Jan. 10, 1939. F. W. SULLINGER 2,143,665

PRECISION RADIO DIAL

Filed July 2, 1937

Fig. 1

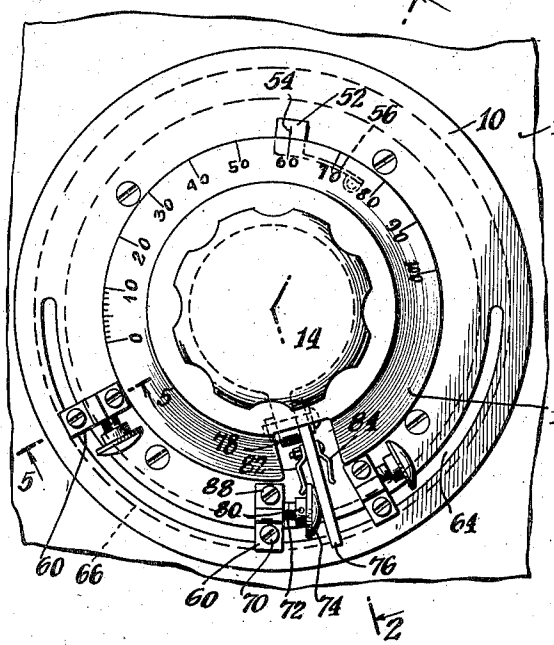


Fig. 2

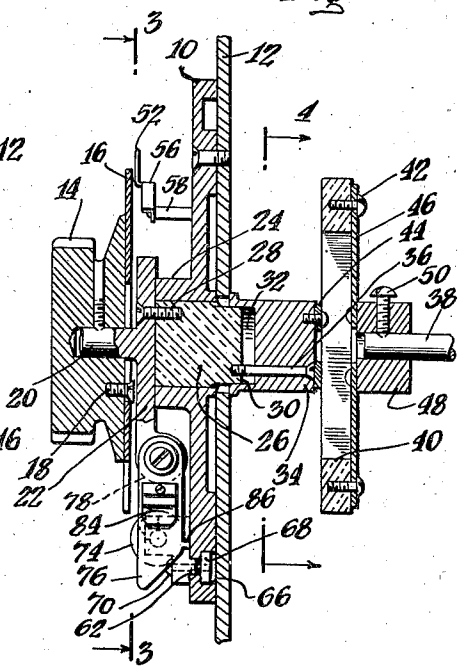


Fig. 3

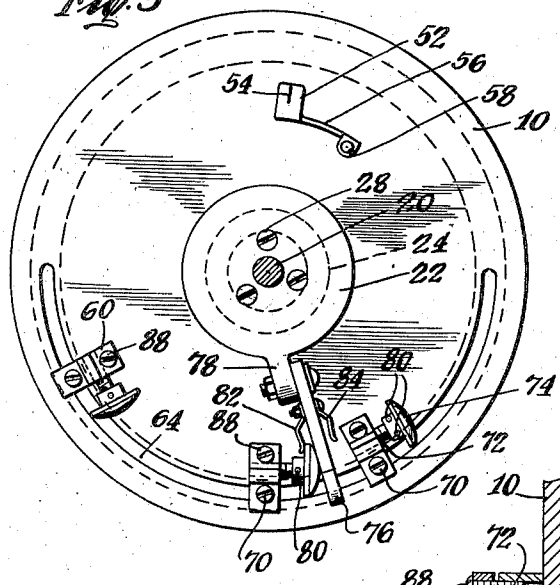


Fig. 4

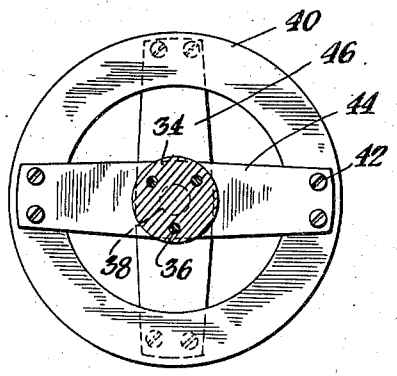
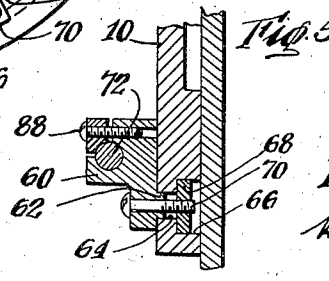


Fig. 5



INVENTOR
Ferris W. Sullinger
BY
Hoguet, Mearg & Campbell
ATTORNEY

Patented Jan. 10, 1939 2,143,665

UNITED STATES PATENT OFFICE

2,143,665

PRECISION RADIO DIAL

Ferris W. Sullinger, Coral Gables, Fla., assignor to Pan American Airways Corporation, Jersey City, N. J., a corporation of Delaware

Application July 2, 1937, Serial No. 151,621

15 Claims. (Cl. 74—10)

My invention relates to dials and more particularly to precision radio dials capable of effecting fine accurate frequency changes and maintaining high frequency stability. The dials of my invention are suitable for use on radio receivers and transmitters and in general for any use where accurate angular displacement of a shaft is desired.

