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(54) **Toroidal ballast lighting fixture.**

(57) A lighting fixture such as a socket adapter is disclosed containing a preferably toroidal ballast choke surrounding a recess adapted to receive the base of a fluorescent or similar bulb.

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TOROIDAL BALLAST LIGHTING FIXTURE

BACKGROUND OF THE INVENTION

The present invention pertains generally to lighting fixtures, and pertains more particularly to fixtures for use with fluorescent and other bulbs.

As is well known, lighting fixtures intended for use with fluorescent and other bulbs of types with which a ballast choke is used are typically larger than those for incandescent bulbs of comparable bulk. It is often desirable to reduce the size of such fluorescent and similar fixtures as much as possible, whether to save space, or for reasons of economy or esthetics.

It would also be desirable to have a device by means of which fluorescent bulbs, etc., could be used with ordinary incandescent lamp sockets. Adaptors designed for such use have been proposed, as have fluorescent lamps specifically designed for use in incandescent lamp fixtures. For example, U.S. Patent 3,551,736 (Doehner) shows a fluorescent lamp in which a fluorescent bulb rests on a ballast unit and has electrical connector pins which extend through passages provided for them in the ballast unit. The ballast unit also receives electrical connector pins from a terminal contact base externally threaded to be screwed into a conventional incandescent lamp screw socket. In that patent, the ballast unit contains a toroidal ballast choke, with the connector pin passages extending through the hole of the torus. The starter and the capacitor are located in the screw base unit.

It would be desirable to provide a still more compact fixture than that shown in U.S. Patent 3,551,736, and to provide such a device that would lend itself to more convenient, simple, reliable and economical manufacture than has heretofore been possible. It would be desirable to provide such a device that could be particularly economically mass-produced without the use of the complex and expensive winding machines conventionally used for the manufacture of toroidalcore chokes.

SUMMARY OF THE INVENTION

Accordingly, it is a principal object of the present invention to provide a socket adapter or other lighting fixture that has a ballast choke and that is more compact than those previously available.

Another object of the invention is to provide such a fixture that is easier and more economical to manufacture than such articles previously available.

Another object of the invention is to provide a toroidal ballast choke for use in such a fixture, which choke is easier and less expensive to manufacture than previously known toroidal chokes. Particularly, it is an object of the invention to provide such a choke that can be quickly, economically and reliably mass-produced without the use of the complex winding machines conventionally required for forming a winding toroidal core.

According to the present invention, the foregoing objects are attained by providing a one-piece lighting fixture, which may be a socket adapter, comprising a one-piece housing having a recess formed therein for receiving substantially the entire base of a light bulb, electrical circuitry means including a ballast choke disposed in the housing, and electrical contact elements for connecting the electrical circuitry with an external power source. If the fixture is a socket adapter, it also has an external securing device for attaching it to a socket. Preferably, the circuit means at least partially surrounds the recess, preferably comprising an annular ballast choke ("annular", and "annulus", as used throughout the specification and claims hereof, are not limited to a toroidal shape but include arcuate, oval, polygonal and other shapes that can surround the recess at least partially), and most preferably comprises a toroidal ballast choke surrounding the recess.

These and other objects and features of the invention will be more clearly and thoroughly understood from the following detailed description of the preferred embodiment, taken in conjunction with the accompanying drawings, in which like reference characters refer to like elements throughout.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 is a perspective view of a socket adapter according to the preferred embodiment of the invention, with a fluorescent bulb in place therein.

Figure 2 is a front elevation view of a toroidal ballast choke used in the socket adaptor of Figure 1.

Figure 3 is a top plan view of the choke of Figure 2.

Figure 4 is an exploded view of the ballast choke of Figure 2.

Figure 5 is a diagram showing in a schematic fashion the circuit connections of the socket adapter of Figure 1.

Figures 6A and 6B are a bottom view and a front elevation view, respectively, of the housing of the socket adapter of Figure 1.

Figure 7 is a bottom view of the housing of the socket adapter of Figure 1, with the ballast choke of Figure 2 in place therein.

Figure 8 is a top view of a core from which the choke of Figure 2 is made, with a layer of insulation thereon.

Figure 9 is a top view of one half of the core of Figure 8, for use in explaining the method of manufacture of the ballast choke of Figure 2.

