

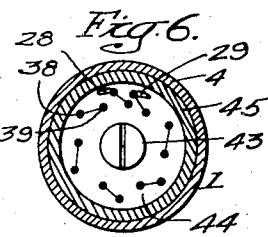
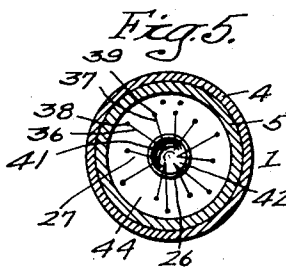
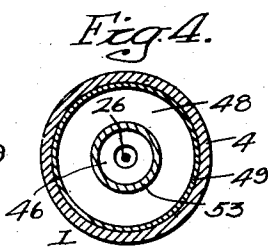
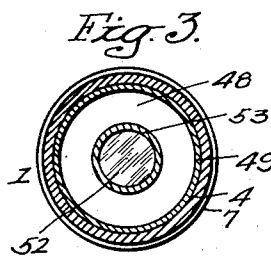
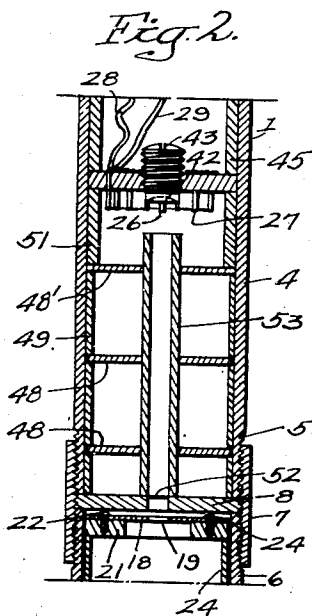
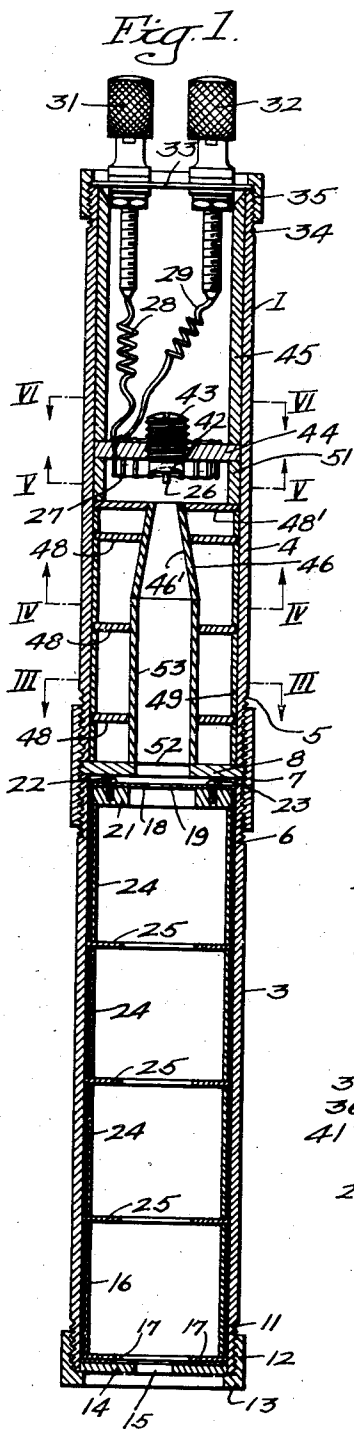
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C. B. THWING

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PYROMETER

Filed Nov. 8, 1929



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UNITED STATES PATENT OFFICE

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PYROMETER

Application filed November 8, 1929. Serial No. 405,736.

This invention relates to pyrometers, and particularly refers to radiation pyrometers.

One object of the invention is to provide a radiation pyrometer of the general type described in my prior application, Serial No. 54,316, filed September 3, 1925, upon which Patent No. 1,734,837 was granted November 5, 1929, characterized by the relatively small angle of view of the pyrometer, permitting readings of very small objects and by the increased concentration of the radiation at the detector. This invention is an improvement over the pyrometer described in the above-referred to patent and provides the substitution of a tubular mirror for the converging lense.

Another object of my invention is to provide a device of the class described of compact and rugged design suitable for inexpensive quantity production and comprising parts which may be easily made and readily assembled with a minimum expenditure of time and money.