In the development of radio transmitters particularly of the master-oscillator power-amplifier type, which were designed to provide high frequency stability and operation on several different frequencies by means of plug-in coils, I have found it essential to employ a dial that would effect accurately fine changes in the operation frequency of this transmitter. The master oscillator circuit of this type of radio transmitter contains a variable condenser and associated circuit that have a high degree of frequency stability with regard to time and temperature. However, when this condenser is varied to change from one frequency to another it is practically impossible, when using the ordinary type of dial, to reset to a frequency precisely without resorting to re-adjustment of the master oscillator condenser dial. This requires the use of frequency measuring apparatus, which is time consuming and expensive.

The dial of my present invention makes possible rapid and precise setting of master oscillator frequencies and operation of this dial is so simple that errors in frequency setting are practically impossible. Where the master oscillator operates on more than one frequency, the dial of my invention is indispensable for quickly and accurately shifting from one frequency to another.

The novel features of my invention are set forth with particularity in the appended claims, the invention itself, however, both as to organization and method of operation, will be clearly understood from the accompanying drawing in which:

Figure 1 is a front view of my precision dial;

Figure 2 is a sectional view of the dial taken on line 2—2 of Figure 1;

Figure 3 is a sectional view of the dial taken on line 3—3 of Figure 2;

Figure 4 is a sectional view taken on line 4—4 of Figure 2, and

Figure 5 is an enlarged sectional view of a portion of the device taken on line 5—5 of Figure 1.

In the form of the invention illustrated, the dial may consist of a dial plate 10 which may be fixed in any desired manner to a radio panel or instrument board 12 and which carries a rotatable tuning knob 14 provided with a dial disk 16. The tuning knob 14 and dial disk 16 are connected by set-screws 18 and are fixedly connected to a stub shaft 20 on a disk member 22 which bears against and rotates relative to a collar or sleeve 24 on the dial plate 10. Rotatably mounted in the collar 24 is a cylindrical block 26 of insulating material which is connected through screws 28 to the disk member 22 and acts as a bearing shaft therefor. The cylindrical block of insulating material 26 is provided with a portion 30 reduced in size which is received in a recess 32 of a cylindrical metallic shaft 34, which bears against and rotates relative to the instrument panel 12. The disk member 22 and the recessed shaft 34 thus act as thrust members, preventing separation of the tuning knob 14 from the dial plate 10. The shaft 34 is detachably connected to the insulating block 26 by means of screws 36 which allow these elements to be connected or separated or adjusted axially of each other to compensate for varying thicknesses of instrument panels or to bring the shaft 34 into abutment with the dial plate 10, when desired.

In order to provide a flexible non-conducting coupling between the tuning knob 14 and the shaft 38 of the tuning device, for example, a variable condenser, I have provided the construction best shown in Figures 2 and 4, which consists of a ring 40 of insulating material, such as for example porcelain, hard rubber, or synthetic resin, to which is connected, by screws 42, flexible metallic plates 44 and 46, arranged at right angles to each other and disposed on opposite sides of the ring. The plate 44 may be connected in any desired manner to the shaft 34. The plate 46 is provided with a hub 48 which receives the shaft 38 and is fixed relative thereto by means of a set-screw 50.

The tuning knob is thus connected directly with the tuning shaft 38 and upon rotation causes the shaft to be displaced angularly about its axis.

The dial disk 16 is preferably provided with a scale indicating approximately the range of frequencies which can be tuned by the dial. Cooperating with the scale on the dial disk 16 is a pointer consisting of a plate 52 having a line 54 thereon, which is supported on an arcuate arm 56 carried by a pin or screw 58 mounted on the dial plate 10.