Figure 10 is a top view of the half core of Figure 9 after winding.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figure 1 shows in perspective a socket adaptor 10 according to the preferred embodiment of the present invention, with a typical fluorescent bulb of one type, shown by way of example only, in place in the adapter to illustrate the use of the latter. As can be seen, the adapter 10 has a one-piece housing 12, which in the embodiment shown has a cylindrical main portion 14 and depending therefrom a cylindrical base portion 16. The housing is preferably made of a plastic material, e.g., polycarbonate or Novel, which is available from General Electric Co. A recess 18 formed in the top of the main portion 14 of the housing is shaped to detachably receive the base of the bulb 20. The bulb 20

shown illustratively is a fluorescent unit having a U-shaped glass envelope 20a in which light is fluorescently generated. Both ends of the envelope 20a are mounted on a base 20b which has the shape of a "T" as seen from the side, and from the arms of which extend downward two electrical connector pins 20c. The recess 18 is shaped to receive substantially the entire base 20b of the type of bulb for which the adapter in question is designed.

A ballast choke is provided in the cylindrical portion 14 of housing 12, and in the embodiment of Figure 1 is manufactured in the shape of a torus surrounding the recess 18. The starter and the capacitor which constitute part of the electrical circuitry of the bulb 20 are preferably housed in the base 20b of the bulb 20. Cylindrical base 16 of housing 12 is provided with a cylindrical electrically conductive sleeve 22 fitted over, and secured in any suitable fashion to, the lower end of the cylindrical base 16. The sleeve 22 has threads on its external surface to permit the adapter 10 to be screwed into a standard screw socket of the type used with incandescent lamps. The sleeve 22 serves to achieve electrical contact with such a socket. An additional electrical contact 24 is provided protruding through an aperture in the sleeve 22 and spaced from the conductive material of the latter at the lower tip of the cylindrical base 16 and, in use, is in electrical contact with the other contact of such a socket.

The recess 18 is formed with holes for receiving the connector pins 20c of the bulb 20, in which holes are provided contact pieces 21 to make electrical contact with the pins.

The electrical connections of the circuit elements described (the choke, starter, capacitor, sleeve, tip contact, and contacts for the contact pins of the bulb) are well known to those skilled in the art. The external threaded sleeve 22 is connected to the winding of the choke, the other end of which is connected to a contact piece 21 that receives one of the connector pins 20c of the bulb 20. The other connector pin 20c is received in engagement with a similar contact piece 21, which is connected to contact 24 on the exterior of the housing 12. In the embodiment shown, the remaining required circuitry is located in the base of bulb 20; however, the starter and capacitor could be provided in the adapter housing 12 or in a separate unit reinforcebly housed in the adapter 10, in a manner known to those skilled in the art.

The toroidal ballast choke 30 used in the socket adapter of Figure 1 is shown in Figures 2 through 4 and comprises conductive windings 32 on two magnetic cores 34, each of which in the embodiment shown defines approximately a hemi-torus. Each winding 32 is insulated from its respective core 34 by a layer of insulative material 36, which, as can be seen from the figures, does not extend all the way to either free end of the core 34. The reason for this feature is explained below.

One obstacle to the practical use of toroidal cores for ballast chokes in the past has been the difficulty of manufacturing toroidal chokes reliably and with reasonable economy. The illustrated choke, however, lends itself readily to simple, reliable and inexpensive manufacture (see Figures 6A through 10). Initially, a toroidal core of a suitable known magnetic material is provided. The tape-wound steel core shown is suitable. The toroidal core is provided with a coating 36 of an electrically insulative material as shown in Figure 7, which covers the top, bottom, inner and outer surfaces of the torus. However, only one surface, for example the inner surface 38 or perhaps better, the outer surface, is completely covered by coating 36 around the entire circumference of the torus. The other three surfaces are covered entirely except for two locations 40, preferably diametrically opposed, at which the core is left completely exposed except on the inner surface 38. If desired, the core can be left exposed at 40 on all surfaces. The insulative layer 36 is preferably provided by means of injection molding, although any other suitable method can be substituted to convenience.