Other objects of my invention, as well as details of construction and operation, will be apparent when taken in connection with the accompanying drawing, in which

Fig. 1 is a longitudinal sectional view of a pyrometer embodying my invention;

Fig. 2 is a partial longitudinal sectional view of a modification thereof;

Fig. 3 is a transverse sectional view taken on the line III—III of Fig. 1, illustrating the tubular mirror;

Figs. 4 and 5 are views taken on the lines IV—IV and V—V of Fig. 1, illustrating the detector; and

Fig. 6 is a sectional view taken along the line VI—VI of Fig. 1, showing the opposite side of the detector support.

In Fig. 1 is shown a pyrometer 1 which comprises an elongated tube having front and rear sections 3 and 4 which have adjacent ends 5 and 6 threaded for the reception of a coupling sleeve 7. A ring 8 is provided which is threaded on its periphery and is positioned intermediate the adjacent ends 5 and 6. A front end 11 of the section 3 is threaded for the reception of a cap 12 having an inwardly-extending flange 13

adapted to clamp a diaphragm 14 which is provided with a central opening 15 against a sleeve 16. A pair of rings 17, 17 may be positioned intermediate the sleeve and diaphragm 14. A second diaphragm 18 having a central opening 19 is mounted on a ring 21 adapted to fit within the other end of the front tube section 3. The diaphragm 18 is secured on the ring 21 by the screws 22 and 23. A plurality of additional sleeves 24 are positioned intermediate the sleeve 16 and the supporting ring 21 and are spaced by rings 25 similar to the ring 17. The sleeves 16 and 24 and the rings 17, 21 and 25, constituting the inner elements of the radiation tube section 3, are coated with a black material. The purpose of this is to permit radiant energy to pass without obstruction through the apertures 15 and 19 to a diaphragm 52 and into the tubular mirror 53. The diaphragm 52 comprises a plain thin disc of quartz glass. The purpose of this quartz diaphragm is to keep out foreign material, such as dust and fumes, to prevent the internal mirrored surface of the tube 53 from deteriorating and becoming dull from the action of any such foreign material. The section 4 has positioned therein a detector 26 which is in the form of a thermo-electric device comprising a plurality of thermocouples 27 connected in series-circuit relation and associated with external circuits by means of a pair of conductors 28 and 29. The conductors are respectively connected to binding posts 31 and 32 supported on a plate 33 clamped to a rear end 34 of the tube section 4 by means of a threaded cap 35.

Each thermocouple may comprise a pair of elements 36 and 37 which extend inwardly from supporting posts 38 and 39 to a common junction point 41. The junction points of the several thermocouples are closely spaced and positioned at the principal focus of a concave reflector 42 mounted on a threaded adjusting member 43 supported by a plate 44 which also serves to support the posts 38 and 39. The member 44 closely fits within the tube section and it may be spaced from the rear end 34 by means of a

sleeve 45. Radiant energy entering the tube section 4 through the diaphragms 18 and 52 is transmitted through a tube 53, having its inner surface highly polished and mirrored, to a conical or funnel-shaped reflecting element 46 also having an inner highly polished reflecting surface 46'. The purpose of this conical or funnel-shaped element is to concentrate the radiant energy upon the thermocouples 27. The tubular mirror 53 and the funnel-shaped reflecting element 46 are mounted on brass rings 48 and 48' and the conical element 46 has its larger end positioned against one end of the tubular mirror and its smaller end is in proximity to the thermocouples 27. The conical reflector 46 and the tubular mirror 53 may be made as an integral unit or as separate units, as desired.

The supporting ring 48' may be positioned at the proper distance with respect to the thermocouples by means of a pair of sleeves 49 and 51, the first of which extends between the ring 48' and the central ring 8. The rings 48 are positioned in the notches along the length of the sleeve 49. The second spacing sleeve 51 is positioned between the ring 48' and the central ring 8. The rings 48 are positioned in the notches along the length of the sleeve 49. The second spacing sleeve 51 is positioned between the ring 48' and the thermocouple supporting plate 44. The spacing sleeves 45 and 51 and the supporting member 44 are coated with a black substance, as is the case with the inner members of the front tube section 3. Thus the radiant energy entering the tube section 4 is transmitted by the tubular mirror 53 to the conical reflector surface 46', where it is concentrated and transmitted to the thermocouples 27. It is important to note that the tubular mirror functions to transmit radiant energy without absorption. Thus radiated energy from the heated body, whose temperature it is desired to measure, is conveyed substantially undiminished to the detector. Any radiant energy which may pass beyond the thermocouples is reflected back thereon by the concave reflector 42.

