

Oct. 30, 1945.

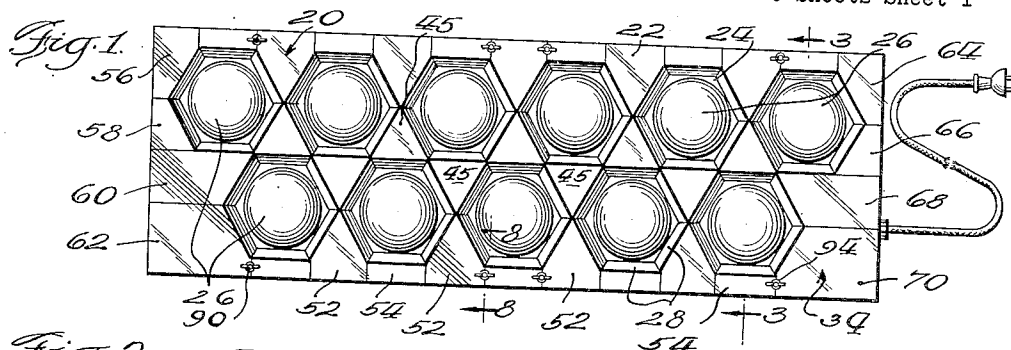
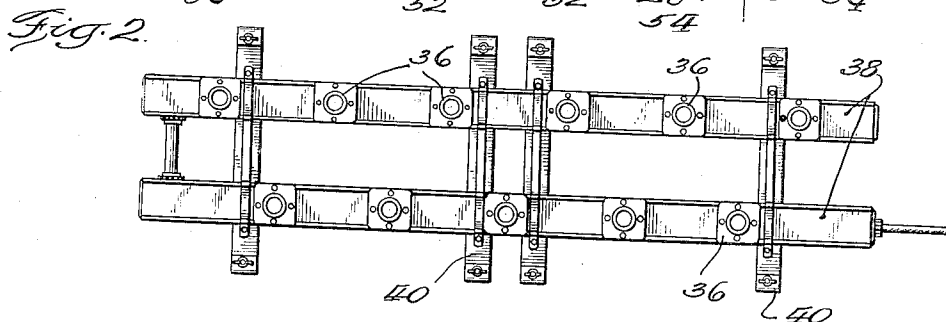
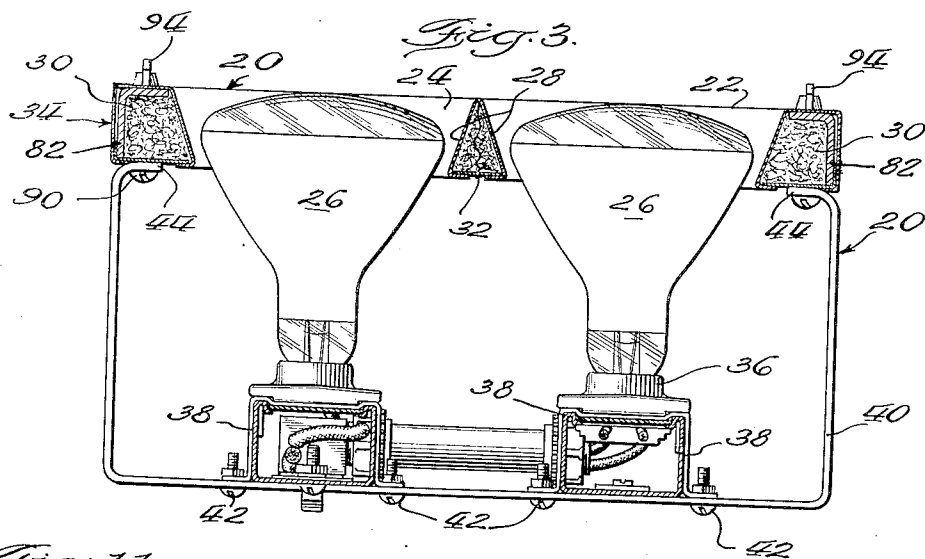
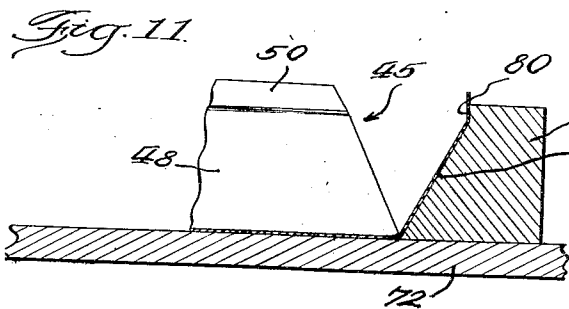
W. J. MISKELLA

2,387,804

REFLECTIVE PANEL

Filed Feb. 5, 1942

3 Sheets-Sheet 1



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Oct. 30, 1945.

