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RADIANT ENERGY LAMP

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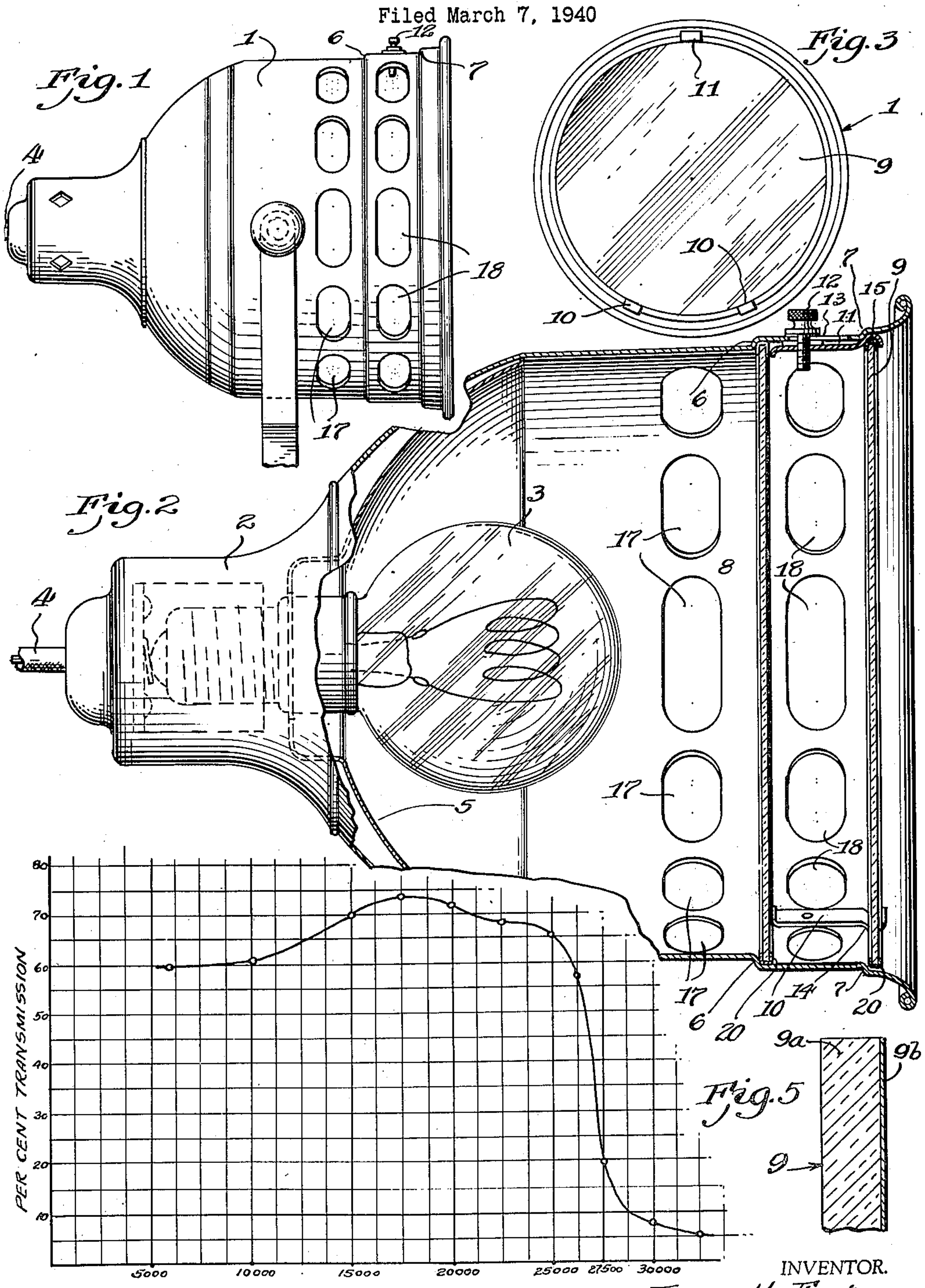

Fig. 4

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RADIANT ENERGY LAMP

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6 Claims. (Cl. 250—86)

This invention relates to radiant energy lamps, and it has to do particularly with a lamp for the radiation of rays which will penetrate the tissue below the surface and which is useful for what is sometimes called deep therapy.