The toroidal core is then cut in two through the exposed locations 40, resulting in two hemi-toroidal cores 34 as shown in Figure 3. A milling machine has been found to do the cutting efficiently and with relatively low heat production, but any suitable method can be used. Each of the cores 34 is then separately provided with its respective winding 32. Because each of the cores 34 has the shape (as seen from above) of a circular arc, i.e., has a center line that defines a semi-circle or other circular arc, the windings can be applied in a very simple and economical fashion, as follows. While being gripped at one end for support, the arcuate core 34 is rotated in the plane of the arc about the axis defining the center the circle of of the arc, viz., along the length of the core itself. As this movement is carried out, a conductive wire is wrapped around the core, producing the desired winding 32. The ends of the wire are secured during the winding process in any suitable fashion within the ordinary skill in the art. After the windings 32 have been wrapped, the ends thereof are permanently secured in place by known expedients to provide two hemi-toroidal chokes, which can then be connected in series to yield a toroidal choke. In the preferred embodiment shown, the hemi-toroidal cores 34 are also mechanically joined at their ends to from a torus, by means of fish paper, or any other suitable known material.

A system for especially easily carrying out the described manufacturing process for the toroidal choke is described in greater detail in copending EPC application No. filed on even date herewith and claiming priority of U.S. applications Serial Nos. 681,493 and 681,120.

The two hemi-toroidal chokes 34 are located in portion 14 of the housing 12 (see Figure 7). The sleeve 22 is secured in place and the remaining electrical connections are made. The interior of the housing 12 is filled with a suitable conventional potting compound such as epoxy resin in known fashion.

The illustrated adapter 10 is unusually compact, since the entire base of the bulb used therewith is received in the recess 18, surrounded by the electrical circuitry and in particular by the toroidal ballast choke 30. It will be appreciated by those skilled in the art, however, that the substantially radiallysymmetric design of the choke 30 and of the cylindrical portion 14 of the housing 12 are not essential to the invention, considered broadly. Less compact, but still practical, variations can be adopted depending upon design convenience and esthetic considerations. Nor is it is not essential that the two exposed portions 40 of the original toroidal core be diametrically opposite to each other, although that arrangement makes cutting the core into two pieces especially easy. Also, the winding process is simplified by making the two pieces of the original core substantially the same size and shape. However, either or both of the two cores 34 into which the original core is cut may, if desired, define less than 180 degress of a circle, if the resulting manufacturing complexities are acceptable. One core may be cut to less than 180 degrees while the other is cut to more than 180 degrees. Again, while not preferred, it is within the scope of the invention, considered broadly, to divide the original core into more than two parts, any two or more of which can then be connected electrically and, if desired, mechanically to form a larger choke.

The present invention is applicable to many types of lamps and light bulbs, including high-pressure sodium, fluorescent, metal halide and quartz halogen devices. As one particular example, it has been found that a socket adapter can be constructed according to the principles of the present invention to permit use of a high pressure mercury vapor bulb in an incandescent fixture. It has further been found that a high pressure sodium bulb can be used in such an adapter designed for a high pressure mercury vapor bulb of twice the wattage, with little difference in the quantity of light so produced. The present invention can also be used either to adapt an incandescent lamp such as a table lamp for use with, e.g., a fluorescent bulb, or in manufacturing a table lamp intended for use with such a bulb, e.g. by replacing the illustrated male screw base 16 with a threaded female portion through which wires can pass.

While the present invention has been described in detail with reference to the preferred embodiment thereof, many modifications and variations thereof will not be apparent to those skilled in the art. Accordingly, the present invention is to be limited, not by the details of the embodiment illustratively described herein, but only by the terms of the appended claims.

Claims

1. A one-piece lighting fixture, comprising:

a one-piece housing having a recess formed therein for receiving a portion of a light bulb of a type having a light-transmissive envelope on a base;

electrical circuitry comprising a ballast choke disposed with said choke surrounding at least a portion of said recess; said choke comprising a core and first and second windings wound on said core, said core comprising two pieces each of which constitutes a portion of a torus; and

electrical contact elements for electrically connecting, via said circuitry, a light bulb received in said recess with an external power source.

2. The fixture of Claim 1, wherein each of said pieces has a center line that defines a semi-circle.

3. The fixture of Claim 1, said fixture being a socket adapter and further comprising a securing device for securing said socket adapter to an electrical socket.

4. A one-piece socket adapter, comprising:

a one-piece housing having a recess formed therein for receiving a light bulb of a type having a light-transmissive envelope on a base; said recess being adapted to receive a light bulb of said type in a position in which substantially only the light-transmissive envelope of the light bulb protrudes from said recess;

electrical circuity disposed in said housing and including a ballast choke, said circuity being adapted to provide electric power to a light bulb of said type whose base is received in said recess;

a securing device for securing said socket adapter to an electrical socket; and

electrical contact elements for electrically connecting said electrical circuitry with electrical contacts in an electrical socket when said socket adapter is received in the socket.

