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REDUCTION DRIVE MECHANISM

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Fig. 1.

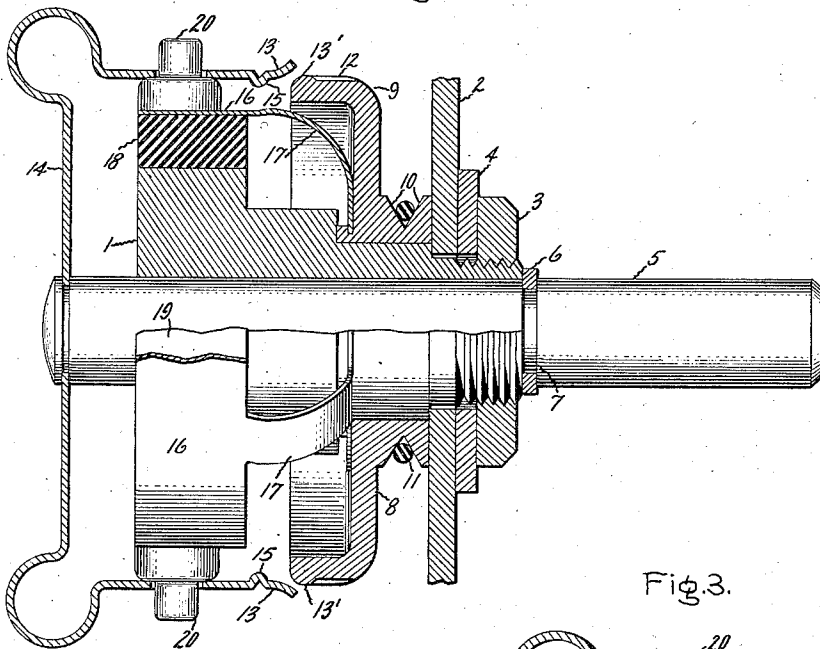


Fig. 2.

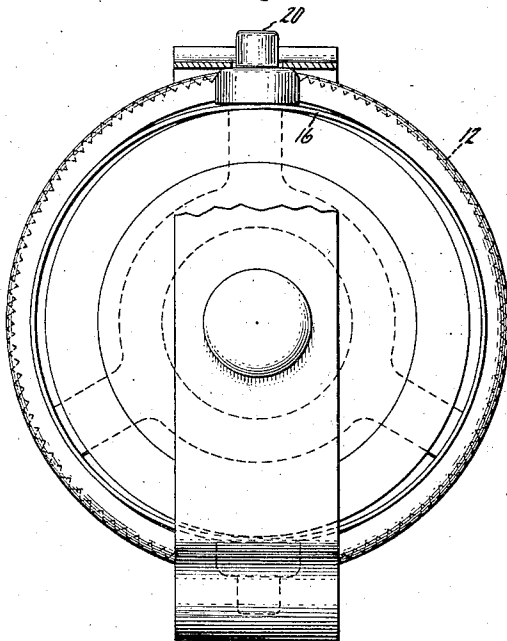


Fig. 3.

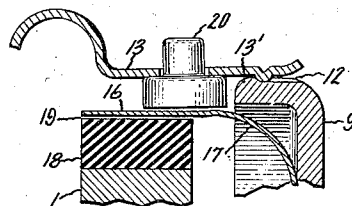
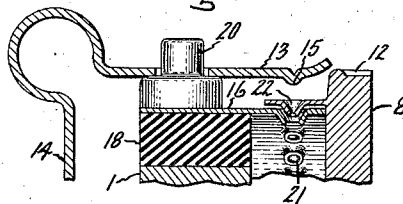


Fig. 5.



Fig. 4.



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REDUCTION DRIVE MECHANISM

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9 Claims. (Cl. 74-10)

My invention relates to drive mechanisms, and more particularly to drive mechanisms adapted for use in connection with the operation of electrical circuit elements, such, for example, as the tuning elements of radio receivers.

My invention has for one of its objects to provide a drive mechanism for operating a driven element at reduced speed with respect to the speed of the driving member, and which is of extremely simple, rugged, compact and of economical construction.

A further object of my invention is to provide a reduction drive mechanism which possesses the above characteristics, and which at the same time operates free from back lash, lost motion, or undesired play between its different component parts.

An additional object of my invention is to provide such a reduction drive mechanism in combination with means whereby direct drive may also be obtained while substantially retaining the simplicity, compactness, ruggedness and economy of the apparatus, and which at the same time operates free from undesired play, or lost motion, at either of the two operating speeds.

