



NEW EUROPEAN PATENT SPECIFICATION

Date of publication of the new patent
specification : **26.08.92 Bulletin 92/35**

Int. Cl.⁵ : **H05B 3/82, H01H 37/48**

Application number : **85109056.3**

Date of filing : **19.07.85**

A self-protected sheathed resistor.

Priority : **22.08.84 IT 2290284 U**

Date of publication of application :
26.02.86 Bulletin 86/09

Publication of the grant of the patent :
07.09.88 Bulletin 88/36

Mention of the opposition decision :
26.08.92 Bulletin 92/35

Designated Contracting States :
AT BE CH DE FR GB IT LI LU NL SE

References cited :
DE-A- 3 401 937
GB-B- 591 997
GB-B- 964 355
GB-B- 1 280 420

Proprietor : **I.R.C.A. S.p.a. Industria
Resistenze Corazzate e Affini
Viale Venezia
I-31020 San Vendemiano (Treviso) (IT)**

Inventor : **Capraro, Duilio
Via Buccari 13
I-31015 Conegliano Treviso (IT)**

Representative : **Forattini, Amelia et al
c/o Internazionale Brevetti Ingg. ZINI,
MARANESI & C. S.r.l. Piazza Castello 1
I-20121 Milano (IT)**

EP 0 172 416 B2

Description

This invention relates to a temperature limiter particularly useful with electric heater elements of the sheathed type operating in air and/or liquid media.

As is known, temperature limiters currently known in the art generally operate either on a liquid expansion, or on the differential thermal expansion between two metals, or even, on changes of electric quantities in electronic components.

In actual practice, prior limiters exhibit difficulties of application and thermal contact with the heater elements owing to the formation, over time, of oxide or lime or other heat-insulating materials deriving from the type of utilization, whereby the temperature limiter is either caused to be inoperative over time or to operate at different temperature values from the preset ones.

Temperature limiters which comprise a rod to be used in combination with a sheathed resistor are known, e.g. from GB-A-1408388, GB-A-1223165, GB-A-1010375, GB-A-964355, GB-A-591997 and DE-A-3 401 937.

The thermal differential expansion between the rod and the sheath of the sheathed resistor results in the opening of the circuit of a switch which interrupts the flow of electric power, thus preventing the resistor from overheating.

The solutions proposed to obviate the mentioned prior art shortcomings, in particular those related to the use of sheathed electric heating elements in air and/or liquids, have, however, an excessive cost when compared to the cost of the sheathed electric heater element itself to which the temperature limiter is to be applied.

In the light of such problems, it is a primary object of this invention to obviate the above mentioned drawbacks affecting the prior art by providing a temperature limiter which operates on the principle of the thermal differential expansion of the materials constituting the sheathed heating element to which the limiter is to be applied, in particular, sheathed (armored) electric resistance heating elements operating in air and/or liquids, said limiter being adapted to perform its action always at the same temperature over time, without any problems of thermal contact.

A further object of this invention is to exploit said temperature limiter as a safety switch adapted to cut off the electric power supply to the sheathed heating element on exceeding a given temperature and/or as a temperature regulator or safety thermostat for the plurality of uses in which sheathed electric heating elements which can cooperate with the temperature limiter of this invention are required to operate.

Another object of this invention is to provide a temperature limiter with an extremely simple construction, which can be easily applied to existing

sheathed electric heating elements.

An important object of this invention is to provide a temperature limiter or safety thermostat which is highly reliable and inexpensive.

These and other objects, such as will be apparent hereinafter, are achieved by a heating device, as claimed comprising a sheathed resistance heating element and temperature controlling and limiting means, so arranged to provide for temperature controlling and limiting effects and thereby protect said sheathed resistance heating element against overheating.

Further features and advantages will be apparent from the following detailed description of a heating device according to the invention, as illustrated by way of example, in the accompanying drawing, where:

Figure 1 is a perspective view of the heating device according to the invention and incorporating a sheathed heating element of known design (see, e.g. DE-A-3 401 937);

Figure 2 shows diagrammatically a side view of the switch in the closed circuit position thereof and in normal operation;

Figure 3 is a side view of the switch of Figure 2 in the open circuit position and with the sheathed resistor in the overheated state thereof; and

Figure 4 is a partly sectioned front view of the switch of Figures 2 and 3, wherein the pushbutton drawn in solid lines is indicative of normal operation, while the one shown in dashed lines is indicative of the resistor being overheated and the electric circuit opened.

