—4. The contact 16 is mounted on the end of the said connector 37. The contact 13 is mounted on one end of an electrical connector 72 and the contact 15 is mounted on the end of a connector 73. The two connectors 72 and 73 are spaced apart by a thick washer 74 and respectively clamped upon the end thereof and secured upon the base 50 in the bottom of the recess 68 by a bolt 75 projecting upwardly through the frame and having terminal nuts 3—3.

By this construction, the bars 17 and 18 normally bridge respectively the contacts 13 and 14 and the contacts 15 and 16, and the contacts 13 and 14 may, at any time, be unbridged by depressing the push-button 22, and means will now be described by which, responsive to thermal conditions the bar 18 will be moved upwardly and unbridge the contacts 15 and 16 and by which the bar 18 may again be moved downwardly to bridge these contacts by depression of the button 22.

Referring to Figs. 1, 2, 3, 4 and 6, at 76 is a U-shaped sheet metal housing, the upper and lower flanges 77 and 78 thereof having T-form perforations 79 and 80 in which is reciprocally mounted a sheet metal plunger 81, the lower end of which is disposed in a recess 82 in the main frame and the upper end portion of which is bent at an angle to provide a finger 20. A spring 84 under the finger 20 abuts at its upper end upon the finger and at its lower end upon the frame, tending to move the finger upwardly.

The plunger 81 and finger 20 are normally held downwardly by the following means. A sheet metal spring 85 is secured to the plunger 81 and has a tongue 86 projecting through a perforation 87 in the plunger, the inner end of the tongue 86 being engaged with one of the teeth 88 on a toothed wheel 89 mounted on a shaft 90.

The shaft 90 is disposed in a bore 91 in a sleeve 92, rigidly secured to the web 93 of the housing 76, as shown in Fig. 4. The shaft 90 at normal working temperature thereof, is secured in the bore 91 by fusible metal 93*a* surrounding the outer end portion of the shaft and adhering to the shaft and to the wall of the bore. Preferably the intermediate portion 94 of the shaft 90 inwardly of the said end portion is of a reduced diameter providing a chamber 95 between the shaft and the bore wall to prevent the fusible metal from creeping inwardly along the shaft, and perforations 96—96 in the wall of the sleeve 92 provide outlet ports through which any excess of fusible metal may escape, whereby the portion of the shaft which is secured to the sleeve will be of definite predetermined length, and whereby only the said end portion will be secured to the sleeve. The fusible metal may be any well known entectic alloy, such for example as an alloy of lead, zinc and bismuth.

By this means, the shaft 90 being normally rigidly connected to the sleeve by the fusible metal, the toothed wheel 89 is held stationary and through the agency of the tongue 86, above described, prevents the upward movement of the finger 20.

When, however, the sleeve 92 is heated in a manner to be described and attains a predetermined temperature at which the fusible metal fuses, the connection between the shaft and the sleeve is broken thereby and the spring 84 moves the finger 20 and the plunger 81 upwardly, the toothed wheel 89 yielding and rotating. It will be observed that the plunger 81 may be assembled through the perforations 79 and 80, by projecting it downwardly therethrough, the tongue 86 passing over the stem portion of the T-form perforation, and ratcheting over the teeth 88 of the plunger 81, and when the plunger 81 is released, the tongue 86 engages under an adjacent tooth and is latched downwardly thereby.

In the embodiment of my invention illustrated in Fig. 1, two devices such as that shown in Figs. 3 and 4 are provided, as evidenced by the housings 76 and 76*a* and fingers 20 and 20*a* thereof, and the push-button 22 has a pair of wings 97 and 97*a* projecting laterally therefrom and disposed over the said fingers 20 and 20*a*, as shown in Figs. 1 and 6.

