April 9, 1929. H. H. HELLER 1,708,092

RADIO INSTRUMENT DIAL

Filed Aug. 27, 1925

Fig. 4.

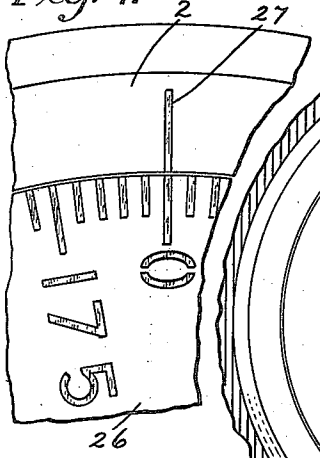


Fig. 1.

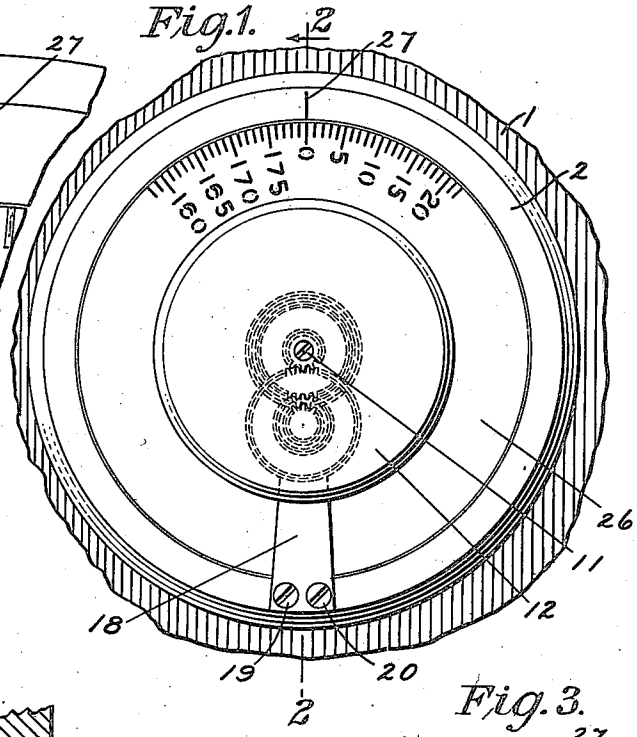


Fig. 5.

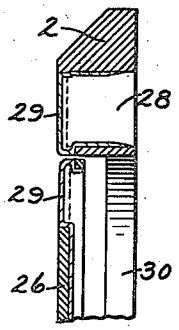


Fig. 2.

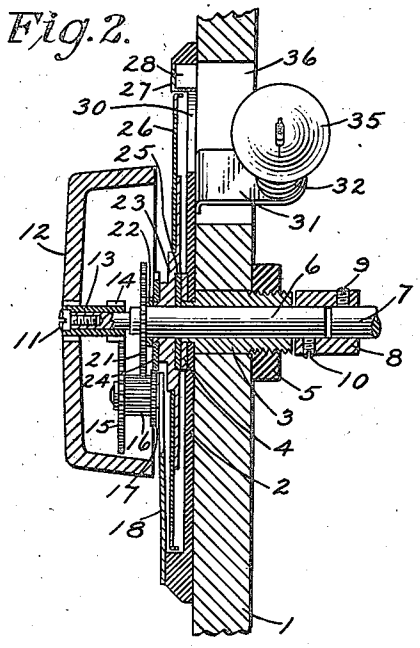
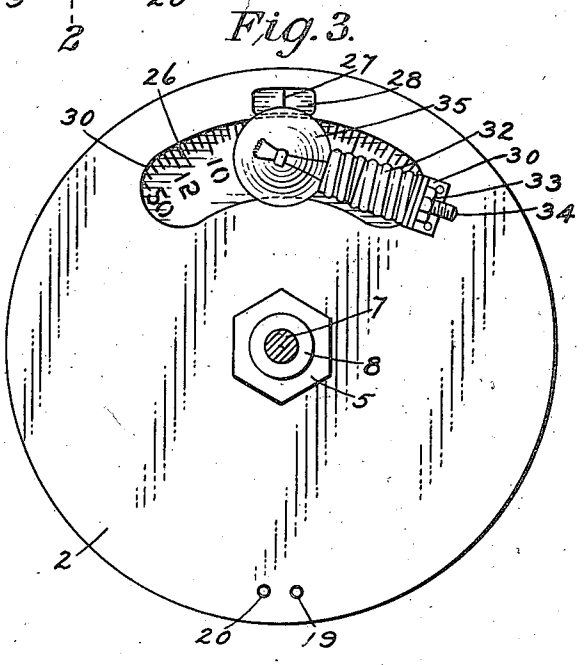


Fig. 3.