With reference to the cited figures, the sheathed electric resistor 10 comprises a tubular metal sheath 11, a coiled resistance heater 12 enclosed in the sheath 11 and embedded in an insulating material 14. The two electric terminals 15 and 16 are connected at the opposite ends of the sheath 11.

Close to the terminals 15 and 16, the opposite ends of the sheath 11 are welded to the flange 17 to provide a rigid form of connection. There is provided a normally closed contact microswitch, whose housing 18 is supported on the flange 17 and a rigid rod 19 connected, at its end 20, to the microswitch housing 18 and, at its end 21, to the point 22 on the sheath.

DE-A-3 401 937 discloses a quite similar structure, whereby, however, the microswitch is maintained closed by the pushing action of the rigid rod. Contrary to said known device, whereby the microswitch housing is rigidly connected to the flange, according to the present invention, a fulcrum means is provided to support the switch housing 18 on the flange 17, this fulcrum means permitting the rocking movement of the switch housing 18 relatively to the flange 17. The switch housing 18 comprises a control pushbutton 23 for the switch itself. The pushbutton 23 is movable relative the switch housing 18 and effects,

when depressed, opening of the normally closed circuit of the switch. The movement of the rod 19 caused by the differential thermal expansion of the sheath 11 causes the switch housing 18 to rock toward the flange 17 and hence the actuation of the pushbutton 23 which, under the action from the flange 17 and the rod 19, is pushed back into the switch housing 18 and causes the circuit to be opened.

The fulcrum means which connects the flange 17 to the switch 18 comprises, for example, two supporting members 31; in the drawing the second supporting member 31 is not visible, being arranged symmetrically. The supporting members 31 may be formed from a small plate bent to a "U", with the base of said "U" attached to the flange 17. The supporting members 31 support a pin 30 which engages pivotably with the switch housing 18. The pin 30 is the fulcrum around which the rocking movement of the switch housing 18 takes place. The rod 19 is connected to the switch housing 18 through a hinge connection which enables the switch housing 18 to rotate around the rod 19. The end of the rod 19 (not shown in the drawing) is configured T-like. The two wings of the "T" engage in two seats provided in the switch housing 18.

The point 32 of the switch housing 18 where to the rod 19 is journaled lies preferably between the pin 30 and pushbutton 23.

Electrically conductive elastic means are provided which comprise, for example, a wire 40 bent to a U-like shape, in order to effect the electric connection of the electric terminal 41 of the switch and terminal 16 of the resistance heater 1.2. The elasticity of Me wire 40 bent to a U-like shape enables the switch housing 18 to rock relative to the flange 17 and fulcrum 30. Resetting of the circuit of the switch to the closed condition may take place either manually or automatically. Where resetting is provided automatically, known elastic means not forming a part of this invention, which normally resist actuation of the pushbutton 23, automatically determine, on release of the urge from the rod 19, resetting to the closed circuit conditions. Where resetting occurs manually, according to a preferred embodiment of the invention, the pushbutton 23 further comprises elastic locking means adapted to lock the pushbutton 23 in the open circuit position and to resist the action of the cited known elastic means which would tend to close the circuit on removal of the urge from the rod 19. The elastic locking means according to this invention comprise a pin 50 movable crosswise to the direction of movement of the push-button 23. The pin 50 engages, under the urge of elastic means of its own, comprising for example the spring 51, into at least one seat 52 correspondingly provided in the body of the switch housing 18. The seat 52 is provided at a relative position between the pushbutton 23 and the switch which causes the electric circuit to be opened.

Preferably, a second seat 53 for the pin 50 is provided at a relative position between the pushbutton 23 and the switch such that, when pin 50 engages into said second seat 53, the electric circuit is closed.

