Feb. 19, 1935. S. S. CRAMER 1,991,845

SPEED REDUCING MECHANISM

Filed Sept. 29, 1933 2 Sheets-Sheet 1

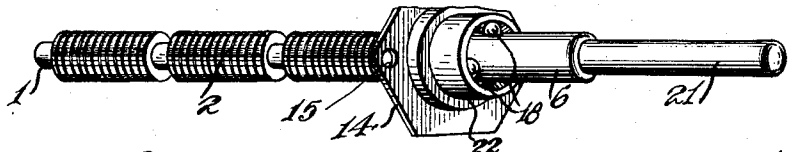


FIG. 1

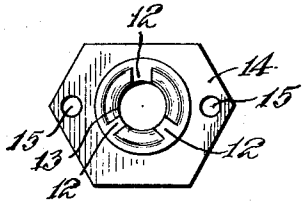


FIG. 2

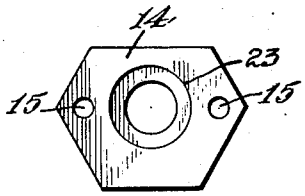


FIG. 3

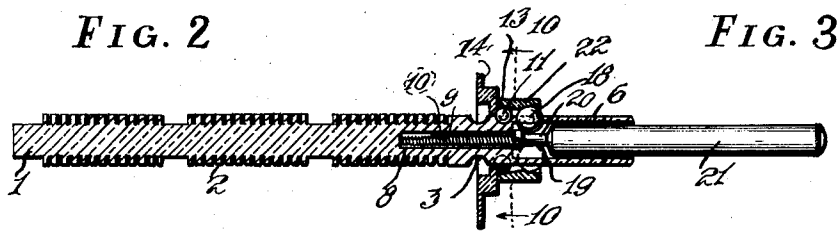


FIG. 4

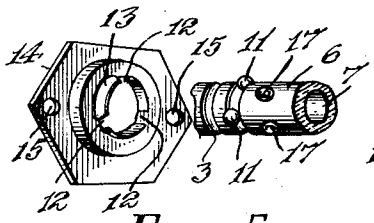


FIG. 5

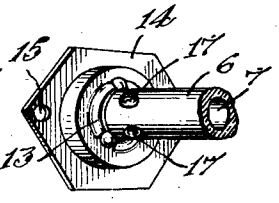


FIG. 6

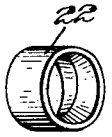


FIG. 7

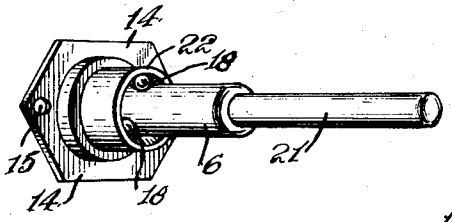


FIG. 8

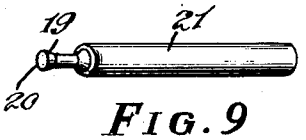


FIG. 9

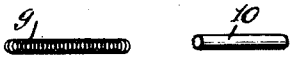


FIG. 11

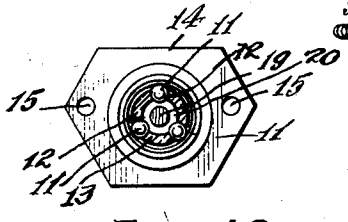


FIG. 10

INVENTOR
STANLEY S CRAMER
BY
A D. T. Libby
ATTORNEY

Feb. 19, 1935. S. S. CRAMER 1,991,845

SPEED REDUCING MECHANISM

Filed Sept. 29, 1933 2 Sheets-Sheet 2

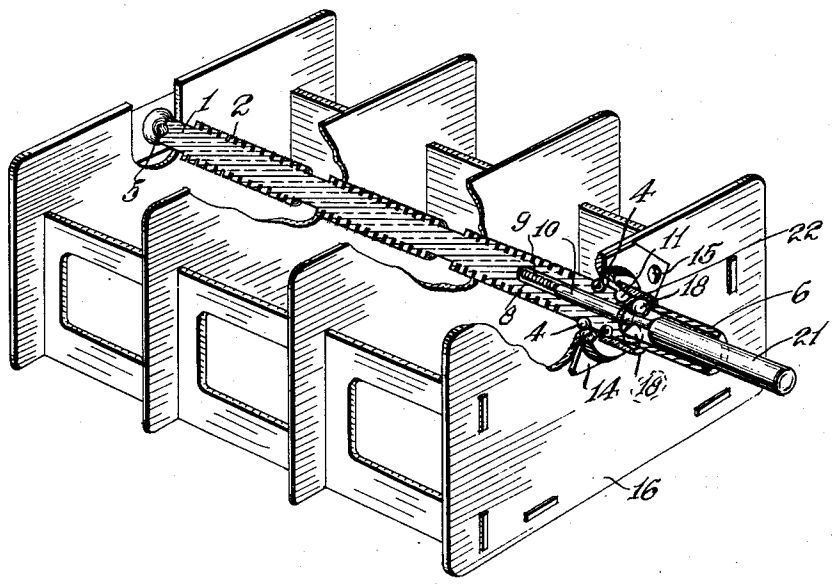


FIG. 12

INVENTOR
STANLEY S. CRAMER
BY
D. T. Libby
ATTORNEY

Patented Feb. 19, 1935 1,991,845

UNITED STATES PATENT OFFICE

1,991,845

SPEED REDUCING MECHANISM

Stanley S. Cramer, Haddon Heights, N. J., assignor to Radio Condenser Company, Camden, N. J.

Application September 29, 1933, Serial No. 691,518

14 Claims. (Cl. 74—301)

This invention relates to improvements in speed reduction transmission devices and is particularly adapted for use in connection with variable tuning condensers, variometers, rheostats or other similar apparatus used in radio receiving sets, wherein it is desirable to have a very fine or close control on such pieces of apparatus, more especially on the pieces of apparatus which do the actual tuning.

In the early days of radio broadcasting, where individual tuning units were utilized in their respective circuits, it was customary to obtain the close or fine adjustment by means of a vernier; but at the present time, where gang condensers are used with a single control, the use of verniers is out of the question, and while the individual units of the gang are provided with compensating devices for balancing or adjusting the circuits with which the separate units of the gang are associated, the single knob control of the gang condenser gives a more or less rough setting of the various tuning elements; hence the desirability of a more sensitive setting means is apparent.

