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F. E. MANN

CRYSTAL DETECTOR

Original Filed May 9, 1925

Fig. 1.

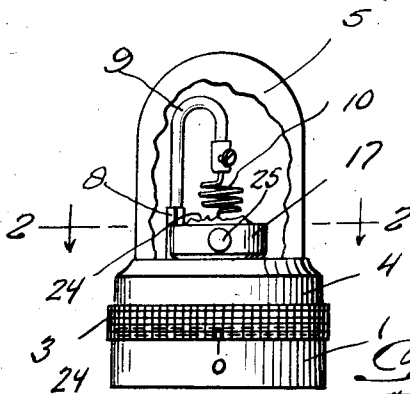


Fig. 2.

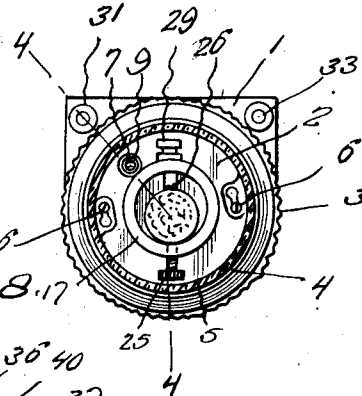


Fig. 3.

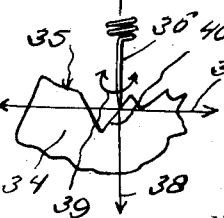


Fig. 4.

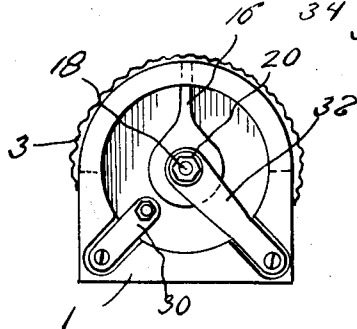


Fig. 5.

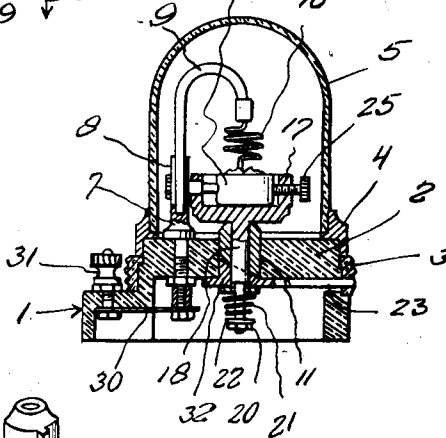


Fig. 6.

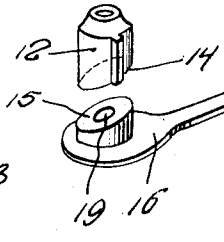
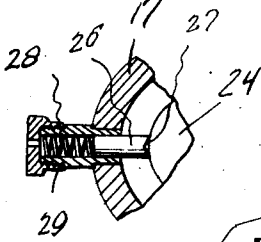


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Fig. 9.



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UNITED STATES PATENT OFFICE.

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CRYSTAL DETECTOR.

Application filed May 9, 1925, Serial No. 29,126. Renewed July 5, 1928.

This invention relates to improvements in crystal detector constructions for radio receiving sets.

In the use of the usual mineral crystals in the radio receiving sets as detectors, it is well known that these crystals usually have a number of substantially sensitive spots at different points on the surface of the crystal, and that due to the complex formation of the surface of the crystal, it is often difficult to place the contact springs on this surface and find one of the sensitive spots after which the proper contact pressure between the crystal and the contact spring can be obtained for obtaining the best results in amplifying and detecting radio signals.

This invention is designed to simplify the setting and adjustment of the contact springs relative to these sensitive spots of the crystal, in order that the highest efficiency of operation of the crystal may be obtained in a radio receiving circuit.

An object of the invention resides in providing a construction having the above stated qualities, which is a substantial improvement over the construction shown in the co-pending application, Serial No. 675,676, filed November 19, 1923.

A further object of this invention is to provide a crystal detector construction, wherein the crystal holder is movably mounted on a support and adjustable by independent means in any one of a plurality of different planes arranged in angular relation for providing a proper adjustment of the crystal relative to the contact spring, after the contact spring has been engaged with the crystal, in order to vary the contact pressure between the spring and the crystal surface, to attain the most efficient setting thereof.

A further object of the invention resides in providing a suitable supporting structure mounting a spring contact member adapted to be engaged with a crystal, suitably mounted in a crystal holder carried by the supporting structure, which is movable thereon, and suitable and independent adjusting means for the crystal holder, operable in a convenient manner to produce micrometric adjustments of the crystal, relative to the contact spring, to vary the pressure of the springs on the surface of the crystal, with micrometric fineness, in order to obtain the highest efficiency of operation of the detector in a radio receiving circuit.

