Oct. 9, 1951 H. E. OVERACKER 2,570,703

OPERATING GEAR FOR TUNING ELEMENTS

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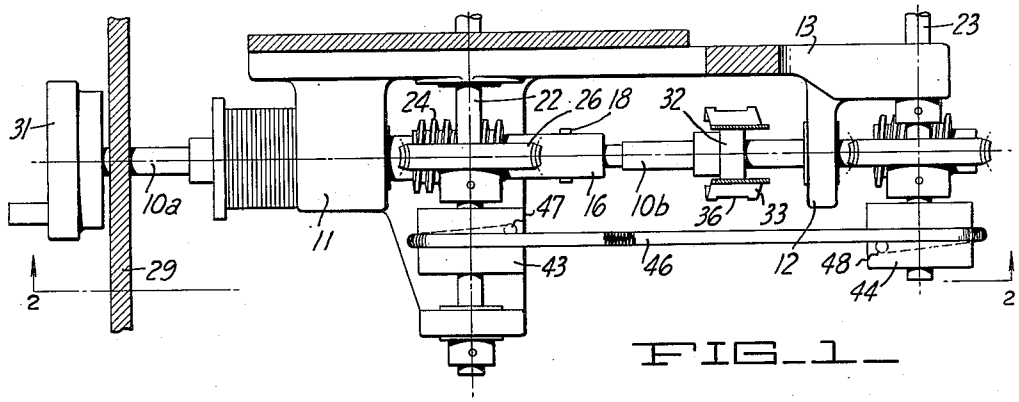



FIG_1_

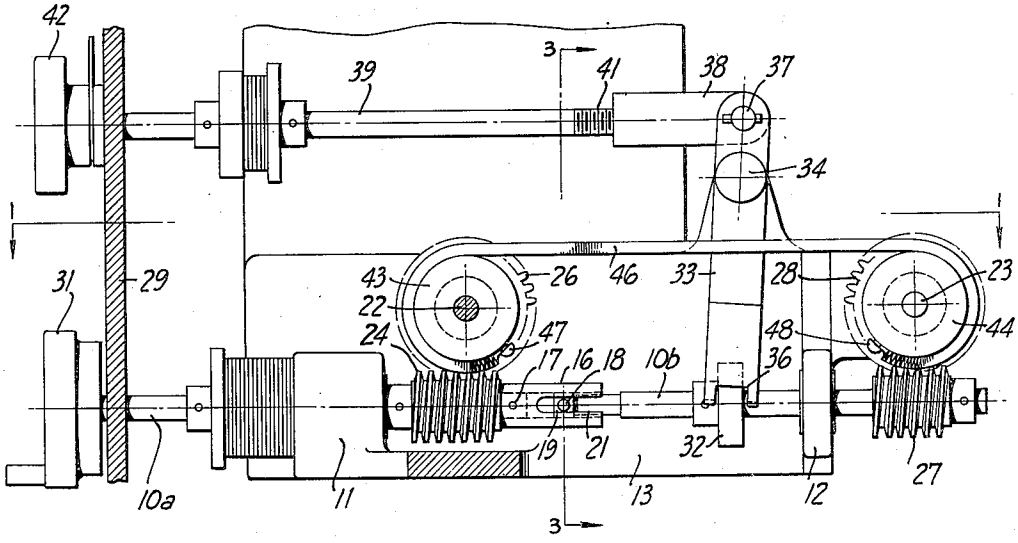



FIG_2_

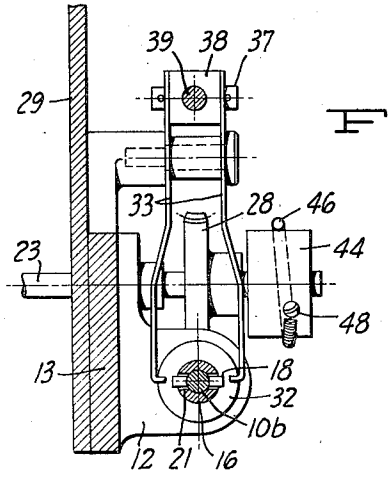



FIG_3_

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## OPERATING GEAR FOR TUNING ELEMENTS

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4 Claims. (Cl. 74—10.85)

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This invention relates generally to drive means for adjusting the angular setting of rotary instruments shafts, particularly electrical instruments such as are employed as component parts of radio signaling or other types of electric equipment.

