Sept. 16, 1952 E. R. GOLDFIELD ET AL 2,611,095

SHOCKPROOF HEAD FOR X-RAY APPARATUS

Filed Aug. 31, 1949 2 SHEETS—SHEET 1

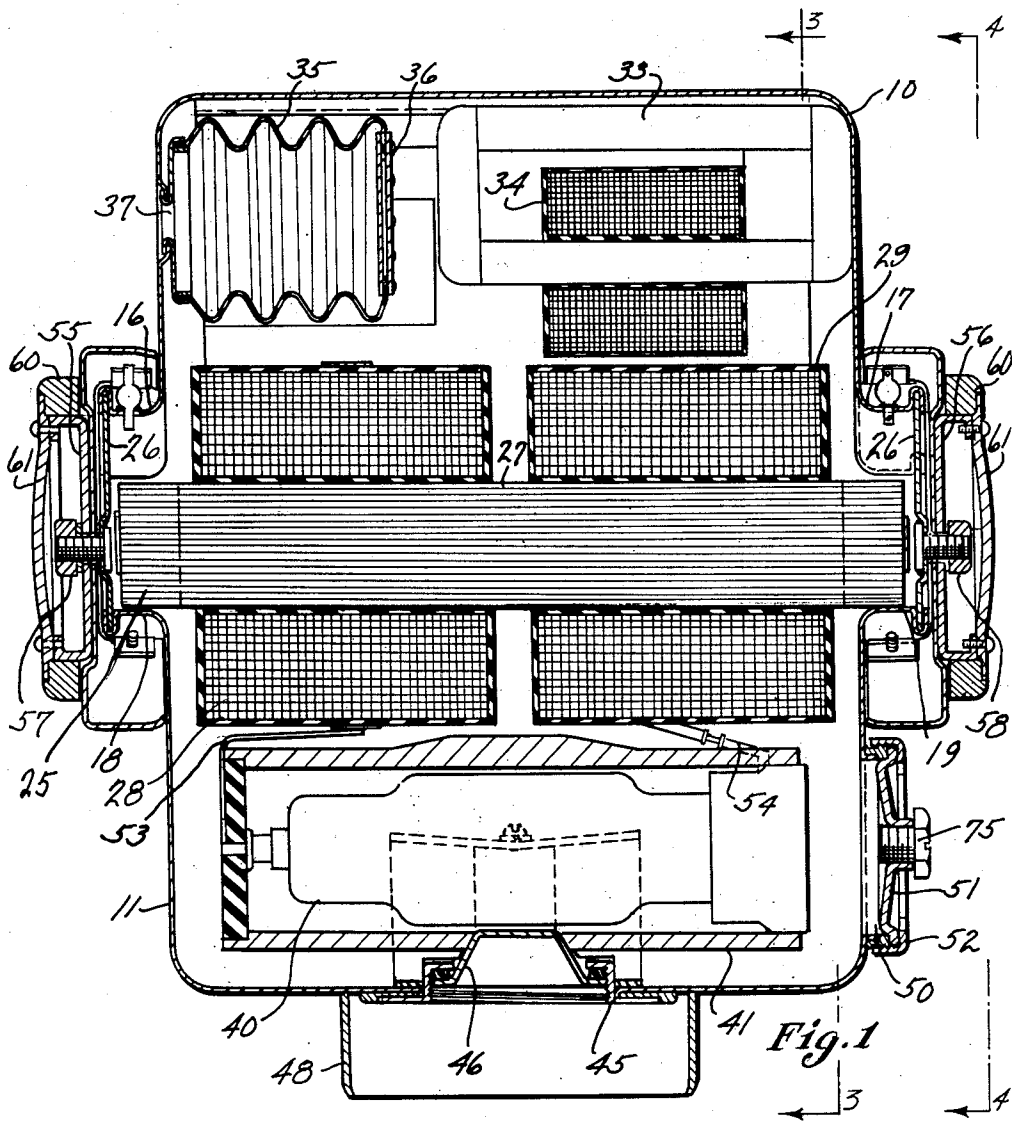


Fig. 1

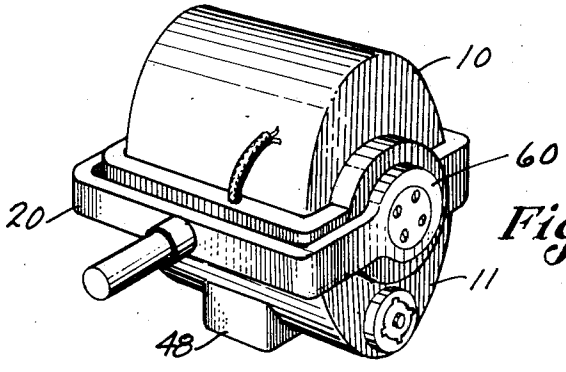


