

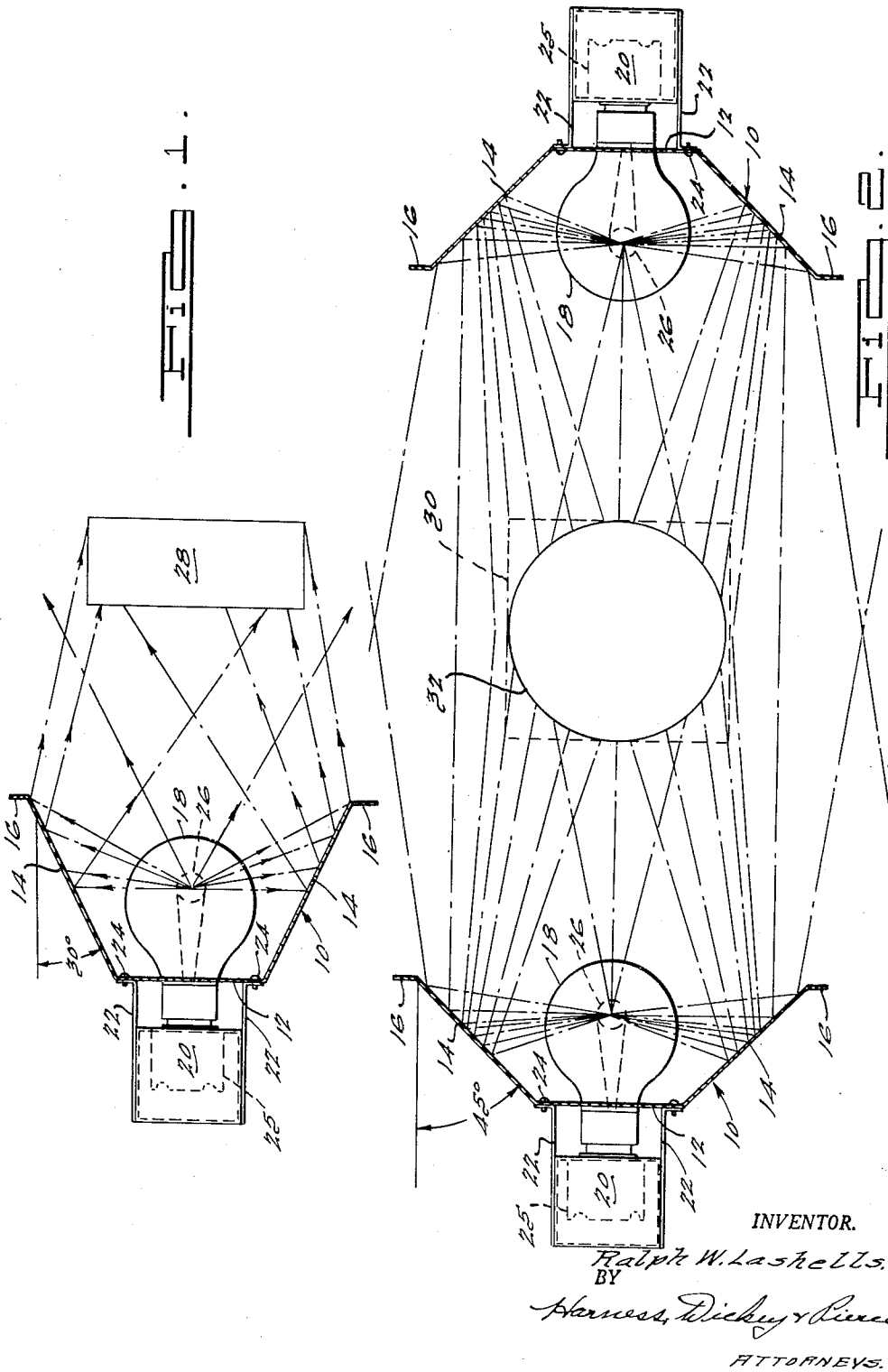
Feb. 14, 1950

R. W. LASHELLS
INFRARED RAY EQUIPMENT

2,497,676