In many types of radio signaling equipment it is desirable to provide gang operating means for changing the setting of two or more instrument shafts. In addition it is frequently desirable to effect individual adjustment of one instrument shaft, without disrupting the gang operating means.

It is an object of the present invention to provide improved means capable of effecting both conjoint and individual instrument shaft control, and which is characterized particularly by relatively simple mechanical construction and ease of operation.

It is another object of the invention to provide improved drive means of the above character which incorporates provision for preventing backlash between the operating elements employed.

Additional objects and features of the invention will appear from the following description in which the preferred embodiment has been set forth in detail in conjunction with the accompanying drawing.

Referring to the drawing—

Figure 1 is a cross-sectional view taken along the line 1—1 of Figure 2, and illustrating one embodiment of the invention.

Figure 2 is a sectional view taken along the line 2—2 of Figure 1.

Figure 3 is a cross-sectional detail taken along the line 3—3 of Figure 2.

The preferred form of the invention illustrated in the drawing consists of two aligned shaft sections, 10*a* and 10*b*, which are carried by the journals 11 and 12 on the chassis or fixed support 13. A coupling sleeve 16 is fixed to shaft section 10*a* as by means of pin 17, and is splined to the adjacent end of shaft section 10*b*. The splined connection can consist of a pin 18 which extends through the shaft section 10*b*, and which has slide blocks 19 attached to its ends. The sleeve 16 has slots 21 which serve to accommodate the blocks 19. The splined connection enables the shaft section 10*b* to move axially relative to section 10*a*, for a purpose to be presently explained.

The two instruments which are to be operated, such as variable condensers (not shown) or the like are assumed to have rotatable adjusting shafts 22 and 23. Both of these shafts extend at right-angles to the axis of the shaft sections 10*a* and 10*b*. Drive gearing serves to operatively connect each instrument shaft with its corresponding shaft section. Thus shaft section 10*a* carries a worm 24, which engages the teeth of worm gear 26. Shaft section 10*b* similarly caries a worm 27, which engages the teeth of the worm gear 28. The two worm gears 26 and 28 are fixed to the instrument shafts 22 and 23.

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The shaft section 10*a* is shown extending through an instrument panel 29, where it is provided with a manually operated control knob 31. Upon turning the knob 31 to turn the shaft sections 10*a* and 10*b*, the instrument shafts 22 and 23 will be turned in unison.

Individual rotation of the instrument shaft 23 without turning shaft 22, is effected by means which is manually operated to shift the shaft section 10*b* axially. It will be evident that such shifting movement results in axial movement of the worm 27, whereby the gear 28 and shaft 23 are turned a limited angular amount. The means provided for axially shifting shaft section 10*b* includes a collar 32 which is fixed to shaft section 10*b*, and which is engaged by the lower extension of the lever 33. Lever 33 is formed of two parts, whereby its lower end portion forms in effect a fork for embracing the opposite sides of collar 32. The lower end of each lever part is bifurcated at 36, to accommodate the rim of the collar. The upper portion of lever 33 is pivoted at 34 to support 13 and at 37 to a member 38. A rotatable rod 39 has its one end portion 41 threaded to engage a threaded bore formed in member 38. Shaft 39 is journaled to the chassis, and likewise extends through the instrument panel 29, where it is provided with the control knob 42. Turning of the knob 42 causes the member 38 to advance or retract relative to rod 39, thereby rocking the lever 33.

In conjunction with the apparatus described above, it is desirable to provide means to prevent backlash between the working parts. Thus the drums 43 and 44 are mounted upon the instrument shafts 22 and 23, and these drums are engaged by the end portions of the coil spring 46. It will be noted that each end portions of the spring is wrapped around its associated drum, and one end of the spring is anchored to drum 43 at 47, and the other end anchored to drum 44 at 48. With the spring 46 under tension, and with the end portions wrapped about the drums 43 and 44 in the manner shown in Figure 2, the spring serves to apply clockwise torque to the

shaft 22, and counterclockwise torque to shaft 23. The amount of torque thus provided serves to take up backlash between the worms and the worm gears, between the collar 32 and lever 33, and also between this lever and the shaft 39. Thus backlash is eliminated both for conjoint rotation of the shafts 22 and 23 in response to turning the knob 31, and also for individual rotation of the shaft 23 responsive to turning the control knob 42.