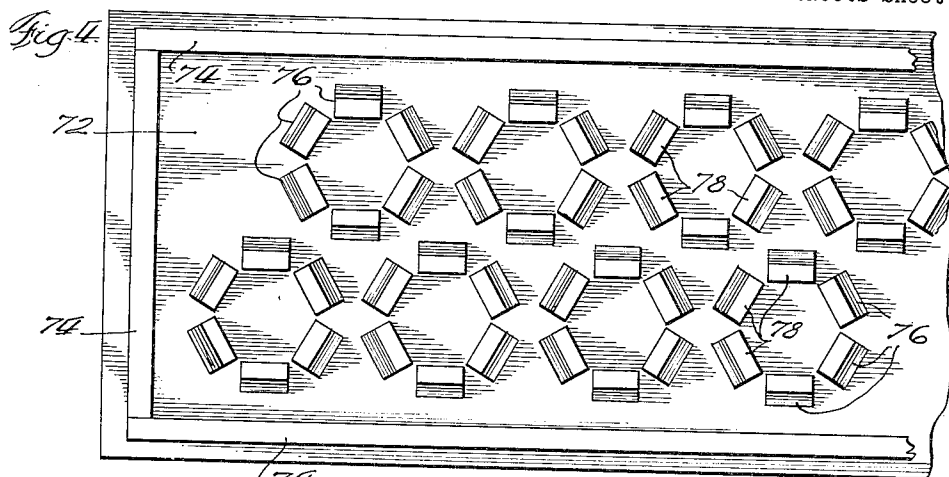
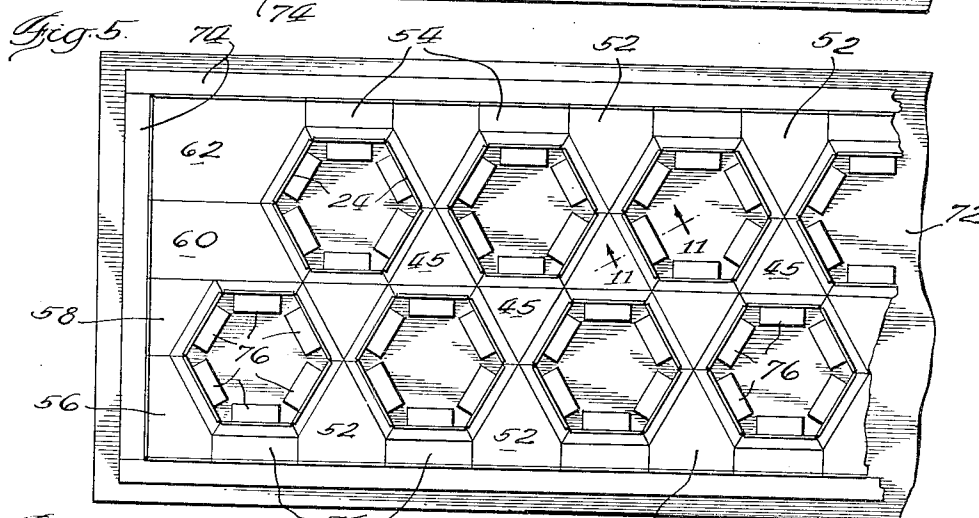
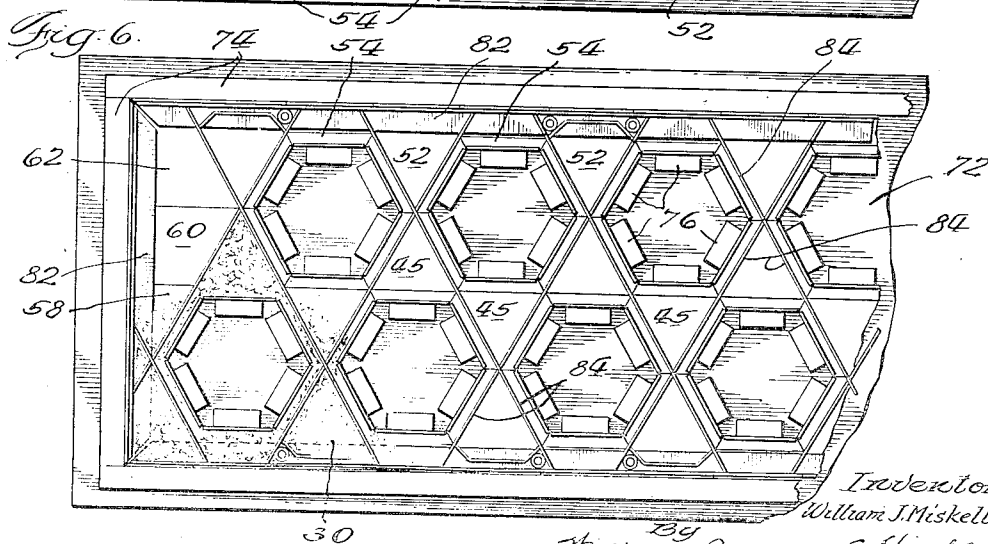
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2,387,804