Filed March 27, 1946

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

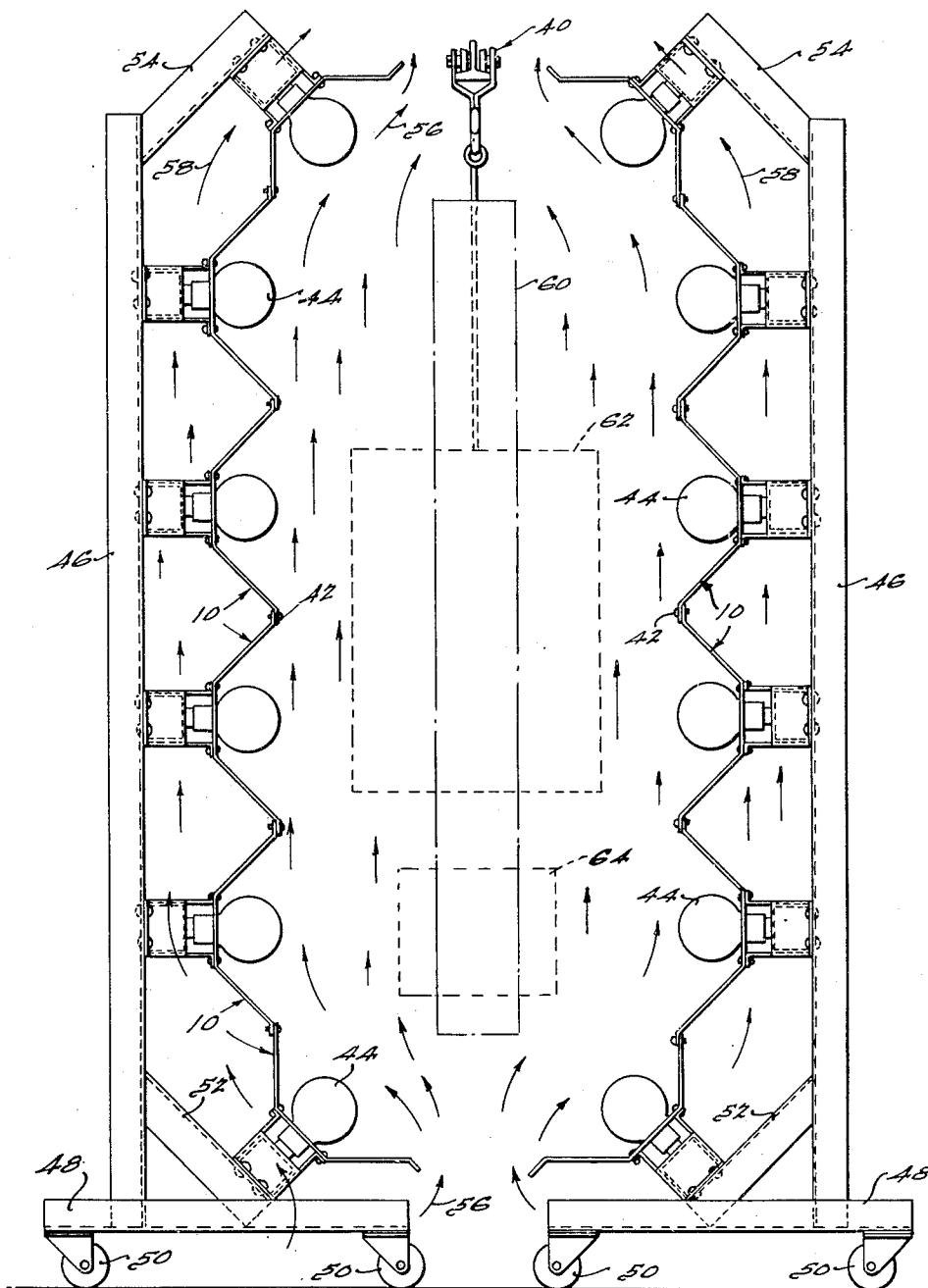


FIG. 3.