Operation of the apparatus described above can be summarized as follows: Normally the shaft sections 10*a* and 10*b* are held in fixed axial relationship to each other. Upon turning knob 31 both shaft sections 10*a* and 10*b* rotate in unison, and similar rotation of the worms 24 and 27 serves to rotate the gears 26 and 28, together with the shafts 22 and 23, in unison. Rotation of the knob 42 serves to rock the lever 33 to shift the shaft section 10*b* axially relatively to shaft section 10*a*. This causes axial movement of the worm 27, with the result that the gear 28 and the instrument shaft 23 are individually rotated. After individually rotating the shaft 23, rotation of the knob 31 for gang control will serve to maintain the new angular relationship between the shafts 22 and 23.

It will be evident from the foregoing that I have provided a novel drive means applicable to various types of equipment where it is desired to adjust two or more instruments conjointly, or adjust one of them individually. Backlash is eliminated from all of the working parts, whereby the instruments can be adjusted to a high degree of accuracy.

Although the apparatus as described above and illustrated in the drawing is particularly adapted for adjusting the shafts of only two instruments, it will be evident that the principles of the invention can be applied to more than two instruments.

Although the worms and worm gears illustrated are intended to turn the shafts 22 and 23 equal angular amounts for a given amount of rotation of shaft section 10*a*, it will be evident that in some instances it may be desirable to modify the drive ratio between a shaft section and its associated instrument shaft. This can be accomplished by introducing additional gear elements, or by changing the sizes of the worm and worm gear elements.

I claim:

1. Drive means for adjusting the angular setting of the rotary operating shafts of two instruments, comprising two aligned shaft sections, means for journaling said shaft sections, a splined coupling between said shaft sections whereby said sections rotate in unison and one section can be moved axially relative to the other, a manual operating member attached to one shaft section for manually rotating both said sections, drive gearing operatively connecting each shaft section with an associated instrument shaft, each drive gearing including a worm mounted upon a shaft section and a worm gear engaged by said worm, and means for effecting axial movement of the other shaft section with respect to said one shaft section to thereby cause individual rotation of one instrument shaft, said last means comprising a manually operated member, and means connecting said manually operated member to said other shaft section to effect axial movement of said other shaft section upon moving said manually operated member.

2. Drive means as in claim 1 in which said means for effecting axial movement of said other shaft section comprises a collar mounted upon said other shaft section, a fulcrumed lever having one end of the same operatively connected to said collar to shift the same in an axial direction responsive to rocking of the lever, a manually operated rotatable member, and means operatively connecting said last member with said lever to cause rocking of said lever responsive to rotation of said member.

3. Driving means for adjusting the angular setting of the rotary operating shafts of two instruments, comprising a pair of aligned shaft sections, means forming a splined connection between said shaft sections whereby the two sections are caused to rotate in unison, means for journaling said shaft sections in alignment, manual means for rotating one of said shaft sections, drive gearing connecting each shaft section with an associated instrument shaft for simultaneous rotation of the instrument shafts when the shaft sections are rotated manually, each drive gearing including a worm mounted upon the shaft section and a worm gear engaging said worm and rotatable about an axis at right angles to the axis of the shaft sections, means for continuously applying oppositely directed torques to said worm gears to prevent backlash, and means for shifting the other shaft section with respect to said one shaft section to effect individual adjustment of one instrument shaft relative to the other.

4. Drive means for adjusting the angular setting of the rotary operating shafts of two instruments, comprising a pair of aligned shaft sections, coupling means serving to form a splined connection between said shafts whereby the two shafts are caused to rotate in unison and one shaft can move axially relative to the other shaft, means serving to journal said shaft sections, a manually operated member attached to one shaft section for rotating both said sections, worm gears attached to the instrument shafts, the instrument shafts extending at right angles to the shaft section, worms attached to the shaft sections and operatively engaging worm gears, drums mounted upon the instrument shafts, a tension spring having its end portions associated with said drums, each end portion of the spring being wrapped about an associated drum and anchored thereto, whereby said tension spring applies torque in opposite directions to said instrument shafts, a collar mounted upon said other shaft section, a lever having one end of the same engaging said collar whereby when said lever is rocked said other shaft section is moved longitudinally, a manually rotatable rod, and means operatively connecting said last named rod with said lever to cause rocking of said lever when said rod is rotated.

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