Claims

1. A heating device comprising a sheathed resistance heating element (10) and temperature controlling and limiting means (18, 19) arranged to provide for temperature controlling and limiting effects and thereby protect said sheathed heating element (10) against overheating, wherein:
 - (a) said sheathed heating element (10) comprises:
 - a tubular metallic sheath (11) enclosing a coiled heating resistor (12) embedded in an insulating material (14),
 - two electric terminals (15, 16) connected to said coiled heating resistor (12) and disposed at the opposite ends of said tubular metallic sheath (11), close to the ends thereof;
 - a supporting flange (17) rigidly connected to said tubular metallic sheath (11) close to the ends thereof; and wherein:
 - (b) said temperature controlling and limiting means comprises:
 - a control switch including a rigid housing (18), a movable control pushbutton (21) projecting peripherally of said housing proximally to one end thereof for selective movement between a normally undepressed position and a depressed position pushed inwardly of said housing, and at least one electric terminal (41) extending from said housing oppositely to said pushbutton for connection with one of said terminals of said coiled heating resistor (12),
 - a rigid rod (19) having one free end (20) operatively connected to said switch and the other end (21) rigidly connected to a point (22) on said tubular metallic sheath (11), said rigid rod (19) being responsible for transmitting to said switch movements resulting from the differential thermal expansion between said tubular metallic sheath (11) and said rigid rod (19), thereby providing for said temperature controlling and limiting effects resulting from said switch being selectively actuated alternatively to its open or closed position;
 - (c) said switch is supported on said flange (17) with said pushbutton (23) oriented towards said flange (17) for movement relative to said housing (18) in a direction substan-

tially parallel to said rigid rod (19); characterized in that:

(d) said switch is, in operation, normally closed with said pushbutton in undepressed position,

(e) said housing is secured to said flange (17) through fulcrum means (30, 31) attached to said flange and intersecting said housing (18) proximately to one end thereof opposed to said pushbutton (23) in such a manner that said housing (18) is rockable about said fulcrum means to cause said pushbutton (23) to move closer and away from said flange (17),
(f) said free end (20) of said rigid rod (19) which is operatively connected to said switch is hinged to said housing (18) at a point thereof (32) located between said pushbutton (23) and said fulcrum means (30, 31), whereby upon movement of said actuating rod (19) in response to a differential thermal expansion of said tubular metallic sheath (10) said housing is caused to pivot towards said flange, and said pushbutton (23) is pressure engaged with said flange thus opening said normally closed switch.

2. A heating device according to Claim 1, characterized in that said fulcrum means (30, 31) comprises two supporting members (31) extending from said flange (17), said supporting members supporting a pin (30), said pin being pivotably connected, with the housing (18) of said switch.
3. A heating device according to Claim 1, characterized in that an electric terminal (41) of said switch and an electric terminal (16) of said coiled heating resistor (12) are electrically connected through electrically conductive elastic means (40) allowing said rocking movement of said housing (18), around said pin (30), relative to said flange (17).
4. A heating device according to Claim 3, characterized in that said electrically conductive elastic means (40) comprises a wire bent to an U-like shape.
5. A heating device according to Claim 1, characterized in that re-closing of the circuit controlled by said switch occurs automatically; said pushbutton (23) being returned automatically, by the action of known elastic means, to its normally closed position upon cessation of the overheating.
6. A heating device according to Claim 1, characterized in that the circuit controlled by said switch is re-closed manually; said pushbutton (23) com-

prising locking means (50, 51, 52) adapted to lock said pushbutton (23) in its open circuit position, against the action of said known elastic means.

- 5 7. A heating device according to Claim 6, characterized in that said locking means (50, 51, 52) comprises a pin (50) movable crosswise to the direction of movement of said pushbutton (23); said pin (50) engaging, under the urge of spring means (51), into at least one seat (52) provided in a wall of the housing (18) of said switch, and corresponding to said open circuit position.
- 10
- 15 8. A heating device according to Claim 7, characterized in that a further seat (53), corresponding to the closed circuit position, is provided in said wall of the housing (18) of said switch; said movable pin (50) engaging alternately into either of said seats (52 or 53) upon the electric circuit controlled by said switch, being open or closed.
- 20

