

Nov. 7, 1939.

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2,178,909

EVACUATED BULB MOUNT FOR PIEZOELECTRIC CRYSTALS

Filed March 17, 1938

Fig. 1

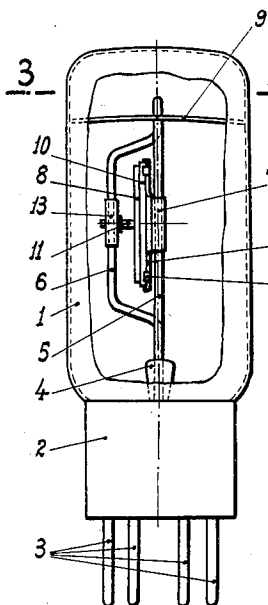


Fig. 2

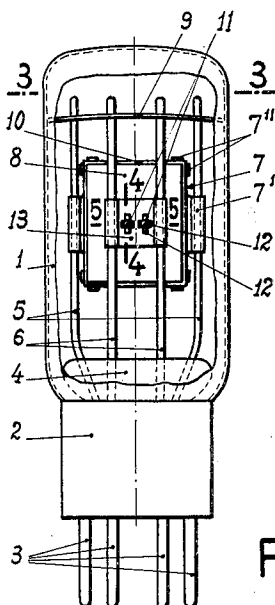


Fig. 3

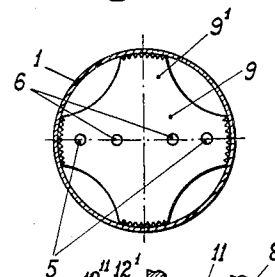


Fig. 4

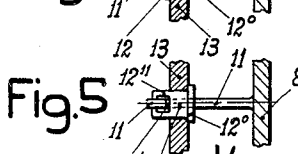


Fig. 5

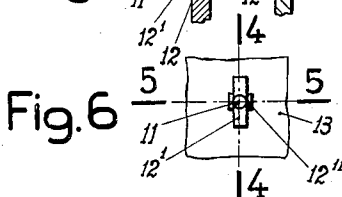


Fig. 6

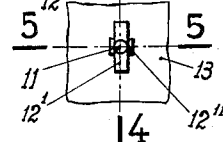


Fig. 7

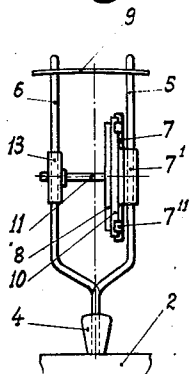


Fig. 8

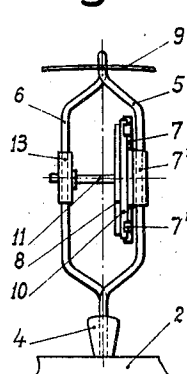


Fig. 9

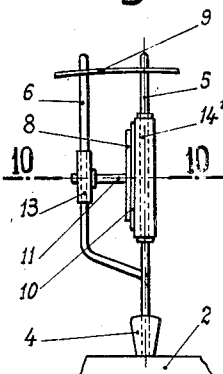


Fig. 11

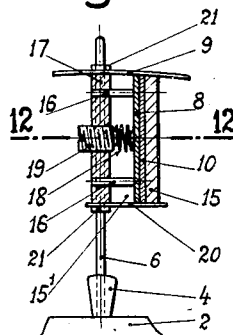


Fig. 13

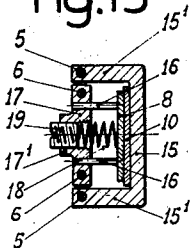


Fig. 10

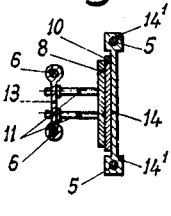
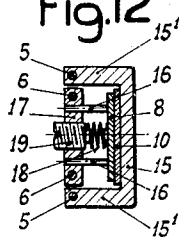


Fig. 12



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UNITED STATES PATENT OFFICE

2,178,909

EVACUATED BULB MOUNT FOR PIEZOELECTRIC CRYSTALS

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Application March 17, 1938, Serial No. 196,510
 In Italy March 22, 1937

18 Claims. (Cl. 171—327)

This invention is directed to improvements in oscillator devices with piezoelectric crystal suspended in an evacuated bulb, and more particularly it includes means for suspending or mounting crystals in evacuated bulbs, which remove the well known objections against the conventional mounts that is their cost and complicated character and also difficulties found in mounting operations and the unsatisfactory strength they are provided with.