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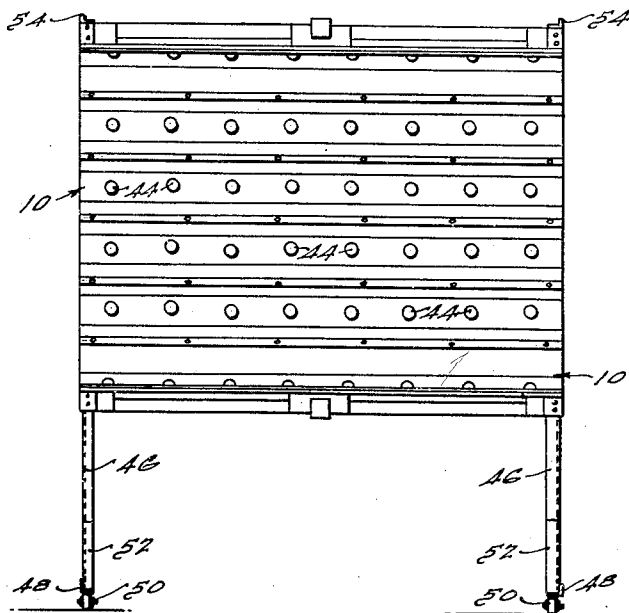


FIG. 4.

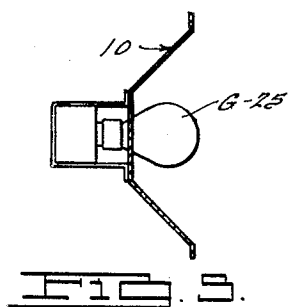


FIG. 5.

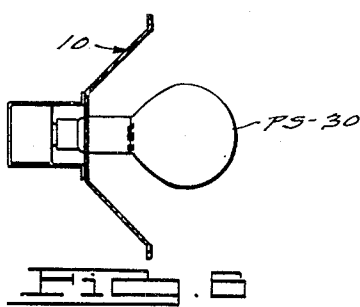


FIG. 6.

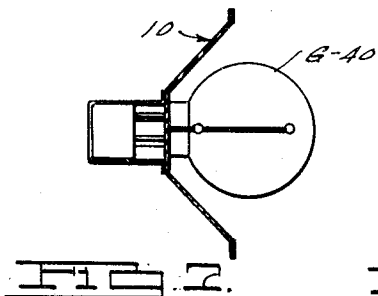


FIG. 7.

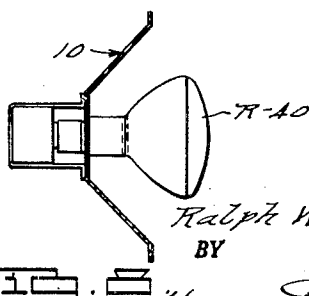


FIG. 8.

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INFRARED RAY EQUIPMENT

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Application March 27, 1946, Serial No. 657,395

1 Claim. (Cl. 219—34)

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This invention relates to infrared ray equipment and particularly to equipment employing infrared ray lamps for the purpose of heating objects of various character and for various purposes, the principal object being the provision of equipment of this type capable of conserving electrical energy, providing a more even distribution of the heat from the infrared ray lamps, and that is readily adapted to various sizes and shapes of objects to be subjected to the rays of infrared ray lamps.

Objects of the invention include the provision of a reflector structure for an infrared ray lamp by means of which a more efficient distribution of the heat rays from an associated infrared ray lamp is possible than in constructions heretofore employed; the provision of equipment of the type described including a reflector so constructed and arranged as to permit a more efficient reflection of heat rays from an infrared ray lamp either directly or indirectly associated therewith than in prior art structures; the provision, in equipment of the type described, of a reflecting device for association with an infrared ray lamp so constructed and arranged as to be capable of directing heat rays from a directly associated lamp simultaneously upon the opposite ends of a body which ends are spaced from each other by a distance greater than the maximum diameter of the lamp; the provision of a reflecting device of the character described provided in extended lengths and capable of receiving a plurality of infrared ray lamps in association therewith; and the provision of a reflector of the type described of a more or less continuous conformation and adapted for a direct association with a plurality of laterally spaced infrared ray lamps, and a plurality of such reflectors and associated lamps being adapted to form banks of such lamps by arranging them with the reflectors in edge to edge relationship.

