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An Ultrasonic Projector Design for a Wide Range of Research Applications

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IN research work concerned with the ultrasonic irradiation of many types of specimens it is desirable to have a flexible projector design which offers features of adaptability to different types of systems as well as possessing the inherent ability to obtain high power output levels.

Figure 1 illustrates in cross section the essential design features of such a projector in which the crystal, vibrating in thickness mode, is held in a vertical plane. The ground plate *H* is constructed so as to be readily connectable to various irradiating chambers.

One major aspect of the design is the clamping of the crystal between two small Neoprene gaskets *A* which in the undeflected position are 0.030 in. thick. The same thickness Neoprene is used for gaskets *B*. Parts *E*, *F*, and *G* are bolted together with gasket *D*. For assembly purposes ground plate *H* is laid in the horizontal position. Then stacked in order, on top of this plate are gasket *A*, the crystal and another gasket *A*. Gaskets *B* and ring *C* are also placed in position. Then *E*, *F*, *G* assembly is laid on top and the whole assembly is bolted together as shown. The gasket grooves in all cases are designed so that the Neoprene is not deflected too much in any tightening operation. This means that ring *C* is pulled against the ground plate and polystrene plate *E* and the gaskets *B* are not over deflected. This pulling together operation also limits the deflection of gaskets *A*.

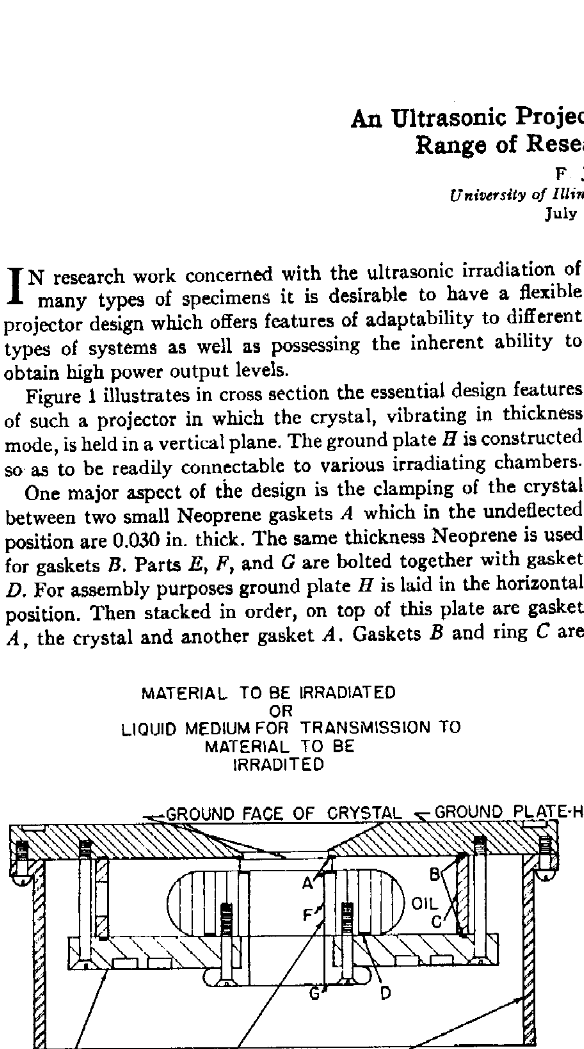

FIG. 1.

After the assembly of the physical parts shown in the figure, the chamber surrounding the crystal edge is filled with oil for the purpose of giving a much higher voltage break down strength to the space between the two crystal faces.

Another important aspect of the design is concerned with the final electrical contacts to the crystal faces. The crystal faces are electroded to a distance from their edges equal approximately to the Neoprene gasket width. A conducting paint is then applied around the crystal faces at the gasket edges, over the gasket edges and to both the ground plate *H* and plate *F*. This produces a desirable configuration of equipotential surfaces for the electric potential.

For flexibility in changing from one crystal to another of different frequency but of the same shape in all but the thickness dimension it is only necessary to have a new length for ring *C*. Rings *C* are made beforehand for all the crystal frequencies wanted, and the limiting time for a change is then the drying time of the conducting paint which can be accelerated with warm air blasts so that only a few minutes is involved in a change of this sort.

The same design features are readily incorporated into set-ups wherein the crystal is mounted horizontally or the crystal must assume any position as in an applicator. It is also apparent that changes in crystal size of other than the thickness dimension are readily incorporated into the design. Crystals with curved shapes for focusing of the sound field can be readily handled.

Experience with eight of these projectors in which the crystals have had both horizontal and vertical mounting has been used as an indication of the general trouble free operation obtained from these design specifications.