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DUAL RATIO DRIVING MECHANISMS

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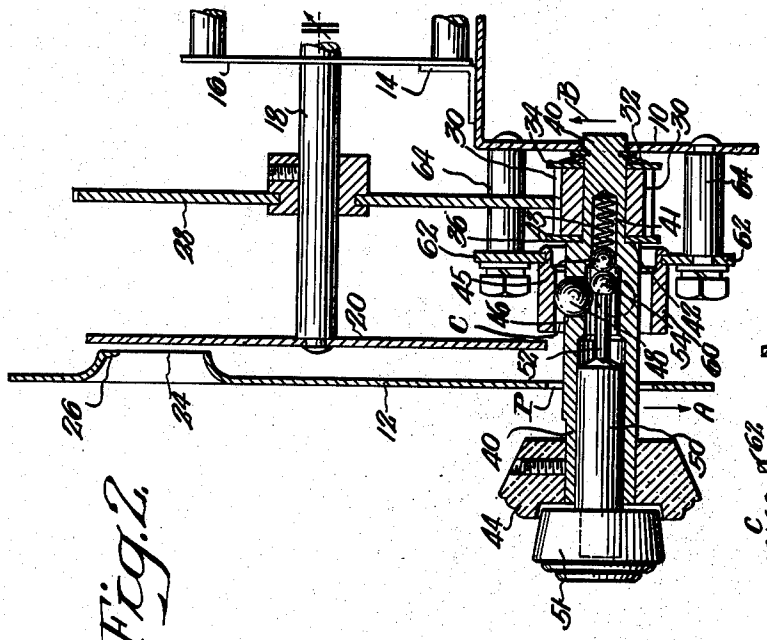


Fig. 2.

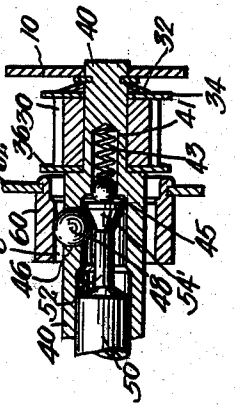


Fig. 3.

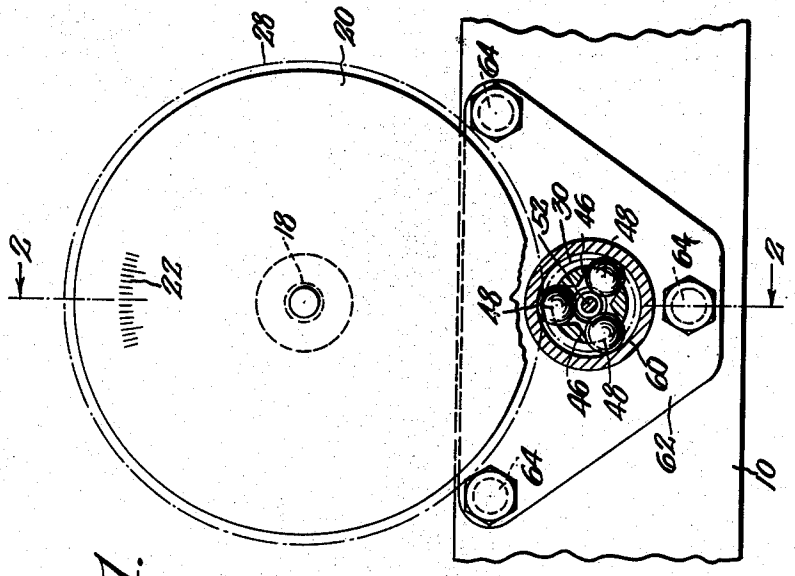


Fig. 1.

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DUAL RATIO DRIVING MECHANISMS

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5 Claims. (Cl. 74—10)

This invention relates to dual ratio driving mechanisms and particularly to improvements in transmissions of the planetary type in which ball bearings are utilized to act as planetary pinions of the gearing.

While the invention will be described as embodied in a manually actuated device for transmitting motion to the tuning elements of a radio receiver it is to be understood that the invention is not limited to such application as the disclosure in this respect is merely illustrative for purposes of explaining the inventive concept.

