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[54] TEMPERATURE RESPONSIVE CONTROL SWITCH WITH BI-METALLIC DISK MEANS

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[51] **Int. Cl.** **H01h 35/32**
[58] **Field of Search** .... 200/83 A, 83 C, 83 W, 200/83 P, 166 M; 337/307, 308, 319

[56] **References Cited**

UNITED STATES PATENTS

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3,619,526	11/1971	Riley	200/166 M

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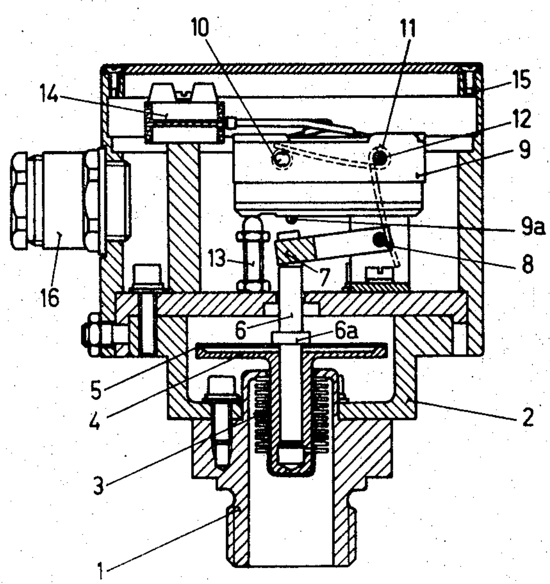
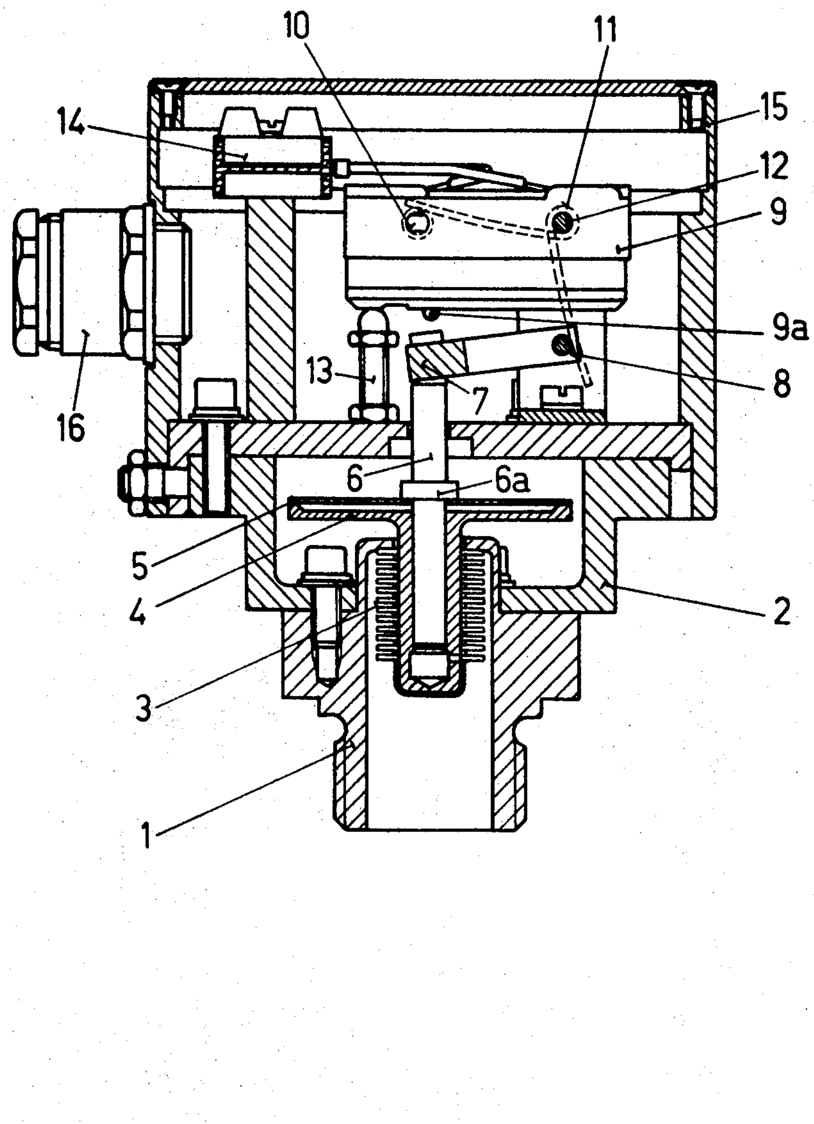
[57] **ABSTRACT**