In accordance with the present invention the suspension or mount of the crystal supporting electrodes is effected by means of rods which also act to connect said electrodes and crystal in circuit and which have their roots fast in the bulb press whilst their opposed ends are engaged in position by means of a transverse insulating sheet whose edges abut against the bulb wall.

The present invention also includes features in respect of means for mounting the electrodes on support rods and for adjusting the pressure under which said electrodes are forced against the crystal located intermediate them.

Some embodiments of the present invention are shown by way of example on the annexed drawing and

Figure 1 is a side view of a device in accordance with the present invention;

Fig. 2 is a side view from left hand as seen in Fig. 1;

Fig. 3 is a section on line 3—3, Figs. 1 and 2;

Fig. 4 is a fragmentary section of an arrangement for mounting one of the electrodes on its support rods, said section being to an enlarged scale and on line 4—4 of Figs. 2 and 6;

Fig. 5 is a section similar to Fig. 4 on line 5—5 of Figs. 2 and 6;

Fig. 6 is a fragmentary view from left hand of Figs. 4 and 5;

Fig. 7 shows another arrangement of the electrode and crystal supporting rods;

Fig. 8 shows a further arrangement of said rods;

Fig. 9 shows a still further arrangement of the electrode and crystal supporting rods;

Fig. 10 is a transverse section on line 10—10, Fig. 9;

Fig. 11 is a vertical section of a further embodiment;

Fig. 12 is a section on line 12—12, Fig. 11, and

Fig. 13 is a section showing a modification of Figs. 11 and 12.

In the embodiment of Figs. 1—6 the device includes a bulb 1 mounted on the base 2 which carries the pins 3; two pairs of rods 5, 5 and 6, 6

located side by side are fastened in the bulb press 4 and connected with appropriate ones of said contact pins 3, and they carry the respective electrodes 7 and 8; the top ends of rods 5, 5 and 6, 6 are engaged in holes of a flexible and insulating sheet 9, conveniently made of mica, having extensions 9' intended to abut on and resiliently engage with the internal surface of the bulb wall said sheet 9 thus correctly positioning the rods 5, 5 and 6, 6 and the electrodes carried thereby.

The rods 5, 5 are straight ones and an electrode plate 7 is mounted thereon by means of sleeves 7' provided by tongues bent from the edges of said electrode plate; lugs 7'' extend from said electrode to engage the edges of the crystal 10 and hold it in correct edgewise position.

The rods 6, 6 are bridge-shaped as shown in Fig. 1 and they carry a second electrode 8; at the same time said rods 6, 6 force the electrode 8 against the crystal 10 with required pressure, by effect of the spring action they have in view of their above stated bridge shape.

The electrode 8 is mounted on the rods 6, 6 in the manner shown in Figs. 4—6; for mounting purposes studs 11 are welded to the electrode plate 8 and extend throughout sleeves 12 inserted through a plate 13 carried by the rods 6, 6; said sleeves 12 have a flange 12^a at one of their ends and lugs 12' at their opposite ends, said lugs 12' being bent outwardly over the plate 13 to secure said sleeves on said plate; said sleeves 12 are further provided with fingers 12'' pointing towards the respective sleeve axis and resiliently engaging the ends of the cooperating studs 11.

The position of the studs 11 with respect to rods 6, 6 and the pressure they impart to the crystal may thus be easily adjusted, said studs and associate electrode plate being then fastened in the adjusted position by soldering each finger 12'' on the cooperating stud 11.

Figs. 7 and 8 illustrate modified constructions of rods 5, 5 and 6, 6.

In Fig. 7 the two pairs of rods diverge at both sides from the middle plane intermediate them where their root portions are located, and their top ends lie in spaced planes the holes in the sheet 9 intended to receive said top ends of said rods being thus located on two parallel and spaced lines.