Fig. 2

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Fig. 3

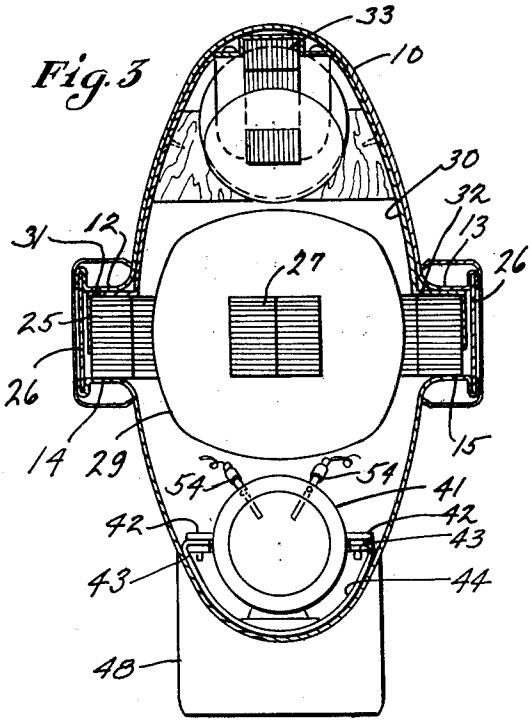


Fig. 4

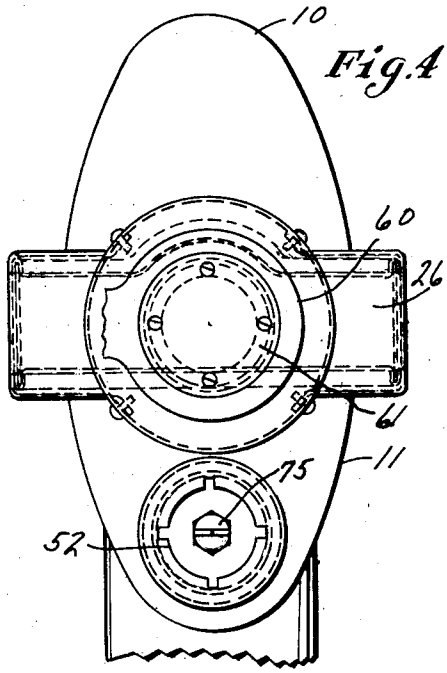
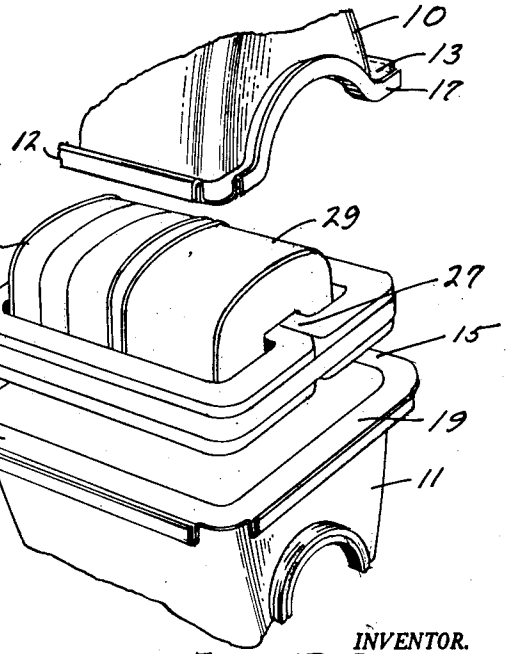


