

- [54] LIGHTING FIXTURE FOR HIGH INTENSITY LAMPS

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- [51] **Int. Cl.**..... **F21v 29/00, F21v 7/06**

- [58] **Field of Search**..... 240/3, 47, 11.4 R,
240/41.38 R, 41.36, 41.5, 41.35 E, 41 B;
339/112 R, 34, 54, 55

- [56]
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[57]

ABSTRACT

A lighting fixture of the floodlight type using a quartz iodine lamp having sealed terminals on opposite ends thereof. The metal sockets into which the lamp terminals fit are designed to carry away heat from the sealed ends by radiation and conduction at a rate sufficient to permit lamp operation below prescribed temperature levels set by the lamp manufacturer. The fixture further incorporates improved reflector mounting, lamp accessibility, socket and heat dissipation features which permit economical manufacture, speedy assembly, operation and maintenance.

8 Claims, 4 Drawing Figures

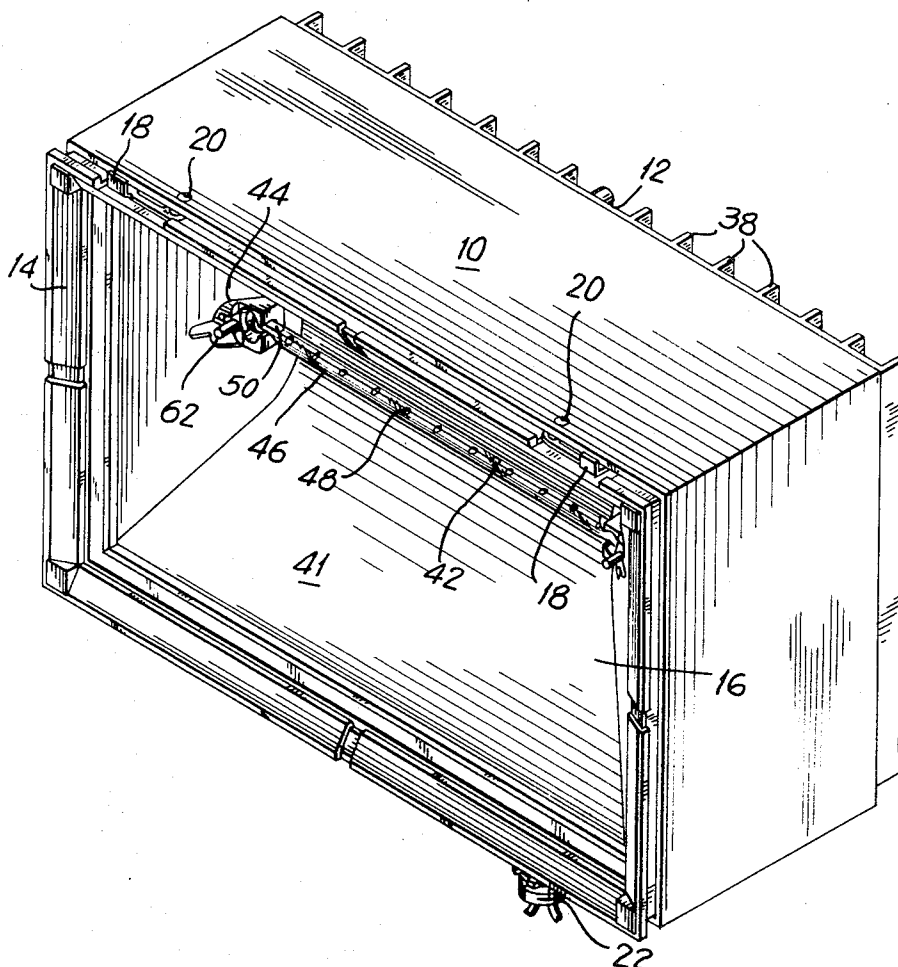


FIG. 1

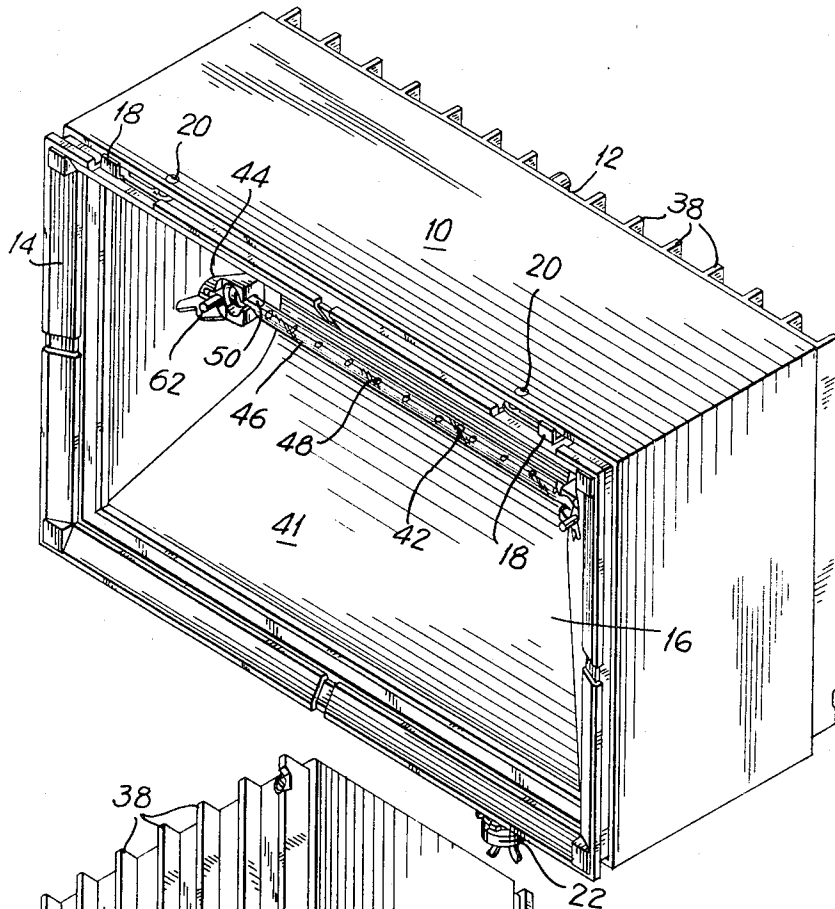
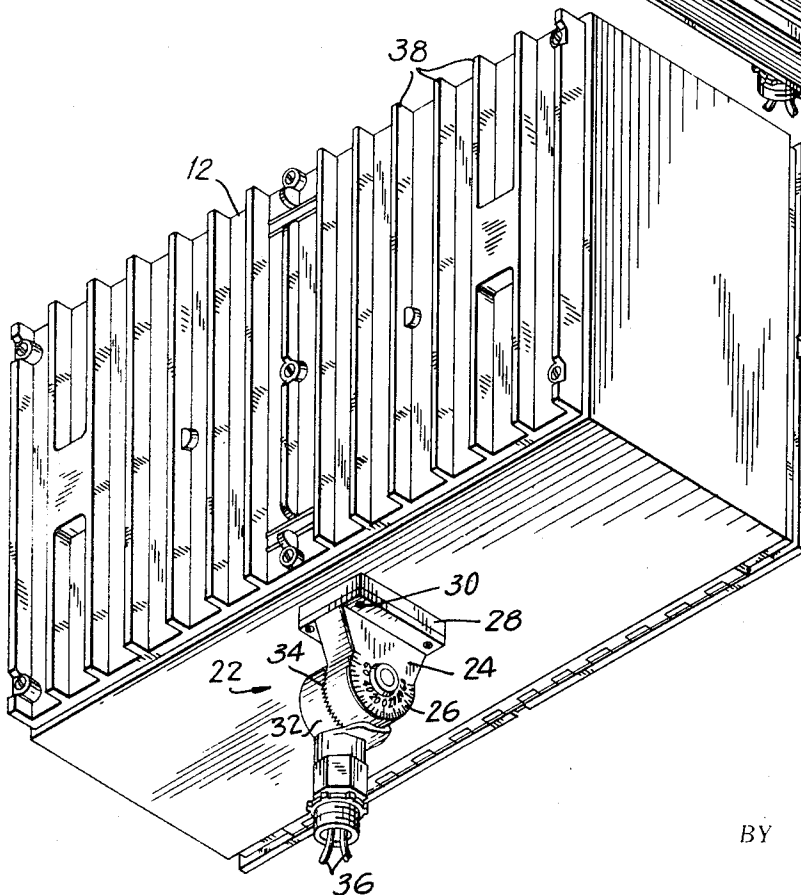