In Fig. 8 the rods 5, 5 and 6, 6 of both pairs are bridge shaped and their ends engaged with the sheet 9 lie in a common plane.

In Figs. 9 and 10 the electrode carried by the rods 5 consists of a plate 14 having shoulders

14' at its sides in which bores are provided to enable said plate to be inserted over the rods 5, 5 which extend throughout said bores; the internal edges of the shoulders 14' provide abutments cooperating to position the crystal 10 in its own plane. The electrode 8 and the plate 13 supporting it are supported in the manner described in connection with Figs. 1-8.

Figs. 11 and 12 illustrate a construction in which all rods 5 and 6 are located in a common plane; in this construction a channel or C-shaped electrode 15 is engaged with the outermost rods 5, 5 of the four rod systems, the second electrode 8 being carried by the rods 6, 6 located intermediate the ones 5, 5; the crystal 10 is engaged between the two electrodes 8 and 15 and is held in correct edgewise position by the side portions 15' of the C-shaped electrode 15.

The electrode 8 has its studs 16 engaged in a plate 17 having parallel bores extending there-through and providing for inserting it over the rods 6.

A spring 18 is located intermediate said plate 17 and the electrode 8 to force said electrode 8 against the crystal 10 and a worm-screw 19 is screwed in the plate 17 to provide an adjustable abutment for the spring 18 as useful for adjusting the pressure under which the crystal is clamped intermediate the electrodes 8 and 15. The crystal 10 is held in position in the direction along the rods 5, 5 and 6, 6 by the mica sheet 9 at its top edge and by a similar sheet 20 located at its bottom and engaged with the plate 17 by means of lugs 21, this plate 17 being in turn engaged with the sheet 9 by means of additional lugs 21.

Fig. 13 illustrates an arrangement similar to that of Figs. 11 and 12; in this construction to provide for widening the range of possible adjustment of the pressure operative on the crystal, the plate 17 has an extended screwthreaded protrusion 17' where the screw 19 is engaged; a portion of said protrusion provides a space in which the spring 18 extends and thus this spring may have a larger length with respect to that permissible in the construction of Figs. 11, 12, to make the pressure adjustment more gradual.

In any case the means of this invention provides a safe and resilient mounting for the crystal, said mounting being further simple and inexpensive.

What I claim as my invention and desire to secure by United States Letters Patent is:

1. An evacuated bulb mount for a piezoelectric crystal comprising coextensive rods having their roots fast in the bulb press, a transverse insulating sheet located in said bulb at the end thereof spaced from said press and having its edges abutting on the internal surface of the bulb wall, said sheet cooperating with said rods to position them, an electrode plate carried by a number of said rods, a second electrode plate carried by other ones of said rods and a crystal intermediate said electrode plates.

2. An evacuated bulb mount for a piezoelectric crystal comprising coextensive rods having their roots fast in the bulb press, a transverse perforated and insulating sheet located in said bulb at the end thereof spaced from said press and having its edges abutting on the internal surface of the bulb wall, the ends of said rods extending through and being engaged in the perforations of said sheet, an electrode plate carried by a number of said rods, a second electrode plate carried

by other ones of said rods and a crystal intermediate said electrode plates.

3. An evacuated bulb mount for a piezoelectric crystal comprising coextensive rods having their roots fast in the bulb press, a transverse perforated and insulating sheet located in said bulb at the end thereof spaced from said press and having its edges abutting on the internal surface of the bulb wall, the ends of said rods extending through and being engaged in the perforations of said sheet, an electrode plate carried by a number of said rods, a second electrode plate carried by other ones of said rods and a crystal intermediate said electrode plates said rods being of conducting material and acting for connecting said crystal in an outer circuit.

4. An evacuated bulb mount for a piezoelectric crystal comprising coextensive rods having their roots fast in the bulb press, a transverse perforated and insulating sheet located in said bulb at the end thereof spaced from said press and having its edges abutting on the internal surface of the bulb wall, the ends of said rods extending through and being engaged in the perforations of said sheet, an electrode plate carried by a number of said rods, a second electrode plate carried by other ones of said rods and a crystal intermediate said electrode plates said rods being resilient and cooperating to force said electrode plates on said crystal intermediate them.