REFLECTIVE PANEL

Filed Feb. 5, 1942

3 Sheets-Sheet 2



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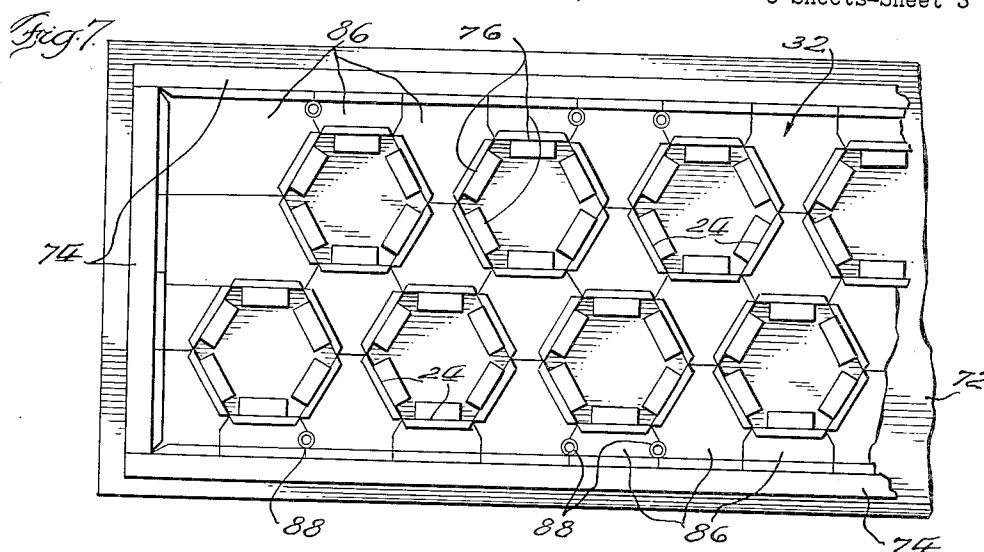
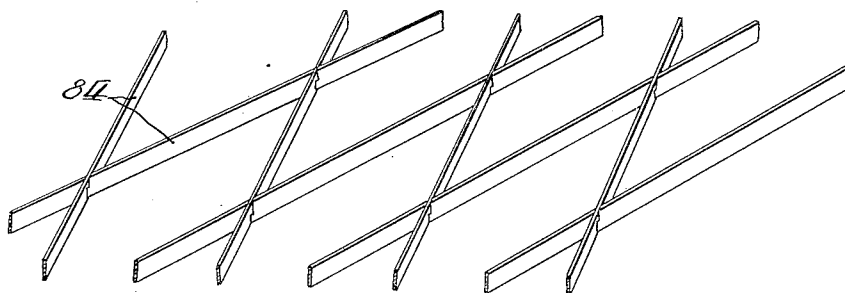
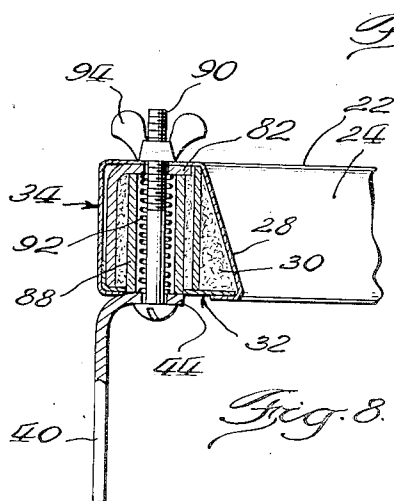
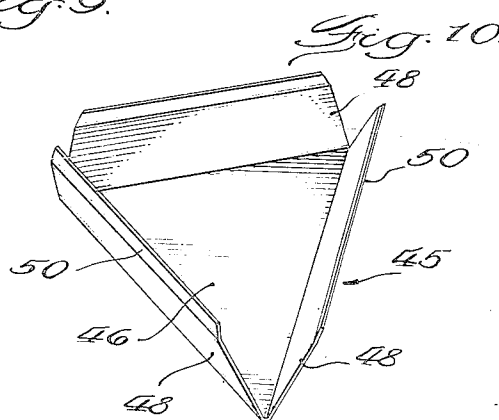
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2,387,804

REFLECTIVE PANEL

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,387,804

REFLECTIVE PANEL

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Application February 5, 1942, Serial No. 429,621

14 Claims. (Cl. 219—34)

The present invention relates to reflective panels and is more particularly concerned with the provision of a reflective panel particularly adapted for use with infra-red lamps. The invention also includes a novel method for manufacturing such panels.

In the past, infra-red lamps have been used for baking and drying and for other purposes where heat is to be applied to some object to obtain a desired result. In order to prevent the loss of heat from the infra-red bulbs and in general to make the operation more efficient, these bulbs have been placed in bowl-shaped reflectors and the reflectors have been arranged in rows or in tunnels so that the infra-red rays from the bulbs will be concentrated upon the object being heated. With such an arrangement considerable energy is lost because some of the rays escape through the spaces between the reflectors. This has two deleterious results. One, of course, is that the efficiency of the system as a whole is reduced; the other is that the escaping rays heat the air or objects in the vicinity of the oven and usually such heating is undesirable.

An attempt has been made in the past to increase the efficiency of such infra-red ovens by using bowl-shaped reflectors having generally hexagonal rims so arranged that the reflectors can be nested with each other, thus more or less closing the openings formerly present between adjacent reflectors. Such an arrangement, however, usually necessitates comparatively complicated racks and frames to support the reflectors in the desired positions, and in general is comparatively expensive to manufacture and install. Even with a system such as this, however, considerable heat is lost by conduction through the reflectors, since these reflectors normally are made of comparatively light gage metal and quickly heat to a high temperature and act in themselves as a heat source.