The principal object of the invention is the provision of a lamp which is highly effective and efficient in its radiation of rays in the penetrating wave length band for the application of heat to the underlying tissue of the portion of a body subjected to such radiation. It is also an object of the invention to provide a lamp which can be used with safety and over a considerable period of time. To this end the lamp is arranged so that the relatively long wave length infra-red rays which are non-penetrating and which may unduly heat or damage the surface of the skin are substantially cut out, so to speak, and are not radiated and thus not applied to the subject. Moreover, it is an object of the invention to substantially cut out or eliminate the shorter non-penetrating rays, such as those of visible light having wave lengths lower than that of red. Accordingly, it will be seen that the rays from the lamp are substantially concentrated in that range of wave length or zone which include the visible red and relatively short wave length infra-red, these being penetrating rays which will reach the underlying tissue.

These and other objects will become more apparent as the detailed description progresses, and a lamp for carrying out the invention is disclosed in the accompanying drawing.

Fig. 1 is a general view of the lamp.

Fig. 2 is an enlarged cross sectional view showing various structural features.

Fig. 3 is an elevation of the front of the lamp.

Fig. 4 shows a curve illustrating the percentage of the transmission of light according to wave length.

Fig. 5 is an enlarged cross sectional view of one of the filters.

The structural features of the lamp may be comparatively simple and may include a shell **1** with a base **2** having a socket for the reception of an electric lamp **3**, the filament of which is suitable for radiating heat rays, while an electrical conductor is illustrated at **4**. Within the shell is a reflector **5**, the surface of which is preferably gold plated for purposes which will presently appear. The shell may be provided or formed with a bead or shoulder **6** and a second bead or shoulder **7**. A filter **8** is designed to be placed against the shoulder **6** so that it is spaced from the lamp **3**, and a filter **9** is placed against the shoulder **7**.

The shell may be provided with abutment pieces **10** in its lower portion for engaging and holding the filters spaced, while in the upper portion is a clip **11** held in place by a thumb screw **12**. In making the assembly the filter **8** is tipped at an angle and its lower edge placed between the shoulder **6** and the pieces **10**, and then its upper edge is swung against the upper part of the shoulder **6**. The clip **11** may now be located loosely. The screw **12** lies in a slot **13** so that the clip **11** may be pushed toward the open end of the shell. The lower edge of the filter **9** may be located in a recess formation **14** of the pieces **10**, and its upper edge in an inverted recess **15** of the clip, and then the filter may be pushed to a position paralleling the filter **8** and the screw then tightened. The filters may have their edges in channel protecting borders **20**.

The shell is provided with a number of openings **17** on one side of the filter **8** and a number of openings **18** on the other side for ventilation purposes for reasons which will presently appear. The filter **8** is preferably of clear glass. The filter **9** has a peculiar formation and is what is known as flashed ruby glass.

The rays which have the most penetrating characteristics are those which lie in the wave band of from about 6500 to about 8000 Angstrom units. This includes the visible red rays. Rays having wave lengths less than about 6500 Angstrom units have less penetrating power, and the penetrating power appears to decrease more or less progressively with the decrease in the wave length. Likewise rays having wave lengths which are longer than the above mentioned band have a decreasing penetrating characteristic. However, some of the shorter infra-red rays, that is for example, infra-red rays running up to a wave length of about 14,000 Angstrom units have penetrating characteristics and the decrease in penetration is not so rapid with these rays as it is with the shorter rays. Accordingly, rays in the band of about 6500 to 14,000 Angstrom units are considered penetrating rays. Information, which is believed to be authoritative, is to the effect that about 20% of the rays of about 7500 Angstrom units penetrates through the skin and into underlying tissue. The light radiated by the lamp of this invention is concentrated in this band of penetrating wave lengths.