Patentansprüche

- 25 1. Heizvorrichtung mit einem ummantelten Widerstand als Heizelement (10) und mit einer Einrichtung zur Regelung und Begrenzung der Temperatur (18, 19), die die Temperatur regelt und begrenzt und damit das ummantelte Heizelement (10) vor Überhitzung schützt, wobei:
 - (a) das ummantelte Heizelement (10) umfaßt:
 - einen rohrförmigen metallischen Mantel (11), der einen in Isoliermaterial (14) eingebetteten, gewickelten Heizwiderstand (12) umschließt,
 - zwei mit dem gewickelten Heizwiderstand (12) verbundene elektrische Anschlüsse (15, 16), die an den einander gegenüberliegenden Enden der rohrförmigen metallischen Ummantelung (11) an deren Enden angeordnet sind;
 - einen Trägerflansch (17), der mit der rohrförmigen metallischen Ummantelung (11) an deren Ende starr verbunden ist; und wobei:
 - (b) die Einrichtung zur Regelung und Begrenzung der Temperatur umfaßt:
 - einen Betätigungsschalter mit einem starren Gehäuse (18), einen beweglichen Betätigungsdruckknopf (23), der peripher vorsteht und sich wechselweise zwischen einer normalerweise nicht gedrückten Stellung und einer gedrückten Stellung, bei der er in das Gehäuse gedrückt wird, bewegt, und mindestens einen elektrischen Anschluß (41), der, dem Druckknopf gegenüber, vom Gehäuse absteht und mit einem der Anschlüsse des gewik-
- 30
- 35
- 40
- 45
- 50
- 55

- kelten Heizwiderstandes (12) verbunden ist,
 – ein starrer Stab (19), dessen eines freies Ende (20) in Wirkverbindung mit dem Schalter steht, und dessen anderes Ende (21) starr mit einem Punkt (22) auf der rohrförmigen metallischen Ummantelung (11) verbunden ist, wobei der starre Stab (19) die Aufgabe hat, Bewegungen auf den Schalter zu übertragen, die von der unterschiedlichen Wärmeausdehnung zwischen der rohrförmigen metallischen Ummantelung (11) und dem starren Stab (19) verursacht werden, und damit die temperaturregelnde und -begrenzende Wirkung zu erzeugen, die dadurch hervorgerufen wird, daß der Schalter wechselweise in offene oder geschlossene Stellung gebracht wird;
 (c) der Schalter von dem Flansch (17) getragen wird, der Druckknopf (23) auf den Flansch (17) gerichtet ist, und er in Bezug auf das Gehäuse (18) im wesentlichen parallel zum starren Stab (19) beweglich ist;
dadurch gekennzeichnet daß:
 (d) der Schalter im Betrieb normalerweise geschlossen ist, wobei der Druckknopf sich in nichtgedrückter Stellung befindet,
 (e) das Gehäuse über Drehmittel (30, 31) am Flansch angebracht ist, die am Flansch (17) befestigt sind und das Gehäuse an einem Ende, dem Druckknopf (23) gegenüberliegend, so durchdringen, daß das Gehäuse (18) um die Drehmittel schwenkbar ist, wodurch der Druckknopf (23) näher an den Flansch (17) oder weiter von ihm weg bewegt wird,
 (f) das in Wirkverbindung mit dem Schalter stehende freie Ende (20) des starren Stabes (19) mit dem Gehäuse (18) an einem Punkt (32) davon, der zwischen dem Druckknopf (23) und den Drehmitteln (30, 31) liegt, gelenkig verbunden ist, wodurch bei Bewegung des Betätigungsstabes (19) in Reaktion auf unterschiedliche Wärmeausdehnung der rohrförmigen metallischen Ummantelung (10) das Gehäuse auf den Flansch zu geschwenkt wird und so den normalerweise geschlossenen Schalter öffnet.
2. Heizvorrichtung nach Anspruch 1, dadurch gekennzeichnet, dass die genannten Drehmittel (30, 31) zwei Befestigungsorgane (31) aufweisen, die vom genannten Flansch (17) abstehen und einen Stift (30) tragen, der schwenkbar mit dem Gehäuse (18) des genannten Schalters verbunden ist.
3. Heizvorrichtung nach Anspruch 1, dadurch gekennzeichnet, dass ein elektrischer Anschluss (41) des genannten Schalters und ein elektrischer Anschluss (16) des genannten gewickelten Heizwiderstandes (12) über elektrisch leitende elastische Mittel (40) elektrisch miteinander verbunden sind, um die genannte Schwenkbewegung des Gehäuses (18) um den genannten Stift (30) gegenüber dem genannten Flansch (17) zu gewährleisten.
4. Heizvorrichtung nach Anspruch 3, dadurch gekennzeichnet, dass die genannten elektrisch leitenden elastischen Mittel (40) aus einem U-ähnlich gebogenen Draht bestehen.
5. Heizvorrichtung nach Anspruch 1, dadurch gekennzeichnet, dass das Wiedereinschalten des vom genannten Schalter gesteuerten Stromkreises automatisch geschieht, wobei der genannte Betätigungs-knopf (23) nach Aufhören der Ueberhitzung durch die Wirkung bekannter elastischer Mittel automatisch in die normalerweise geschlossene Schalterstellung zurückgeführt wird.
6. Heizvorrichtung nach Anspruch 1, dadurch gekennzeichnet, dass der vom genannten Schalter gesteuerte Stromkreis von Hand wiedereingeschaltet wird; wobei der genannte Betätigungs-knopf (23) Verriegelungsmittel (50, 51, 52) aufweist, die zur Arretierung des Betätigungs-knopfes (23) in der Stellung, bei der der Stromkreis geöffnet ist, gegen die Wirkung der genannten bekannten elastischen Mittel eingerichtet ist.
7. Heizvorrichtung nach Anspruch 6 dadurch gekennzeichnet, dass die genannten Verriegelungsmittel (50, 51, 52) einen Stift (50) aufweisen, der quer zur Bewegungsrichtung des genannten Betätigungs-knopfes (23) bewegbar ist und durch die Kraft von Federmitteln (51) in mindestens einen Sitz (52) eingreifen kann, der in der Wandung des Gehäuses (18) des genannten Schalters vorgesehen ist und der genannten Offenstellung des Stromkreises entspricht.
8. Heizvorrichtung nach Anspruch 7, dadurch gekennzeichnet, dass ein weiterer Sitz (53), der der Schliessstellung des Stromkreises entspricht, in der Wandung des Gehäuses (18) des genannten Schalters vorgesehen ist, wobei der genannte bewegliche Stift (50) abwechselnd in den einen und den anderen Sitz (52 oder 53) eintritt, je nachdem, ob der von genannten Schalter gesteuerte Stromkreis geöffnet oder geschlossen ist.

