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2,827,539

RADIATION SOURCE

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FIG. 1

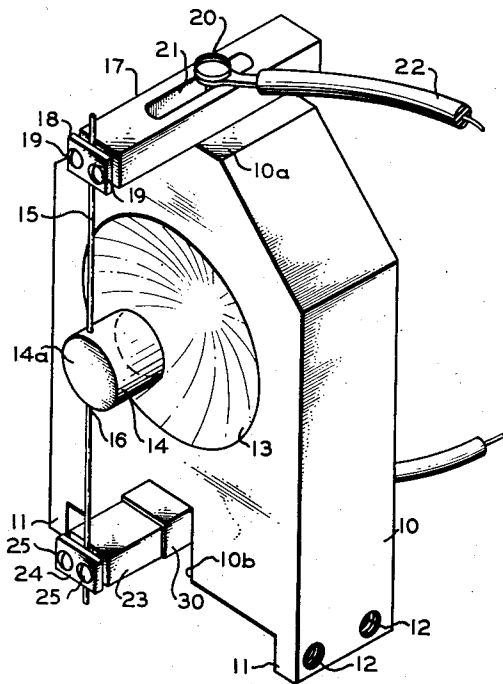


FIG. 2

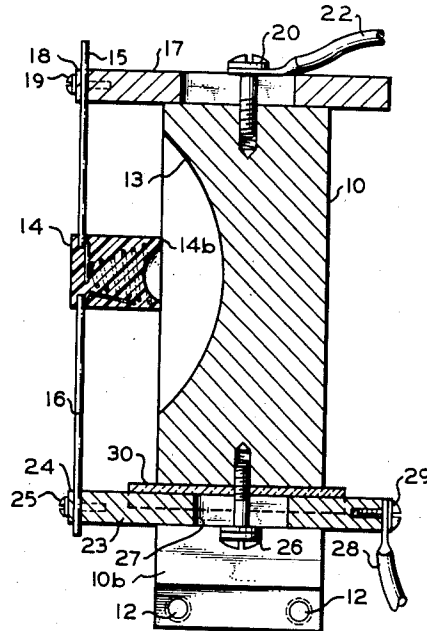


FIG. 3

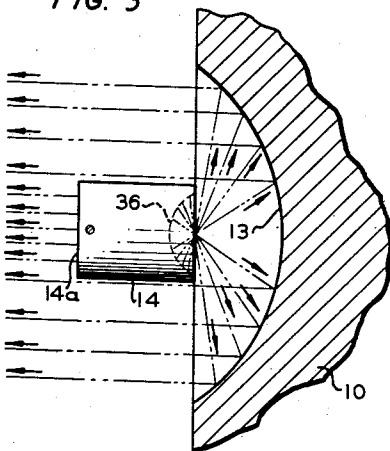
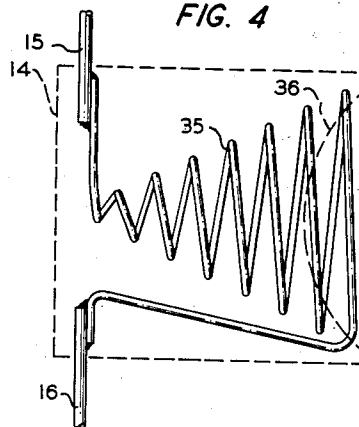


FIG. 4



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RADIATION SOURCE

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3 Claims. (Cl. 219—34)

This invention relates to a radiation source.

In many applications where a radiation source is required, it is necessary or desirable that the radiation be emitted in parallel rays to permit a production of a collimated beam. This is particularly true of composition analyzers utilizing infrared radiation, where the energy beam may pass through several sample cells, filter cells and the like before reaching an energy detector. Radiation sources previously proposed for such instruments provide a beam which is somewhat scattered with resultant loss in reliability and accuracy of the instrument.

In accordance with this invention, a collimated beam formed from parallel rays is effectively produced. A radiant heating element, preferably of generally cylindrical contour, is placed adjacent a paraboloid reflector. The surface of the heating element facing the reflector has a convex spherical recess formed therein, the center of the sphere coinciding with the focus of the paraboloid surface. In this manner, the radiant source is a virtual point source so that the rays emitted from the reflector are parallel.

Preferably and advantageously, a heating element is a generally cylindrical member formed of refractory cement within which is disposed a coil of resistance wire. With this arrangement, the front surface of the heating element supplies radiation at the central part of the beam which would otherwise be blocked out by the heating element so that a collimated beam is produced with energy substantially uniformly distributed throughout the cross section of the beam. The heating element is further supported by a novel terminal structure in desired position relative to the paraboloid reflector.

Accordingly, it is an object of the invention to provide an improved radiation source, particularly of infrared radiation.

It is a further object to provide a source producing a collimated radiation beam.

It is a still further object to provide a source of rugged construction which is very reliable in operation and economical to manufacture.

Various other objects, advantages and features of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

Figure 1 is a perspective view of a radiation source constructed in accordance with the invention;

Figure 2 is a vertical sectional view of the radiation source of Figure 1;

Figure 3 is an enlarged detail view illustrating a feature of the invention; and

Figure 4 is a schematic view illustrating the positioning of the resistance element in the heating element.

Referring now to the drawings, the source includes a metal block 10, preferably of aluminum, provided with lower flange base portions 11 having tapped openings 12 therein to permit convenient mounting of the source.

Formed in one side of the block 10 is a recessed por-

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tion 13 having the configuration of a paraboloid, the surface of this recess preferably being plated with a reflecting material, such as gold.