In Fig. 2 is shown a modification in which the tubular mirror 53 extends from the quartz diaphragm 52 directly to the thermocouples 27. In this modification, no concentrating reflector is provided and the radiant energy passes directly from the quartz diaphragm 52 to the thermocouples. By providing a tubular mirror for transmitting the radiant energy instead of using a converging lense, as is done in the prior art, all of the losses which are inherent in such lenses are substantially eliminated. In this modification, the tubular mirror is of much smaller diameter than that shown in Fig. 1 so that the energy passing through it will be

concentrated and confined to a smaller area and substantially all of it will be impressed on the thermocouples 27.

The operation of the device is as follows:—When the front-end 11 of the pyrometer is pointed at a heated body, the radiant energy therefrom passes through the diaphragm opening 15 and 19 to the quartz diaphragm 52 and is transmitted by the tubular mirror 53 to the conical concentrating reflector 46, where a complex reflection takes place with the result that a maximum concentration occurs at the thermocouples 27. Such energy as passes beyond the thermocouples is reflected backwardly by the concave reflector 42 so that the thermocouples are subjected to a maximum concentration of energy. The resulting electro-motive forces developed by the thermocouples 27 cause currents to flow when a galvanometer or other indicating instrument is operatively associated with the binding posts 31 and 32.

It is apparent that other modifications and changes may be made in the construction without departing from the invention and I, therefore, desire that only such limitations shall be imposed as are indicated in the appended claims.

I claim:

1. A pyrometer comprising a thermocouple, a conical concentrating reflector on one side thereof, and a tubular mirror in operative relation to said conical reflector for transmitting radiant energy to said thermocouple.
2. A pyrometer comprising a detector, means for concentrating the rays on said detector, and means comprising a tubular mirror adjacent said first-mentioned means for transmitting the rays to said concentrating means.
3. A pyrometer comprising a thermocouple, a concave reflector on one side thereof, a conical concentrating reflector on the other side thereof, and a tubular mirror in operative relation to said conical reflector.
4. A pyrometer comprising a thermocouple, a concave mirror on one side, a concentrating reflector on the other side, and a tubular mirror adjacent said reflector for reflecting the rays on said concentrating reflector.
5. A pyrometer comprising a casing having an opening, a diaphragm for said opening, a detector, a tubular mirror positioned intermediate said detector and said diaphragm for transmitting radiant energy to said detector, and a concentrating reflector positioned intermediate said tubular mirror and said detector.
6. A pyrometer comprising a sectional tube provided with a coupling member, one section of said tube having an opening for radiant energy, the other section containing a detector, a tubular mirror positioned with-

in said tube, and a reflector adjacent said tubular mirror for concentrating the rays passing through said tubular mirror.

5 A pyrometer comprising a tube having an opening, a diaphragm for said opening adapted to permit radiant energy to enter said tube, a detector positioned within said tube, a tubular mirror positioned intermediate said detector and said diaphragm,
10 a second diaphragm in operative relation to said tubular mirror, and a reflector for concentrating the radiant energy passing through said tubular mirror on said detector.

15 8. A pyrometer comprising a tube having an opening, a diaphragm for said opening adapted to permit radiant energy to enter said tube, a detector positioned within said tube, a tubular mirror positioned intermediate said detector and said diaphragm, a second diaphragm in operative relation to said tubular mirror, a reflector for concentrating the radiant energy passing through said tubular mirror on said detector, and a second concentrating reflector adjacent to said detector.

20 9. A radiation pyrometer comprising a conical reflector, a tubular mirror adjacent said reflector, heat-responsive means operatively associated with the apex of said reflector, and means for preventing the passage of undesired radiation to said tubular mirror.

25 10. In a radiation pyrometer, a tubular casing, a funnel-shaped concentrating reflector therein, a detector adjacent the apex of said reflector, and a tubular mirror arranged in said casing between the reflector and the opening of said casing at a distance from said opening relatively great with respect to its distance from the said reflector, whereby the passage of substantially all the undesirable radiation through the tubular mirror is prevented.

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