FIG. 2



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FIG. 3

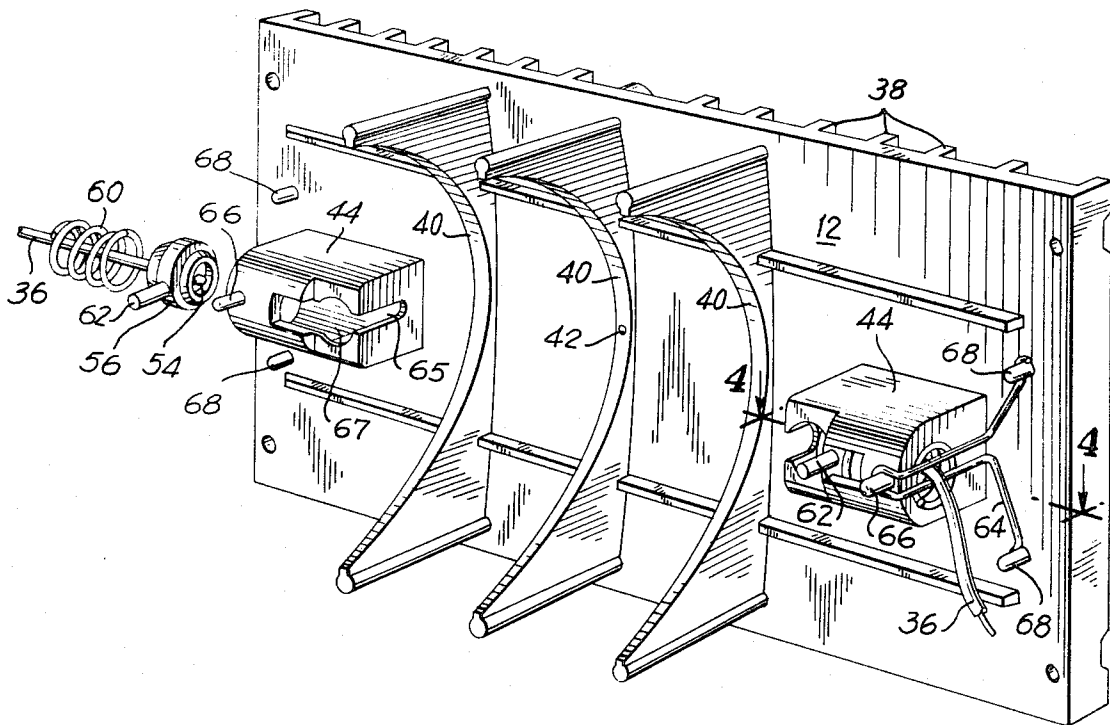
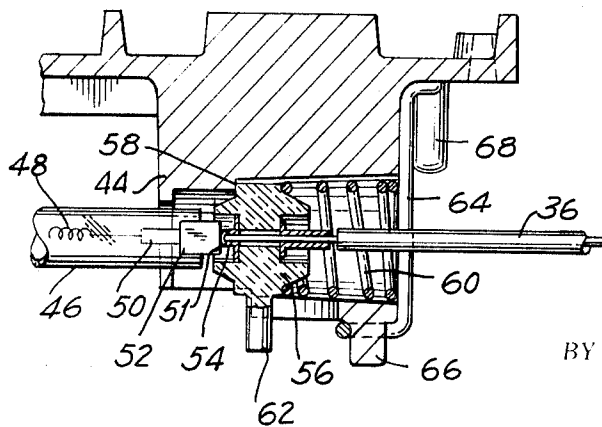


FIG. 4



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LIGHTING FIXTURE FOR HIGH INTENSITY LAMPS

FIELD OF THE INVENTION

The invention described herein relates to lighting fixtures and more particularly to an improved floodlight designed to use high intensity lamps of the quartz iodine type in illuminating outdoor stadiums, ball parks, auditoriums, parking lots and the like.

