United States Patent [19]

Osteen

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[45] **May 13, 1975**

[54] **BALLAST TRANSFORMER WITH HEAT DISSIPATING DEVICE**

[75] Inventor: **Carl M. Osteen,** Zirconia, N.C.

[73] Assignee: **General Electric Company,** Pittsfield, Mass.

[22] Filed: **Dec. 13, 1973**

[21] Appl. No.: **424,559**

[52] **U.S. Cl.** **336/61;** 174/DIG. 5; 336/92

[51] **Int. Cl.** **H01f 27/08**

[58] **Field of Search** ..... 336/61, 90, 92, 100; 174/15 R, 16 R, DIG. 5, 359 S

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Primary Examiner—Thomas J. Kozma

Attorney, Agent, or Firm—Sidney Greenburg

[57] **ABSTRACT**

Ballast transformer is arranged in a housing with its coils resting on a spring bracket in contact with the housing so that heat from the coils is transmitted by the bracket to the housing for dissipation thereby.

6 Claims, 4 Drawing Figures

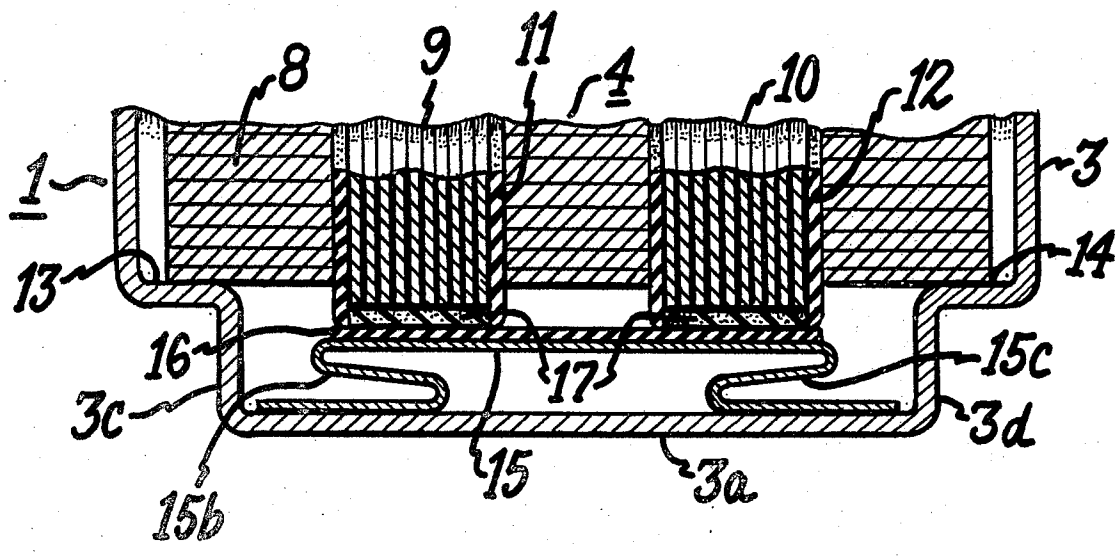


Fig.1.

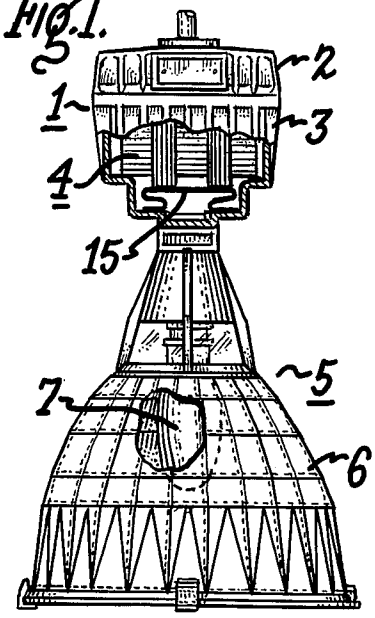


Fig.2.