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Patented Apr. 9, 1929. 1,708,092

UNITED STATES PATENT OFFICE.

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RADIO INSTRUMENT DIAL.

Application filed August 27, 1925. Serial No. 52,822.

This invention relates to instrument dials and particularly to dials such as are used on radio telephone apparatus.

The principal object of this invention is to provide an instrument dial which is accurate, adjustable to a minute degree and having only one such adjustment, simple in operation, and relatively inexpensive to manufacture.

Another object of this invention is to provide an illuminated dial of such a character that the graduations thereof are clearly definable under any conditions of exterior illumination.

A further object is to provide a completely self-contained instrument adjusting unit having a continuously rotatable dial and a fixed index coacting with the graduations thereof, and operating means arranged so that the turning member rotates at a greater speed than the dial and the dial rotates at a greater speed than the attached instrument and at different speed ratios.

Other objects will become apparent from the advantages of the invention as disclosed in this specification and described in connection with the accompanying drawings.

Heretofore, instrument dials, and particularly those commonly used on radio receiving apparatus, have been difficult to adjust to any degree of accuracy and as difficult to decipher unless clearly illuminated by exterior means and such means are ordinarily not available inasmuch as radio apparatus is usually disposed in out-of-the-way corners or against a wall away from the light. Attempts have been made to illuminate such dials by artificial lighting or by delineating the numerals and graduations with radio-active substances, but the first named means is unsatisfactory because of the glare and reflection of direct illumination, while the latter method is likewise unsatisfactory because radio-active substances are not clearly visible except under completely darkened conditions, which is not usually the case. By this invention the dial will be visible under any condition of exterior illumination, whether bright, semi-dark or completely dark.

The illuminating means is preferably so arranged that the operator is enabled to illuminate the instrument dials as he desires merely by turning a switch. This is of obvious advantage at night or in darkened areas when an accurate dial setting is desired without making it necessary to use special exterior lighting or resort to tedious hunting for the proper dial setting.

The invention consists of a continuously rotatable dial associated with a turning member through a gear train of such an arrangement that a large movement of the turning member causes a relatively small angular deflection of the dial, whereby an accurate reading is obtainable without the necessity of a vernier attachment or any auxiliary means for effecting a small adjustment. The aforementioned gear train has additional coacting parts associating the dial with the instrument shaft so that the dial rotates at a greater speed than the instrument shaft, which consequently rotates at a speed considerably less than the rate at which the turning member is operated.

The invention further comprehends a novel dial which is preferably of opaque material perforated with characters and graduations which are filled with initially fluid translucent material of such a color as to cause the characters and graduations to be clearly definable without illumination in ordinary light, and as clearly distinguishable when illuminated by artificial means from a point at the rear of the dial, so that they are defined without glare under any conditions of and without dependence on or regard to the exterior illumination.

Referring to the drawings in which a preferred embodiment of this invention is illustrated, and in which like reference characters designate like parts in the several views,

Fig. 1 is a face view of the instrument dial of this invention,

Fig. 2 is a vertical cross-section along the line 2—2 of Fig. 1,

Fig. 3 is a rear view of the dial as removed from its mounting;

Fig. 4 is a magnified view of a portion of the dial disc showing the reference markings; and

Fig. 5 is an enlarged portion of a cross-section of the dial as shown in Fig. 2.

Referring particularly to Fig. 1, numeral 1 designates a panel such as is used to mount the instrument adjusting members of a radio receiving apparatus, and upon which is mount-

ed the dial, having a base plate 2 which bears directly against the surface of the panel 1. A stud 3 is rigidly mounted in the center of base plate 2 and held in place by means of the washer 4 which is attached to the outer face of base plate 2 as shown in Fig. 2. The base plate stud 3 is fitted into an aperture in panel 1 and is securely held in place by means of the nut 5 which must be removed in order to dismount the dial.

A shaft 6 is freely rotatable in an axial bore in stud 3, and is the means by which the instrument proper is operated which may be, for example, a variable air condenser, the shaft 7 of which is attached to dial shaft 6 by means of the coupling 8 and the two set screws 9 and 10. The outer end of shaft 6 is tapped for a machine screw 11 which mounts the turning knob 12 loosely to the shaft 6. The hub 13 of the knob 12 is provided with an integral pinion 14 which meshes with gear 15 of a gear unit comprising, in addition to gear 15, pinion 16 and gear 17, the whole of which is rotatably mounted on a cantilever 18 attached to the bezel of base plate 2 by means of screws 19 and 20.