The prior art is replete with transmissions designed to impart motion, for example to the shaft of a tuning condenser, at both a direct driving ratio, to obtain a "coarse" adjustment, and at a reduced speed ratio, to obtain a fine or vernier adjustment. Regardless of the advantages claimed for the mechanisms of the prior art it may be said generally that unless extreme care is taken in manufacturing and assembling the several parts the device may freeze or jam in operation. Thus it has been found that in some cases an inaccuracy of the order of a few thousandths of an inch in the machining of one or another of the driving elements will render the device incapable of satisfactory operation.

An object, therefore, of the present invention is to provide a dual ratio driving mechanism which lends itself readily to mass production methods and one capable of useful operation in spite of inaccuracies in manufacture.

Another object of the invention is to provide an inexpensive, trouble-free driving mechanism, and one characterized by an economy of moving parts.

Other objects will be apparent and the invention itself will be best understood by reference to the following specification and to the accompanying drawing, wherein:

Figure 1 is an end elevation, partly in section, of a radio tuning mechanism embodying the invention,

Fig. 2 is a section taken on the line 2—2 of Fig. 1 and showing the detailed construction of a dual ratio driving means constructed and mounted in accordance with the principle of the invention, and

Fig. 3 is a fragmental sectional view of an alternative embodiment of the invention.

In the drawing 10 designates a portion of the chassis and 12 the front panel of a radio receiver. A bracket 14 on the chassis supports a gang condenser 16 whose shaft 18 extends outwardly to a point adjacent the rear of the panel 12. The front end of the condenser shaft carries a dial 20 suitably marked with calibrations 22, to indicate the frequency to which the condenser and its associated electrical elements (not shown) are tuned. The dial is viewed through an aperture 24 in the front panel or escutcheon of the set; a pointer 26 fixed in the center of the aperture provides a reference line or point for the scale markings.

The gang condenser and shaft 18 therefor are rotatable through a given range of about 180°. For the purpose of rotating the shaft 18 to make tuning adjustments a disc gear 28 is fixed thereto. The gear teeth on the periphery of disc 28 engage complementary teeth on a pinion 30 which is slippingly fixed for rotation with the main shaft 40 of the driving mechanism as by means of a rosette spring 32 which exerts its tension outwardly from the frame 10, in which shaft 40 is journaled, through washer 34 to urge the pinion 30 against a second washer 36 which is positioned intermediate the pinion and a shoulder 42 on the shaft 40. This shaft 40 is journaled rather loosely in the chassis or frame 10 to permit of any slight eccentric movement of the shaft which may occur for reasons later set forth.

For all "normal" degrees of rotation the pinion 30 will rotate with shaft 40 because of the frictional drive (constituted by the spring 32 and washers 34 and 36) therebetween. However, should more torque be applied to shaft 40, as through knob 44 on the end thereof, than is required to drive the condenser shaft 18 to the limit of its 180° range then the frictional spring contact will be unable to transmit it, as the pinion 30 will slip on the shaft 40.

Shaft 40 may be designated the "direct-drive" shaft. It is hollow substantially throughout its length and contains a second or "vernier" shaft 50 coaxially mounted therein. The direct-drive shaft 40 contains a plurality of circumferentially spaced holes 46 which communicate with the hollow interior of the shaft and contain balls 48 which are free to rotate in these holes.

The central or vernier shaft 50 has an extension 52 of reduced diameter which extends inwardly beyond the plane of rotation of balls 48. This extension 52 terminates in a spherical member 54 (Fig. 2) or a conical member 54' (Fig. 3) which provides a point contact for the rotatable balls 48. A sleeve 60 constitutes an outer retainer or raceway for the balls 48. Sleeve 60 is fixed against movement by means of a plate 62 which is supported on studs 64 fixed to the chassis or frame 10.

The hollow portion of the outer shaft 40 terminates in a bore 41 of reduced diameter. This section of the shaft accommodates a spring 43 and a ball 45. This latter element 45 is pressed longitudinally against the end 54 of the inner shaft; end member 54 in turn urges the planetary balls 48 outwardly to maintain them in contact with the sleeve or outer raceway 60.

It will be observed that there is a clearance "c" between the outer surface of the main shaft 40 and the inner surface of raceway 60. This clearance is greater than that required for a running fit between these surfaces and is spanned by the free-running planetary balls 48. These balls together with the point contact member 54 on the end of the inner shaft constitute a ball-bearing support for the front section of the entire shaft assembly. In this connection it will be observed that no additional support is provided for the assembly at the point "p" where it passes through the front panel 12 of the set.