In order to accurately adjust the dial and tuning device to the desired frequencies to be received or transmitted, I have provided a micrometric adjusting mechanism for positioning the tuning knob 14 and the tuning shaft 38 at a plurality of predetermined positions correspond-

ing to the frequencies desired. I have also provided a mechanism for allowing rapid changes from one frequency to another, without requiring a recalibration or readjustment of the dial and associated tuning mechanism. In the construction illustrated, this mechanism comprises one or more blocks 60 each having a depending non-circular lug 62 disposed in an arcuate slot 64, concentric with the axis of the tuning knob 14 and the tuning shaft 38. The slot 64 may be of any desired length or may consist of a series of slots to permit setting the dial over the entire 360° of the dial. The slot 64 is provided with an undercut or enlarged portion 66 on the back of the dial plate 10, in which is received a rectangular or square nut 68 for clamping the block 60 in any desired position. The block 60 and nut 68 may be retained in clamping relationship by means of a bolt 70 passing through the block 60 and threaded into the nut 68. Adjustment of the block along the slot 64 allows rough adjustment of the position of the tuning knob 14 and tuning shaft 38.

Accurate adjustment of the angular displacement of the tuning knob 14 is produced by means of a set screw 72 threaded into each block and having an enlarged dome head 74 which is engageable with an arm 76 pivotally mounted on an extension 78 forming a part of the disk member 22. The axis of the set screw 72 lies in a plane parallel to the dial plate 10 and is tangent to a circle concentric with the axis of the tuning knob 14. As shown in Figures 1 and 3, inward adjustment of the set screw 72 moves the head 74 in a substantially clockwise direction, while outward movement of the set screw allows counter-clockwise movement of the head 74. Displacement of the screw 72 will result in a corresponding clockwise or counter-clockwise angular displacement of the tuning knob 14 and shaft 38. To facilitate rotation of the set screw, I have provided a series of holes 80 extending through the set screw, which are adapted to receive a pointed implement for turning the set screw 72 about its axis.

The pivoted arm 76 may be retained in engagement with the head of the set screw by means of either of a pair of resilient spring clips 82 and 84 fixed to opposite sides of the arm 76. The spring clip 82 as illustrated in Figure 1 is adapted to engage the back of the head 74 of the set screw 72 and retain the arm 76 against the front of the set screw head 74. The clip 84 may be utilized when it is desired to make small shifts in frequency by removing the set screw 72 from the right-hand side of the block 60 and threading it into the opposite side so that the head will be directed to the left.

Since the heads 74 of the set-screw are rounded, it is desirable to bring the arm 76 into accurate engagement with the same point on the head in every instance when changing from one angular position of the dial to another. Accurate positioning of the arm 74 is assured by providing a leg 86 on the inner surface of the arm which can be brought into engagement with the surface of the dial plate 10.

The adjusted position of the set-screw 72 may be maintained by means of set-screws 88 which span a split communicating with the threaded aperture in the block 60. By turning down the set-screw 88 the block firmly grips the set-screw 72.

The blocks 60 and set-screws 72 which control the angular position of the tuning knob 14 and tuning shaft 38 may be adjusted in the following manner. The bolts 70 which normally lock the blocks to the dial plate 10 may be loosened and with the aid of a master oscillator, the block moved to a position which approximately tunes the condenser to the frequency desired, the arm 76 being in engagement with the head 74 of the set-screw during this adjustment. The block 60 is then clamped in position by turning down the bolt 70 and the set-screw 72 adjusted inwardly or outwardly, as the case may be, until the tuning device is adjusted accurately to the desired frequency. Thereafter the other blocks 60 may be adjusted in the arcuate slot 64 in a like manner in order to position them according to the different frequencies to be tuned. Operation of the dial to rapidly shift to these various frequencies thereafter consists of lifting the arm 76 out of engagement with the head of a set-screw 72, turning the knob 14 to a position where the arm can engage a different selected set-screw and swinging the lever down to engage the head 74 of the set-screw between the arm and the clip 82 or 84, depending upon the direction in which the set-screw extends.

Where extreme accuracy is required over a wide temperature range, an error will be introduced with the use of the more common metals or alloys due to thermal expansion, or contraction, of various parts of the precision dial and especially the micrometer screw. This error can be minimized by the use of some material having a low coefficient of temperature expansion such as invar. Another detail of construction to eliminate the effect of expansion in the lever is to design the parts so that the plane of the surface of the lever, which comes in contact with the vernier button, goes through the center line of the shaft to be controlled.

It will be seen from the preceding description that I have provided a device which allows extreme accuracy and rapidity in tuning to predetermined frequencies. The device is simple, durable and extremely stable.

