Aug. 16, 1938. G. B. ENGELHARDT 2,127,109

DRIVING MEANS FOR ADJUSTABLE APPARATUS

Filed Nov. 13, 1936

FIG. 1

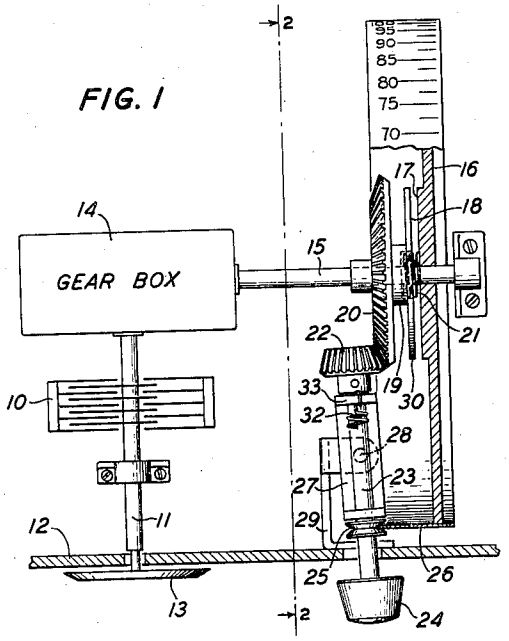
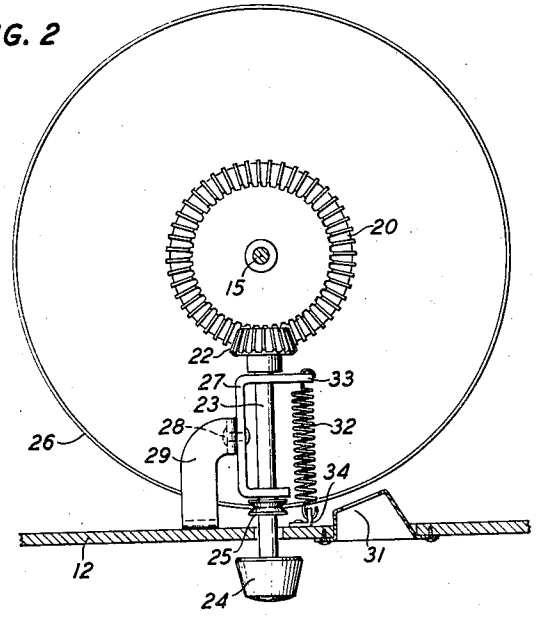


FIG. 2



INVENTOR
G. B. ENGELHARDT
BY
G. H. Campbell
ATTORNEY

Patented Aug. 16, 1938

2,127,109

UNITED STATES PATENT OFFICE

2,127,109

DRIVING MEANS FOR ADJUSTABLE APPARATUS

George B. Engelhardt, Hartsdale, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application November 13, 1936, Serial No. 110,621

7 Claims. (Cl. 116—124.3)

This invention relates to tuning units and particularly to means for driving such units.

The object of this invention is a multiple speed drive for a tuning unit, all speeds of which are controllable by the action of a single knob. A feature of the invention is a combination of a greatly extended numerical scale with a more condensed direct scale. Another feature is a high reduction vernier drive which operates continuously over the entire range of the tuning unit.

In its preferred form, the invention comprises a dial which is directly connected to the shaft of the tuning unit, a second and much larger dial, preferably of the drum type which is operatively connected to the shaft of the tuning unit through a worm reduction gear and a two-speed friction drive cooperating with the drum dial. The two-speed drive is controlled from a manually rotatable shaft journaled in a laterally movable support the movement of which is utilized to effect the change in speed, a knob secured on one end of the control shaft being used for rotating this shaft and the tuning unit at any one of the two speeds.

A better understanding of the invention may be had by reference to the following detailed specification taken together with the accompanying drawing which forms a part thereof and in which,

Fig. 1 is a plan view of a tuning unit and driving mechanism showing a number of operating parts with portions cut away; and

Fig. 2 is a cross-sectional view taken on line 2—2 of Fig. 1.