5. An evacuated bulb mount for a piezoelectric crystal comprising coextensive resilient and conducting rods having their roots fast in the bulb press, a transverse perforated and insulating sheet located in said bulb at the end thereof spaced from said press and having its edges abutting on the internal surface of the bulb wall, the ends of said rods extending through and being engaged in the perforations of said sheet, an electrode plate carried by a number of said rods, a second electrode plate carried by other ones of said rods and a crystal intermediate said electrode plates, said rods cooperating to force said electrode plates on said crystal and to connect it in an outer circuit.

6. An evacuated bulb mount for a piezoelectric crystal comprising coextensive resilient and conducting rods having their roots fast in the bulb press along a common line, a transverse insulating sheet located in said bulb at the end thereof spaced from said press said sheet having perforations and abutting by its edges on the internal surface of the bulb wall, the ends of said rods extending through and being engaged in said perforations of said sheet and a set of said rods being bent away from the other ones, an electrode plate carried by said bent rods, a second electrode plate carried by the other ones of said rods and a crystal intermediate said electrode plates.

7. An evacuated bulb mount for a piezoelectric crystal comprising coextensive resilient and conducting rods having their roots fast in the bulb press along a common line, a transverse insulating sheet located in said bulb at the end thereof spaced from said press said sheet having perforations and abutting by its edges on the internal surface of the bulb wall, the ends of said rods extending through and being engaged in said perforations of said sheet and said rods providing two sets bent away from each other, an electrode plate carried by the rods of one of said sets, a second electrode plate carried by the other one of said rod sets and a crystal intermediate said electrode plates.

8. An evacuated bulb mount for a piezoelectric

crystal comprising coextensive resilient and conducting rods having their roots fast in the bulb press along a common line, a transverse insulating sheet located in said bulb at the end thereof spaced from said press said sheet having aligned perforations and abutting by its edges on the internal surface of the bulb wall, the ends of said rods extending through and being engaged in said perforations of said sheet, a set of said rods being bridge-shaped in their portion intermediate said roots and ends thereof, an electrode plate carried by said bridge shaped rods, a second electrode plate carried by the other ones of said rods and a crystal intermediate said electrode plates.

9. An evacuated bulb mount for a piezoelectric crystal comprising coextensive resilient and conducting rods having their roots fast in the bulb press along a common line, a transverse insulating sheet located in said bulb at the end thereof spaced from said press said sheet having aligned perforations and abutting by its edges on the internal surface of the bulb wall, the ends of said rods extending through and being engaged in said perforations of said sheet said rods being bridge-shaped in their portion intermediate said roots and ends thereof and providing two sets having said bridge-shaped portions extending in opposed directions away from an intermediate plane containing the rod root portions, an electrode plate carried by one of said rod sets, a second electrode plate carried by the other one of said rod sets, and a crystal intermediate said electrode plates.

10. An evacuated bulb mount for a piezoelectric crystal comprising coextensive rods having their roots fast in the bulb press, a transverse perforated and insulating sheet located in said bulb at the end thereof spaced from said press and having its edges abutting on the internal surface of the bulb wall, the ends of said rods extending through and being engaged in the perforations of said sheet, an electrode plate carried by a number of said rods, a second electrode plate, means for adjustably supporting said second electrode plate on the other ones of said rods and a crystal intermediate said electrode plates.

11. An evacuated bulb mount for a piezoelectric crystal comprising coextensive rods having their roots fast in the bulb press, a transverse perforated and insulating sheet located in said bulb at the end thereof spaced from said press and having its edges abutting on the internal surface of the bulb wall, the ends of said rods extending through and being engaged in the perforations of said sheet, an electrode plate carried by a number of said rods, a second electrode plate, studs extending from said second electrode plate, a part carried by the other ones of said rods and having means for adjustably supporting said studs and said second electrode plate and a crystal intermediate said electrode plates.