Heretofore, various means have been proposed to get this close or fine adjustment on such pieces of apparatus, and my present improvement has for its principal object the obtaining of such fine or close adjustment in a new and novel manner whereby exceedingly easy tuning or greater sensitivity to the hand of the operator is obtained. It is especially advantageous to have this closeness or fineness of adjustment to enable a person who does not have a sensitive touch to obtain the proper adjustment which the mechanism herein to be described is capable of delivering.

While obtaining the principal object of my invention, another object is to obtain the required result by a relatively simple and easily constructed mechanism.

My invention will be understood by reference to the annexed drawings wherein:

Figure 1 is a perspective view of a three-gang rotor shaft without the plates being mounted thereon, showing certain parts of my speed reduction transmission applied to such shaft.

Figure 2 is a front view of the restrictor plate shown in perspective in Figure 1.

Figure 3 is a rear view of the restrictor plate shown in Figure 2.

Figure 4 is a sectional view through the condenser shaft shown in Figure 1, but showing the operating shaft associated therewith in elevation.

Figure 5 shows a view of the restrictor plate with a fragmentary end of the condenser shaft which fits into the restrictor plate.

Figure 6 is a view similar to Figure 5 but with the end of the shaft in position in the restrictor plate.

Figure 7 is a perspective view of the speed transmission collar or raceway used in connection with the mechanism.

Figure 8 is a perspective view of the restrictor plate showing the raceway of Figure 7 in position; also the end of the condenser shaft and the end of the drive shaft.

Figure 9 is a perspective view of the operating shaft used in the speed reduction mechanism.