The pinion 14 of knob hub 13 meshes with gear wheel 21 which is integral with instrument shaft 6 and revolves it as pinion 14 is rotated by means of knob 12. A washer 22 separates gear 21 from the dial disc hub 23 on which is rigidly mounted gear wheel 24 which meshes with gear 17 to rotate therewith. The hub 23 is freely rotatable on shaft 6 and is separated from base plate washer 4 by means of washer 25.

The dial disc 26 mounted on hub 23 is of thin opaque material, preferably metal, and is provided at its periphery with radial graduations and reference characters in the manner of a stencil as is most clearly shown in the enlarged view of Fig. 4. Colinear with the respective radial graduations of dial disc 26 is an index line perforation 27 in the bezel of base plate 2, which has been milled out to form a space 28 as shown in Fig. 3 so as to make the index line perforation 27 accessible from the rear.

The rear face of dial disc 26 and space 28 are coated with a specially prepared fluid material which forms a film across each of the perforations as shown in the enlarged section of Fig. 5, the film and liquid coating being designated by numeral 29. When the fluid material becomes dry and hard, the film 29 is translucent to light, so that when it is illuminated from the rear the characters and graduations of disc 26 as well as index line 27 glow luminously and are clearly defined irrespective of the degree of exterior illumination.

A portion of the rear face of disc 26 is exposed through an aperture 30 in the same way that the rear of index line 27 is exposed through space 28, as shown in Fig. 3. A bracket 31 is mounted to base plate 2 adjacent one side of aperture 30, and carries an electric light socket 32, the electrical connection to which is made at nut 33 of the stud 34 which passes into the socket 32. Socket 32 is disposed so that the light from electric light bulb 35 shines through aperture 30 and space 28 in the base plate 2 so as to illuminate the rear side of the characters and graduations on disc 26 and the index line 27. The panel 1 is provided with an aperture 36 through which the light 35 projects as shown in Fig. 2.

It is apparent that the dial unit is completely self-contained and that merely by removing nut 5 and disconnecting the instrument shaft 7 from the coupling 8 by loosening set screw 9, the entire unit may be lifted out of and away from the mounting panel 1.

Having described the preferred embodiment of the invention illustrated in the accompanying drawings, the operation, function and method of making thereof will be further explained in detail.

The gear train connecting the turning knob 12 with the dial 26 and comprising knob pinion 14 and associated intermeshing speed reducing gears 15, 17 and 24, is so arranged that the revolution increment of the knob over the dial is relatively large, as, for example, ten to one, so that the knob must be rotated ten times for one revolution of the dial. This arrangement obviously makes for accuracy of adjustment, since the sensitivity of the operator's hand is ordinarily not commensurate with the degree of accuracy and fineness of adjustment which is usually required. The instrument shaft 6, which is attached to shaft 7 of a variable condenser or other instrument, is rotated by means of knob 12, pinion 14, gear 15, pinion 16 and gear 21 on shaft 6, which gear train is also arranged to produce a reduced speed between the disc 26 and the instrument shaft 7 which may be, for example two to one, whereby the dial disc rotates twice for each revolution of the instrument shaft 7. It is understood that the gear ratios may be any other as desired for the purposes of sensitivity and accuracy.

By means of the two gear trains an exact adjustment is obtainable since the knob must be rotated ten times, for example, for one revolution of the dial disc, and the dial disc must be rotated twice, for example, for one revolution of the instrument shaft. This compounded speed reduction permits a minute scale adjustment for a smaller actuation of the instrument.

The dial 26, as hereinbefore explained, consists of opaque material, preferably metal, and perforated by means of a dividing engine or a die with the requisite characters and graduations at its periphery or at any other location upon its surface. The stencilled perforations of the dial 26 as wall as index line

27 are filled with a specially prepared viscous material of such an initial fluidity that it may be readily flowed over the under surface of the dial at the perforations as shown in Fig. 5 so that it leaves a film suspended between the sides of each of the perforations.