The above being among the objects of the present invention, the same consists in certain novel features of construction and combinations of parts to be hereinafter described with reference to the accompanying drawings, and then claimed, having the above and other objects in view.

In the accompanying drawings which illustrate suitable embodiments of the present invention and in which like numerals refer to like parts throughout the several different views.

Fig. 1 is a vertical sectional view taken transversely through a reflector constructed in accordance with the present invention, illustrating an infrared ray lamp in association therewith

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and illustrating the reflection of heat rays from the infrared ray lamp by the reflector upon an object to be heated.

Fig. 2 is a view similar to Fig. 1, but illustrating a pair of such reflectors and associated lamps in opposed relationship with respect to each other and illustrating the heat rays emanating from the lamps and reflected by the reflector.

Fig. 3 is an end elevational view illustrating a typical arrangement in which two banks of infrared ray lamps equipped with reflectors constructed in accordance with the present invention are arranged in opposed relationship with respect to each other and upon opposite sides of a conveyor mechanism by means of which work may be caused to be moved between the banks.

Fig. 4 is a reduced face view of one of the banks, shown in Fig. 3, but with the infrared ray lamps removed therefrom, and,

Figs. 5, 6, 7 and 8 are reduced views, similar to Fig. 1, but illustrating the application of different types of infrared ray lamps to reflectors constructed in accordance with the present invention.

In infrared ray lamp equipment employed for drying painted coatings on objects, or for any other reason, it is desirable, from a commercial standpoint, that such equipment be made up mainly from standard parts which may be assembled to one another to form completed structures of various sizes and shapes adapting them to a relatively wide variation in uses, and sizes and shapes of objects being treated thereby. Otherwise, it would require special parts for each installation with corresponding increased costs of parts and increased time required to construct the same.

Additionally, part of such infrared ray lamp equipment desirably provides reflecting surfaces for the infrared rays emanating from the lamps. This is true because of the fact that many infrared ray lamps are not equipped with their own reflectors, that is, silvered surfaces incorporated as a part of the bulb itself, and therefore require for efficient operation some means for directing the heat rays therefrom upon the work. Even in those cases where the bulbs are provided with their own reflecting surfaces, inasmuch as such bulbs are usually arranged in opposed banks or series such reflecting surfaces are desirable in each bank or series to reflect the heat received thereby from the bulbs of the opposite bank or series. Such reflecting surfaces are, of course, preferably such as to result in an even concentration, or diffusion of both the reflected and the

direct heat rays from the infrared ray bulbs upon the work and, where a number of such bulbs are employed, to get an even pattern of such heat rays upon the work.

As far as I am aware, no infrared ray equipment has heretofore been provided including reflecting surfaces so constructed and arranged as to permit a pair of opposed rows of infrared ray lamps, each extending in the direction of travel of an object therebetween, to project the rays from the associated lamps in such a manner as to strike all surfaces of such object when such object is of a greater size than the maximum diameter of the lamp. It will be appreciated that the value of providing such a reflecting surface is that certain sizes of objects, of a maximum dimension between opposite sides substantially greater than the diameter of the lamp bulbs employed, may be completely subjected to the effects of infrared rays from the lamp without the necessity of employing multiple rows, or banks, of lamps as is now conventional practice. The saving is, of course, not only in the amount of electrical energy consumed for a particular operation but is also material from the standpoint of cost of equipment.

The present invention deals particularly with a reflector for infrared ray equipment by means of which the above desirable characteristics are obtainable. Furthermore, the reflector of the present invention is formed in lengths such that any desirable number of infrared ray lamps may be mounted in laterally spaced relation with respect to each other over the length of a single such reflector, thus eliminating the necessity of forming a separate reflector for cooperation with each lamp as is now common practice. Additionally, such reflectors are so constructed and arranged that they may be positioned in edge to edge relationship with respect to each other in banks of any desired length and height and at suitable angles with respect to each other so as to enable them to be adapted to any size and shape of object to be treated by infrared rays. Thus, the construction is such as to provide a standard section for the reflectors, which section may be economically manufactured in relatively long lengths and simply cut to the length desired in any particular installation, and a plurality of which lengths may be readily associated with each other to form banks of lamps of any width or height.