A heating element 14 of generally cylindrical contour is held in front of the reflector 13 by a pair 15, 16 of stiff wires or leads. The upper lead 15 is clamped to a supporting member 17 by a plate 18 and a pair of bolts 19. The member 17, in turn, is secured to an upper flat surface 10a of the block 10 by a bolt 20 which is secured to the block 10 and extends through a slot 21 formed in the member 17. The bolt 20 has the dual function of adjustably securing the top lead 15 and thus the element 14 in desired position relative to the block 10 and also of forming a convenient connection for a wire 22 which is attached to the lead 15 through the block 17.

The lead 16 is, in similar fashion, adjustably secured to a member 23 by a plate 24 and bolts 25, and the member 23 is secured within a complementary recess 10b of the block 10 by a bolt 26 extending through a slot 27, Figure 2. A wire 28 is attached to the block 23 by a bolt 29, and this wire is electrically connected to the lead 16 through the member 23.

The member 23 is electrically insulated from the member 10 by a strip 30 of insulating material, preferably glass tape. Further, the bolt 26 is formed from insulating material or is otherwise suitably insulated from the member 10, as by an insulating bushing, as those skilled in the art will readily understand.

In this manner, the element 14 is securely held in desired position relative to the reflector 13, and the position of this element can be adjusted, either axially or laterally, in view of the provision of the slotted members 17, 23 and plates 18, 24.

The element 14 is formed from a suitable refractory cement and it is heated to incandescence by an interior coil of resistance wire. A suitable cement for this purpose is Sauereisen cement. Embedded within the element 14 is a coil 35 of resistance wire, the ends of which are secured to the leads 15, 16, as by spot welding. The coil 35 is of generally helical contour with the turns being of increasing diameter proceeding toward the reflector surface 13.

In accordance with the invention, a convex spherical recess 36 is formed in the end of the element 14 which faces the reflector surface 13. Moreover, the element 14 has its axis coincident or substantially so with the axis of the paraboloid surface 13, and the center of this spherical surface is coincident or substantially so with the focus of the paraboloid surface. In this manner, the rays of radiation, in effect, emanate from a point source at the focus of the paraboloid surface with the result that they are reflected from the parabolic surface in strictly parallel paths. Moreover, there is no "dead space" at the center of the beam as a result of utilizing the member 14 because the front surface 14a of this member is heated to incandescence by the passage of current through the coil and supplies radiant energy at the central part of the beam. Thus, with the structure of the invention, a collimated beam is produced wherein the rays are parallel, and there is no dead space at the center of the beam.

In one specific embodiment of this radiation source, the member 14 was a cylinder 0.6" in diameter, and the heating element was of such size and dimensions that it had a resistance of 1 ohm at a temperature of 1400° F. The radius of the spherical surface 36 was 0.2", and the diameter of the paraboloid was 1.6", the paraboloid being formed in accordance with the equation $Y^2=1.6x$.

It will be noted that, with this construction, it is not necessary that the surface 13 extend beyond the plane of the inner surface 14b, Figure 2, of the element 14. This is not necessary because none of the energy from the spheri-

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cal surface would strike the extending portion of the paraboloid surface, and the arrangement shown is actually advantageous in that convection currents can readily circulate around the reflector 13 with resultant reduction in over-heating of the reflector.

While the invention has been described in connection with a present, preferred embodiment thereof, it is to be understood that this description is illustrative only and is not intended to limit the invention.

We claim:

1. An infrared radiation source which comprises, in combination, a member shaped to form a recessed reflecting surface of paraboloid configuration, a generally cylindrical heating element formed from refractory cement disposed with its axis substantially coincident with the axis of said paraboloid surface, said element having a recessed portion of spherical configuration facing said paraboloid reflecting surface, the center of said spherical surface substantially coinciding with the focus of said paraboloid, a coil of resistance wire embedded in said element, a pair of stiff conductor leads protruding in opposite directions from said element, each lead having one end thereof embedded in said element and connected to a terminal of said coil, means for adjustably securing the other end of each lead to said member.

2. An infrared radiation source which comprises, in combination, a member shaped to form a recessed reflecting surface of paraboloid configuration, a generally cylindrical heating element formed from refractory cement disposed with its axis substantially coincident with the axis of said paraboloid surface, said element having a recessed portion of spherical configuration facing said paraboloid reflecting surface, the center of said spherical surface substantially coinciding with the focus of said paraboloid, a coil of resistance wire embedded in said

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element, a pair of stiff conductor leads protruding in opposite directions from said element, each lead having one end thereof embedded in said element and connected to a terminal of said coil, a pair of metal strips secured to opposite sides of said member, one of said strips being insulated from said member, and each strip having a slotted portion adjacent said member, a bolt extending through each slotted portion to adjustably secure the corresponding strip to said member, and a plate secured to one end of each strip, the other end of each lead being secured between one of said plates and its corresponding metal strip.

3. In a radiation source, in combination, a metal support having a recessed reflecting surface formed therein, a heating element of refractory insulating material having a coil of resistance wire embedded therein, a pair of stiff conductor leads protruding from opposite sides of said heating element to hold said heating element in position in front of said reflecting surface, the end of each lead remote from said element extending beyond the edge of said reflector surface, a pair of slotted metal strips, bolts extending through the respective slots and into said member to secure said strips adjustably to said member, a metal plate at one end of each strip, one of said leads being positioned between each plate and its associated strip, and means securing each plate to its corresponding strip to adjustably secure the associated lead to said strip.

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