BACKGROUND OF THE INVENTION

The introduction in 1960 of quartz iodine and other high intensity lamps of long slim configuration represented a significant advance in the lamp industry since it permitted the manufacture of smaller, less expensive lighting fixtures having the ability to provide a greater light output at increased efficiencies. However, since the lamp is a source of brilliant white light it also generates fiery white heat. Lamp manufacturers, being acutely aware of the destructive effects of excessive lamp heat, have established maximum permissible temperatures at which the quartz iodine and similar lamps may be operated if the design life is to be achieved. One such critical and maximum temperature for the quartz iodine lamp is 662°F. at the seal ends of the lamp, i.e., where molybdenum conductors welded to and extending from the tungsten filament pass through seals provided at each end of the quartz envelope. In the conventional lamp, the ends of the quartz envelope through which the conductors pass are pinched from a round to a relatively flat configuration and a ceramic sleeve of cylindrical shape which holds an electrical contact button, is bonded to the outside surface.

The major problem confronting lighting fixture manufacturers since introduction of the quartz iodine lamp resides in designing a fixture which will permit operation of the lamp within the manufacturer's prescribed temperatures. The problem has its genesis in the lamp being so small compared to the heat generated during operation that the heat cannot be dissipated by radiation and conduction at a fast enough rate to obtain operation within the permissible temperature range. It generally is recognized in the industry that lighting fixtures currently being manufactured do not permit operation of the lamp within the lamp manufacturer's established limits, providing the heat dissipation means used utilizes only conduction and radiation principles. Since these known fixtures or luminaries operate above the maximum temperature limits, adverse lamp conditions often result, such as cooking of gaskets, melting of socket fittings and explosion of the heat tempered glass lens. Most importantly, the lamp used in such fixtures normally fails long before its design life has been achieved.

The seal areas at the end of the lamp are most critical because the molybdenum conductors passing through the seals oxidize at 662°F. and expand, thus cracking the seal and permitting air to enter into the quartz envelope with consequent destruction of the lamp.

To overcome these problems, manufacturers have resorted to a number of different designs to obtain the proper transfer of heat from the lamp ends to a heat sink into which they fit. These devices usually take the form of specially designed sockets arranged to transfer heat from the lamp seals to nearby heat sinks which conduct the heat to housing walls for radiation into the atmosphere. Metal sleeves also are placed adjacent to

or in contact with the outside surface of the seal or the ceramic sleeve to transfer heat therefrom to the metal sleeve and then into the heat sink which in the usual form, comprises an integral part of the lighting fixture housing. In other forms, the metal sleeve extends into an extension of the socket which is equipped with heat radiation fins.

The major disadvantages with these prior designs is that good heat transfer paths cannot be established and maintained between the lamp seals and the housing walls and as a result, the lamp ends operate at temperatures greater than that permitted.

One well-known design manufactured by applicant's assignee has successfully solved the problem by mounting a fan within the fixture housing, thus effectively carrying away the heat by a combination of conduction, radiation and convection. However, no known designs operate within the prescribed limits by utilizing conduction and radiation heat transfer principles alone.

An object of our invention therefore is to provide a lighting fixture which permits operation of high intensity lamps within the manufacturer's prescribed temperature limits.

Another object of our invention is to provide an improved lamp socket which inhibits the radiation of heat to the sealed ends and effectively dissipates heat from the seals thereby allowing operation of a lamp throughout its design life.

Still another object of our invention is to provide a simple economical and efficient design of socket including an arrangement for quickly and safely replacing lamps in the fixture.

Still another object of our invention is to provide a compact design of fixture of simple parts which economically and conveniently may be assembled during the manufacturing operations.

The subject matter which we regard as our invention is particularly pointed out and distinctly claimed in the concluding portion of this specification. Our invention, however, both as to organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a perspective view of the improved lighting fixture;

FIG. 2 is a perspective view taken from the bottom back portion of the fixture showing a ribbed back plate and an adapter used for supporting the fixture on a support;

FIG. 3 is a view of the back or base plate showing the lamp socket and ribs for supporting the reflector; and

FIG. 4 is a detailed view of the lamp socket.