By this means, when either of the fingers 20 or 20*a* is released by the thermal action described, it will be projected upwardly by its corresponding spring 84, with a quick jump action as soon as the tongue 86 leaves the tooth of the wheel 89 with which it is engaged, and the finger 20 or 20*a* will strike the corresponding wing 97 or 97*a* with a blow, thereby raising the push-button 22 and removing the bridging bar 18 from the contacts 15 and 16, with a quick break action;

notwithstanding that the rotary movement of the wheel 89 may be slow or sluggish due to the fusible metal.

The thermally responsive devices above described, and as shown separately in Figs. 3 and 4, are preferably made as a unit, the plunger 81 being trapped in the perforations 79 and 80, as above described, and the sleeve 92 being secured to the web 93 of the housing 76, and these units may be identical. In order to render them of right and left hand, as shown therefor in Fig. 1, the plunger 81 may be projected inwardly first through the perforation 79, or first through the perforation 80.

In order to mount these assembled units on the base 50, the sleeve 92 is disposed in a groove 98 provided in a transverse rib 99 on the base 50, to be referred to, and a clamp bar 99*a* is placed over the sleeve 92 and clamps it in the groove being held down on the stem by screws 100—100 projected upwardly through the base 50, and screwed into the bar 99*a* on each side of the sleeve 92.

When the push-button 22 has thus been moved upwardly to disengage the bar 18 from the contacts 15 and 16 by the thermal action referred to, the corresponding springs 84 or 84*a* will hold it in said raised position. To reset the push-button it may be depressed, and, assuming that the fusible metal has cooled to again connect the shaft 90 to the sleeve 92, the wing 97 or 97*a* will again depress the finger 20 or 20*a* and cause it to be latched downwardly, the same movement again engaging the bar 18 with the contacts 15 and 16, and the pushbutton will take up its normal position independently of the spring 66, of Fig. 6, as described. The lower end of the stem 63 rests upon the bar 17, but the bar 17 and bar 18 are held in engagement with their respective contacts by the spring 66.

The means for heating the thermo-responsive devices above described is as follows:

Mounted up on the base 50 at one end thereof is a pair of laterally oppositely disposed plates 101—101 secured to the base by screws 102—102 projected through the base. At the other end of the base in a similar corresponding pair of plates 103—103. These plates have terminal connection screws 45 and T2, and 43 and T1, referred to in the description of Fig. 12. A heating element of sheet metal having suitable electric resistance is shown at 29 and comprises wings 105—105, connected to the plates 101—101 by screws 106—106, and between the wings is formed into a loop 107, looped under the said sleeve 92. A like heater 28 is provided on the plates 103—103.

The electric current flowing through the heaters 29 and 28, as described in conection with Fig. 12, heat the same because of their electrical resistance and the heat is conducted or radiated through the surrounding air to the sleeve 92, heating the same.

The heaters 29 and 28 may be variously constructed. When the current is of medium amperage, a heater of the form shown and described above may be utilized. When the current is of small amperage, a heater in the form of a wire connected at opposite ends to the plates 101—101 and coiled into a helix co-axial with, but spaced from the sleeve 92, as shown in Fig. 13 may be provided. When the current is of large amperage the arrangement shown in Fig. 11 for the heater may be utilized. Here the heater 29 of the other figures is shown, and combined therewith is a shunt element 108 having wings 109—109 in intimate conducting relation with the wings 105 of the element 29, and having a loop 110 adjacent to, but spaced from the loop 107 of the heater 29. The resistance of the element 108 may be less than that of the element 29 and the resistance of the two elements 108 and 29 may have any desired relation whereby the critical heating value for the sleeve 92 may be attained by any desired electric current value.

It will be observed from an inspection of Figs. 1 and 2 that the heater 29, as well as the heater 28 at the other end of the device, may be assembled with the sleeve 92 in the heating relation thereto by telescoping the loop 107 thereof over the end of the sleeve 92, and may be removed by the reverse operation, whereby the heater may be at any time changed quickly and conveniently.