12. An evacuated bulb mount for a piezoelectric crystal comprising coextensive rods having their roots fast in the bulb press, a transverse perforated and insulating sheet located in said bulb at the end thereof spaced from said press and having its edges abutting on the internal surface of the bulb wall, the ends of said rods extending through and being engaged in the perforations of said sheet, an electrode plate carried by a number of said rods, a second electrode plate, studs extending from said second electrode plate, a part carried by the other ones of said rods and having means for slidably support-

ing said studs and said second electrode plate, a spring operative between said part and second electrode plate and a crystal intermediate said electrode plates.

13. An evacuated bulb mount for a piezoelectric crystal comprising coextensive rods having their roots fast in the bulb press, a transverse perforated and insulating sheet located in said bulb at the end thereof spaced from said press and having its edges abutting on the internal surface of the bulb wall, the ends of said rods extending through and being engaged in the perforations of said sheet, an electrode plate carried by a number of said rods, a second electrode plate, studs extending from said second electrode plate, a part carried by the other ones of said rods and having means for slidably supporting said studs and said second electrode plate, an adjusting screw extending throughout said part, a spring operative between said screw and second electrode plate and a crystal intermediate said electrode plates.

14. An evacuated bulb mount for a piezoelectric crystal comprising coextensive rods having their roots fast in the bulb press, a transverse perforated and insulating sheet located in said bulb at the end thereof spaced from said press and having its edges abutting on the internal surface of the bulb wall, the ends of said rods extending through and being engaged in the perforations of said sheet, an electrode plate carried by a number of said rods, a second electrode plate, studs extending from said second electrode plate, a part carried by the other ones of said rods and having means for slidably supporting said studs and said second electrode plate, said part providing a protrusion extending therefrom away from said second electrode plate and a screw-threaded bore throughout said protrusion, an adjusting screw engaged in said bore and leaving a space therein in front of said second electrode plate, a spring extending into said bore and operative between said screw and second electrode plate and a crystal intermediate said electrode plates.

15. An evacuated bulb mount for a piezoelectric crystal comprising coextensive and co-planar rods having their roots fast in the bulb press, a transverse perforated and insulating sheet located in said bulb at the end thereof spaced from said press and having its edges abutting on the internal surface of the bulb wall the ends of said rods extending through and being engaged in the perforations of said sheet, a C-shaped electrode plate carried by the side ones of said rods, a part carried by the intermediate ones of said rods, a second electrode plate carried by said part and located within the said C-shaped electrode plate and a crystal intermediate said electrode plates.

16. An evacuated bulb mount for a piezoelectric crystal comprising coextensive rods having their roots fast in the bulb press, a transverse perforated and insulating sheet located in said bulb at its end spaced from said press and having its edges abutting on the internal surface of the bulb wall the ends of said rods extending through and being engaged in the perforations of said sheet, an electrode plate engaged with a number of said rods by means of holes provided in said electrode plate and passed through by the cooperating rods, a part engaged with others of said rods by means of holes provided in said part and passed through by the cooperating rods, an electrode plate carried by said part, and a crystal intermediate said electrode plates.

17. An evacuated bulb mount for a piezoelectric crystal comprising coextensive rods having their roots fast in the bulb press, a transverse perforated and insulating sheet located in said bulb at the end thereof spaced from said press and having its edges abutting on the internal surface of the bulb wall, the ends of said rods extending through and being engaged in the perforations of said sheet, an electrode plate carried by a number of said rods, a second electrode plate carried by the other ones of said rods and a crystal intermediate said electrode plates one of said electrode plates having edge means for engaging said crystal to position it in its own plane.
18. An evacuated bulb mount for a piezoelectric crystal comprising coextensive rods having their roots fast in the bulb press, a transverse perforated and insulating sheet located in said bulb at the end thereof spaced from said press and having its edges abutting on the internal surface of the bulb wall, the ends of said rods extending through and being engaged in the perforations of said sheet, an electrode plate carried by a number of said rods, a second electrode plate carried by other ones of said rods, a crystal intermediate said electrode plates and having an edge portion abutting on said insulating sheet, and a second insulating sheet engaging an opposite edge portion of said crystal and secured on one of said electrode plates.

LEONE KAMENAROVIC.