The perforation filling material should be of such a color when hardened as to be clearly discernible in ordinary light without additional exterial illumination, and should permit the passage of the light rays directed upon a film thereof so as to be translucent. Therefore, the character and graduation perforations of the dial 26 and the lubber line 27 when filled with such a material will be translucent and glow luminously when the light emanating from incandescent bulb 35 is directed or reflected against the rear face of the dial 26 and index line 27. The direct or reflected rays of light are thus diffused by the translucent film and the characters and graduations are clearly defined and are at the same time not as glaring as direct light rays nor as indistinct as characters delineated with radio-active material.

It is readily conceivable that any source of light may be used and directed against the rear face of the dial and that in some cases the light emanating from the filaments of some types of uncoated vacuum tubes may be utilized to advantage for such illuminating purposes.

The incandescent dial illuminating bulbs may be arranged to be lighted by separate means or with the vacuum tube electrode energizing means, as for example, the "A" or "B" batteries, or the house lighting current if it is used for the same purpose, so that when the apparatus energizing current is turned on the dials are immediately illuminated, and the incandescent light may be as readily turned off at the same time and in the same operation as the electrode rheostats are turned off when no longer required.

While this specification and the accompanying drawings illustrate and describe a preferred embodiment of this invention, it is to be understood that changes in form and arrangement may be freely made without departing from the spirit of the invention within the scope of the appended claims.

I claim:

1. A radio instrument dial comprising a turning member, a revolvable disc having perforations therein, a translucent film in said perforations having substantially parallel opposite surfaces and forming translucent characters, an operating connection between said member and said disc, and a source of light behind said disc.

2. An instrument dial comprising a disc having perforations therein, a solidified film of initially fluid translucent material in the perforations adhering to the portions of the disc that border the perforations, said film having substantially parallel opposite surfaces in said perforations, means for turning said disc, and a source of light disposed at the rear face of said disc.

3. In dials for radio apparatus, a base plate, a bezel on said plate having a radial index perforation, a disc turnable on said plate and having reference character perforations, a turning member, reduction gearing joining said disc and said member, translucent material in the perforations, and a light behind the disc for illuminating said translucent material.

4. An instrument dial having a circumferential flange and provided with graduation perforations extending through the wall of the dial and into said flange, and a translucent film in said perforations partly parallel with the face of said dial and extending laterally into said flange for a distance greater than the thickness of the wall of the dial.

5. An instrument dial having a circumferential flange and provided with L-shaped graduation perforations through the dial and flange, translucent film in and shaped correspondingly to said perforations, the free edge of said flange being continuous.

6. An instrument dial formed of opaque sheet material and bent to form a circumferential flange, there being graduation perforations extending through the dial and into said flange, and translucent films in said perforations partly parallel with the face of the dial and being bent to extend into said flange.

7. An instrument dial formed of opaque sheet material and bent to form a laterally projecting flange, there being graduation perforations extending through the dial and into said flange beyond the wall of the dial, and a translucent film of substantially uniform cross sectional thickness in said perforations and of less thickness than the sheet material of the dial, said film being partly parallel to the face of the dial and being bent to extend into said flange.

8. An adjusting means for radio instruments comprising a base plate, a bezel on said plate having an index line perforation, there being an aperture in said plate adjacent said bezel at the index line, a light in said aperture, a shaft piercing said plate, a knob mounted on said shaft, a disc revolvable on said shaft and having reference perforations therein, reduction gearing associating said knob and said disc, and translucent material in the perforations.

9. An instrument dial comprising a hub provided with an annular flange of greater diameter than the hub, an opaque dial disc having a central aperture entered by said hub, the inner marginal border of said disc being overlapped and combined with the flange of

said hub, translucent characters at the outer edge of said disc, and a source of illumination co-acting with the characters.

10. An instrument dial comprising a stationary base plate having an index perforation near the periphery of said plate, a disc rotatable on said plate and having perforations adapted to coact with the index perforation, there being apertures in said plate behind the perforations, a light mounted on said plate for illuminating the perforations, a rotatable shaft, and an operating connection between said disc and said shaft.

11. In indicators for radio apparatus, a scale member having perforations, a solidified film of initially fluid material in said perforations shaped to avoid lens formations and forming translucent characters, an index member associated with said scale member, said members being relatively movable, means for producing relative movement between said members, and means for illuminating the characters.

12. In indicators for radio apparatus, a scale member having perforations, a solidified film of initially fluid material in said perforations shaped to avoid lens formations and forming translucent characters, an index member associated with said scale member, means for moving said members relatively to each other, and means behind said scale for illuminating the characters.

In testimony whereof I affix my signature.

H. HOWARD HELLER.