A cover 111 is provided, secured on the base by screws 112 and covers the sleeve 92 and the heater 29 and a corresponding cover 111*a* covers the sleeve 92*a* and the heater 28. As will be observed, from an inspection of Figs. 1, 2 and 10, the sleeve 92 projects into a chamber 113, the side walls and curved bottom wall of the chamber, as plainly shown in Fig. 2 and Fig. 10, being formed in the material of the base 50. The inner end wall of the chamber is provided by a tongue 114 on the cover 111 projecting downwardly into a recess 115 in an end wall 116. When the cover is removed and the tongue 114 withdrawn the above described assembling operation of the heater 29 and the sleeve 92 is facilitated, the recess 115 receiving the loop 29 of the heater as it is moved axially over the sleeve 92. The cover 111 proper, constitutes the upper wall of the said chamber 113.

The said chamber constitutes an enclosure for the heating element on the sleeve preventing the interference of their response to current effected temperature changes by ambient air currents. Furthermore, upon melting of the fusible metal, as described, if some of the metal should flow out of the sleeve 92, it will be caught in the chamber and may be recovered.

Furthermore, by providing an air space between the heater and the sleeve, and an air space between the heater and the walls of the chamber, a time interval is interposed between the attainment of the critical current value at which it is desired that the metal shall fuse and the push-button 22 shall be raised, and the attainment of the metal fusing temperature. By this means, if an overload of current flowing through the heater should be only momentary, or of short duration, the device will remain inoperative.

By this means also, the greater the overload the quicker the response. I have found, for example, that with the proportional sizes and arrangement of parts approximately as illustrated in the drawings, the thermally responsive parts will not operate to open the contacts at 15 and 16 for a time period of forty-five minutes, if the overload is not more than 130% of the normal current load, but if the overload is above 550% to 600% of the normal current, the device will operate within fifteen to thirty seconds.

From the foregoing, therefore, it will be seen that I have provided a control contactor which may be used in connection with an electro-magnetic contactor to start and stop an electric motor by manual push-button operation and which will automatically stop the motor upon the occurrence of a current overload thereto within a time interval inversely commensurable

with the degree of the overload, and which, after the overload condition has been corrected, may again be reset by manual push-button operation. Obviously, my invention may be utilized in connection with other circuits than those supplying power to an electric motor.

My invention is not limited to the exact details of construction illustrated and described. Changes and modifications may be made within the spirit of my invention without sacrificing its advantages and within the scope of the appended claims.

I claim:

1. In a contactor construction, a main base, a push-button device reciprocable on the base and provided with a shoulder, means yieldingly supporting the device in a normal intermediate position on the base to permit it to be depressed or elevated from said position, butt contacts operable to be opened upon manual depression of the device, other butt contacts operable to be opened upon elevation of the device, an actuator movable to elevate the device and disposed at a distance from the shoulder to permit the device to be depressed, spring means for moving the actuator, holding means for holding the actuator from moving, thermally responsive means responsive to a predetermined temperature for releasing the holding means to permit the actuator to be moved by the spring means through said distance and to strike a blow on the device to elevate it and open said other contacts with a snap action, and an electric resistance heating means for heating the thermally responsive means to said temperature.

2. In a contactor construction a main base, a push-button device reciprocable on the base and provided with a shoulder, means yieldingly supporting the device in normal intermediate position to permit it to be depressed or elevated from said position, butt contacts operable to be opened upon manual depression of the device, other butt contacts operable to be opened upon elevation of the device, an actuator having a normal position and movable to elevate the device and disposed at a distance from said shoulder to permit the device to be depressed, spring means tending to move the actuator from its normal position, latch means for holding the actuator in its normal position, thermally responsive means responsive to a predetermined temperature for releasing the latching means to permit the actuator to be moved by the spring means through said distance and to strike a blow on the shoulder to elevate the device and open said other contacts with a snap action, an electrical resistance heater for heating the thermally responsive means to said temperature, the actuator being movable back to its said normal position by manual depression of the device, and the latch means being operable at temperature of the said responsive means below said predetermined temperature to latch the actuator in said normal position against the tension of the spring means.