5. The socket adapter of Claim 4, wherein a portion of said electrical circuitry surrounds said recess at least partially and is spaced from said recess.

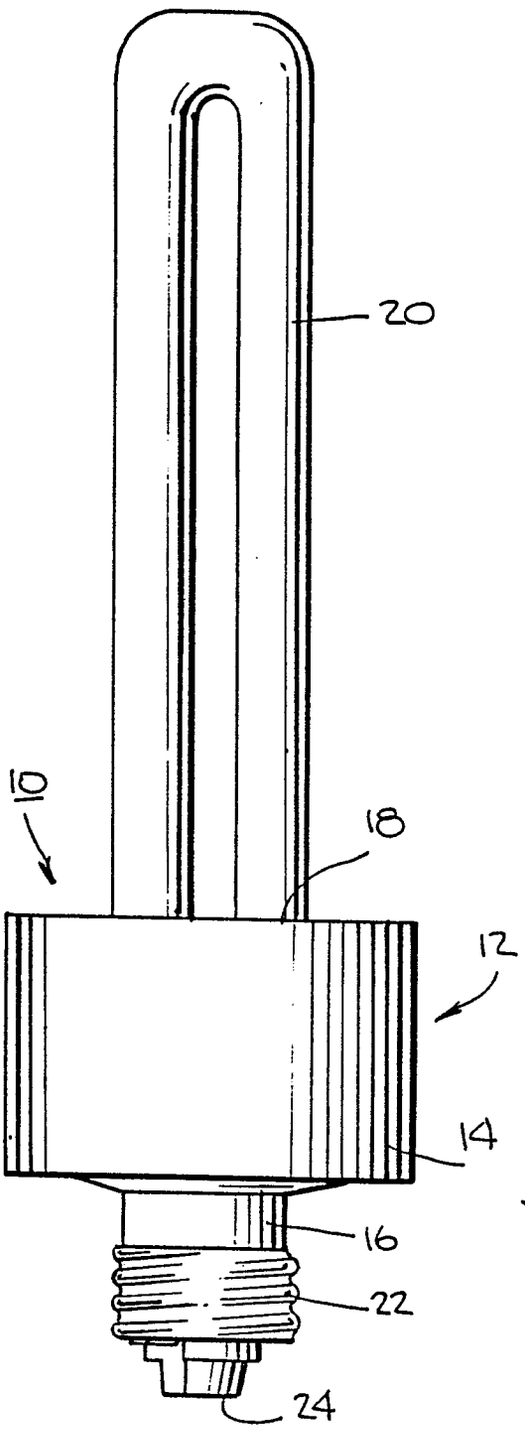
6. The socket adapter of Claim 5, wherein said portion of said electrical circuitry includes said ballast choke, and wherein said ballast choke itself at least partially surrounds said recess.

7. The socket adapter of Claim 6, wherein said ballast choke comprises a core having the shape of a torus.

8. An annular choke, comprising at least first and second core pieces and first and second windings respectively wound on said first and second core pieces, each of said core pieces defining a portion of an annulus and said core pieces together defining a substantially complete annulus.

9. The choke of Claim 8, wherein said annulus is a torus.

Fig. 1.



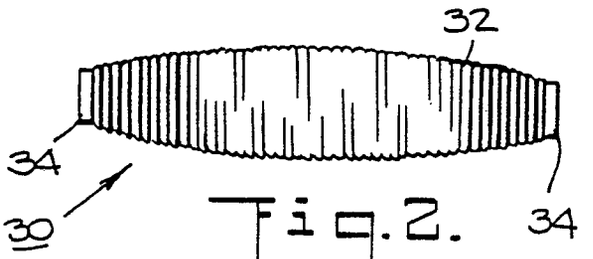


Fig. 2.