A temperature-compensated gas density relay includes a bellows unit subjected to the gas, the pressure from which is transmitted by the bellows unit through a support mounting a bi-metallic disc and a shaft carried by the central portion of the bi-metallic, and longitudinal displacement of the shaft in response to the change in gas pressure serves to actuate the contacts of an electrical switch component of the relay. Should there be a change in the gas temperature, compensation therefor is accomplished by a temperature-induced displacement of the central portion of the bi-metallic disc, and hence also the shaft, in a direction opposite to that caused by the change in the gas pressure resulting from that same change in temperature.

4 Claims, 1 Drawing Figure

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TEMPERATURE RESPONSIVE CONTROL SWITCH WITH BI-METALLIC DISK MEANS

This invention is directed to an improvement in the construction of a temperature-compensated gas density relay and wherein an element responding both to pressure and to temperature of the gas act in opposite directions on the operating element for an electrical switch component of the relay.

Such gas-density relays are used, for example, in gas circulating switches of the closed gas circuit type which are operated preferably with sulphur hexachloride (SF_6) that serves both as a quenching gas for arc extinction and also as an insulation gas for the switch parts at high voltage. A relay of this type is disclosed, for example, in German Patent No. 1,166,878 and a corresponding U.S. Patent No. 3,129,309 granted Apr. 14, 1964 to Daniel H. McKeough et al. which functions to actuate a control switch for connecting and disconnecting a compressor for the gas in dependence upon its density. In this known embodiment, the gas pressure responsive element acts against a temperature-compensating a back-pressure created by a fluid substance in a sensor responsive to changes in temperature. However, the fastening and adjustment of the heat sensor are still relatively complicated and also expensive.

The objective of the present invention is to provide a more simple and inexpensive solution for compensating temperature changes in a gas density relay. The objective is attained in that a shaft component of the relay utilized for actuating contacts of the electrical switch included in the relay is secured to the center of a bimetallic disc responsive to a change in temperature, this disc being secured at its periphery to a support member which in turn is secured to one end of a bellows unit subjected to the pressure of the gas being supervised. Should a change in gas temperature occur which would tend to actuate the assembly of the bellows unit, support member and contact-actuating shaft in one direction, the central portion of the bi-metallic disc and the shaft will be displaced by a corresponding amount in the opposite direction relative to the support member, thus nullifying the effect of the temperature change.

The foregoing as well as other objects and advantages inherent in the invention will become more apparent from the following detailed description of one suitable embodiment of the invention and from the accompanying drawing wherein the single view presented is a central vertical section through the relay with certain components shown in elevation.

With reference now to the drawings, the improved relay structure includes a threaded nipple 1 which is adapted to be screwed onto the end of a pipe or container containing the gas whose pressure is to be supervised. The nipple 1 is rigidly connected to the lower part of a housing 2 by means of a plurality of fastening bolts one of which is shown, and the upper part of the nipple terminates in an end wall provided with an opening and around which one end of a bellows unit 3 is secured within the nipple by soldering. The hollow stem portion of a mushroom-shaped supporting member 4, which operates within the housing part 2, extends through the opening in the end of the nipple 1 and interiorly through the bellows unit 3 to the bottom of the latter, the arrangement being such that as the gas pressure within the nipple changes, the length of the bellows unit 3 will also change and hence the support member 4 will go up or down dependent upon the sense of the change in pressure. The circular head portion of the support member 4 has secured to it the rim of a bimetallic temperature compensating disc 5 and the latter is provided with a central opening and through which the lower portion of a shaft 6 extends slidably into the hollow stem portion of the support 4 for guiding the shaft. An intermediate collar 6a on shaft 6 abuts and is secured to the upper face of the bimetallic disc 5 at the pass-through point of the shaft. Hence as the bellows unit 3 contracts or expands longitudinally in accordance with a change in gas pressure, the corresponding longitudinal movement of the stem portion of the support 4 will be transmitted through the bimetallic disc 5 and collar 6a to shaft 6.