3. In a contactor construction, a main base, a contactor on the base comprising contacts and a movable contact operating member, a unitary thermally responsive actuator for moving the operating member comprising a channel-form member detachably mounted on the base and provided with aligned perforations in the channel flanges, a plunger reciprocable in the perforations, a yieldable tongue on the plunger projecting laterally therefrom and between the channel flanges, a spring tending to move the plunger in one direction, a sleeve supported by the channel web, a shaft in the sleeve connected thereto by fusible metal, a toothed wheel between the channel flanges connected to the shaft, the tongue engaging a tooth thereof to prevent spring-effected movement of the plunger except at fusing temperature of the fusible metal, the movable contact operating member being in the path of said movement of the plunger, and an electrical heating means for heating the said sleeve.

4. In a contactor construction, a main base, a contact and a movable contact operating member on the base; a unitary thermally responsive device comprising a channel-shaped frame, a sleeve mounted on the channel web substantially midway between the flanges and extending from the web oppositely with respect to the flanges, a shaft in the sleeve connected thereto by fusible metal, a toothed wheel on the shaft, the flanges being provided with aligned perforations, and a plunger mounted on the frame reciprocable in the perforations, a tongue on the plunger engaged with a tooth of the wheel, a spring tending to move the plunger in one direction; the contactor operating member being disposed in the path of the plunger, a rib on the base having a recess therein, the sleeve being disposed in the recess, a detachable clamp member on the base above the sleeve clamping it in the recess to detachably mount the sleeve and thereby the frame on the base, and an electrical heater disposed adjacent to the sleeve.

5. In a contactor construction, a base, a chamber in the base comprising a bottom wall, side walls and a wall at one end, and being open at the opposite end, contacts on the base outside the chamber, thermally responsive means for operating the contacts comprising an elongated element to be heated projecting into the chamber through the end wall of the chamber, an elongated heating element of loop form arranged to be telescoped over the elongated element through the open end of the chamber and a removable cover for the top of the chamber having a tongue thereon closing the open end of the chamber outwardly of the heating element.

6. In a contactor construction, a base, a chamber in the base closed at the bottom, the sides and one end, a thermally responsive device comprising a sleeve projecting through the said closed end of the chamber, a shaft in the sleeve connected thereto by fusible metal and a spring externally of the chamber tending to rotate the shaft and rotating it upon the attainment by the sleeve of a temperature at which the fusible metal fuses, contact and contactor operating means actuated by the spring upon rotation of the shaft, an electric heater of loop form arranged to be telescoped over the sleeve and shaft through the open end of the chamber, to dispose it in the chamber, and a removable cover for the top of the chamber having a tongue thereon closing the open end of the chamber outwardly of the heater loop.

7. In a contactor construction, a base having a chamber therein comprising an end wall and bottom and side walls and open at the other end, an elongated thermo responsive element in the chamber, an electric heater comprising a loop telescopable over the thermo responsive element through the open chamber end, electrical connections for the heater supported on the chamber side walls, a cover overlying the electrical connections and covering the chamber and hav-

ing a tongue closing said open chamber end, outwardly of the heater loop.

8. In a contactor construction, a reciprocable push-button device comprising a head and a stem, a first and a second yielding contact-bridging-element on the stem, a pair of butt contacts normally bridged by the first bridging element, a pair of butt contacts normally bridged by the second bridging element, the first pair of contacts being unbridged by manual depression of the head and stem, the second pair of contacts being unbridged upon elevation of the head and stem, and thermally responsive means comprising a thermally releasable spring impeller normally spaced from the push button device and upon release striking a blow thereon to elevate the stem with a snap action.

BERNHARD A. PEARSON.