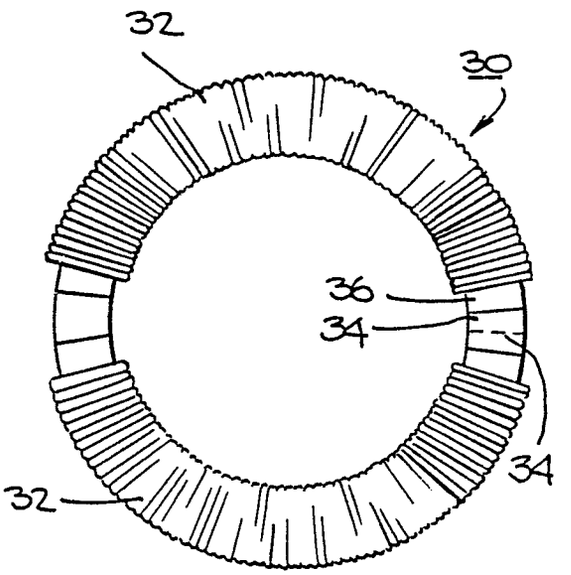


Fig. 3.

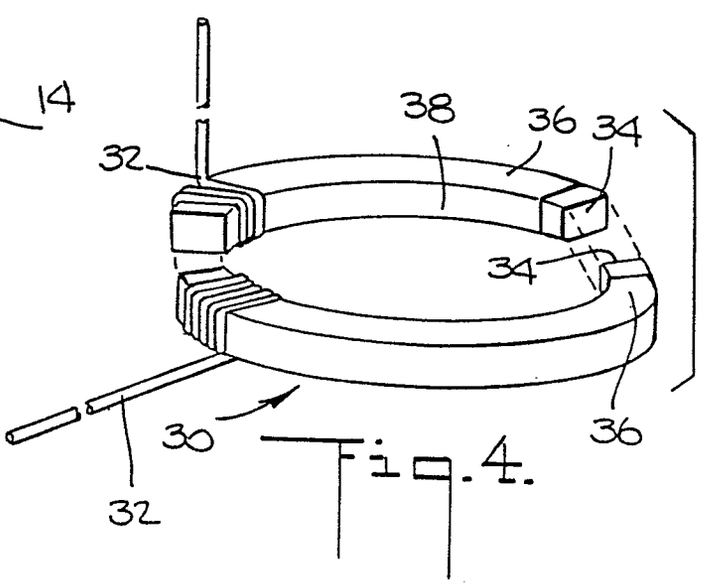
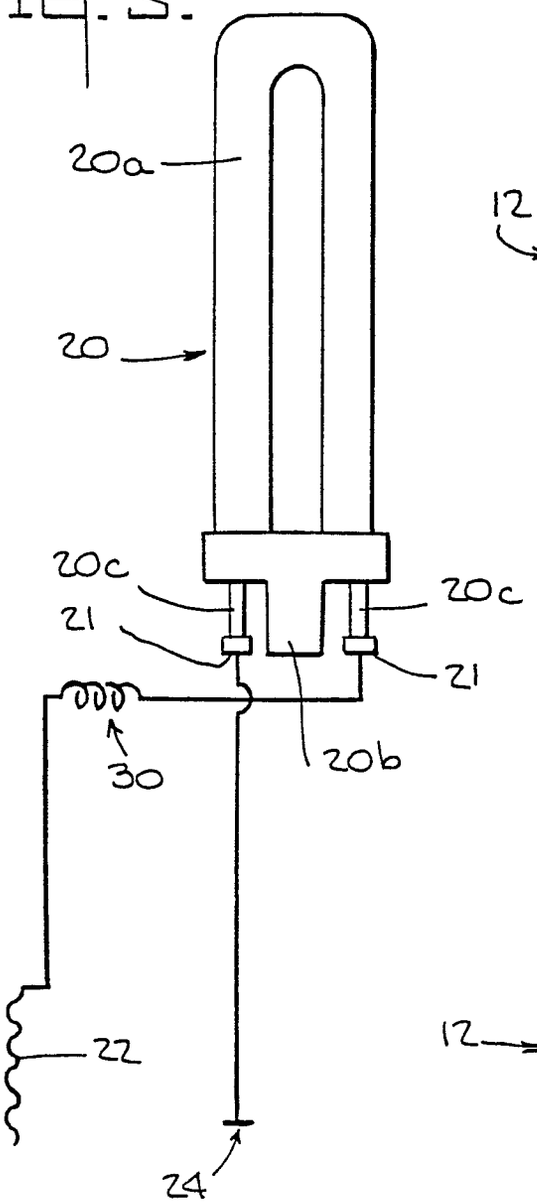


Fig. 4.

Fig. 5.