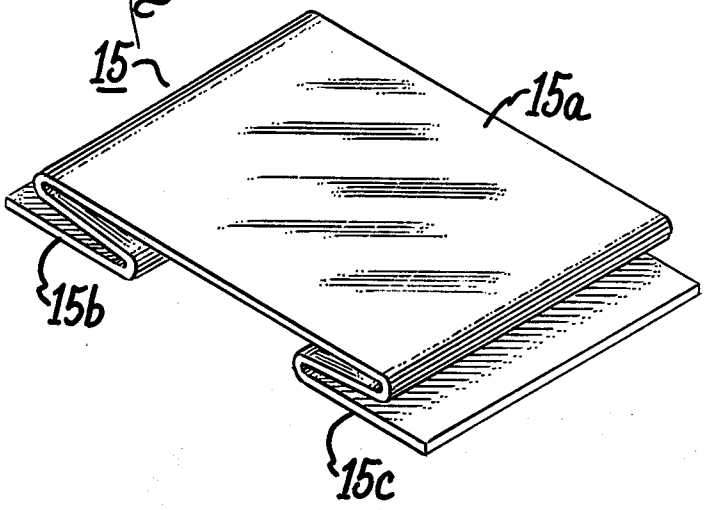


Fig.3.

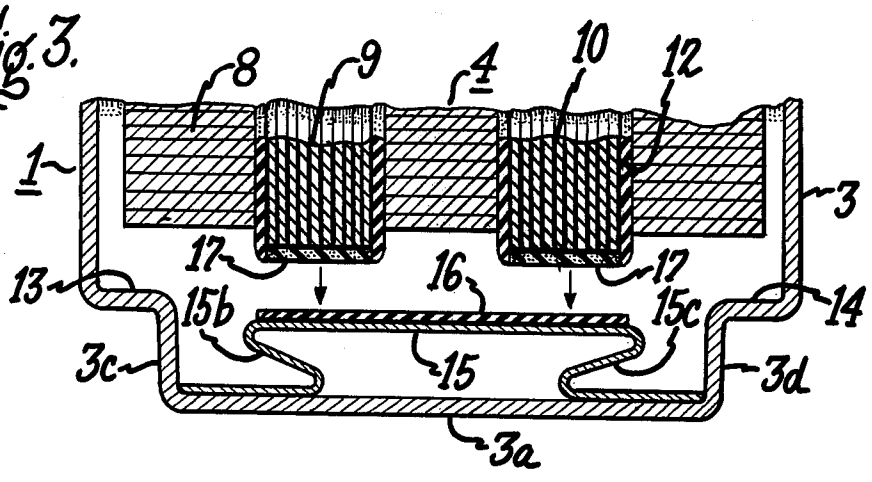
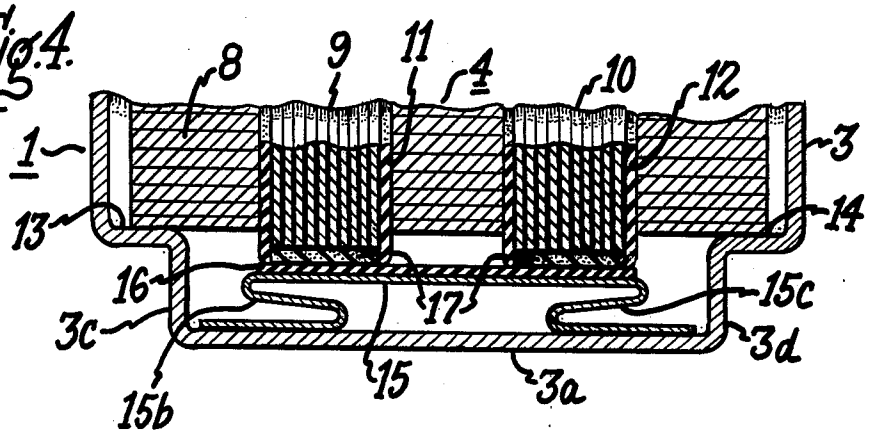


Fig.4.



BALLAST TRANSFORMER WITH HEAT DISSIPATING DEVICE

The present invention relates generally to heat dissipating devices and more particularly to a heat dissipating device for induction coil devices such as ballast transformers of the type used for gaseous discharge lamp systems.