The upper portion of shaft 6 passes through an opening in an intermediate plate which latter serves to close off the space within which the support member 4 operates and the upper end of the shaft terminates within a chambered part of the housing structure in which one or more micro switches 9 are mounted for pivotal movement by means of a pivot shaft 12. A spring 11 of the double leaf type provided for each micro switch includes a central loop around the pivot shaft 12, a first laterally-extending leaf portion having its end in abutment with a lug 10 on the casing of the micro switch 9, and a second donwwardly extending leaf portion which bears against an abutment established by a pivot shaft 8 which mounts a lever 7 that is operated by the upper end of shaft 6. Lever 7 in turn, actuates a plunger 9a for each micro switch controlling the contacts of the latter.

Spring 11 biases the micro switch 9 in a counterclockwise direction about the pivot shaft 12 so as to abut against the upper end of an adjustment screw 13 by means of which the distance between the plunger 9a and its contact with the upper side of lever 7 can be adjusted thus effecting a corresponding adjustment in the working point of the switch contacts in relation to the pressure condition of the gas.

A hood 15 which closes off the upper end of the switch housing is mounted in position by screws which when removed provides access to a terminal strip 14 to which connecting conductors are led from the right to the micro switches 9, and also access to a stuffing box 16 secured to a side wall of the housing through which the external conductors can be led into the housing and fastened to terminal strip 14.

As has been explained, as the pressure of the gas within nipple 1 being supervised changes, e.g., increases, bellows 6 will be pushed up and shortened, this movement being transmitted by way of the support member 4 and bi-metallic disc 5 to shaft 6 thus displacing the latter upward to actuate lever 7 which in turn presses against and actuates the plunger 9a of the micro-switch 9 so that the switch contacts open and hence cut off the gas compressor. Conversely, should the gas density and hence its pressure decrease, the component parts will move in the opposite direction thus releasing plunger 9a and permitting the switch contacts to close so as to start up the compressor.

In order to compensate the relay for a change in temperature of the gas at the measuring point, the bimetallic disc 5 effects a compensating change in the longitudinal position of shaft 6 relative to the stem portion of the support **4**. Thus for example, should there be an increase in gas temperature which would be reflected in a corresponding increase in its pressure tending to shift the support **4** and shaft **6** upward, this is counter-acted and nullified by a compensating downward displacement of the center portion of the bimetallic disc **5** which thus carries shaft **6** downwardly to the same extent. Should there be a decrease in the gas temperature, compensation in the opposite sense would occur. Thus it will be evident that the resultant change in position of the shaft **6** for a change in gas temperature will be nil.

We claim:

1. In a temperature-compensated gas density relay the combination comprising a bellows unit subjectable to a pressurized gas to be supervised, one end of said bellows unit being fixed in position and the other end which is movable in response to a change in gas pressure being secured to a support member to effect a corresponding movement thereof in a direction longitudinally of the bellows unit, a temperature-compensating bi-metallic disc subjectable to the temperature of the gas and having only the peripheral portion thereof secured to said support member for movement therewith, and a relay operating shaft secured to the central portion of said bi-metallic disc which is moved in one direction to actuate a relay member such as the contacts of an electrical switch in response to movement of said bellows unit effected by an increase in gas pressure, said central portion of said bi-metallic disc being spaced from said support member and said central portion together with said relay operating shaft secured thereto being movable in the opposite direction upon an increase in gas temperature thereby to compensate for an increase in gas pressure resulting solely from an increase in its temperature.

2. A temperature compensated gas density relay as defined in claim **5** wherein said support member includes a head portion to which the periphery of said bimetallic disc is secured and a hollow stem portion into which a portion of said shaft extends and is guided as said shaft is displaced, said stem portion extending into and being secured to one end of said bellows unit, the opposite end of said bellows unit being secured in a fixed position.

3. A temperature compensated gas density relay as defined in claim **2** wherein said bellows unit is located within and secured to one end of a nipple and the end wall of said nipple includes an opening through which said stem portion of said support member extends into said bellows unit.

4. A temperature compensated gas density relay as defined in claim **2** wherein said shaft extends through said bi-metallic disc and includes an intermediate collar secured to the central portion thereof, the part of said shaft below said collar extending within the hollow stem portion of said support member and the part of said shaft above said collar serving to actuate said relay member.

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