Referring now to the accompanying drawings and particularly to Fig. 1, there is shown a reflector indicated generally at 10 formed from a single piece of sheet metal and having a base or bottom wall 12 and opposite side walls 14. It will be understood that the view in Fig. 1 is a transverse section through such reflector and that in practice the reflector is elongated and therefore of more or less trough like conformation. While the base or bottom wall 12 may be slightly curved or flat and similarly the side walls 14 may be slightly curved or flat, they are preferably flat as shown in order to obtain a more evenly distributed and controlled reflection of light therefrom. Likewise, the base or bottom wall 12 may be joined to the side walls 14 through a radius of greater or lesser extent, these walls being shown in the drawings as having a substantially sharp corner between them. The free edges of the side walls 14 are preferably provided with a relatively narrow but continuous flange 16 bent outwardly therefrom and formed integrally therewith, not only to aid in rigidifying the struc-

ture but for an additional purpose which will hereafter be apparent.

An infrared ray lamp bulb 18 is positioned with its axis in the longitudinal central plane of the reflector. While it may be supported in any suitable or conventional manner, in the particular case shown a sheet metal box or conduit 20 of rectangular section is mounted in spaced relation with respect to and in back of the base or rear wall 12 and is provided with a pair of forwardly projecting legs 22, the free ends of which are bent outwardly and rigidly secured in contact with the rear wall 12 of the reflector by means of screws 24. The member 20 has fixed interiorly thereof a socket 25 of conventional construction in which the threaded end of the bulb 18 is adapted to be received. The rear wall 12 is, of course, apertured in line with the socket 25 in the member 20 so that its stem portion may be projected therethrough. The member 20 and the socket 25 carried thereby is positioned at such distance behind the rear wall 12 that the ray emitting element of the lamp 18, shown in the conventional form of a coil 26, is positioned a material distance rearwardly of the plane of the forward edges of the side walls 14. It is preferable that the last mentioned relation exist regardless of the particular size of the lamp 18 employed where such lamp is of the type shown having a transparent body devoid of reflecting material forming a part thereof and the presence of which would prevent direct projection of the rays of heat from the lamp upon the reflection 10. The projection of the forward edges of the side walls 14 beyond the point of heat ray emission from the lamp 18 is necessary to obtain full advantage of the present invention, but even in cases where a lamp of such shape or size is employed that the point of heat ray emission thereof lies outwardly beyond the plane of the free edges of the side walls of the reflector certain material advantages of the present invention are still obtainable.

Where the point of heat ray emission of the lamp, shown as the coil 26 in the lamp 18 in Fig. 1, lies a sufficient distance inwardly from the plane of the free edges of the side walls 14, and the side walls 14 are arranged at the proper angular relation with respect to the axis of the lamp 18, then, as brought out in Fig. 1, the opposite ends of an object, such as 28, to be heated by the lamp 18 and spaced from each other by a distance greater than the diameter of the lamp 18, may be heated thereby. In such case, the opposed face of the object 28 may receive direct rays from the lamp 18 as well as rays therefrom striking and being reflected from the side walls 14 as indicated in the various lines showing the reflection of rays in Fig. 1. The opposite ends of the object 28, whose height is greater than the diameter of the lamp 18, may be heated due to reception of heat rays from the lamp 18 reflected from the side walls 14. Thus, three surfaces of the object 28 may be heated by reception of rays from the lamp 18 when positioned directly and centrally in front thereof.

Obviously, by positioning two lamps and their cooperating reflectors in opposed and spaced relationship with respect to each other as indicated in Fig. 2, then when an object such as the object 28 of Fig. 1, an object of square section such as indicated by dotted lines 30 in Fig. 2, a round object such as indicated at 32 in Fig. 2, or any other shaped object when positioned centrally with respect to the axis of the lamp and when of greater vertical dimension than the di-

ameter of the lamps and yet of smaller vertical dimension than the dimension between the free edges of the reflectors, may be heated on both the side and top and bottom surfaces, and if the object is moved in a direction longitudinally of the reflectors under such circumstances then all surfaces of the object may be heated by the two lamps.