It is an object of the invention to reduce the operating temperatures of electrical heat producing devices and particularly induction ballast devices of the above type.

A particular object of the invention is to provide a simple and inexpensive heat dissipating device for ballast transformers which is readily assembled with the transformer.

Another particular object of the invention is to directly remove the heat from the coils of transformers of the above type.

Other objects and advantages will become apparent from the following description and the appended claims.

With the above objects in view, the present invention in one of its aspects relates to an electrical ballast device comprising, in combination, a housing of heat conductive materials having a wall, an inductive ballast device mounted in the housing comprising a core and coil assembly, a heat conductive resilient member arranged between the core and coil assembly and the housing wall in thermal contact therewith for transmitting heat from the assembly to the housing for dissipation thereby, and electrically insulating and thermally conducting means interposed between the resilient member and the core and coil assembly.

The invention will be better understood from the following description taken in conjunction with the accompanying drawing, in which:

FIG. 1 is an elevational view, partly broken away, of an industrial lighting fixture having a ballast unit embodying the present invention;

FIG. 2 is a perspective view of the heat transmitting spring bracket incorporated in the FIG. 1 fixture;

FIG. 3 is an enlarged cross-sectional view of the lower portion of the ballast unit showing the ballast transformer and spring bracket prior to being placed in operative position; and

FIG. 4 is a similar view of the ballast housing showing the ballast transformer and spring bracket in operative position therein.

Referring now to the drawing, and particularly to FIG. 1, there is shown a lighting fixture such as an industrial luminaire for indoor lighting purposes in which the present invention may typically be embodied. The illustrated fixture comprises a ballast housing 1 made of heat-conducting metal, such as aluminum, having a cover 2 and container 3 defining an enclosure for housing electrical ballast components including transformer 4. Suspended from ballast housing 1 is optical assembly 5 including reflector 6 in which is mounted lamp 7, such as a mercury vapor or other type of gaseous discharge lamp, operated by the ballast components in ballast housing 1.

As seen in FIGS. 3 and 4, ballast transformer 4 includes a core and coil assembllly of conventional type comprising a laminated magnetic core 8 on which primary coil 9 and secondary coil 10 are wound spaced from each other. Typically, coils 9 and 10 are formed

of wire coated with insulating enamel of conventional type and wound on bobbins 11 and 12 of electrically insulating material surrounding core 8. Bobbins 11, 12 have peripheral flanges or rims for retaining the wire coils, as shown. As will be understood, transformer 4 is secured to ballast housing 3 by any suitable means, not shown, such as by screws engaging the core portions. In the illustrated arrangement as seen in FIG. 4, the ends of transformer core 8 rest on steps or ledges 13, 14 formed in ballast housing 1 as shown, so that in the assembled condition coils 9 and 10 project somewhat into the space between core 8 and bottom wall 3*a* of the ballast housing.

Ballasts of the type described generate a substantial amount of heat during the operation of the lighting fixture, and various means have been employed in the past for removing the heat from the ballast unit to avoid adverse effects of excessive temperature on the life and operating characteristics of the ballast components and other parts of the fixture. Prior devices employed for this purpose have mainly provided for thermal contact of the transformer core with a heat sink device or the outer housing, but such devices have not been fully satisfactory because the heat generated by the coil windings has not been adequately dissipated in this manner. Usually a larger housing than necessary to enclose the components has been used to dissipate the ballast heat, resulting in a more expensive enclosure.