Referring now to the drawing, 10 is a tuning unit which is shown by way of illustration as a variable condenser. By "tuning unit" is meant any electromechanical device the electrical properties of which are adapted to be changed or adjusted, either quantitatively or qualitatively by a mechanical movement. Thus variable inductances and resistances are likewise embraced by this term as well as combinations of these devices. The rotor plates of condenser 10 are mounted on a shaft 11, a portion of which projects through panel 12. A dial, scale, or other position indicating device 13, is mounted on the projecting portion of shaft 11 and may serve to indicate the electrical quantity, such as capacity, frequency, etc., corresponding to a given position of the tuning device.

Shaft 11 is driven through suitable gearing, shown as a box at 14, from transverse shaft 15. The gearing used should be such that no backlash is present between the driving and driven members thereof. This is important since the accuracy of the drive is so high that a large part of it would be nullified by an appreciable backlash. Rigidly secured to shaft 15 is a disc 16, one face 17 of which is raised near the center and machined or faced with a material such as cork to provide a friction surface. The diameter of the disc may be as large as is necessary to give the desired accuracy of reading. Diameters of about one-third of a meter, providing a circumference of one meter, have been used. A graduated band 26, preferably of steel, may be wrapped around disc 16 with the graduated surface facing outward. A standard steel rule one meter long and graduated in centimeters and millimeters is a convenient and economical form such a band may take. This scale may likewise be calibrated directly in electrical units.

Cooperating with friction surface 17 is another and similar friction surface 18 which forms one face of a disc 30 secured to the hub 19 of a bevel gear 20 loosely mounted on shaft 15. A retractile spring 21 normally maintains the friction surfaces disengaged and the gear 20 in engaged relation with the pinion 22 as shown in Fig. 1. It is apparent that the friction surfaces when engaged as will be hereinafter described in detail form a clutch by which disc 16 and its shaft 15 may be rotated according to the speed ratio of pinion 22 and gear 20 which is of the order of substantially three to one.

Pinion 22 is secured to a shaft 23 provided with a portion extending beyond panel 12. A knob 24 is secured to the protruding end of shaft 23 and comprises the means by which the motion of the shaft is controlled. Also secured to shaft 23 is a small pulley 25 which when this shaft is moved in the position shown in Fig. 1 is adapted to engage the edge of band 26 so that when knob 24 is rotated the shaft 15 will be rotated according to the speed ratio of pulley 25 and the diameter of band 26 which is of the order of substantially thirteen to one. Shaft 23 is mounted on a pivoted bearing member 27, which is adapted to rotate about pin 28 in a plane normal to the plane of surface 17. A bracket 29, mounted on panel 12, supports pin 28 and bearing member 27.

Turning knob 24, therefore, normally causes disc 16 to be driven through pulley 25, and since the diameter of pulley 25 is very small compared to the diameter of disc 16, a large angular displacement of knob 25 causes a very small angular displacement of disc 16. The movement of knob 24 to the left is effective to disengage pulley 25 fom band 26, and renders the central friction clutch operative. In view of the relatively small difference in the diameters of pinion 22 and cooperating bevel gear 20, a relatively small angular displacement of knob 24 results in a large angular displacement of band 26. For purposes of viewing drum 26, a window 31 shown in Fig. 2 is provided in panel 12.

A spring 32, tensioned between lugs 33 and

34, is used to maintain knob 24 in either one of its positions in the manner of a toggle mechanism which will be hereinafter described in detail. Lug 34 is located mid-way between the extreme lateral positions of knob 24, and is secured to panel 12 or to some other rigid support. Lug 33 is located on bearing member 27 at a point wherein the longitudinal axis of spring 32 is in line with its attaching point on bracket 34, the vertical axis of pivot 28 and its attaching point on lug 33 of shaft support 27, these points being on the line of maximum tension of spring 32 so that a lateral movement of support 27 and shaft 23 carried thereby beyond the line of maximum tension of this spring in clockwise or counter-clockwise direction, the tension of spring 32 will yieldably hold the bearing member 27 and the shaft 23 in such positions for engaging either the disc 30 with the disc 16 against the resistance of its retractile spring 21 or the pulley 25 with the edge of drum 26 as the case may be, thus by suitably tensioning spring 32, only two stable positions will be provided for knob 24, one in which the knob is at the extreme left, or coarse adjustment position and the other in which the knob is at the extreme right, or fine adjustment position.