The construction and arrangement of each lamp and reflector unit illustrated in Fig. 2 is substantially identical to that illustrated in Fig. 1, the only difference being that the side walls 14 of the reflectors 10 shown in Fig. 2 are bent outwardly at a greater degree with respect to the central plane of the reflector than in the construction illustrated in Fig. 1. This feature of being able to bend the side walls 14 with respect to the base 12 so as to vary the angle in question is one of the advantages of the present invention as in such case reflectors having side walls at varying angles to the base or rear wall 12, or to the lamp axis, may be provided from standard size and shape reflectors. This is so particularly in view of the fact that the reflectors 10 are preferably made of relatively light gage metal, preferably only as heavy as requirements for strength and rigidity demand. In this connection, it will be noted that the side walls 14 of the structure shown in Fig. 1 are disposed at an angle of approximately 30° with respect to the central plane of the reflector, while in the construction shown in Fig. 2, the equivalent angle is approximately 45°. The variations in these angles are preferably within these limits and it will be appreciated that the concentration and/or diffusion of rays from the lamps 18 reflected from the side walls 14 may be varied by simply varying this angle in the manner above described.

Although, in the broader aspects of the invention, the reflectors 14 may be formed from any suitable material having the desired light reflecting characteristics or having a surface imparting such characteristics to it, they are preferably made from aluminum or aluminum alloy having a specular finish having a reflectivity in the neighborhood of 80% or more. It has been found that by the use of such material the reflectors 10 are relatively cheap and an extremely effective reflecting surface is provided.

It will, of course, be appreciated that in actual practice very few installations will be made comprising a single reflector 10 having one or more bulbs such as 18 mounted in cooperation therewith, or a single pair of reflectors 10 each with one or more bulbs such as 18 mounted in cooperative relation therewith as shown in Fig. 2. The reason for this is that most installations will be such as to permit a relatively wide variation in size and shapes of objects to be treated thereby and in such case an arrangement of the general character shown in Fig. 3, or the equivalent, will ordinarily be resorted to.

Referring to Fig. 3, it will be noted that in this case there are two banks of reflector and lamp assemblies arranged in opposed relationship to each other on opposite sides of a monorail conveyor indicated generally at 40. In this case, each bank of lamps and reflectors includes six horizontally extending parallel reflectors 10 arranged in succession one above the other with the adjacent flanges 16 in overlapping relationship with respect to each other and secured together by means of suitable fastening devices such as sheet metal screws 42. The four center reflectors 10 are arranged with the axes of the lamps 18, or

their central planes, horizontally so as to direct the rays of heat therefrom generally in a horizontal direction except, of course, concentrated and/or diffused, as explained in connection with Figs. 1 and 2. The lower reflector of each bank is arranged with the central plane thereof, or the axis of its various lamps 18, directed inwardly and upwardly, in the particular case shown at approximately 45° to the horizontal. Similarly, the upper reflector 10 of each bank is arranged with the central plane of the reflector, or the plane including the axis of the lamps 18, directed inwardly and downwardly, shown in the particular case illustrated as approximately at 45° to the horizontal.

It will be understood that each bulb 18 in the construction illustrated in Fig. 3 is supported with respect to its reflector 10 in identically the same general manner as illustrated in Figs. 1 and 2, and it will also be understood that in the arrangement shown in Fig. 3 each reflector 10 will be relatively elongated and have a plurality of lamps 18 associated in spaced relationship with respect to each other over its length. This feature is brought out in Fig. 4, which is a face view of one of the banks shown in Fig. 3 except that the lamps 18 have been removed, and from which it will be noted that each reflector 10 is provided with eight openings 44 arranged in equally spaced relation with respect to each other over the length of the reflector and through each of which the stem of a lamp 18, or the equivalent, is adapted to be projected for reception in a socket therefor, one arranged directly to the rear of each opening 44. Accordingly, in the particular arrangement shown, each bank of lamps shown in Fig. 3 will include 48 lamps when a lamp is inserted in each of the sockets.