Another serious disadvantage of the bowl type reflecting units is that the bases of the infra-red bulbs heat to a comparatively high temperature, and with high wattage bulbs especially, this temperature frequently becomes sufficiently high to soften the cement used to secure the glass bulbs in their metal screw bases, thus resulting in destruction of the bulbs and thereby necessitating frequent expensive replacement.

Recently bulbs have appeared upon the market in which the reflector is built into the bulb. These bulbs in general have the disadvantage that if separate reflectors are not provided, considerable heat will be lost between the bulbs, and similarly

the high wattage bulbs are frequently broken because of softening of the cement which secures the bulb to its base.

One of the objects of the present invention is to provide a novel self supporting reflective panel for use particularly with bulbs having built in reflectors which overcomes the defects recited above.

Another object of the present invention is to provide an improved reflective panel which can be constructed quite largely of standard units available upon the open market in a semi-fabricated condition, and which, therefore, reduces the manufacture of this panel quite largely to an assembly operation.

Still another object of the present invention is to provide a novel reflective panel having the aforementioned advantages and in which the number of parts and the complexity of the parts which must be manufactured for this panel is kept at a minimum.

Still another object of the present invention is to provide a self supporting reflective panel which can be constructed in a large number of sizes from standard units, thereby enabling a small manufacturer to build panels in substantially any size without the necessity for providing special means for constructing the panels manufactured in each of the separate sizes.

Still another object of the present invention is to increase the efficiency of ovens which employ infra-red bulbs for their heat source.

Yet another object of the present invention is to provide a novel reflective panel for use with infra-red bulbs which can be manufactured at extremely low cost and which has marked advantages over any panels heretofore used.

Still another object of the present invention is to provide a reflective panel having the above-mentioned advantages, and which is so constructed that panels of various sizes can be taken apart and rearranged into panels of different dimensions with a minimum of loss of the materials salvaged from the disassembled panels.

Another object of the present invention is to provide a novel method for building up or assembling a panel of the type set out in the before-mentioned objects.

Still another object of the present invention is to provide a novel fixture for use in carrying out the last above-mentioned method.

Yet another object of the present invention is to provide a reflective panel for use with infra-red lamps which enables the user to obtain higher operating temperatures with lower wattage bulbs.

Other objects and advantages will appear from

the following description of a preferred embodiment of my invention which is illustrated in the accompanying drawings, wherein similar characters of reference indicate similar parts throughout the several views, and in which

Fig. 1 is a front view of a reflective panel embodying the present invention shown with the infra-red bulbs arranged in the panel in the places they assume during operation;

Fig. 2 is a front view of the frame and sockets comprising a portion of the device shown in Fig. 1. This figure may be considered as the portion of the device immediately behind the reflecting face shown in Fig. 1.

Fig. 3 is a transverse sectional view through the device of Fig. 1 and is taken in the direction of the arrows along the line 3—3 of Fig. 1;

Fig. 4 is a plan view of a fixture preferably used in assembling a panel such as that shown in Fig. 1;

Fig. 5 is a plan view similar to Fig. 4 of the device shown in Fig. 4 after a plurality of panel elements have been located upon the fixture during the assembly operation;

Fig. 6 is similar to Fig. 5 but shows a further step in the operation of assembling the device of the present invention. This figure illustrates the appearance of the device after the insertion of a plurality of obliquely arranged bracing and spacing members, and a portion of this figure shows the device after the additional step of placing insulating material within the panel;

Fig. 7 is a view similar to that shown in Fig. 6 but after the completion of the step of assembling the reflective portion of the panel and before the panel has been removed from the fixture;

Fig. 8 is a transverse sectional view through a portion of a reflective panel and may be considered as having been taken in the direction of the arrows substantially along the line 8—8 of Fig. 1;

Fig. 9 is a perspective view of the obliquely arranged bracing and spacing members which form a portion of the panel comprising the present invention;

Fig. 10 is a perspective view of one of the reflective elements used in constructing the present device, and

Fig. 11 is a transverse sectional view through a portion of the fixture and one of the reflective elements arranged thereon, and may be considered as having been taken in the direction of the arrows substantially along the line 11—11 of Fig. 5.

As best illustrated in Figs. 1 and 3, the panel, indicated generally by the numeral 20, when ready for use presents a flat polished forward face 22 having hexagonal openings 24 therein within which the several bulbs 26 are arranged. The side walls 28 of each of these hexagonal openings are tapered inwardly toward the rearward surface of the panel, and since the thickness of this panel is approximately a matter of one and one-half inches or so, these side walls act together to form a reflective surface which concentrates the oblique rays issuing from the bulbs toward the work to be treated. In other words, the reflective surfaces formed within the bulbs themselves act as the principal reflecting agent, while the panel serves to fill the space between the bulbs, thus preventing energy from being lost, and also serves to reflect toward the work being treated the stray rays issuing from the bulbs.

The forward or reflective portion of this panel may be filled with insulating material, such as rock wool, fiber glass, or the like, indicated by the numeral 30 so as to prevent the back surface of the reflecting panel from becoming hot enough to serve as a heat source in itself. Thus, very little heat is lost to the room in which the oven is placed by conduction through the panel.