A still further object of my invention is to provide a dual drive mechanism having the above advantages and which, when operated for drive at either of its two speeds, the connection for operation at the other speed is completely broken, thereby to remove any drag between components of the mechanism.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and the method of operation, together with further objects and advantages thereof, will be best understood by reference to the following specification taken in connection with the accompanying drawing in which Fig. 1 is a side view partially in section of a mechanism embodying my invention; Fig. 2 is an end view of the arrangement shown in Fig. 1; Fig. 3 is a detailed cross-sectional view of certain elements embodied in my improved mechanism; Fig. 4 is a cross-sectional view showing a modified arrangement of the component parts of my improved mechanism, and Fig. 5 is a detail view of certain of the elements shown in Fig. 4.

Referring to Fig. 1 of the drawing, I have shown one embodiment of my invention in which a step-shaped bearing member 1 is mounted on a panel 2 by means of a nut 3 threaded on one end of the bearing and held in place by a lock washer

4. A driving or control member in the form of a shaft 5 is journaled in the bearing 1 for axial and rotatable movement with respect thereto. A suitable knob (not shown) is mounted on one end of the shaft 5 for actuating the shaft to adjust the tuning, or driven devices. A retaining ring 6 resting in a groove 7 cut in the shaft 5 is provided as a stop for retaining the shaft 5 in the bearing member 1. A driven member comprising a pulley 8 having an enlarged cup-shaped portion 9 and a belt groove 10 is rotatably mounted on the bearing 1 adjacent the panel 2. The devices to be controlled are belted to the pulley 8 by means of a belt 11 resting in the groove 10. The enlarged cup-shaped portion 9 of the pulley 8 is provided with a roughened, knurled, or toothed surface 12 around its outer periphery which is adapted to be engaged by resilient inwardly biased spring arms 13 of a U-shaped member 14 fixedly mounted on one end of the driving member 5. Stamped projections 15 are provided at the outer extremities of the arms 13 which engage the teeth 12 when the shaft 5 is axially shifted to a position such that the ends of the arms 13 overlap the periphery of the cup-shaped portion 9 of the pulley 8. A raised ridge 13' extends around the circumference of the cup-shaped portion 9 which serves to retain the projections 15 on the arms 13 in engagement with the toothed surface 12 when the parts are in the direct drive position. In this manner the component parts of the mechanism are retained in the selected driving position by the ridge 13'. The position of the elements of the mechanism for direct drive is shown in detail in Fig. 3.

It will be seen that to drive the pulley 8 directly from the shaft 5, the shaft is axially shifted to the right until the stamped projections 15 on the arms 13 ride over the ridge 13' and engage the teeth 12 on the periphery of the cup-shaped portion 9, in which position the driving member may be rotated and a one to one driving ratio is established between the shaft and the pulley.

In accordance with my invention, I provide a reduction drive mechanism for driving the pulley 8 at a speed less than the speed of the shaft 5. This reduction drive mechanism includes a resilient, deformable and normally annular member 16 mounted on the pulley 8 by means of resilient arms 17. The resilient member 16 is normally concentrically disposed in radially spaced apart position with respect to an annular member 18, which is fixedly mounted about the outer surface of the stationary bearing member 1.

The member 18 is made of any suitable material, such as rubber, which presents a frictional surface 19 highly resistant to relative movement between its outer surface and the internal surface of the resilient member 16. If desired, the member 18 may be dispensed with, the outer metallic surface of the member 1 being enlarged and roughened to present the desired friction to the inner surface of the member 16. As shown in detail in Fig. 3, the internal diameter of the resilient annular member 16 is slightly greater than the peripheral diameter of the annular friction member 18. By this arrangement the annular member 16 is maintained out of contact with the friction surface 19 when the driven member 8 is directly coupled to the driving member 5.

The arms 13 retain friction brushes 20 in engagement with the outer periphery of the annular member 16 when the driving member 5 is axially shifted to the left. In this position the projections 15 of the arms 13 no longer engage the surface 12 of the cup-shaped portion 9 of the pulley 8, but instead press members 20 against the outer surface of member 16, thereby deforming the member 16 and pressing its inner diametrically opposite surfaces into engagement with the outer surface of member 18. It will of course be understood that the friction brushes 20 may be replaced by rollers, or balls, mounted on the arms 13 in any suitable manner.