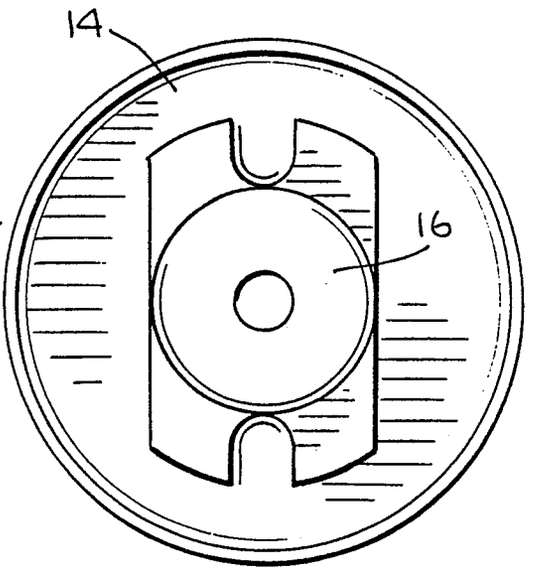


Fig. 6A.

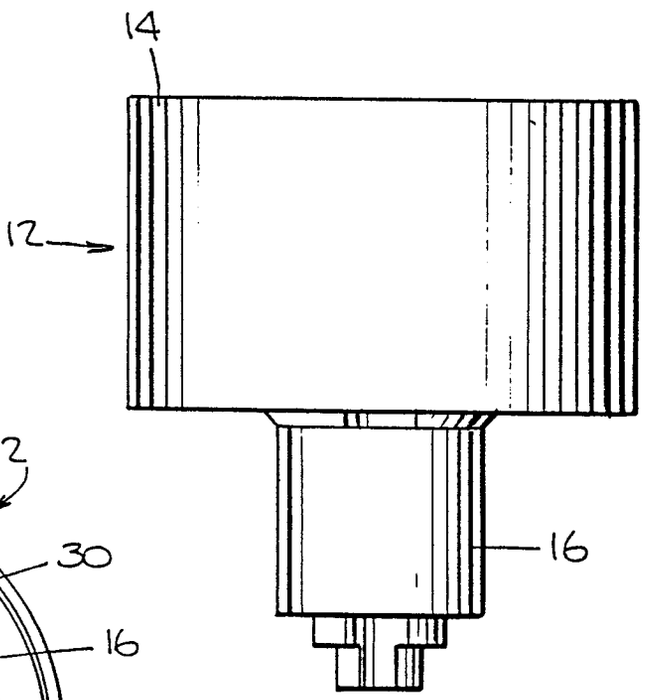


Fig. 6B.

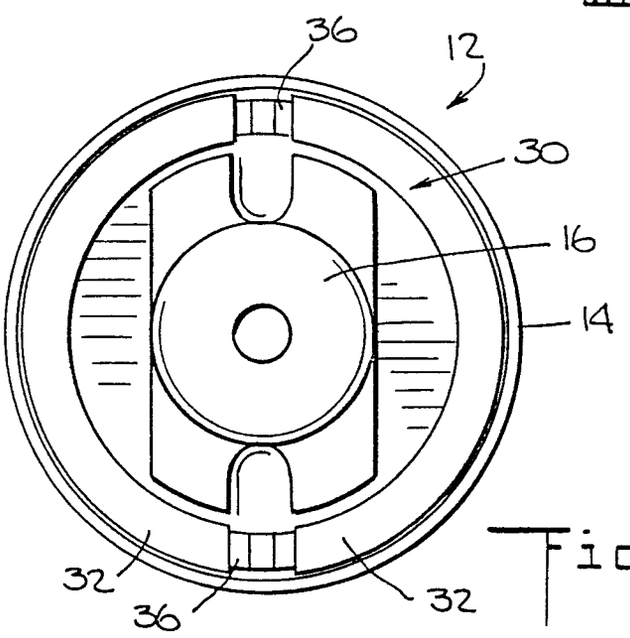


Fig. 7.