The forward portion comprised of the reflective surface 22, the insulating material 30, and a back plate 32 will, for matters of convenience, be referred to as the reflector 34. This reflector supports the remainder of the structure comprised of the sockets 36, the lighting strips 38 which carry the sockets, and a plurality of brackets 40, by means of which the strips are attached to the reflector 34. Although the reflector 34 has been mentioned as supporting these other elements, it will be appreciated that when the device is assembled, it becomes a single unit and the actual point of support may be at either the reflector 34 or by means of the attachment of some securing means to the brackets 40 or the strips 38.

The strips 38 including the sockets 36 are standard articles of manufacture and can be purchased already assembled with the sockets 36 arranged with any spacing between centers desired. For instance, if it is desired to use the lamps at a spacing of seven and one-half inches between centers, the manufacturer can purchase as standard articles of manufacture strips such as those indicated by the numeral 38 with the sockets 36 arranged at seven and one-half inch centers. These strips can be of considerable length when in the as purchased condition, and then when it is desired to make a reflective panel having, for instance, six sockets, a portion of the strip having six sockets thereon can be sawed from the long strip and can be assembled into the device. It will be appreciated that this scheme simplifies the manufacture of the device and enables the manufacturer quickly to construct a device of specified dimensions after an order has been received. Since the lighting strips 38 having the sockets 36 thereon are standard articles of manufacture, they need no additional description here.

In constructing a panel such as that shown in Fig. 1 wherein six sockets are arranged in the top row, and five sockets in the bottom row, two pieces of lighting strip 38 are cut to proper size and are arranged in side by side relationship with the sockets staggered, as shown in Fig. 2, and are secured by means of screws 42 to a plurality of U-shaped brackets 40. These brackets extend transversely of the strips and at their ends are bent upwardly to provide upstanding portions which at their upper ends are bent inwardly to provide ears 44 which bear against the rearward face of the reflector 34. The lighting strips 38, therefore, in addition to supporting the sockets, also serve as structural members of the device and form a portion of the framework, and together with the brackets 40 serve to position the sockets 36 accurately with relation to the openings 24 in the reflector 34.

Reflector 34 has its reflective surface, which is comprised of the front polished surface 22 and the inclined surfaces 28, composed of a plurality of small elements, one of which is shown in Fig. 10. The particular element shown in Fig. 10 and indicated generally by the numeral 46 is comprised of an equilateral triangular front piece 46, each edge of which is connected to an obliquely

outwardly extending wing 48 at the free edge of which is arranged a vertically extending strip or tab 50. The piece 45 is formed from a sheet of metal, the outer surface of which is preferably of a highly reflective character, that is it can be plated with chromium or gold or some other reflective metal. These pieces can easily be formed with relatively simple dies on a punch press, or if formed in smaller quantities, they can be bent on a press brake or similar device.

As shown in Fig. 1, a large number of the pieces which comprise the panel are of the shape illustrated in Fig. 10. In general, these triangular pieces are arranged down the center of the panel where each of the obliquely inwardly extending faces 48 forms one-sixth of the reflective surface surrounding one of the bulbs. Since the elements 45 are triangular, one of these elements is used at each point in the panel where three bulbs are in juxtaposition.

In order to provide finished edges and ends for the panel, each of these panels will require several elements, in general similar to the element 45, but differing therefrom in certain specific features. For instance, along each edge of the panel at the juxtaposition of two bulbs an element 52 is used. This element 52 is similar to the element 45 excepting that one of the triangular edges is extended toward the edge of the panel and then is bent straight downwardly so as to provide a vertical rather than an oblique edge. To fill in the spaces between the elements 52, an element 54 is used. This element has one oblique edge, a narrow rectangular flat portion, and a vertical edge. It will be seen, therefore, that a plurality of the elements 52 and 54 are alternated along the edges of the panel and together with the elements 45 complete the panel with the exception of the two ends.

Each of the ends requires four specially formed pieces which have either the shapes of the elements, indicated by the numerals 56, 58, 60 or 62, or the reverse complements of these shapes. Pieces formed as reverse complements of the before-mentioned elements are indicated respectively by the numerals 64, 66, 68 and 70. The shape of each of these pieces will be apparent from Fig. 1 of the drawings. In general, each of the pieces 56, 58, 62, 64, 66 and 70 have one obliquely extending reflecting edge properly positioned, a flat surface of whatever shape and extent as is necessary to fill out the top flat face of the panel, one downwardly bent vertically extending edge to finish a portion of the end, or in the case of the elements 56, 62, 64 and 70, two downwardly bent edges are provided to finish a corner. The elements 60 and 68 are in general similar to the elements 58 and 66, but are provided with a more extensive flat surface and with two obliquely downwardly extending edges which form portions of the reflective surface around two separate bulbs.

In constructing the device, I provide a fixture such as that shown in Fig. 4. This fixture is comprised of a baseboard 72, which may be made of plywood or other suitable material, to which is attached four upstanding rails or bars 74. These bars are approximately one and one-half inches high and are so arranged that the space confined by the bars conforms to the space occupied by the panel to be constructed. Within the space to be occupied by the panel, six blocks 76 are secured to the panel by bolting or by some other suitable means around each of

the positions which will be occupied by one of the bulbs 26 in the finished device.