Figure 10 is a section on the line 10—10 of Figure 4.

Figure 11 is a view of the spring and plunger used in the end of the rotor shaft.

Figure 12 is a perspective view of the rotor shaft without the rotor plates and the other transmission devices mounted in the frame of a three-gang condenser.

Referring now to the details, wherein like numbers refer to corresponding parts in the various views, 1 is a condenser shaft having annular grooves 2 formed therein for the reception of rotor plates. The three portions shown for carrying the rotor plates may, however, be separate sleeves grooved or otherwise formed to carry the rotor plates, and fastened to the shaft 1 in any well-known manner. At the forward end of the shaft 1 there is provided a ball race 3 to receive balls 4 for an anti-friction bearing of the type shown in my Patent 1,800,719, issued April 14, 1931, a cooperating raceway 23 being located in the back side of the member 14. As shown in Figure 12, the rear bearing is indicated by a single ball 5, although this end of the shaft may be supported by a bearing similar to the forward bearing, all as set forth in my patent just mentioned.

The forward end of the shaft 1 is provided with a stem 6 having a hollow portion or bore 7. Extending toward the rear end of the shaft 1, as a continuation of the bore 7, is a smaller bore or recess 8 within which is positioned a spring 9 and plunger 10 for a purpose to be hereinafter described. Adjacent the raceway 3 in the shaft 1, is another raceway carrying a plurality of balls 11, three being shown as clearly indicated in Figure 10. The balls 11 are held in position in their raceway by being located in slots 12 positioned in a flange 13 comprising part of a restrictor plate 14. The flange 13 and slots 12 are so constructed that the balls 11 have a snap fit

therein, or at least of the order to effect a slightly frictional relationship between these parts to prevent spilling in the act of assembling the transmission mechanism.

The restrictor plate 14 is provided with holes 15 by which it may be fastened to the end plate 16 of the condenser frame as shown in Figure 12. The stem 6 of the shaft 1 is provided with a plurality of holes 17, three being indicated in the drawings, preferably set at angles of 120° and extending from the outer surface of the stem to the bore 7. In these holes or openings 17, are positioned ball members 18 which, when in place, are adapted to engage the conical surface 19 of the spherically shaped end 20 of the operating shaft 21 which is carried in the stem 6 as clearly illustrated in Figure 4.

Positioned over the ball members 11 and 18, and guided by the flange 13 on the restrictor plate 14, is a speed transmission collar or raceway 22 which has reversely positioned conical surfaces as shown in Figure 4 to engage the respective sets of balls 11 and 18. The plunger 10 engages the spherical end 20 of the shaft 21 and is held under tension thereon by the spring 9, whereby the frictional engagement of the balls 18 on the conical surface 19 is determined by this spring and plunger. It is to be understood that the transmission collar 22 can be held in operative position by the means into which the stem 6 passes in mounting the condenser, or by some other suitable means.

The operation of the mechanism above described will be now readily understood. As the shaft 21, which may be termed an operating shaft, is turned, the frictional engagement between the surface 19 and the balls 18 and their associated raceway on the member 22, causes the same to turn and this in turn operates, through frictional engagement, the balls 11, and they in turn act on their raceway to transmit a reduced rotary motion to the shaft 1, which may be termed a control shaft. In Figure 4, which illustrates substantially a full-size working arrangement of a three-gang condenser, the speed reduction illustrated is approximately of the order of thirty to one. This reduction, of course, can be varied by changing the relative diameters of the balls 11 and 18. For manufacturing purposes, I prefer to make the balls 11 and their raceway substantially the same as the raceway 3 and the balls 4, so that the same balls can be used in the two different places.

From what has been said, it will be apparent that such a transmission device will provide a very close and fine adjustment of the condensers even with the roughest hand operating the knob or other device connected to the operating shaft 21.