The reflector employed is preferably gold plated because the gold reflecting surface has a selective reflecting ability and is most efficient in reflecting light within the band wave desired. The reflected light, as well also as some light which is radiated directly from the lamp, is first passed through the clear glass filter. This filter is substantially opaque to the non-penetrating infra-red rays; that is, the rays of long wave length. These waves are stopped by thin layers of water and as the living cells are largely of water, this radiation cannot penetrate deeply. As a result, such rays effect heating at the surface and not only may create an uncomfortable condition, but may at times burn or blister the surface. However, should the filter 8 become heated, it will radiate the non-penetrating ray of long wave length. Accordingly, the shell is provided with the apertures 17 and 18 for the dissipation of the energy which would otherwise cause a radiation of such undesirable wave lengths.

Even with this arrangement for dissipating the heat, the filter 8 may nevertheless become heated and emit some long rays. Accordingly, the filter 9 is employed and it is also cooled because one surface is exposed and the other subjected to air currents passing through the openings 18, and accordingly, it operates cooler than the filter 8. As a result, infra-red rays, which may be radiated by the filter 8, are in a large measure stopped by the filter 9. The filter 9 does not reach such a temperature as to emit or radiate any substantial infra-red rays.

Now as to the peculiar character of the filter 9: This filter is of such a character as to perform at least two functions. The first function is as above noted, namely, that of offering opaqueness to infra-red rays emanating from the filter 8. Its second function is to filter out or offer opaqueness to rays of the lower wave lengths, as for example, those having a wave length less than about 6500 Angstrom units. These are the visible rays in the bands including orange, yellow, green, blue and violet. It will be seen, therefore, that wave lengths in the visible red band are radiated while those both visible and invisible in the shorter wave lengths are minimized and at the same time the infra-red or longer wave lengths are minimized.

The filter 9, as above mentioned, is of the so-called flashed ruby glass. This is a glass, the coloring of which is obtained by the use of copper or gold added to the glass. However, a piece of glass of such thickness that it can be satisfactorily handled as a structural element and which is so colored, has a coloration so intense that it will hardly pass any rays of light therethrough, and obviously, a filter thus constructed would have a very low efficiency, if, indeed, it had any value at all. This is particularly true where copper is used. The use of gold may be so handled that lighter tints may be obtained wherein the intensity of the color is not so great as that of copper, but even with this noble metal a higher efficiency is obtained by the use of the so-called flash glass.

The ruby flash glass is one wherein the main body of glass is clear and it has only a very thin film of the colored glass on one surface. The large cross sectional view of Fig. 5 gives a diagrammatic illustration of this where the body of the glass is shown at 9*a* and the ruby film at 9*b*. This is obtained by a fusion or flash process wherein in the finished article the glass film 9*b* is united with and constitutes an integral part of the whole, but the coloring lies only in this thin film. Attempts have been made to measure the thickness of this film, but at the present time the exact thickness is not known to the applicant, except to say that the film appears to be thinner than an ordinary sheet of paper. Of course, a flashed glass may be used where both sides have the flash ruby glass, but this is not only unessential but is believed to be detrimental because it would merely undesirably increase the intensity of the color and thereby cut out some of the desired rays.

Tests have shown that a lamp of this construction is highly efficient. The two filters function largely in filtering out the infra-red rays, while the ruby flash glass filters the shorter wave lengths, including those in the visible range and those of the invisible ultra-violet. The curve (Fig. 4) gives the percent of transmission of light at various wave lengths, given in terms of Angstrom units. The curve starts at approximately 6000 Angstrom units, and it will be seen that the percentage runs high, say from about 60 to 73% to about 25,000 Angstrom units. At this point the curve drops rapidly. Now, as above pointed out, the most penetrating rays are those having a wave length of about 7500 Angstrom units, but, of course, there is an efficient penetrating radiation throughout a range which may be stated as being from about 6500 Angstrom units to about 14,000. Wave lengths longer than 14,000 have some penetrating value, but in the higher bands, say from 27,500 Angstrom units up to 120,000 Angstrom units, the penetrating value is low, and these are undesirable because of the surface heating. The curve shows definitely an abrupt drop from about 25,000 to 27,500, with the result that the percentage of transmission of light having a wave length of about 35,000 Angstrom units is dropped to less than 5%.