In Fig. 11 a section through one of these blocks 76 is shown. The block has a flat lower surface secured to the baseboard 72, an obliquely upwardly extending surface 78 and a short vertically extending surface 80. These blocks are so arranged on the board 72 that they serve to locate the pieces 45, 52, 54, 56, 58, 60, 62, 64, 66, 68 and 70 when these pieces are laid in between the blocks or between certain of the blocks and the rails 74.

In assembling the elements comprising the reflective face of the panel, it is necessary merely to select the proper number of appropriately shaped pieces and set these pieces in between the blocks 76, or between certain of the blocks 76 and the rails 74. With a small amount of practice, an operator readily becomes familiar with the location of the pieces to be used and readily fits these pieces into their proper location against the board 72. After these pieces have been placed upon the board, the board appears as seen in Fig. 5.

As the next step in constructing this device, four angle iron rails 82 are located in the bight between the flat inner face provided by the several assembled elements and the vertically extending edges formed of portions of these elements. Two of the rails 82 extend across the ends of the panel while similar but longer rails extend along each of the side edges. These rails serve to stiffen the panel at its edges and give great strength to the structure as a whole.

An additional set of spacing and stiffening members 84 are comprised of strips of sheet metal which are notched at proper intervals and interlaced and which extend obliquely across the panel from side to side in the space provided between the staggered lamp openings. These strips 84 add strength and rigidity to the structure, and also serve the function of spacing the front face of the reflective panel away from its back face. After the angle iron pieces 82 and the obliquely extending pieces 84 are in place, I preferably stuff all of the space within the panel with an insulating substance such as rock wool or fiber glass, for instance. After the panel has been stuffed, it will appear as shown in the lower left hand corner of Fig. 6.

The next operation as shown in Fig. 7 is to arrange a plurality of flat sheet metal members 86 in place around the lamp openings so as to cover the back surface of the panel, much in the manner that the previously mentioned panel elements cover the front surface, side edges and inclined edges which outline the lamp openings. If desired, the elements 86 may not be cut into as small pieces as is shown in Fig. 7. In fact, the back plate can be a single sheet with the hexagonal openings cut therein, or any number of these small elements desired can be combined into a single sheet. The reason that such a combination of these elements is possible on the back sheet, even though not advisable in the pieces which form the front face, is that the front face forming pieces must be bent to form vertically extending and obliquely extending edges, while the back face forming pieces are all perfectly flat.

Since the plurality of pieces which make up the back plate are all flat, this back plate can be given added rigidity by forming each of these pieces with small tabs which fit beneath the adjacent pieces. For instance, the several pieces

along the center line which are formed as triangles with their points cut off, and which are so arranged that they are in butted relation with each other, can be formed if desired as complete triangles; that is the points need not be cut off, in which case the points of some of the triangles will lie beneath portions of others of the triangles, thus stiffening the structure as a whole.

After the back pieces 86 are in place, all of the upstanding marginal tabs 50 are bent over and pressed or hammered down against the pieces 86 so as to secure the whole structure rigidly together in one piece.

The next operation consists in forming holes at the margins of the panel through which short pieces of pipe or other tubing 38 are inserted. Each of these pieces of tubing is arranged to permit passage of a screw 90 which extends through each of the ears 44 of the bracket 40 and which serve to secure the reflector to the remaining portion of the apparatus. After the insertion of these pieces of tubing, the device appears as shown in Fig. 7.

After removal of the reflector from the fixture shown in Fig. 4, coil springs 92 are preferably placed within the tubes 38 and bear against the inner surface of the angle iron rails 82 with one end, while their opposite ends bear against the upper surfaces of the ears 44. The screws 90 are then inserted through the ears 44, through the springs 92, through openings in the angle iron rails 82, and the outer surface of the reflector and at their outer ends are fitted with wing nuts 94. By tightening or loosening the wing nuts 94 the reflector 34 can be tilted relative to the brackets 30 so as to position the lamps 26 properly within the lamp openings, that is, tightening of the wing nuts 94 will urge the reflector toward the bracket 40, while loosening the wing nuts 94 will enable the springs 92 to force the reflector 34 away from the brackets 40.

With the arrangement I have shown, it will be appreciated that through the use of a minimum number of easily formed standard pieces, together with a minimum of assembly expense, a reflective panel of any desired dimensions can be formed. It will be appreciated further that a plurality of these panels can be arranged in any desired manner to form a tunnel or oven, and that the circulation of air around the back portion of the panel will keep the necks of the bulbs sufficiently cool to prevent deterioration of the cement which secures the bulbs in their screw bases. Additionally, it will be seen that very little radiant energy can leak out around the bulb and be lost, and because of the insulating material 30, very little heat will be lost by conduction from side to side of the reflective panel.