The principal advantage of the above described construction and mounting will be apparent if it is assumed that, because of some inaccuracy in the machining of the reduced extension 52 on the vernier shaft, the sphere 54 (or cone 54' Fig. 3) is out of alignment, or off-center with respect to the axis of rotation of the main body portion of this shaft 50. In this case the spherical member 54, or conical member 54', will move eccentrically with respect to the axis of rotation of shaft 50, so that if the assembly were rigidly mounted at its front and rear ends one or another of the balls 48 would be jammed against the raceway 60 and "freeze" both shafts 40 and 50 against rotation. With the described construction the device will neither jam nor freeze for if ball 48 (Fig. 2) is pressed with excessive force against the inner surface of the raceway 60 by reason of the above mentioned eccentric movement of sphere 54, the outer end of the assembly will be displaced or give in the direction of arrow "a"; and the inner end of the assembly will give, by reason of its relatively loose mounting in the direction of arrow "b".

In tuning the set the coarse or low ratio adjustment is provided by turning knob 44 on the main tuning control shaft 40. As this hollow shaft is continuous it transmits torque directly to the pinion 30, which is fixed thereon in the manner previously described. During the coarse tuning adjustment the vernier shaft 50 will idle by reason of the motion imparted thereto through its end member 54, by balls 48.

The vernier or high ratio adjustment is provided by turning knob 51 on the central shaft 50. This causes the sphere 54, or cone 54', to rotate. Since this member 54 is maintained in contact with the balls 48, by spring 43 and ball 45, it will transfer its simple rotary motion to balls 48 which will revolve as planets thereabout. The contact of the balls 48 with the sleeve 60 causes their axes to roll in the same direction, but at a reduced speed, with respect to the sphere 54 from which they derive their motion. Since the balls 48 are retained in holes 46 in the outer shaft 40 they will rotate this shaft in the same direction as the vernier shaft 50 but at a reduced speed with respect thereto. As the outer shaft 40 rotates, pinion 30, fixed thereon will likewise rotate and will impart its motion to the condenser shaft 18 through disc gear 28.

What is claimed is:

1. In a transmission, a shaft having a plurality of spaced peripheral orifices intermediate the ends thereof, a ball in each of said orifices and free to rotate therein, a retainer for said balls spaced from said shaft, said balls and retainer constituting an intermediate support for said shaft, and a second support immovably fixed with respect to said retainer and in which one end of said shaft is journaled to permit of eccentric movement, within a limited range, of the free end of said shaft.

2. In a transmission, a hollow driven shaft, a driving shaft mounted within said driven shaft, a plurality of balls mounted in torque transfer relation between said driving and driven shafts, the peripheries of said balls extending beyond the outer surface of said driven shaft and constituting elements of an external support for said shafts, and a second support adjacent one end of said driven shaft and in which said shaft is journaled to permit of eccentric movement of said shaft within said first mentioned support.

3. In a transmission, a hollow shaft having a plurality of spaced peripheral orifices intermediate the ends thereof, a ball in each of said orifices and free to rotate therein, a second shaft rotatably mounted within said hollow shaft and having an extension of reduced diameter extending beyond the axes of the plane of rotation of said balls, means for maintaining the terminal end of said extension in contact with said balls, an outer retainer for said balls spaced from said outer shaft, said balls and retainer constituting an intermediate support for said shafts, and a second support in which one end of said outer shaft is journaled to permit of eccentric movement, within a limited range, of the free ends of said shafts.

4. The invention as set forth in claim 3 wherein said balls and the terminal end of said inner shaft which is in contact with said balls constitute a reduction gear for transmitting torque from said inner to said outer shaft at a reduced speed.

5. In a dual ratio transmission, a pinion, a rotatable hollow shaft adjacent one end of which said pinion is mounted, means for rotating said shaft to drive said pinion directly, a second shaft rotatably mounted within said hollow shaft, a gear reduction mechanism comprising a plurality of balls mounted in torque transfer relation between said shafts, the peripheries of said balls extending beyond the outer surface of said hollow shaft and constituting elements of an external support for said shafts, a retainer for said balls, means for rotating said second shaft to drive said pinion through said balls and outer shaft at a reduced speed, and an additional support for said shafts adjacent the end of said outer shaft upon which said pinion is fixed, said end support being sufficiently flexible to permit of rotation of said balls in said retainer in spite of displacement of the free ends of said shafts from axial alignment.

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