Further tests have shown that, of the total radiation of light from the lamp of this invention, 95% was less than 27,500 Angstrom units. This, it will be seen, includes the highly penetrating band; and although some infra-red rays having wave lengths in excess of 27,000 are transmitted, the proportion or ratio is so small that the lamp can be used hour on end continuously without any disturbing or uncomfortable surface heating and with no deleterious effects from this standpoint.

Accordingly, it will be seen that a lamp is provided which has a high efficiency in the radiation of light in the penetrating wave bands, while the radiation of light of wave lengths on both sides thereof, namely, the long wave length infra-red, and the shorter visible and infra-red wave lengths are practically eliminated.

We claim:

1. A radiant energy lamp for radiating penetrating visible red and short infra-red rays, comprising in combination, a light source, a reflector therefor, a substantially clear glass filter for filtering out non-penetrating relatively long wave length infra-red rays, a second filter spaced from the first filter and comprising a body of substantially clear glass having on a surface thereof a thin film of ruby glass, said second filter serving to filter out long wave length infra-red rays which may have their source at the first filter, and the ruby glass film serving to filter out rays in the visible band having wave lengths shorter than that of red rays.

2. A radiant energy lamp for radiating penetrating visible red and short infra-red rays, comprising in combination, a light source, a reflector

therefor, a substantially clear glass filter for filtering out non-penetrating relatively long wave length infra-red rays, a second filter spaced from the first filter and comprising a body of substantially clear glass having on a surface thereof a thin film of ruby glass, said second filter serving to filter out long wave length infra-red rays which may have their source at the first filter, and the ruby glass film serving to filter out rays in the visible band having wave lengths shorter than that of red rays, and means mounting the filters so that air currents may move past both surfaces of each filter for cooling purposes.

3. A radiant energy lamp for radiating penetrating visible red and short infra-red rays comprising in combination, a light source, a reflector therefor, a substantially clear glass filter for filtering out non-penetrating relatively long wave length infra-red rays, a second filter spaced from the first filter and comprising a body of substantially clear glass having on a surface thereof a thin film of ruby glass colored by the introduction of a metal selected from the group consisting of copper and gold, said second filter serving to filter out long wave length infra-red rays which may have their source at the first filter, and the ruby glass film serving to filter out rays in the visible band having wave lengths shorter than that of red rays.

4. A radiant energy lamp for radiating penetrating visible red and short infra-red rays comprising in combination, a light source, a reflector therefor, a substantially clear glass filter for filtering out non-penetrating relatively long wave length infra-red rays, a second filter spaced from the first filter and comprising a body of substantially clear glass having on only one surface thereof a thin film of ruby glass colored by the introduction of a metal selected from the group consisting of copper and gold, said second filter serving to filter out long wave length infra-red rays which may have their source at the first filter, and the ruby glass film serving to filter out rays in the visible band having wave lengths shorter than that of red rays.

5. A radiant energy lamp for radiating penetrating visible red and short infra-red rays comprising in combination, a light source, a reflector therefor having a reflecting surface of gold, a substantially clear glass filter for filtering out non-penetrating relatively long wave length infra-red rays, a second filter spaced from the first filter and comprising a body of substantially clear glass having on a surface thereof a thin film of ruby glass colored by the introduction of a metal selected from the group consisting of copper and gold, said second filter serving to filter out long wave length infra-red rays which may have their source at the first filter, and the ruby glass film serving to filter out rays in the visible band having wave lengths shorter than that of red rays.

6. A radiant energy lamp for radiating penetrating visible red and short infra-red rays comprising in combination, a shell having an open end, a light source in the shell at its closed end, a reflector in the shell, a substantially clear glass filter in the shell spaced from the light source and spaced from the open end thereof, a second filter substantially at the open end of the shell, said second filter comprising a body of substantially clear glass having a thin film of ruby glass on a surface thereof, the first named filter serving to filter out non-penetrating relatively long wave length infra-red rays, the second filter serving to filter out relatively long wave length infra-red rays which may have their source at the first filter, and the ruby glass film serving to filter out rays in the visible band having wave lengths shorter than that of red rays, said shell having openings therein between the light source and the first filter, and openings therein between the two filters for the passage of air therethrough for cooling the filters.

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