BRIEF SUMMARY OF THE INVENTION

Briefly stated, we eliminate the disadvantages inherent in prior art constructions by providing a lighting fixture having a socket capable of permitting lamp operation within the lamp manufacturer's recommended temperature levels for the design life of the lamp. To achieve dissipation of heat at the desired rates, we design the socket to additionally perform the function of a heat sink and by shielding the lamp seals from the filament source of white heat, only minimum quantities of heat will be absorbed by the seals and their protective ceramic sleeves.

DETAILED DESCRIPTION

Referring now to the drawings wherein like reference characters designate like or corresponding parts throughout the views, there is shown in FIG. 1, an aluminum housing 10 closed on all sides and at the back by a ribbed plate 12. The opening at the front is closed by a hinged door 14 containing a heat treated glass lens 16 such as a plain glass window or a focusing lens. Levers 18 of conventional design having curved ends are pivoted on the door and are arranged to engage posts 20 mounted on the housing for selectively locking the door in a closed position. The lighting fixture is adapted to be mounted on a pole or other support by an adapter 22 which permits focusing the light emanating from the fixture into a predetermined area.

The adapter shown in FIG. 2 comprises a cast aiming quadrant 24 having degree markings 26 on its outer surface to assure precise and uniform alignment on the desired area. A deformable cushion 28 of sponge rubber or other material is positioned between the adapter and the housing to compensate for eccentricity in the mounting up to 5° with the horizontal when bolts 30 are tightened. Both the quadrant 24 and the other half of the adapter 32 have serrated teeth 34 for locking the fixture in a set position. The adapter also is hollow thus providing access to the fixture by lead-in conductors 36.

As further illustrated in FIG. 2, the back cover plate is equipped with ribs 38 which extend from top to bottom for providing a large surface area for dissipation of heat as more fully described hereafter.

As illustrated in FIG. 3, the inner side of the back plate 12 has cast-in curvilinear ribs 40 of a concave configuration for receiving an initially flat highly polished reflector 41 which is flexed upon installation to conform to the ribs. Side reflectors are secured to the concave reflector by means of tabs, or other standard connecting means, inserted through appropriately sized openings in the main reflector and then turned over. The concave reflector is held in place by a single screw threaded into opening 42 in the center rib.

Each socket 44 is integrally cast with the aluminum back plate 12 during manufacture and comprises an up-standing member of relatively thick cross-section for providing a massive heat transfer path to the plate body. In the design illustrated, the plate measures 8 ¼ × 13 ½ inches and the front end of the sockets are spaced about 8 ½ inches for receiving a 1,500 Watt quartz iodine lamp having an over-all length of 10 inches. It will be apparent that the dimensions given are for illustrative purposes and that variation in size of the parts will need to be made to accommodate lamps of different manufacturers or lamps of lesser wattage and smaller length.

Each socket measures about 1 ¼ × 1 ¼ × 1 ½ inches and is designed to hold the 10 inch lamp 46. The conventional lamp 46 is made of quartz with a tungsten filament 48 extending substantially the lamp length and each end of the filament terminates in a molybdenum or other metal plate 50. The ends of the lamp are squeezed flat and the conductors extend beyond the ends and respectively terminate in conductor button terminals 51. Each terminal is embedded in a ceramic sleeve 52 bonded to each sealed end of the tube.

To support and to provide electric power to the lamp, a conductor 36 extending from a power source termi-

nates in a button 54, complementary to button 51, loosely mounted in a slideable terminal block 56. The terminal block is cylindrical and is made of dense porcelain having good heat conducting and electrical insulating properties. To permit flexibility in parts and to accommodate part movement, the button 54 while permanently affixed in the terminal block, can rotate with its attached conductor within the block and the block can be tilted in an upward direction relative to the socket. Although the description herein is directed to one socket, it will be understood that two sockets with their associated parts are necessary for proper lamp operation. Each socket has a flange 58 of a diameter less than the diameter of the cylindrical porcelain terminal block so that when the porcelain block is inserted in the socket from the outer side, it abuts the flange thus fixing its forward position in the socket. It can be moved rearwardly however against the action of spring 60. To effect such movement, the porcelain block has an outwardly projecting tab 62 which facilitates manually moving the block rearwardly when it is desired to insert a lamp in the fixture.