One method which I have found to be of advantage for using these panels in constructing a tunnel or oven is carried out as follows: A number of panels, which may be alike, are formed. For example, each of these panels can be of such a size as to have four bulb openings therein. These panels are then arranged and attached to a rack in such a manner that they form the side walls of a tunnel or other type oven. For instance, they may be arranged to form vertical side walls on each side of a conveyor, or they may be formed in an arch around a conveyor, or they can be located in any other arrangement that appears to be advisable. At the ends of the oven under ordinary conditions it will be found that some stray radiant energy will be lost. I, therefore, provide blank panels which need no illus-

tration since they may be similar to the panels shown, excepting that the front and back faces may be formed of single sheets with insulating material between the sheets, if desired. These blank panels have no bulb openings and no sockets. They are then arranged at the ends of the tunnel or oven and reflect back into the baking zone radiant energy that would otherwise be lost.

In some installations the ovens may have to be of considerable length, but the temperature need not be as high as can be obtained when lighted panels of the type shown are used over the full surface. Under these conditions I ordinarily intersperse lighted panels of the type shown with blank panels of the type mentioned above, thus obtaining the full benefit of the radiant energy from the lighted panels without overheating the oven which is comprised of these elements. It will be appreciated further that at any time the temperature within the oven or tunnel is higher than necessary, separate panels having bulbs therein can be turned off so as to provide a lower temperature and economize on electric power. For this purpose I preferably provide each of my panels with its own switch so that it can be connected or disconnected, as desired.

It will be seen that the arrangement of my panels, wherein the reflectors are attached to the framework, which carries the sockets, or in the case of the blank panels, a framework which need not be provided with sockets, by means of a comparatively small number of screws and wing nuts, facilitates easy removal or tilting of individual ones of the panels whenever such removal or tilting is desirable. For instance, in the panel shown which accommodates eleven bulbs, the reflectors can be removed from the framework simply by the removal of eight wing nuts after which the panel can be pulled away from the framework. If a fewer number of bulbs are accommodated in a panel of smaller size, or a similar size of blank panel is used, it will be appreciated that a correspondingly fewer number of wing nuts need be removed in order to enable separation of the panel from the framework.

Having described my invention, what I claim as new and useful and desire to secure by United States Letters Patent is:

1. A reflector panel comprising a plurality of bulb supporting sockets, frame means adapted for supporting said sockets in spaced relation and in parallel rows, the sockets in one of said rows being staggered with relation to the sockets in another of said rows, a generally plane reflector positioned in front of said sockets, said reflector being of substantial thickness and having hexagonal openings therein to accommodate the enlarged portions of bulbs secured in said sockets, said reflector comprising a back plate, a front plate, reinforcing and spacing members positioned between said plates, said front plate being comprised of a plurality of generally similar reflecting elements secured to said back plate at the peripheral edges of said reflector and at the edges of the openings which accommodate said bulbs.

2. A reflector panel comprising a plurality of bulb supporting sockets, frame means adapted for supporting said sockets in spaced relation and in parallel rows, the sockets in one of said rows being staggered with relation to the sockets in another of said rows, a generally plane reflector positioned in front of said sockets, said reflector being of substantial thickness and having hex-

agonal openings therein to accommodate the enlarged portions of bulbs secured in said sockets, said reflector comprising a back plate, a front plate, reinforcing and spacing members positioned between said plates, and a quantity of heat insulating material substantially filling the otherwise unoccupied space between said plates, said front plate being comprised of a plurality of generally similar reflecting elements secured to said back plate at the peripheral edges of said reflector and at the edges of the openings which accommodate said bulbs, and each of the hexagonal edges of each of said openings being formed by a piece of sheet metal attached to one of said elements and secured to said back plate.

3. A reflector panel comprising a plurality of bulb supporting sockets, frame means adapted for supporting said sockets in spaced relation and in parallel rows, the sockets in one of said rows being staggered with relation to the sockets in another of said rows, a generally plane reflector positioned in front of said sockets, said reflector being of substantial thickness and having hexagonal openings therein to accommodate the enlarged portions of bulbs secured in said sockets, said reflector comprising a back plate, a front plate, and reinforcing and spacing members positioned between said plates, said front plate being comprised of a plurality of generally similar reflecting elements secured to said back plate at the peripheral edges of said reflector and at the edges of the openings which accommodate said bulbs, and each of the hexagonal edges of each of said openings being formed by a piece of sheet metal attached to one of said elements and secured to said back plate.

4. An element for use in the construction of a reflector panel comprising a piece of sheet metal formed and bent so as to provide a generally centrally located equilateral triangular surface, a rearwardly inclined strip of metal attached to each of the edges of said triangle, the distance between the opposite free edge of said inclined strip and said triangular surface being approximately equal to the thickness of the reflector and the angle between said triangular surface and said inclined strip being obtuse, and an attachment tab comprising a second strip formed integrally with said inclined strip at the said free edge thereof and adapted to be bent to lie in a plane parallel to said triangular surface and to form an acute angle with said inclined strip.

5. An element for use in the construction of a reflector panel comprising a piece of sheet metal formed and bent so as to provide a flat surface having at least three edges, a rearwardly inclined strip of metal attached to one of said edges, the distance between the opposite free edge of said inclined strip and said surface being approximately equal to the thickness of the reflector and the angle between said flat surface and said inclined strip being obtuse, an attachment tab comprising a strip of metal formed integrally with said inclined strip at the said free edge thereof and adapted to be bent to be in a plane parallel with the plane of said flat surface and to form an acute angle with said inclined strip, a second rearwardly extending strip of metal attached to a second edge of said flat surface, the angle between said second strip and said surface being approximately 90° and the depth of said strip being approximately equal to the thickness of the reflector, and a second attachment tab comprising a strip of metal formed integrally with said second strip at the free edge thereof

opposite the edge attached to said surface and adapted to be bent to lie in a plane parallel to said flat surface and to form a right angle with said second strip.