While the reflectors 10 and lamps 18, or the equivalent, may be supported in the arrangement illustrated in Figs. 3 and 4 in any suitable manner, in the particular case shown by way of illustration, each bank includes an end frame comprising a vertical angle member 46 suitably secured as by welding at its lower end to a horizontally directed member 48 mounted upon a pair of spaced casters 50. An angularly disposed angle iron 52 arranged with its face in a plane perpendicular to the central plane of the lower reflector 10 interconnects the members 46 and 48 outwardly of their first described point of attachment and not only serves as a brace for the joint between them but for the purpose of supporting the lower reflector 10 and lamps carried thereby as will be appreciated. A short angularly directed angle iron 54 directed upwardly and inwardly from the upper end of each member 46 is suitably secured thereto by welding or the like and serves the same purpose as the members 52 in the support of the corresponding reflector 10 and lamps 18.

In the construction illustrated in Figs. 3 and 4, the members 20 first described are assumed to be elongated channel sectioned members interconnecting the members 46, 52 and 54 at opposite ends of each bank so as to rigidly interconnect them and serve as a means for supporting the various sockets for the lamps 18. Thus, each bank of lamps and reflectors comprises a unit mounted upon the caster wheels 50 and may be readily moved on a supporting surface such as the floor. When the two banks of lamps and reflectors are arranged in the relation illustrated in Fig. 3 and in close but spaced relationship with respect to each other, they cooperate to form

between them an oven through which articles may be passed to be heated thereby, as for instance on a conveyor such as the conveyor 40 shown. The lower reflectors 10 being spaced from each other, and from the floor, provide for the ready flow of air below the and between them into the central portion of the oven where such air, being heated from contact with the reflectors 10 and articles being treated may freely escape upwardly between the opposed edges of the upper reflectors 10. This is pointed out by the arrows 56 in Fig. 3 showing the flow of such air. This flow of air is often important, particularly where the banks of lamps are employed for drying a coat of paint or enamel, or the like, on the surface of an object, as the lamps drive off the volatile fluid of the paint or enamel and the flow of air carries this away, thereby constantly providing a supply of fresh air which may more readily absorb such volatile fluids.

It will be appreciated that in practice the reflectors may become very hot and this is particularly so where the lamp bulbs 18 or their equivalent are not the type incorporating the reflector surface as an integral part thereof. Even in the latter case they usually become very hot because of reception of light rays from the lamps of the opposite bank. Therefore, it is desirable to provide a free flow of air particularly over the back surfaces of the reflectors 10 so as to dissipate such heat and prevent any deleterious effects thereof on the wiring for the various lamps. In the present case, the rear faces of the reflectors 10 are open to the surrounding air so that such air in being heated may freely flow upwardly over the backs of the reflector, as indicated by the arrows 58 and carry the heat away.

An important advantage of the present invention is that in heating objects passed through opposed banks of the lamps, such as those shown in Fig. 3, the amount of electrical energy required for heating the objects to the desired extent may be kept at a minimum. Where the objects to be treated are of such depth, as for instance in the case of the article 60 illustrated in Fig. 3, that its upper end is at a level with or above the upper edge of the second from the top reflector in each bank, and the bottom edge is on the level with or below the lower edge from the second from the bottom reflector in each bank, then of course all of the lamps 18 in such banks must be energized if all the surfaces of the object 60 are to receive the rays of heat from the lamp and be affected thereby. On the other hand, if an object such as indicated by dotted lines at 62 is the object to be treated and which object 62 is of less vertical height than the width of two reflectors 10 then, as illustrated at Fig. 3, it may be so suspended from the conveyor 40 that its upper edge is below the upper edge of one reflector of each bank and its lower edge is above the lower edge of the next adjacent reflector of each bank, so that in this case only the lamps 18 in two reflectors 10 of each bank are required to be energized in order to completely cover all surfaces of the object 62. On the other hand, if an object such as illustrated by dotted lines at 64 in Fig. 3 is to be treated between the two banks of lamps and its vertical dimension is less than the width of the open side of a single reflector 10, then it may be arranged in substantially of the same relation as the objects 30 and 32 in Fig. 2, and as brought out in Fig. 3, so that the lamps in only one reflector in each bank are required to be energized to

cover all surfaces of the object 64 to be treated.