Fig. 5



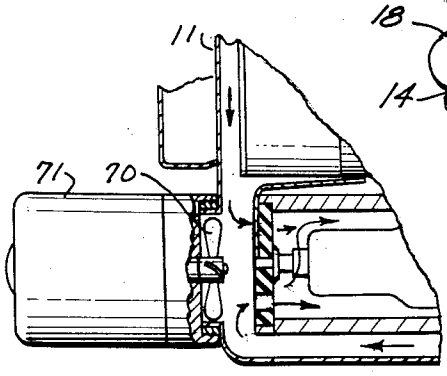


Fig. 6

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SHOCKPROOF HEAD FOR X-RAY APPARATUS

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7 Claims. (Cl. 250—87)

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This invention relates to improvements in housings for X-ray tubes, and particularly to a housing which contains the transformer, as well as the tube, and which embodies a unit that is mounted for pivotal movement with respect to a supporting arm.

One of the difficulties encountered in the manufacture of an X-ray tube housing which has the transformer and tube mounted as a unitary construction therein has been the relatively low ratio of radiation output per pound of weight. This has been due inherently to the fact that the weight must be kept sufficiently low to permit movement of the head with respect to the support. A relatively low weight, however, diminishes the radiation power of the X-ray tube.

An object of the present invention therefore is to construct an X-ray tube head which is sufficiently compact as to increase the relative ratio of radiation output per pound of weight, and which had adequate space for the component parts. An additional object is to provide adequate cooling of the X-ray tube with a minimum amount of fluid, and at the same time to obtain a construction which is attractive in appearance.

Referring now to the drawings, Fig. 1 is a vertical section taken longitudinally through an X-ray tube head embodying the present invention; Fig. 2 is a perspective view of the head mounted in a supporting bracket; Fig. 3 is a section taken on a plane indicated by the line 3—3 in Fig. 1; Fig. 4 is an end view of the head taken from the end indicated by the line 4—4 in Fig. 1; Fig. 5 is an exploded perspective view illustrating a part of the assembly; Fig. 6 is a fragmentary sectional view showing a modified construction.

In the drawing, the invention is shown as a unit which includes a liquid tight shell or housing comprising an upper section 10 and a lower section 11, each of which is substantially semi-elliptical in cross-sectional shape. The upper section has flanges 12 and 13 (Fig. 3), while the lower section has flanges 14 and 15 extending longitudinally of the unit and outwardly therefrom. Similarly, the end portions of the upper section have flanges 16 and 17 while the end portions of the lower section have flanges 18 and 19 respectively. All of the flanges of the lower section lie in the same plane, whereas the end portions of the end flanges or the upper section lie in the same plane as the longitudinal flanges, but the mid-portions of the end flanges are arched as is shown in Fig. 5.

The housing sections are assembled upon a core 25 of the main transformer and in such

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manner as to hold the transformer core laminations securely clamped together without the need for extraneous clamping means. A preferred form of apparatus for clamping the sections together embodies a band 26 which extends around the core and is engaged by the respective flanges of the upper and lower sections. As shown in Fig. 3, each flange is bent near its marginal edges outwardly away from the core and thence inwardly so as to provide a recess into which an edge portion of the band may extend. Thereupon the edge portions of the respective flanges are soldered or brazed to the band so as to effect a tight joint against the transformer core and also to obtain a fluid tight casing.

The core 25 is shown as a shell type having coils 28 and 29 on the central leg 27 thereof which occupy substantially all of the central portion of the housing. Within the chamber above the coils and in close fitting engagement with the curved walls of the upper section is a plate 30 which extends for substantially the full length of the section, and which may have flanges 31 and 32 that extend outwardly along the lower longitudinal edges and are disposed between the core and the respective flanges 12 and 13 of the upper section. The curved plate 30 provides a support for a filament transformer having a core 33 and coils 34 and also provides a support for an expansible bellows 35. The bellows has one end 36 sealed but has the other end 37 open to the atmosphere through an opening in an end wall of the section 10.