Revendications

1. Dispositif chauffant comprenant un élément chauffant à résistance enveloppée (10) et des moyens de commande et de limitation de la température (18, 19) aménagés pour déterminer un effet de commande et de limitation de la température et protéger ainsi ledit élément chauffant enveloppé (10) vis-à-vis d'une surchauffe, dans lequel :

(a) ledit élément chauffant enveloppé (10) comprend:

– une enveloppe métallique tubulaire (11) entourant une résistance chauffante en serpent (12) noyée dans un matériau isolant (14),

– deux bornes électriques (15, 16) reliées à ladite résistance chauffante en serpent (12) et disposées aux extrémités opposées de ladite enveloppe métallique (11) ; et

– une traverse de support (17) reliée rigidement à ladite enveloppe métallique tubulaire (11) à proximité de ses extrémités ; et dans lequel :

(b) lesdits moyens de commande et de limitation de température comprennent :

– un interrupteur de commande comportant un logement rigide (18), un bouton-poussoir de commande mobile (23) faisant saillie périphérieurement avec un mouvement sélectif entre une position normalement relâchée et une position actionnée enfoncée à l'intérieur du logement, et au moins une borne électrique s'étendant à partir dudit logement de façon opposée au bouton-poussoir pour la liaison avec l'une desdites bornes de ladite résistance de chauffage enveloppée (12),

– une tige rigide (19) dont une extrémité libre (20) est reliée fonctionnellement audit interrupteur et dont l'autre extrémité (21) est reliée rigidement en un point (22) à ladite enveloppe métallique tubulaire (11), ladite tige rigide (19) étant ainsi apte à transmettre à l'interrupteur les mouvements résultant de la dilatation thermique différentielle entre ladite enveloppe métallique tubulaire (11) et ladite tige rigide (19), déterminant ainsi les effets de commande et de limitation de la température résultant du fait que ledit Interrupteur est actionné sélectivement alternativement vers sa position ouverte ou vers sa position fermée ;