Since the block must be removable for maintenance purposes, a biasing spring 64 of essentially U-shaped configuration with extended arms, has its top portion fitted around a stud 66 on the top of the socket, with the legs of the U crossing the socket opening, thus holding the porcelain block spring in position. The ends of the spring likewise frictionally engage spaced studs 68 cast in the plate 12 surface. The spring arrangement for holding block spring 60 in position is simple in design, involves no moving parts, and can be installed and removed quickly without the use of tools merely by placing the aforementioned spring parts in contact with the studs.

To insert a lamp in position, it is only necessary to grasp a tab on one porcelain block, move it rearwardly and, if desired, upwardly, and insert one end of the lamp into the socket. These steps are repeated for the other end of the lamp by moving the other block rearwardly a distance sufficient to provide a clearance space between the end of the lamp and the block, whereupon the lamp is lowered into alignment with the block and the tab then released so that the action of both springs centers the lamp in the fixture. A major advantage gained by using terminal blocks of the kind described herein is the opening in which the block is located can be made substantially larger than the block, thus permitting it to be moved off the socket axis and in a direction to conveniently receive the end of a lamp.

An important aspect of this invention relates to minimizing the radiation of heat into the seal areas. In the prior art constructions the socket opening is relatively large because of the method used for insertion of the lamp or to accommodate other devices associated with the socket for carrying away heat from the lamp seals. Tests show that when large socket openings are used, heat is radiated directly from the tungsten filament to the lamp sealed ends positioned in the socket. This same heat also raises the temperature of the socket and the socket metal is therefore much less efficient in transmitting heat radiated from the sealed ends to the fixture housing. Because of the large opening, heat also is radiated to the seals from the reflector used in focusing the fixture light to predetermined areas.

In accordance with this invention, radiated heat from the tungsten filament and the reflector is minimized by designing the socket with as small an opening 65 as possible into which the sealed ends of the quartz lamp fit. The receptacle area 67 inside the socket preferably is of a size and formed to a configuration complementary with the ceramic sealed ends of the quartz lamp. It therefore may be cylindrical, rectilinear or of other configuration. The entire length of the ceramic portion on the sealed ends should lie within the socket 44 and the terminal block 56.

As is evident, the area 67 is of a larger cross-section size than opening 65 because of the design of the sealed ends. Some designs of lamps however may permit making both the area and opening of the same cross-section dimension. In any event, the design objective should be to have the socket walls as close as reasonably possible to the walls of the lamp sealed ends to permit maximum transfer of heat across the small clearance space therebetween, and to have the lamp sealed ends fit the socket opening 65 as closely as possible for minimizing the amount of heat which can be radiated into the lamp sealed ends from the tungsten filament and/or from the reflector. By holding these clearances relatively tight, i.e., just sufficient to permit lamp insertion, and by designing the socket to have a substantial mass of metal very close to the seal ends, the possibility of heat being radiated into the seal ends is minimized to a marked degree. Likewise, because the seal is so close to the metal of the relatively cold body socket, heat flowing into the seal from the tungsten filament and molybdenum connectors is rapidly radiated outwardly and effectively transmitted to the socket heat sink for subsequent transfer to the back plate. Since the plate is ribbed, the large exposed surface area rapidly dissipates the heat to the surrounding area.

To determine the effectiveness of the lighting fixture described herein, and particularly the ability of the sockets to carry away heat from the seal ends of the quartz lamp, a multiplicity of tests were conducted on different fixtures using the design described herein. It was found that many of the designs transfer the heat from the seal ends to the socket with such a degree of efficiency that the lamp ends operate at a temperature less than the 662°F. prescribed by the lamp manufacturers. An indication of such tests are as follows: (A thermocouple was sealed in the end of each lamp and the lamp operated at 240 volts until the temperature stabilized, the time being approximately 1 hour.)