In accordance with the present invention, a simple and convenient heat removal device is provided for the ballast unit which directly transfers heat from the coil windings to the ballast housing to markedly reduce the heat level of the ballast component. As seen in FIG. 2, the heat removal device comprises a spring bracket 15 made of a material of good heat conductivity, e.g., steel, aluminum, copper or the like, or other stiff spring-like material, the bracket having a flat top 15*a* and being formed at opposite ends with legs or flanges 15*b*, 15*c* having a reverse bend or S-shape, so that the bracket is resiliently compressible when a load is placed on its upper surface. The free ends of legs 15*b*, 15*c* project a substantial distance laterally beyond the top portion of bracket 15 when the legs are uncompressed, as seen in FIG. 3. The form and dimensions of bracket 15 are such that it fits readily within the space or recess at the bottom of ballast housing 1, and when in uncompressed condition, as seen in FIG. 3, has a height somewhat greater than the depth of the space left in the final assembly between coils 9, 10 and the housing bottom surface on which bracket legs 15*b*, 15*c* rest. Also, the overall length of bracket 15 is preferably such that its free ends engage the opposite wall flange portions 3*c*, 3*d* of ballast housing 3 when bracket 15 is uncompressed, i.e., the distance between the free ends of bracket legs 15*b*, 15*c* is slightly greater than the distance between wall flanges 3*c*, 3*d*. Accordingly, when bracket 15 is initially placed in position at the bottom of housing 1, it is frictionally retained in this position until transformer 4 is placed on its top (see FIG. 3). As a result of the weight of transformer 4 (or the force applied thereby) being exerted on spring bracket 15 in the assembly, the free ends of bracket 15 are automatically inwardly retracted from the housing wall flanges to the position shown in FIG. 4.

To ensure effective transmission of heat from coils 9 and 10 to housing 3 by way of spring bracket 15 while preventing electrical conduction between these parts,

a dielectric sheet **16** of relatively good thermal conductivity is arranged on top of bracket **15** between the latter and coils **9** and **10.** Suitable material for this purpose may comprise, for example, a fiber glass sheet or a sheet of bonded mica flakes, such as a material commercially known as mica mat. In addition, a layer **17** of a suitable composition or compound that is electrically insulating and thermally conductive is applied to the outer surface of coils **9, 10** in the recesses defined by the rims of the coil bobbins, so as to fill the space between the coils and dielectric sheet **16,** and is of such consistency and resiliency as to have intimate contact with the outer layer of wire turns of coils **9** and **10** as well as dielectric sheet **16.** Such a composition may comprise, for example, a silicone grease compound. Specific compounds which may be used are polymethyl di-siloxane, phenyl-methyl siloxane, and di-ethyl phenyl siloxane. In general, any resilient non-flowing material such as high temperature rubbers or greases having the aforementioned properties may be used. The composition selected for this purpose should not be a solvent for the wire enamel or varnish coating or otherwise adversely affect its properties.

By virtue of the described arrangement, heat from the wound coils, which generate a major part of the total heat produced by the transformer, it conducted directly to the metal ballast housing, rather than through the bobbin, core and intervening air gaps such as in conventional arrangements. Further, since spring bracket **15** is in constant pressure contact with ballast housing **3** in the assembly, it serves to ensure good heat transfer between the parts. As a result, the thermal safety margin of ballast and housing combinations is considerably improved, standard types of ballast housings may be used with higher watt-loss ballast designs than heretofore considered permissible, and less thermally resistant materials such as used for the insulating wire coating can be employed with resultant economic savings.

While in the illustrated embodiment spring bracket **15** is arranged at the bottom wall of ballast housing **3,** it will be understood that the invention is not limited to that particular arrangement. Bracket **15** may, for example, be arranged in contact with the top or side walls of the ballast housing, depending on the position and configuration of the transformer and its coils. The specific shape and size of bracket **15** may, of course, also be different from that shown without going beyond the scope of the invention.

In those cases where the rims of bobbins **11** and **12** do not project beyond the coil surface, the coils **9** and **10** may rest directly on dielectric sheet **16** and resilient layer **17** may be dispensed with. Where no bobbins are used with the coils and the latter are covered with a dielectric tape, the coils may rest directly on spring bracket **15.**

It will be understood that the invention may also have application to heat producing devices other than light fixture ballast components such as described.

While the present invention has been described with reference to particular embodiments thereof, it will be understood that numerous modifications may be made by those skilled in the art without actually departing from the scope of the invention. Therefore, the appended claims are intended to covoer all such equivalent variations as come within the true spirit and scope of the invention.