Having thus described my invention, what I claim is:

1. In a speed reducing mechanism, a driving shaft and a driven shaft, means interconnecting said shafts including; a stem at one end of the driven shaft having a bore therein within which one end of the driving shaft is positioned, said driving shaft-end having a conical surface, said stem having a plurality of holes through the wall of the stem and arcuately spaced around the stem, balls positioned in said holes and engaging said conical surface on the driving shaft-end, said driven shaft having a recess opening into the stem bore, resiliently actuated means positioned in said recess for applying a force against the end of said driving shaft for the purpose described, said driven shaft having a raceway positioned near the beginning of said stem, balls operating in said raceway, a plate having a slotted collar for positioning the last-mentioned balls, and a transmission collar having raceways therein for both sets of balls positioned over and engaged by said sets of balls.

2. A speed reducing mechanism as set forth in claim 1, further characterized in that the balls of one set are of different diameters than the balls of the other set.

3. In a speed reducing mechanism comprising driving and driven shafts arranged in tandem and one journaled within the end of the other, a ball raceway on the surface of one outer shaft-end with balls operating therein with means for positioning said balls in operative position, a second set of balls carried by said outer shaft-end so as to have frictional engagement with the shaft-end journaled within, means for ensuring that such frictional engagement is made positive-acting, and a transmission collar having raceways therein for both sets of balls positioned over and engaged by both sets of balls.

4. A speed reducing mechanism as set forth in claim 3, further characterized in that the balls in one set are larger than the balls in the other set.

5. A speed reducing mechanism as set forth in claim 3, further characterized in that the balls in the second-mentioned set of balls are larger than the first-mentioned balls for the purpose described.

6. A speed reducing mechanism as set forth in claim 3, further characterized in that the driving shaft is journaled within the driven shaft and has a reduced conically shaped end which is engaged by the second set of balls.

7. A speed reducing mechanism as set forth in claim 3, further characterized in that the driving shaft is journaled within the driven shaft and has a reduced conically shaped end which is engaged by the second set of balls, and still further characterized in that the said ensuring means comprises a resiliently mounted plunger carried within the driven shaft that acts on the end of the driving shaft tending to force it out of the driven shaft, thereby securing the said positive frictional engagement.

8. A speed reducing mechanism as set forth in claim 3, further characterized in that another raceway is provided in the driven shaft adjacent the first-mentioned raceway therein to receive balls for a bearing for the driven shaft, and a plate having a raceway to complete the said driven shaft bearing, said plate also including said means for positioning the first-mentioned set of balls.

9. A speed reducing mechanism as set forth in claim 3, further characterized in that another raceway is provided in the driven shaft adjacent the first-mentioned raceway therein to receive balls for a bearing for the driven shaft, and a plate having a raceway to complete the said driven shaft bearing, said plate having an annular flange with slots therein comprising the means to position the first-mentioned set of balls, said flange also acting as a guide for said transmission collar.

10. A speed reducing mechanism for the control shaft of an electrical apparatus as herein set forth, including an operating shaft connected to the control shaft through a double set of balls arcuately arranged in adjacent planes, one set of balls having a raceway in the control shaft with means for positioning the balls in operative position and the other set engaging a surface provided on the operating shaft, means for ensuring

sufficient friction by such engagement, and a transmission collar having raceways therein for both sets of balls positioned over and engaged by both sets of balls.

11. A speed reducing mechanism as set forth in claim 10, further characterized in that the set of balls engaging the operating shaft is larger than the other set of balls.

12. A speed reducing mechanism as set forth in claim 10, further characterized in that the set of balls engaging the operating shaft is positioned by means on the control shaft, and these balls are larger than the balls of the other set.

13. A speed reducing mechanism for interconnecting two rotary shafts including; two sets of balls arranged in adjacent planes and arcuately spaced around the axis of the shafts, one set of balls operating in a raceway on one shaft with means for positioning the balls in operative position in said raceway and the other set of balls engaging a raceway on the other shaft with means for positioning said last-mentioned set of balls in operative position in its raceway, and a transmission collar having raceways therein for both sets of balls positioned over and engaged by both sets of balls.

14. A speed reducing mechanism as set forth in claim 13, further characterized in that one set of balls is larger than the other set.

STANLEY S. CRAMER.