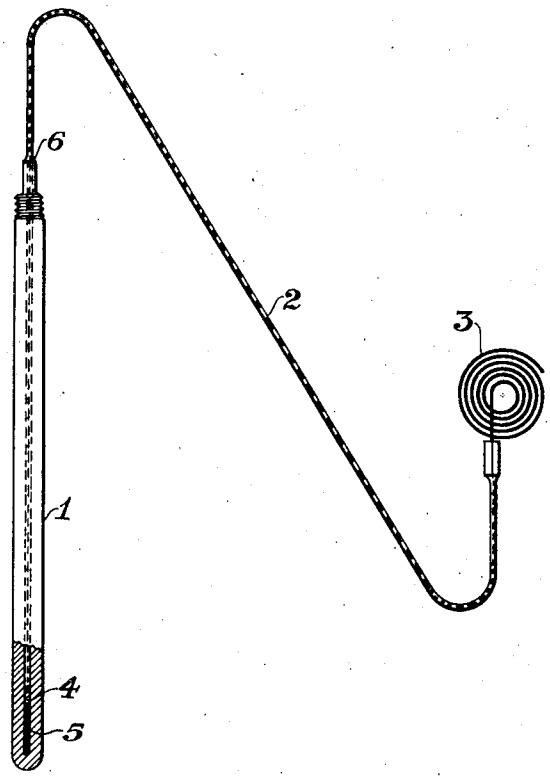
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HIGH TEMPERATURE VAPOR PRESSURE RECORDER AND REGULATOR

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HIGH-TEMPERATURE VAPOR-PRESSURE RECORDER AND REGULATOR.

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This invention relates to the class of heat-measuring instruments commonly referred to as pyrometers.

It is the general object of the invention to provide a pyrometer simple in construction and operation.

The more special and principal object is the provision of a pyrometer of the expansion thermometer type, which is available for the measurement of higher temperatures than was heretofore possible with instruments of this class.

For the measurement of temperatures in excess of 1000° F. pyrometers of the expansion thermometer type such as the usual mercury expansion and vapor-pressure instruments, could not be satisfactorily used because of the high vapor-pressure of mercury at such temperatures and for that reason it was general practice to use optical or electrical pyrometers.

The present invention is based on the idea of lowering the vapor-pressure of the mercury by addition of less volatile metals, in accordance with the well known law of Raoult.

While in theory metals other than mercury may come under consideration or may be actually used as the basic part of a mixture or an alloy having a vapor-pressure suitable for the purposes of the invention, mercury is for reasons of practical requirements the only metal available. Although there are various metals that may be added to mercury to reduce the vapor-pressure thereof, I consider thallium as the only metal which satisfies practical requirements.

My invention, briefly stated, is the application of a mercury-thallium alloy as the active thermometric fluid in a container of highly heat resistive material.

Alloys of mercury and thallium are known and in fact the application of a mercury-thallium alloy as active thermometric fluid is disclosed in the patent to Steinmetz No. 935,940. However, in that case the question of vapor-pressure is not involved and the particular alloy or amalgam was chosen for the purpose of obtaining a thermometric liquid of low freezing point.

For a full understanding of the invention, the principle of operation on which it is based and its advantages, reference is made to the accompanying drawing which is an elevation, partly in section, of a device embodying the invention.

In the drawing 1 denotes the fire tube or bulb element to be inserted into a heat zone or otherwise exposed to the action of heat to be measured or controlled. The bulb 1 is connected by a capillary tube 2 to a pressure responsive element indicated schematically as a Bourdon tube 3.

The fire tube 1 which consists of highly heat resisting non-oxidizing material such as, for instance, a nickel-chromium alloy or the like may be advantageously constructed by boring out a rod of the required diameter to near its end so as to receive with a tight fit the capillary 2. The bulb proper for confining the actuating fluid 5 may be formed by pushing the capillary 2 inwardly to define with the remaining wall of the bore the bulb space 4 which includes the actuating fluid and a small vapor space.

In practical embodiments I have used capillaries measuring about .196″ O. D. and the bulb space had a volume of the order of 1 cc.

With the aid of a suitable filling apparatus the entire system is preferably first entirely filled with the liquid and then a small amount i. e. about ¼ cc. of the liquid is removed to provide for the vapor space in the bulb.

The capillary is preferably welded into the fire tube where it issues from the latter, as indicated by the numeral 6.

Generally stated, the decrease in the vapor-pressure of the actuating fluid is substantially proportional to the precentage increase of the thallium in the alloy. However, due to a continued rise of the freezing point or the solidification point after an initial fall, a practical limit is reached near the ratio of 40% of thallium and 60% of mercury, which composition freezes at about +38% F. and produces a vapor-pressure approximately one half that of pure mercury.

If it were practically feasible to use the alloy solely as a source of vapor-pressure and to use a separate fluid as a transmitting fluid, the limit of 40% thallium would not be necessary and the rise of the freezing point would not be objectionable. However, inasmuch as it is for practical considerations essential that a single fluid be used for trans-

mitting as well as for actuating purposes, the composition must be so chosen that transmission is not impeded at ordinary temperatures.

In the foregoing I have made special reference to vapor-pressure instruments. It is understood, however, that the advantage of a decreased vapor-pressure is obtained also when the indication depends solely upon the expansion of the fluid in the bulb and not upon the variation of the vapor-pressure.

A pyrometer of the type described may be used for measuring temperatures up to 1800° F. without obtaining any unduly high vapor-pressures i. e. vapor-pressures in excess of those obtained with mercury for ranges above 1000° F.

I claim as my invention:

1. In a thermometric device of the expansion thermometer type, the combination with a fluid-pressure container and fluid connection thereto, of a bulb consisting of a material capable of resisting temperatures in excess of 1000° F. and a mercury-thallium alloy therein containing substantially 60% mercury and substantially 40% thallium.

2. In a thermometric device of the expansion thermometer type, a fluid-pressure system including a bulb, a pressure-responsive container, a capillary interconnecting the same and a mercury-thallium alloy substantially filling the system, the alloy being fluid at ordinary temperatures and having a vapor-pressure materially lower than that of mercury.

3. In a thermometric device of the expansion thermometer type, a fluid-pressure system including a bulb, a pressure-responsive container, a capillary interconnecting the same and a mercury-thallium alloy filling the system so as to leave a vapor-space in the bulb, the alloy being fluid at ordinary temperatures and having a vapor-pressure materially lower than that of mercury.

4. In a thermometric device of the expansion thermometer type, a fluid-pressure system including a bulb, a pressure-responsive container, a capillary interconnecting the same and a mercury-thallium alloy substantially filling the system and having a vapor-pressure approximately one half that of mercury.

5. In a thermometric device of the expansion thermometer type, the combination with a fluid pressure container and fluid connection thereto, of a bulb consisting of a material capable of resisting temperatures in excess of 1000° F. and a mercury-thallium alloy therein containing more than 10% of thallium and not materially exceeding 40% of thallium.

In testimony whereof I affix my signature.

KENNETH L. TATE.