(c) ledit interrupteur de commande est supporté par ladite traverse (17) avec ledit bouton-poussoir (23) orienté vers ladite traverse

(17) pour le mouvement relatif audit logement (18) dans une direction sensiblement parallèle à ladite tige rigide (19) ; caractérisé en ce que :

(d) ledit interrupteur est, en fonctionnement, normalement fermé avec le bouton-poussoir en position relâchée,

(e) ledit logement est fixé sur la traverse (17) par des moyens à point d'appui (30, 31) fixés sur ladite traverse et coupant ledit logement 18 de façon proximale sur son extrémité opposée audit bouton-poussoir (23) de sorte que ledit logement (18) peut basculer autour desdits moyens à point d'appui pour faire se rapprocher ou s'éloigner ledit interrupteur (23) de ladite traverse (17),

(f) ladite extrémité libre (20) de ladite tige rigide (19) qui est reliée fonctionnellement audit interrupteur est articulée sur ledit logement (18) en un point (32) de celui-ci situé entre ledit bouton-poussoir (23) et lesdits moyens à point d'appui (30, 31), de sorte que lors du mouvement de ladite tige d'actionnement (19) en réponse à une dilatation thermique différentielle de ladite enveloppe métallique tubulaire (10), ledit logement est mis en pivotement en direction de ladite traverse, et ledit bouton-poussoir (23) est mis en contact de pression avec ladite traverse ouvrant ainsi ledit interrupteur normalement fermé.

2. Dispositif chauffant selon la revendication 1, caractérisé en ce que lesdits moyens à point d'appui (30, 31) comprennent deux éléments de support (31) s'étendant à partir de ladite traverse (17), lesdits éléments de support supportant un axe (30), ledit axe étant relié de façon pivotante au logement (18) dudit interrupteur.

3. Dispositif chauffant selon la revendication 1, caractérisé en ce qu'une borne électrique (41) dudit interrupteur et une borne électrique (16) de ladite résistance chauffante en serpent (12) sont reliées électriquement par ledit moyen élastique et électriquement conducteur (40) permettant ledit mouvement de bascule dudit logement (18) autour dudit axe (30) par rapport à ladite traverse (17).

4. Dispositif chauffant selon la revendication 3, caractérisé en ce que ledit moyen élastique et électriquement conducteur (40) comprend un fil relié en forme de "U".

5. Dispositif chauffant selon la revendication 1, caractérisé en ce que la refermeture du circuit commandé par ledit interrupteur a lieu automati-

quement; ledit bouton poussoir (23) étant ramené automatiquement sous l'action de moyens élastiques connus à sa position normalement fermée lorsqu'il y a cessation de la surchauffe.

5

6. Dispositif chauffant selon la revendication 1, caractérisé en ce que le circuit commandé par ledit interrupteur est refermé manuellement; ledit bouton poussoir (23) comprenant des moyens de blocage (50, 51, 52) adaptés à bloquer ledit bouton poussoir (23) dans sa position de circuit ouvert à l'encontre de l'action desdits moyens élastiques connus. 10
7. Dispositif chauffant selon la revendication 6, caractérisé en ce que lesdits moyens de blocage (50, 51, 52) comprennent un plot (50) mobile transversalement à la direction du mouvement dudit bouton poussoir (23); ledit plot (50) venant s'engager, sous la sollicitation de moyens à ressort (51), dans au moins un siège (52) prévu dans une paroi du logement (18) dudit interrupteur, et correspondant à ladite position de circuit ouvert. 15 20
8. Dispositif chauffant selon la revendication 7, caractérisé en ce qu'un autre siège (53), correspondant à la position de circuit fermé, est prévu dans ladite paroi du logement (18) dudit interrupteur; ledit plot mobile (50) venant s'engager alternativement dans l'un ou l'autre desdits sièges (52 ou 53) lorsque le circuit électrique commandé par ledit interrupteur est ouvert ou fermé. 25 30

35

40

45

50

55