To establish a reduction drive through the mechanism described above for fine adjustment of the devices to be controlled, the shaft is axially shifted to the position shown in Fig. 1 of the drawing in which position the projections 15 are disengaged from the teeth 12 of the cup-shaped portion 9 of the pulley 8. As the shaft 5 is shifted to accomplish this disengagement, the resilient arms 13, which are normally biased toward each other, contract to press the friction brushes 20 against the resilient member 16 thus forcing segments of the internal surface of the member 16 into substantially nonslipping engagement with segments of the friction surface 19 of the member 18. This operating position of the mechanism is also shown in Fig. 2, where it will be seen that the normal circular contour of the resilient member 16 is deformed into an elliptical shape. With the elements of the mechanism in this position, rotation of the shaft 5 causes the brushes 20 to slide over the external surface of the resilient member 16 thereby to press successive segments of the internal surface thereof into substantially nonslipping engagement with successive segments of the friction surface 19. Since the internal diameter of the member 16 is greater than the diameter of the friction surface 19 the sliding movement of the brushes 20 over the external surface of the resilient member 16 causes the free portions of the resilient member to be advanced around the periphery of the friction surface. Thus, for each complete revolution of the brushes, a point on the resilient member 16 will be advanced from a starting point on the friction surface 19 to a second point on the friction surface 19 displaced from the starting point by a distance equal to the difference between the internal circumferential length of the resilient member 16 and the outer circumferential length of the friction surface 19. Since the resilient member 16 is directly connected to the pulley 8 this advancement of portions thereof around the friction surface 19

causes rotation of the pulley 8. The ratio of the speed of the shaft 5 to the speed of the pulley 8 is proportional to the ratio between the internal diameter of the resilient member 16 and the diameter of the friction surface 19.

In the use of my improved dual control mechanism for adjusting electric circuit tuning devices it will be understood that a rough adjustment may first be obtained by shifting the shaft 5 to the right, thereby directly coupling the driving and driven members in the manner hereinbefore explained, and turning the driving, or control, member until an approximate adjustment is obtained. The driving member is then axially shifted to the left to establish the reduction driving connections and rotated until an exact adjustment is obtained.

While in Fig. 1 I have shown the resilient member 16 connected to the cup-shaped member 8 by the resilient arms 17, it will be readily understood that other connecting arrangements between these two elements may be employed. Thus, in Figs. 4 and 5, I have shown a connection in which the resilient member 16 is a cylinder having an external diameter slightly less than the diameter of the inner cylindrical portion 9 of the member 8. Depressions 21 are provided around the circumference of the right-hand portion of the resilient member which are arranged to engage depressions 22 stamped inwardly around the circumference of the cylindrical portion of the member 8. The co-action between the depression 21 and 22 is such that when the stamped projections 15 of the resilient arms 13 are in engagement with the teeth 12 thus establishing a one to one driving connection, as shown in Fig. 3, the resilient member 16 is loosely held in position as shown in Fig. 4. It will be seen that in this position the depressions 21 and 22 are in a loose engagement which is just sufficient to retain the resilient member 16 connected to the member 8. When the driving member 5 is shifted axially to the left to establish a reduction drive between the member 5 and the driven member 8, diametrically opposed portions of the resilient member 16 are forced outward, thus causing the inner surface of certain of the depressions 21 positively to engage the outer surface of the depressions 22 as shown in detail in Fig. 5. This locking action between the depressions 21 and 22 is transferred between successive sets thereof as the brushes 20 are rotated around the resilient member 16, thereby maintaining a positive connection between the member 16 and the pulley 8 during the reduction drive action.

It will be observed that the device as described above is capable of operation to drive the driven member 8 at either of the two speeds provided without any appreciable lost motion, back lash or undesirable play of any type. Any lost motion which might occur in the device would be due to distortion of one of its members, such as edgewise distortion of the member 14 and arms 17. This, however, can readily be completely eliminated by making the member 14 and the arms 17 sufficiently rigid to effect the desired driving operation without such distortion. It has been found that such rigidity can be obtained without making the member 14 and the arms 17 of undesirably large dimensions. By employing the connection between the members 16 and 8 shown in Figs. 4 and 5 backlash or lost motion between these members is completely eliminated.

The ratio of movement of the driving and driven members obtainable with a device con-

structured in accordance with my present invention may be varied over a large range by proper dimensioning of the resilient member 16 relative to the friction surface 19 and is dependent to some extent upon the material of which the element 16 is composed. For example, with a device cheaply and roughly constructed, without regard to precision, I have been able to obtain ratios of movement between the driving and driven members of from 7:1 to 300:1. It will of course be understood that the range may be extended by making the internal circumference of the member 16 approach the circumference of the surface 19 with a minimum tolerable allowance for clearance. In fact, if the device be constructed for drive at a single large speed ratio, that is, the dual drive feature being obviated, the inner circumference of the member 16 may be equal to the circumference of the surface 19; the resilience of the latter member, which may be of rubber, being relied upon for the desired speed reducing operation.

My device has the advantage of free and unrestricted movement during both reduced and direct drive when the dual drive feature is retained. This is due to the particular arrangement of the elements by which complete disengagement of the arms 13 from the member 8 is effected during reduced drive and a similar complete disengagement of the member 16 from the friction surface 19 is obtained during direct drive.