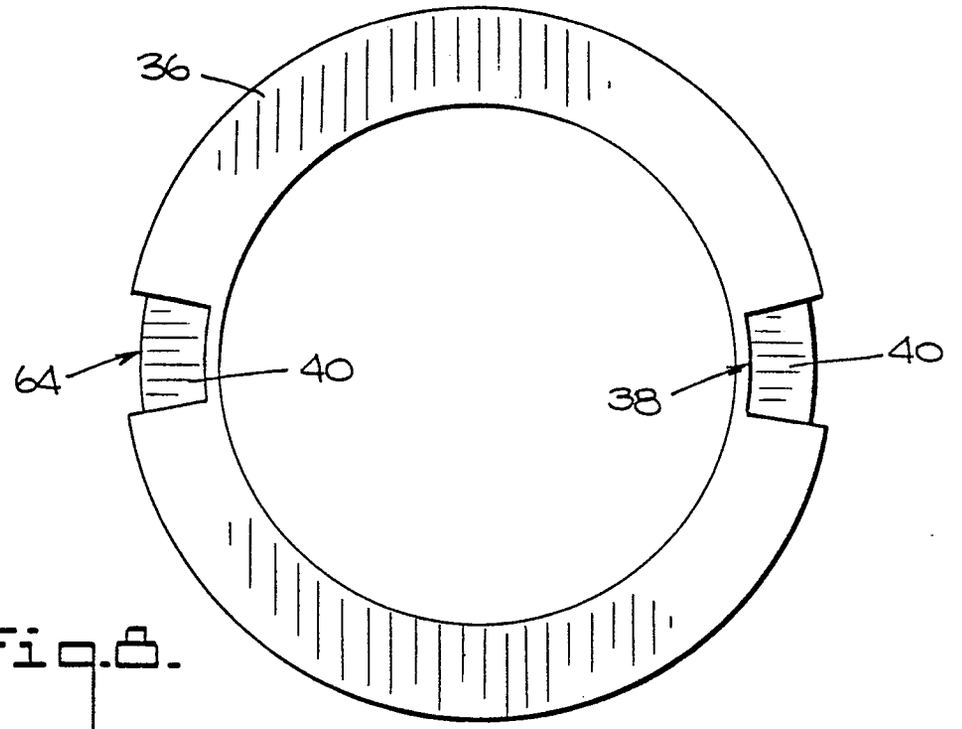


Fig.8.

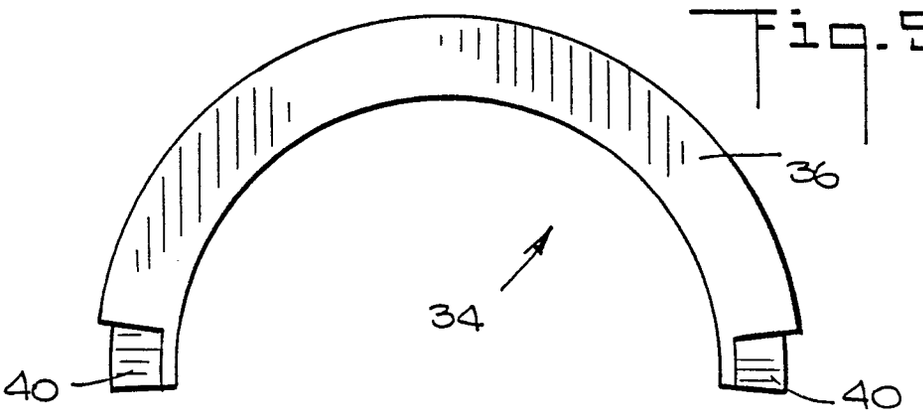


Fig.9.

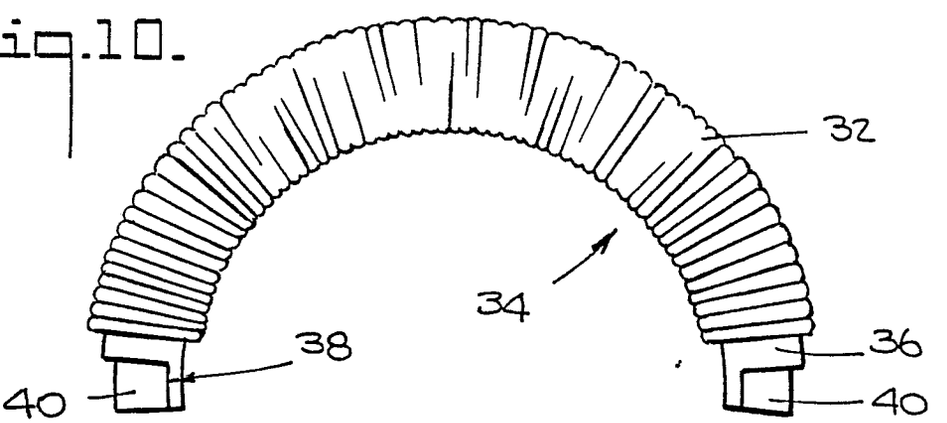


Fig.10.