The chamber within the lower section beneath the transformer coils 28 and 29 is occupied by the X-ray tube which is indicated at 40 as being positioned within a cylindrical X-ray proof insulating shield or casing 41 which, in turn, is suitably fastened to the shell. A preferred form of such fastening includes ears 42 which extend outwardly from the casing and which are adapted to engage flanges 43 on a curved supporting plate 44. Such plate is rigidly fastened, as by soldering, to the shell and has an aperture in its lower central portion for receiving an inverted cup-shaped member 45 which is internally threaded and is adapted to receive a transparent plate window member 46. The member 46 may be drawn tightly against the gasket 47 so as to maintain a liquid tight seal within the housing. An outer guide 48 surrounds the opening and serves as an additional medium for confining the rays.

Access to the interior of the housing for in-

sertion and removal of the X-ray tube may be had through an opening 50 in an end wall of the lower section. The opening may be sealed by a removable closure plate 51 that is fastened to the housing by a nut 52. Connections from the transformers to the tube may be made automatically through the connectors 53 and 54 upon insertion of the X-ray tube into the casing 41.

The bearing supports for the unit comprise trunnions which, in Fig. 1, are shown as cup-shaped members 55 and 56 that are fastened by securing members 57 and 58 respectively to the band 25. The bearing members extend into corresponding apertures in the arms 60 of the yoke 26 and are held in place by cap plates 61 in such manner as to permit an oscillating movement of the head with respect to the yoke.

Fig. 6 shows a modification of the invention wherein provision is made for dissipating the heat developed upon operation of the X-ray tube. This may be accomplished by mounting a motor driven impeller 70 within a casing 71 which is attached to the housing, preferably to the bottom section 11 thereof and on the end opposite the opening 50. The housing may then be filled with liquid through an opening in the plate 51 which is closable by a plug 75, and the arrangement is such that upon operation of the impeller the liquid will be made in the direction indicated by the arrows in Fig. 6 and thus circulated throughout the interior of the housing.

An important advantage of the present invention is the compactness of the head as well as the relatively high ratio of radiation output per pound of weight. By mounting the main transformer at the central portion of the housing the core laminations can be securely clamped together by means of the band which is utilized for making the joint between the upper and lower sections. There is thus adequate space above the transformer for the filament transformer, as well as the expansible bellows, and there is ample space beneath the main transformer for the reception of the X-ray tube.

We claim:

1. An X-ray tube head comprising in combination, a transformer core of the shell type having a central leg, a pair of transformer coils positioned on said central leg, a pair of hollow sheet metal members each having an open end with outwardly extending marginal flanges adapted to bear in abutting relation against opposite marginal edges of said core, a band extending around the core respectively and means for sealing the band to the flanges so as to provide a leak proof housing, trunnion members attached to the band at opposite ends of the core, said housing sections each being substantially semi-elliptical in cross sectional shape and having chambers therein above and below said transformer coils, a tubular member within one of said chambers and adapted to receive an X-ray tube, and a filament transformer and an expansible bellows occupying the other of said chambers.

2. An X-ray tube head comprising in combination, a pair of hollow half-sections each having an open end with marginal outwardly extending flange portions, a main transformer core positioned between said hollow sections and having a dimension in the plane of said marginal flange portions greater than the open end of said half-sections, means clamping said respective flange portions in abutting relation to adjacent marginal edges of said core to provide a fluid-tight housing therefor, transformer coils on said core within the housing, a receptacle positioned in said housing at one side of the transformer coils adapted to receive an X-ray tube, said lower section having an opening in registration with the receptacle sufficiently large to pass an X-ray tube, removable means for sealing said opening, and a filament transformer positioned in the housing on the opposite side of said transformer coils.

3. An X-ray tube head comprising in combination, a pair of half-shell sections each having an open end with marginal outwardly extending flange portions, a transformer core, a pair of transformer coils mounted on said core, said core and coils positioned between the respective open ends of said half-shell sections and having a dimension in the plane of said flange portions greater than the open ends of said half-shell sections, means clamping said respective flange portions in abutting relation to adjacent marginal edges of the core to provide a fluid-tight housing therefor and forming chambers above and below the transformer coils, means in one of said chambers including an opening through the chamber adapted for removably receiving and supporting an X-ray tube therein, means for sealing the opening, and the other of said chambers having a filament transformer and an expansible bellows mounted therein.