It is to be particularly noted that with infrared ray lamp equipment as heretofore produced and having lamps arranged in banks as in the general manner illustrated in Fig. 3, it would be necessary in the treating of objects such as 62, and by shifting the same vertically from the position shown, to employ at least three rows of lamps in each bank, and in order to treat an object such as 64 to employ at least two rows. Thus, the possible relative saving in cost of electrical energy by the use of the present invention will be appreciated. Where, as above explained, the size of the object being passed between the opposite banks of lamps shown in Fig. 3, or their equivalent, is such as to permit only a portion of the various rows of lamps in each bank to be utilized in properly treating it, then the effect of the remaining rows of lamps may be eliminated in any suitable manner. For instance, the lamps 18 of each other rows may simply be removed. On the other hand, however, a switch is preferably provided in the circuit for each row of lamps 18 so that by simply opening certain such switches any desired row or rows may be deenergized. In this manner, the opposed banks of lamps may be quickly conditioned to process any desired size of object capable of being received between the opposite banks of lamps.

As previously mentioned, while the reflector of the present invention is probably more efficient when employed with a lamp of the relative size illustrated in Figs. 1, 2, and 3, and which lamp is there shown as the type commercially known as the G-30, and while, of course, such reflectors may be made in any size so as to be correspondingly associated with other sizes of infrared ray lamps, other relative sizes of lamps may, of course, be used with any particular size reflector. This is brought out in Figs. 5, 6, 7, and 8, in which lamps of a size different from the G-30 size, shown as a lamp 18 in the previous figures, is illustrated with the same relative size of reflector. For instance, in Fig. 5 a lamp commercially known as G-25 is shown in association with a reflector 10 assumed in this case to be the same size as the reflectors previously shown. This lamp is slightly smaller than the G-30 lamp, shown as a lamp 18 in the previous figure, and the relative relation of the same with respect to the reflector 10 is thus indicated. In Fig. 6 an infrared ray lamp commercially known as type PS-30 is illustrated; in Fig. 7 an infrared ray lamp of a type commercially known as type G-40 is shown; and in Fig. 8 an infrared ray lamp of a type commercially known as type R-40 is shown. These lamps all vary in size from the lamp of the type G-30 and the relative relation with the same size reflector as employed with the latter type lamp in the previous figures is illustrated. The advantages above described are all realized to a greater or lesser extent in connection with all these various types of lamps, or other types, but in the case of lamps of the R-40 type or similar lamps which incorporate their own reflecting surfaces, then, of course, the rays from the lamp itself will not be directly reflected from its own reflector 10 but the rays therefrom will be projected to the opposite bank of lamps and there be re-reflected in a manner similar to that above described.

Having thus described my invention and the advantages thereof, what I claim by Letters Patent is:

Infrared ray equipment comprising in combina-

tion a relatively elongated one piece trough-like member formed from sheet aluminum having a specular finish and comprising a relatively flat base and a pair of opposed outwardly diverging substantially flat side walls projecting from the edges thereof, and terminating at their free edges in laterally outwardly directed flanges, said sheet aluminum being of such a thickness as to permit the angularity between said side walls and said base to be readily varied between 30° and 45° with respect to the central plane of the reflector by bending the side walls with respect to said base, and the angularity of said flanges with respect to such side walls may be readily varied by bending said flanges with respect to said side walls, and an infrared ray lamp supported in fixed relations with respect to said reflector with the infrared ray emitting element thereof approximately centrally of the central plane of said re-

flector and at such distance inwardly of the open end of said reflector that at least a part of the rays projected from said emitting element will strike said side walls and be reflected therefrom toward said central plane.

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The following references are of record in the file of this patent:

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Certificate of Correction

Patent No. 2,497,676

February 14, 1950

RALPH W. LASHELLS

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows:

Column 7, line 6, after the word "below" strike out "the"; column 8, line 21, for "each" read *such*;

and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 13th day of June, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

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