Lamp	Time (Minutes)	Temperature (Degrees F.)
KS 1	60	641
KS 1	60	641
KS 1	60	645
KS 2	60	635

As indicated previously, the recommended operating temperature for the seal ends of the lamp should not exceed 662°F. if the design life of 2,000 hours is to be achieved. The above temperatures are representative of lamp and fixture performance utilizing the design disclosed herein which clearly indicate that for the first time, a lighting fixture can be designed to operate within the manufacturer's prescribed temperature limits without resorting to the use of convection means, such as an integral fan for carrying away the heat generated by the lamp during operation. The particular design of the socket inhibits the radiation of heat to the

sealed ends and still permits heat to be transferred to the massive metal of the socket which acts as a heat sink for transmitting it to the housing. By decreasing the clearance space, a lesser portion of the seal area is exposed to the direct rays of the bulb of the lamp, and when the clearance is maintained within the established limits, the seals are more sheltered and therefore operate at a lower temperature.

In view of the above, it will be apparent that many modifications and variations are possible in light of the above teachings. It therefore is to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What we claim is new and desire to secure by United States Letters Patent is:

1. A lighting fixture of the floodlight type comprising:
 - a housing comprising a heat dissipation plate having ribs of concave configuration integrally cast with the inner surface of the plate, said housing having a hinged front door supporting a heat treated glass lens therein movable between open and closed positions,
 - a reflector mounted on the ribs and secured to conform to the concave ribs in said housing,
 - a pair of spaced lamp receiving sockets mounted on said housing,
 - a movable porcelain block in each of said sockets having a centrally-disposed electrical contact element therein and lead-in conductors connected to said contact elements,
 - a high-intensity filament type lamp mounted in front of said reflector,
 - said lamp having sealed ends and terminals extending from the lamp filament element embedded in a ceramic sleeve bonded to each of said sealed ends, each of said terminals being arranged for contact with said contact element in said sockets for furnishing electrical power to said lamp,
 - each of said sockets having an opening therein in alignment with the end of said lamp and of a size just sufficient to accommodate replacement of said lamp, and of a size less than the diameter of said ceramic sleeve, and
 - wherein a major portion of the sealed ends on the lamp lie within said sockets, the parts being arranged such that the socket walls forming the relatively narrow opening into which the lamp ends fit, inhibits the radiation of heat from the lamp filament element to the sealed ends on the lamp, but permits the radiation of heat from said sealed ends to the socket walls which comprise a heat sink for absorbing such heat and conducting it to said housing.

2. The combination according to claim 1 wherein said sockets are mounted on a heat dissipation plate, and

each of said sockets have approximately one-half of their height comprising solid metal which serves the function of a heat sink for absorbing the heat radiated thereto by said lamp, and wherein an portion of each of said sockets has an opening which extends from the front toward the back thereof.

3. The combination according to claim 1 wherein the interior portion of each of said sockets which lies adjacent to the sealed end of said lamp disposed therein is

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essentially flat and lie in a plate parallel to the said sealed end, and

a flange in said socket for limiting the forward movement of said porcelain block towards the lamp ends and a spring in each of said sockets for urging said porcelain block into a lamp engaging position, and means for holding said porcelain block and spring in their respective socket.

4. The combination according to claim 3 wherein the outer portion of said socket is equipped with a groove extending for a portion of the length of said socket, and a tab extending outwardly and available to be grasped by an operator for moving said porcelain block rearwardly against the action of said spring for permitting the insertion of the sealed ends of said lamp in said sockets.

5. The combination according to claim 3 wherein said means for holding the porcelain block in each of said sockets comprises a single restraining element in contact with said spring and held by friction means on said housing.

6. The combination according to claim 3 wherein the

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means for holding said porcelain block in each of said sockets comprises a flexible member of essentially U-shaped configuration having outwardly extending legs, a stud mounted on each of said sockets and on said housing on opposite sides of said socket, and the arrangement being such that a central portion of said flexible member engages the stud on said socket and the outwardly extending legs therefrom frictionally engage the studs on the opposite sides of said socket, the legs serving to hold the spring in the socket in position.

7. The combination according to claim 3 wherein said sockets are mounted on, the heat dissipation plate which serves as the back of said housing, and closely-spaced ribs on the back of said plate for dissipating the heat from said sockets to the surrounding air.

8. The combination according to claim 1 wherein said reflector is a thin initially flat element that is deformed for mounting on said concave ribs.

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