6. The method of forming a heat reflector from a plurality of pre-formed sheet metal reflector elements, which comprises providing a fixture having hexagonal members thereon spaced according to the heater elements to assist in the proper location of said elements, locating a plurality of said elements in said fixture in the positions they are to assume in the completed reflector, said elements being arranged in a face down position, inserting reinforcing and spacing members against the back faces of said elements while said elements are in said fixture, inserting a back plate over said reinforcing elements, said back plate being spaced from the face of said reflector by said reinforcing and spacing elements, and bending portions of said elements over said back plate to bind together all of said elements and associated parts into a one piece reflector.

7. A reflector for use with infra-red bulbs comprising a generally rectangular reinforcing frame; a reflecting surface covering the area defined by said frame, said surface having a plurality of hexagonal openings therein to accommodate infra-red bulbs, said reflector having a back plate positioned generally parallel to said reflecting surface; a portion of said reflecting surface being comprised of a plurality of sheet metal reflecting elements which are bent so as to overlap said back plate at the periphery of said reflector, extend across the edge of said reflector, across a portion of the front face of said reflector to one of said openings, extend obliquely inwardly at the edge of said opening, and being bent over said back plate at the edge of said opening; and other portions of said reflecting surface being comprised of pieces which are bent over said back plate adjacent one of said openings, which extend obliquely outwardly from said back plate, across the front surface of said reflector to another of said openings, which extend obliquely inwardly at the last said opening and are bent over the back plate at the last said opening.

8. A reflector comprising a generally plane surfaced element of substantial thickness having openings therein to accommodate the enlarged portions of bulbs, said element comprising a back plate, a front plate, reinforcing and spacing members positioned between said plates, and said front plate being comprised of a plurality of generally similar reflecting elements secured to said back plate at the edges of a plurality of the openings which accommodate said bulbs.

9. A reflector comprising a generally plane surfaced element of substantial thickness having hexagonal openings therein to accommodate the enlarged portions of bulbs, said element comprising a back plate, a front plate, reinforcing and spacing members and heat insulating material positioned between said plates, and said front plate being comprised of a plurality of generally similar reflecting elements secured to said back plate at the edges of the openings which accommodate said bulbs.

10. A reflector comprising a generally plane surfaced element of substantial thickness having openings therein to accommodate the enlarged portions of bulbs, said element comprising a back plate, a front plate, reinforcing and spacing members and heat insulating material positioned

between said plates, and said front plate being comprised of a plurality of generally similar reflecting elements secured to said back plate at the peripheral edges of said reflector and at the edges of the openings which accommodate said bulbs.

11. A reflector comprising a generally plane surfaced element of substantial thickness having openings therein to accommodate the enlarged portions of bulbs, said element comprising a back plate, a front plate, reenforcing and spacing members positioned between said plates, and said front plate being comprised of a plurality of generally similar reflecting elements secured to said back plate at the peripheral edges of said reflector and at the edges of the openings which accommodate said bulbs.

12. A reflector for an infra-red oven comprising a generally plane surfaced element of substantial thickness having openings therein of such size and shape as closely to encompass the enlarged portions of infra-red bulbs which are in the general plane of the reflector, said element comprising a back plate, a front plate secured to said back plate, means spacing said plates from each other, heat insulating material filling the space between said plates, and reflecting elements secured to said front plate and to said back plate at the edges of said openings and adapted to reflect radiant heat toward the interior of the oven thereby preventing radiant heat from passing beyond said element and overheating the base portions of the infra-red bulbs.

13. A reflector for an infra-red oven comprising a generally plane surfaced element of substantial thickness having openings therein of

such size and shape as closely to encompass the enlarged portions of infra-red bulbs which are in the general plane of the reflector, said element comprising a back plate, a front plate having a reflective surface and spaced from said back plate, means securing said front plate to said back plate at the peripheral edges of said element, heat insulating material filling the space between said plates, and reflecting elements in said openings and secured to said front plate and to said back plate at the edges of said openings and adapted to reflect radiant heat toward the interior of the oven thereby preventing the radiant heat from passing beyond said element and overheating the base portions of the infra-red bulbs.

14. A reflector for an infra-red oven comprising a generally plane surfaced element of substantial thickness having openings therein of such size and shape as closely to encompass the enlarged portions of infra-red bulbs which are in the general plane of the reflector, said element comprising a back plate, a front plate having a reflective surface and spaced from said back plate, means securing said front plate to said back plate at the peripheral edges of said element, heat insulating material filling the space between said plates, and reflecting elements in said openings adapted to reflect radiant heat toward the interior of the oven thereby preventing the radiant heat from passing beyond said element and overheating the base portions of the infra-red bulbs, said reflecting elements being integral with said front plate and having means for securing them to said back plate at the edges of said openings.

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