4. An X-ray tube head comprising in combination, a transformer core, upper and lower hollow half sections each having a substantially semi-elliptical cross-sectional shape and each having an open end with marginal outwardly extending flanges, a band embraced by portions of said flanges and extending around the marginal edge of said core normal to said flange portions, said band coacting with said flange portions to clamp said respective flange portions in abutting relation to adjacent marginal edges of said transformer core to provide a fluid-tight housing therefor, transformer coils on said core within the housing, said housing having chambers above and below the transformer coils, a filament transformer and an expansible member carried by the upper section and occupying one of said chambers, an X-ray tube receptacle occupying the other chamber, said lower section having an opening in registration with the receptacle through which an X-ray tube may be inserted into or withdrawn from said receptacle, and means for sealing said opening.

5. An X-ray tube head comprising two hollow half-sections, each of said sections having an open end with marginal outwardly extending flange portions, a transformer core disposed between the respective open ends of said half-sections and having a dimension in the plane of said flange portions greater than the respective open ends of said sections, means clamping said respective flange portions in abutting relation to adjacent marginal edges of said core to secure the half-sections thereto and to provide a fluid-tight housing therefor, transformer coils on said core, supporting plates in contiguous engagement with the inner walls of said respective half-sections, a tubular receptacle mounted upon one of said plates adapted to receive an X-ray tube within one section, an opening through said one section adapted to pass an X-ray tube into said receptacle, means for sealing the opening, an expansible device carried by the other of said plates in the other section, and a filament transformer mounted in one of said sections.

6. An X-ray tube head comprising in combination, a pair of hollow half-sections having a

substantially semi-elliptical cross-sectional shape, each of said half-sections having an open end with outwardly extending marginal flange portions, a main transformer core and coils centrally positioned between the open ends of said hollow sections and having a dimension in the plane of said flange portions greater than the open ends of said sections, means securely clamping said respective flange portions in abutting relation to adjacent marginal edges of said transformer core to provide a fluid-tight housing therefor, trunnions on said housing adjacent opposite ends of said core, said housing having chambers above and below the transformer, an X-ray tube supported in one of said chambers, said tube supporting chamber having normally sealed means providing access to said X-ray tube, a filament transformer occupying another of said chambers, said housing having a liquid therein, and impeller means in one of said sections for circulating said liquid.

7. An X-ray tube head comprising in combination, a pair of complementary hollow half-sections adapted to coact to form a housing, each of said hollow half-sections having an open end with marginal outwardly extending flange portions, a main transformer core and coils centrally positioned between the open ends of said respective half-sections, said core having a dimension in the plane of said flange portions greater than the opening in said half-sections, a band embraced by portions of said flanges normal thereto and extending around the marginal edge of said core, said band and flange portions coacting to

securely clamp the respective flange portions to adjacent marginal edges of said core to provide a fluid-tight housing therefor, said housing having chambers above and below the transformer, a filament transformer occupying one of said chambers, an X-ray tube removably supported in the other of said chambers, and means effecting an automatic connection between said X-ray tube and said transformers consequent upon positioning the tube within the chamber.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,973,415	Mutscheller	Sept. 11, 1934
1,984,277	Morrison	Dec. 11, 1934
1,987,790	Mutscheller	Jan. 15, 1935
2,019,362	Schnitzer	Oct. 29, 1935
2,048,237	Verhoeff	July 21, 1936
2,081,077	Wantz	May 18, 1937
2,086,045	Pieper	July 6, 1937
2,121,630	Gross et al.	June 21, 1938
2,170,933	Werner	Aug. 29, 1939
2,194,369	Simon	Mar. 19, 1940
2,230,176	Bouwers et al.	Jan. 28, 1941

FOREIGN PATENTS

Number	Country	Date
703,037	France	Apr. 22, 1931