To adjust condenser 10 to a particular value, knob 24 is swung toward the left and rotated until the approximate value on dial 13 is reached. The exact value is then obtained by swinging knob 24 to its right-hand position and by slowly rotating it until scale 26 indicates the desired value, or until the desired adjustment of tuning unit 10 is obtained.

The scale on the drum may be graduated in any units such as degrees, ohms, microfarads, henries, etc. It is possible with the above-described drive, to obtain a vernier reduction of 1000 to 1 by virtue of the long scale which it is possible to use, and if the gear reduction between shafts 11 and 15 is 10 to 1, an adjustment to

$$\frac{1}{10{,}000}$$

of the 180-degree displacement ordinarily provided for tuning units is readily obtainable. It is preferred that dial 13 be graduated in revolutions, or fractions of revolutions, of scale 26. Since friction pulley 25 can be engaged with drum 26 at any point along its edge, the vernier provided by this adjustment operates continuously over the entire range of the tuning unit.

It is understood that the foregoing description is merely illustrative of the invention and that the scope of the invention is not to be limited thereto, but is to be determined by the appended claims.

What is claimed is:

1. In an adjustable electrical apparatus, a main shaft, a second shaft connected to the main shaft through reduction gearing, a scale secured to said main shaft, a scale secured to said second shaft, a plurality of drives for actuating said second shaft at different speeds and a movable shaft for actuating said drives independently, said scales cooperating with each other for indicating the adjusted position of the apparatus.

2. Apparatus as in claim 1, the drives for the second shaft comprising a clutch and a friction drive, adapted to impart different speeds to said second shaft, and means for rendering one of said clutches inoperative when the other is operative.

3. In an adjustable electrical apparatus, a main shaft, a second shaft connected to the main shaft through a reduction gearing, a disc mounted on the second shaft, a scale mounted on the periphery of the disc, a friction surface on the central portion of the disc, a friction surface near the periphery of the disc, and means for selectively engaging the friction surfaces whereby said second shaft may be driven at different speeds.

4. Apparatus as in claim 3, the engaging means comprising a third shaft, a pivoted mounting therefor, a friction wheel on the third shaft adapted to cooperate with the peripheral surface, a friction disc on the second shaft adapted to cooperate with the central friction surface, gearing between the friction disc and third shaft, and a control knob mounted on the third shaft whereby said third shaft may be rotated about its pivot to effect a change in driving speed and rotated about its axis to adjust the associated electrical apparatus.

5. In a tuning device, a main shaft, a second shaft, a gear reduction mechanism interconnecting said shafts, a dial mounted on each of said shafts for indicating the angular movement thereof, a third shaft, a pivoted support for the last-mentioned shaft, a plurality of drives effective alternately upon the pivotal movement of said support, and means for rotating said third shaft for actuating said main shaft and the second-mentioned shaft according to the operation of each of said drives.

6. In a tuning device, a main shaft, a second shaft operatively connected to said main shaft for movement at a different speed relative to each other, a dial secured to each of said shafts, a plurality of normally ineffective drives, a third shaft, a pivoted support for said third shaft, means for moving said third shaft and said support to render said drives alternately effective with respect to said shafts, means for rotating said third shaft in each position of said support for actuating said dials according to the operation of each of said drives for indicating the adjusted position of the tuning device, and a toggle mechanism for holding each of said drives in each of said effective positions.

7. In a tuning device, a main shaft, a second shaft, a dial carried by each of said shafts, a speed reduction mechanism operatively connecting said shafts, a normally ineffective clutch mechanism mounted on said second shaft, a manually operable shaft, a gear secured on one end of said manually operable shaft, a pivoted supporting member for the last-mentioned shaft, a gear loosely mounted on said second shaft for rotating the driving element of said clutch, a pulley mounted on the other end of said manually operable shaft in engageable relation with the dial on said second shaft, a knob for moving said shaft and said supporting member on said pivot in two opposite directions for alternately engaging said clutch mechanism and said pulley with said dial whereby the rotation of said shaft is effective to actuate said main shaft at a speed corresponding to the speed ratio of said pinion and said gear and at another speed corresponding to the speed ratio of said pulley with said dial, and detent means for yieldably holding said manually operable shaft in each of said directions.

GEORGE B. ENGELHARDT.