Due to insulated couplings no capacity changes can be introduced through normal manipulation of the dial.

It will be understood that the embodiment above described is illustrative, only, and that many changes can be made in the construction without departing from the invention, as defined in the claims.

I claim:

1. In a radio dial, the combination of a tuning shaft, an element adjustable concentrically with the axis of said shaft, a pivoted arm operatively connected to the shaft and movable toward and from the adjustable element and micrometrically adjustable means engageable with the arm and carried by the adjustable element for accurately controlling the angular displacement of the shaft.

2. In a radio dial, the combination of a tuning shaft, a dial plate, an element carried by and adjustable relative to the dial plate and concentric with the axis of said shaft, micrometrically adjustable means carried by said element and disposed at an angle to said shaft, an arm connected to said shaft and pivotally movable toward and from said dial plate to engage the adjustable means and regulate the angular displacement of the shaft.

3. In a radio dial, the combination of a tuning shaft, a dial plate, an arcuate slot in said dial plate, an element adjustably mounted in said slot, micrometrically adjustable means carried by the element at an angle to said shaft, an arm

operatively connected to said shaft movable toward and from said dial plate and means on said arm receiving a portion of the micrometrically adjustable means to regulate the angular displacement of the shaft.

4. In a radio dial, the combination of a tuning shaft, a dial plate, an arcuate slot in said dial plate, an element adjustably mounted in said slot, a set-screw threaded into said element in a plane parallel to the dial plate and tangentially to a circle concentric with the axis of the shaft, an arm operatively connected to the shaft and pivotally movable toward and from said dial plate, and means on said arm engageable with the set-screw to regulate angular displacement of the shaft.

5. The radio dial set forth in claim 4 wherein the element comprises a block having a non-circular lug disposed in the slot.

6. In a radio dial, the combination of a dial plate, a tuning knob rotatably mounted on said dial plate, an element on the dial plate adjustable concentrically with the knob, means carried by the knob and micrometrically adjustable toward and from said element in a plane at an angle to the axis of said shaft, an arm connected to said knob and pivotally movable toward and from said dial plate and means on said arm for engaging the micrometrically adjustable means to regulate the angular displacement of said knob.

7. In a radio dial, the combination of a dial plate, a tuning knob rotatably mounted on said dial plate, a slot in the dial plate concentric with the axis of said knob, an element adjustably mounted in said slot, a headed set-screw threaded in said element in a plane parallel to the dial plate and tangentially to a circle concentric with the axis of the knob, an arm pivotally connected to the knob for movement toward and from the dial plate, and means on the arm for engaging the head of the set-screw to regulate the angular displacement of the knob.

8. The radio dial set forth in claim 7 wherein the means on the arm comprises a resilient clip.

9. The radio dial set forth in claim 6 including an insulated coupling member fixedly connected between the dial shaft and the shaft that is to be rotated.

10. The radio dial set forth in claim 7 wherein the element comprises a block provided with a non-circular lug disposed in the slot.

11. In a radio dial, the combination of a tuning shaft, micrometrically adjustable locating means concentrically disposed relative to the axis of said shaft, and a member operatively connected to the tuning shaft and having spaced means adjacent its free end movable toward and away from the locating means for receiving the said locating means therebetween to determine the angular displacement of said shaft.

12. In a radio dial, the combination of a plate, a tuning shaft, a plurality of locating means on the plate, and a pivoted member operatively connected to the tuning shaft having a gripping element adjacent the free end thereof for selectively receiving a portion of said locating means to determine the angular displacement of the said shaft.

13. In a radio dial, the combination of a dial plate, a tuning shaft, a plurality of locating means on the dial plate adjustable concentrically about the shaft, and a pivoted member operatively connected to the tuning shaft and having a gripping element adjacent the free end thereof for selectively receiving a portion of said locating means to determine the angular displacement of the said shaft.

14. In a radio dial, the combination of a tuning shaft, an element adjustable concentrically with the axis of said shaft, an arm operatively connected to the shaft and movable toward and from the adjustable element, and micrometrically adjustable means engageable with the arm and carried by the adjustable element for accurately controlling the angular displacement of the shaft.

15. In a radio dial, the combination of a plate, a tuning shaft, a member having a gripping element adjacent its free end operatively connected to the tuning shaft and movable toward and away from the plate, and means on the plate adjustable inwardly and outwardly at an angle with respect to the plate and selectively receivable in the said gripping element for determining the angular displacement of the said shaft.

FERRIS W. SULLINGER.