My improved drive mechanism has the further obvious advantages of extreme ruggedness, compactness, and simplicity and at the same time it is of economical construction.

While I have shown a particular embodiment of my invention, it will of course be understood that I do not wish to be limited thereto since many modifications in the structure may be made, and I contemplate by the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a dual drive mechanism, a driven member, a driving member axially and rotatably movable with respect thereto, a stationary friction surface, a resilient member surrounding said friction surface and connected to said driven member, means including a resilient arm mounted on said driving member for directly coupling said driving and driven members in one axial position of said driving member, and means including said resilient arm for advancing successive increments of said resilient member around said friction surface during rotation of said driving member when said driving member is shifted to another axial position.

2. In a dual drive mechanism, a driven member, a driving member axially and rotatably movable with respect to said driven member, means including a resilient arm mounted on said driving member for directly coupling said driving and driven members in one axial position of said driving member, means for establishing a reduction drive between said driving and driven members when said driving member is axially shifted to another position, said last named means including a member having a friction surface, a deformable resilient annular member mounted on said driven member and surrounding said friction surface, and means including said resilient arm for advancing successive increments of said resilient member around said friction surface during rotation of said driven member.

3. In a dual drive mechanism, a driven member having an enlarged cup-shaped portion toothed around its outer periphery, a driving member axially and rotatably movable with respect to said driven member, a stationary friction surface, a resilient member surrounding said friction surface and connected to said driven member, means including a resilient arm mounted on said driving member and having a raised portion thereon for engaging said toothed periphery thereby directly to couple said driving and driven members in one axial position of said driving member, and means including said resilient arm for advancing successive increments of said resilient member around said friction surface during rotation of said driven member when said driving member is axially shifted to another position.

4. In combination, a bearing member, a driving member journaled in said bearing member, a driven member, an annular member mounted on said bearing member having an outer friction surface, a resilient member surrounding said friction surface and connected to said driven member, and means including a resilient arm mounted on said driving member for advancing successive increments of said resilient member around said friction surface during rotation of said driving member.

5. In combination, a bearing member, a driving member journaled in said bearing member, a driven member mounted on said bearing member, a flexible annular member mounted on said bearing member having an outer friction surface, a resilient member surrounding said friction surface and connected to said driven member, a U-shaped resilient member mounted on said driving member, the arms of said U-shaped member being normally biased toward each other, and friction reducing means interposed between said arms and said resilient member, said U-shaped member, friction reducing means and friction surface co-operating during rotation of said driving member to advance successive increments of said resilient member around said friction surface and thereby impart rotary movement to said driven member.

6. In combination, a driving member, a driven member having a cylindrical portion projecting therefrom, a friction surface, a resilient member having a portion surrounding said friction surface and a second portion normally loosely engaging said cylindrical member, and means mounted on said driving member for advancing successive increments of said first portion of said resilient member around said friction surface and for pressing successive increments of said second portion of said resilient member into positive engagement with successive increments of said cylindrical member thereby to impart rotary movement to said driven member during rotation of said driving member.

7. In combination, a driving member, a driven member having a cylindrical portion projecting therefrom, said cylindrical portion having inwardly extending depressions disposed around the circumference thereof, a friction surface, a resilient member having a portion surrounding said friction surface and depressions extending inwardly around the circumference of another portion thereof, said last-named depressions being arranged normally loosely to engage said first-named depressions to connect said resilient member to said driven member, and means mounted on said driving member for advancing successive in-

crements of said resilient member around said friction surface and for pressing successive sets of said-second-named depressions into positive engagement with successive sets of said first-named depressions thereby to impart rotary movement to said driven member during rotation of said driving member.

8. The combination, in a dual drive mechanism, of a driving member, a driven member, a stationary friction surface, a resilient member surrounding said friction surface and normally spaced therefrom, said resilient member being fixedly attached to said driven member, an arm attached to said driving member arranged in one position to engage said driven member to establish a direct drive connection between said driving and driven members, and in a different position thereof to press a portion of said resilient member in contact with said friction surface to establish a reduction drive connection between said driving and driven members, and means including said arm so arranged that when either of

said connections is established the other connection is completely broken whereby either connection operates free from drag through the other connection.

9. In a dual drive mechanism, a driven member, a driving member axially and rotatably movable with respect to said driven member, a stationary friction surface, a resilient member surrounding said friction surface and connected to said driven member, means including a resilient arm mounted on said driving member for directly coupling said driving and driven members in one axial position of said driving member, and means including said resilient arm for advancing successive increments of said resilient member around said friction surface during rotation of said driving member when said driving member is shifted to another axial position, said resilient member being completely disengaged from said friction surface in the direct drive position of said driving member.

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