What I claim as new and desire to secure by letters patent of the United States is:

1. An electrical ballast device comprising, in combination, a housing of heat conductive material having a wall, an inductive ballast device mounted in said housing comprising a core and coil assembly, a heat conductive resilient member arranged between said core and coil assembly and said housing wall and resiliently urged in thermal contact therewith for transmitting heat from said assembly to said housing for dissipation thereby, and electrically insulating and thermally conducting means interposed between said resilient member and said core and coil assembly, said resilient member being formed of a top and compressible spring leg means, said inductive ballast device resting on said top and holding said spring leg means compressed in contact with said housing wall, said core and coil assembly comprising an elongated core member and coil means surrounding said core member, said coil means resting against said resilient member, said electrically insulating and thermally conducting means being arranged between said coil means and the top of said resilient member, said electrically insulating and thermally conducting means comprising a layer of elastic material on said coil means and a sheet of dielectric material between said elastic material and said resilient member.

2. An electrical ballast device comprising, in combination, a housing of heat conductive material having a wall, an inductive ballast device mounted in said housing comprising a core and coil assembly, a heat conductive resilient member arranged between said core and coil assembly and said housing wall and resiliently urged in thermal contact therewith for transmitting heat from said assembly to said housing for dissipation thereby, and electrically insulating and thermally conducting means interposed between said resilient member and said core and coil assembly, said resilient member being formed of a top and compressible spring leg means, said inductive ballast device resting on said top and holding said spring leg means compressed in contact with said housing wall, said core and coil assembly comprising an elongated core member and coil means surrounding said core member, said coil means resting against said resilient member, said electrically insulating and thermally conducting means being arranged between said coil means and the top of said resilient member said housing having opposite ledges, said elongated core member resting at its opposite ends on said ledges in thermal contact therewith.

3. An electrical ballast device comprising, in combination, a housing of heat conductive material having a wall, an inductive ballast device mounted in said housing comprising a core and coil assembly, a heat conductive resilient member arranged between said core and coil assembly and said housing wall and resiliently urged in thermal contact therewith for transmitting heat from said assembly to said housing for dissipation thereby, and electrically insulating and thermally conducting means interposed between said resilient member and said core and coil assembly, said heat conductive resilient member comprising a flat bearing portion having spaced legs projecting from one side thereof, said legs being of generally S-shaped compressible spring form.

4. A device as defined in claim **3,** said housing wall comprising a main wall portion and opposite flange

portions defining a recess for receiving said resilient member, said spring legs of said resilient member having free ends projecting laterally in opposite directions, the distance between said free ends in uncompressed condition of said spring legs being greater than the distance between said opposite wall flange portions, whereby the ends of said spring legs are adapted to engage said opposite wall flange portions for holding said resilient member in assembly with said housing when said member is in uncompressed condition.

5. A device as defined in claim **1**, said coil means comprising insulating bobbin means having a wire coil thereon and spaced rim portions projecting beyond said wire coil, said bottom rim portions resting against said resilient member and defining therewith a space in which said elastic material is confined.

6. An electrical ballast device comprising, in combination, a housing of heat conductive material having a wall, an inductive ballast device mounted in said housing comprising a core and coil assembly, a heat conductive resilient member arranged between said core and coil assembly and said housing wall and resiliently urged in thermal contact therewith for transmitting heat from said assembly to said housing for dissipation thereby, and electrically insulating and thermally conducting means interposed between said resilient member and said core and coil assembly, said resilient member comprising a flat strip of spring material having an intermediate bearing surface and formed at its opposite ends with generally S-shaped legs having flat bottom portions generally parallel to said intermediate bearing surface and in thermal contact with said housing wall over substantially their entire bottom surface.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,883,834

DATED : MAY 13, 1975

INVENTOR(S) : CARL M. OSTEEN

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

COL. 1, LINE 26, - "MATERIALS" SHOULD BE - MATERIAL -

3, LINE 26, - "IT" SHOULD BE - IS -

5, LINE 14 - "BOTTOM" SHOULD BE - BOBBIN -

Signed and Sealed this

twenty-eight Day of *October 1975*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks

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