The invention further comprehends other objects and improvements in the construction of the detector and the arrangement of the parts, for carrying out the principles above stated, which are more particularly pointed out in the following detailed description, and in the claims, directed to a preferred form of the invention, it being understood, however, that various changes in the size, form, and assemblage of the parts may be made, without departing from the spirit or scope of the invention as set forth herein.

In the drawings, forming a part of this application,

Figure 1 is a side elevation of the improved crystal detector construction, showing a portion of the cover broken away.

Figure 2 is a horizontal sectional view, taken on the line 2—2 of Figure 1.

Figure 3 is a bottom plan view of the detector construction.

Figure 4 is a vertical sectional view through the assembled detector structure.

Figure 5 is a detail sectional view of a portion of the crystal holder, showing the mounting for the plunger which is projected against the crystal to hold it against the adjusting screw within the crystal holder.

Figure 6 is a disassembled perspective view of the crystal holding mounting part, which cooperates to produce a movement of the crystal holder in a vertical plane passing through its axis.

Figure 7 is a detail sectional view, showing the manner of mounting the crystal holder in the base to permit its vertical movement and at the same time prevent a rotative movement, due to the operation of the cam structure shown in Figure 6.

Figure 8 is a diagrammatic illustration of a portion of the crystal for illustrating the character of the surface of the crystal with which the contact spring engages and the advantage of providing a movable crystal holder adjustable in a plurality of angularly arranged planes.

1 indicates the base member or support for the detector, which is formed with an upwardly projecting cylindrical extension 2, for rotatably receiving an operating ring 3, retained on the cylindrical extension by the rim 4 of the glass cover 5, adapted for removable connection with the base, through the medium of suitable separable fasteners, indi-

cated by the numeral 6. At one side of the central portion of the cylindrical projection 2 on the base member or support is mounted a post member 7, having a tubular extension 5 split longitudinally thereof, indicated by the numeral 8, for adjustably receiving the arm 9 having the curved upper end to which is removably secured the contact spring 10, which is adapted to engage the crystal. Any form 10 of contact spring or wire element may be used for cooperation with the crystal in rectifying the current in a radio receiving circuit, which is well known in the art, and which may be used in place of the spring structure, illustrated in the drawing. 15

An axial bore 11 is provided in the cylindrical projection 2 of the base member, which receives a sleeve member 12, for sliding movement therein, which is held against rotation 20 by the rib and slot connection indicated by the numeral 13 in Figure 7, the lower end of the sleeve being in angular relation with respect to the axis as indicated at 14, for cooperation with the cam 15, carried by the operating lever 16. A crystal receiving cup 17 25 which is hereinafter termed the crystal holder is provided with an axial extension 18, in the form of a rod or shaft, which rotatably fits within the sleeve 12 and extends through the opening 19, in the cam and operating lever 15 and 16 respectively. This extension 18 projects substantially below the operating lever 16, for the cam, as clearly illustrated in Figure 4, and receives by threaded connection 35 a nut 20, which secures the coil spring 21, under tension between the washers 22, so as to hold the crystal receiving cup or holder 17 in engagement with the upper end of the sleeve 12. The operating lever 16 projects 40 through a slot formed in the cylindrical extension 2 of the base member as indicated at 23 and is received by the operating ring 3, rotatably mounted on the cylindrical extension 2 as above described. This provides a means 45 for operating the cam 15 so that upon the manual rotation of the operating ring 3, the lever 16 will be rotated, for rotating the cam, 15, relative to the sleeve 12, which will effect a vertical adjustment of the crystal holder 17. 50 The crystal holder 17 may be rotated freely, by manual operation, while the portion for receiving the crystal 24 is substantially larger than the usual size of the mounting for crystals, as sold in commerce. This is for the purpose of permitting a lateral adjustment of the crystal within the cup 17 by means of the set screw 25, in order to provide for a movement 55 of the crystal in a plane substantially at right angles to the movement effected by the operation of the operating ring 3. In order that the crystal will be maintained against the set screw 25, a plunger 26 is provided with a notched end 27, for engagement with the periphery of the crystal mounting, which is 60 projected by the coil spring 28 seated within

the housing structure 29, carried by the cup 17. This structure is located diametrically opposite to the set screw 25, and it will be seen permits the relative movement of the crystal within the cup in accordance with the operation of the set screw 25. 70

A contact strip 30 is connected to the lower end of the post 7 for establishing an electric circuit with the binding post 31 mounted on the base member 1, in order that the crystal 75 may be connected in a circuit with other radio receiving apparatus.

A strip 32 electrically connects the projection 18 of the crystal holder, with the binding post 33 on the base 1, for receiving the other side of the circuit connection of the receiving circuit. 80

Referring particularly to Figure 8, a section of a crystal is indicated at 34, showing on an enlarged scale an example of the surface formation of the crystal as indicated 85 by the numeral 35, in which a plurality of substantially flat angularly arranged surfaces of various size are pressed. With a surface structure of this character which is considerably more complex than the average crystal structure, it will be seen that by the manual adjustment of the contact spring 36, it would be substantially difficult to obtain the proper pressure of adjustment of the end of the spring on the surface of the crystal, 90 when a sensitive point is reached on the surface of said crystal, in order to obtain results of the highest efficiency, for receiving and rectifying purposes, in a radio circuit. 95 This difficulty appears to present the greatest disadvantage in the use of crystal rectifiers. It is for this reason that various forms of contact springs are used, some of which include a large number of fine wires assembled in a group and pulled apart for engagement with different portions of the surface of the crystal at the same time. Even this character of construction has been unsatisfactory for best results, which have been found to be 100 highly obtainable by the present invention. For instance, the adjustment of the set screws 25 moves the crystal in a plane at right angles to the plane of the contact spring 36, in either direction, as indicated by the line and arrows 105 37, while the operating ring 3 in operating the cam 15 and sleeve 12 produces a movement of the crystal in a vertical plane, as indicated by the arrow 38 which is substantially at right angles to the movement of the crystal in the line of the arrow 37. In addition to this, the rotation of the crystal holder will produce a further adjustment, as indicated diagrammatically by the arrow 39. This provides a plurality of adjustments in different 110 angularly arranged planes, so that in the use of the crystal for a detector in a radio receiving circuit, with these three adjustments as above set forth, a very fine contact pressure between the spring 36 and the surface of the 115 120 125 130

crystal 34 can be obtained, which is found to be highly desirable to obtain the most efficient results.

In the operation of the crystal detector, in order to obtain this point of highest efficiency, the contact spring 36 is first engaged with the crystal and then the adjusting devices are operated to vary the pressure of contact on the spring on the surface of the crystal. Where the spring engages an inclined surface, as indicated by the numeral 40, in Figure 8 of the drawing, it has been found necessary that to obtain the proper contact tension, at a sensitive point on this surface, requires not only a vertical adjustment in the plane of the arrow 38, but also a horizontal adjustment in the plane of the arrow 37, in order that the crystal may be moved to carry the surface 40 in a lateral or vertical direction, so that the spring contact 36 extends substantially vertically downward and touches the sensitive spot of the crystal surface 40, with a micrometric pressure. It will be seen that if the point at which the contact spring is engaged with the surface of the crystal is not the most sensitive point, by lowering the crystal slightly in the plane of the arrow 38 and then moving it laterally or giving it a slight rotation in the plane of the arrows 37 or 39, this surface 40 can be again engaged to accurately find this most sensitive spot and at the same time vary the pressure of contact of the spring 36, on the surface of the crystal with micrometric fineness, in order to get the greatest efficiency of rectification of the signal received in a radio receiving circuit, in which the detector is connected. Without this character of adjustment of a crystal, relative to a spring contact, it is substantially impossible to obtain the micrometric variation of contact or point of contact of the spring 36, with any desired surface formation of the crystal.

While a special construction of crystal detector has been described, in which specially constructed elements have been provided for

producing the movement of the crystal in a vertical plane indicated by the arrow 38, a horizontal plane indicated by the arrow 37 or rotated as indicated by the arrow 39, it is to be understood that the specific embodiments of these constructions are merely for the purpose of disclosing one example by which the adjustment may be carried out, and that it is entirely within the scope of the present invention to provide any other desired structure of specific elements for carrying out these relative adjustments of the crystal in the angular relation illustrated and described, or in other angular relations apparently desirable for the purpose of the invention.

What is claimed is:

1. A crystal detector, comprising a support, a sleeve member slidably mounted in said support, a cam member movably mounted in said support and engaged with said sleeve member for moving the sleeve member in the movement thereof, a crystal holder rotatably mounted in said sleeve member and slidable therewith, a contact member mounted on the support for engagement with a crystal in said holder, and manually operable means for moving said cam member.

2. A crystal detector, comprising a support, a sleeve member slidably mounted in said support, a cam member operably mounted in said support for operating said sleeve member, a crystal holder rotatably mounted in said sleeve member, and manually operable means carried by said support movable for operating said cam member.

3. A crystal detector, comprising a support, a sleeve member slidably mounted in said support, a cam member mounted on said support for operating said sleeve member, a crystal holder mounted in said sleeve member, and manually operable means for operating said cam member.

In testimony whereof I affix my signature.

FREDERICK E. MANN.