Sept. 19, 1944. L. ROBBINS 2,358,595

MECHANICAL MOVEMENT

Filed April 15, 1943 2 Sheets-Sheet 1

Fig. 1.

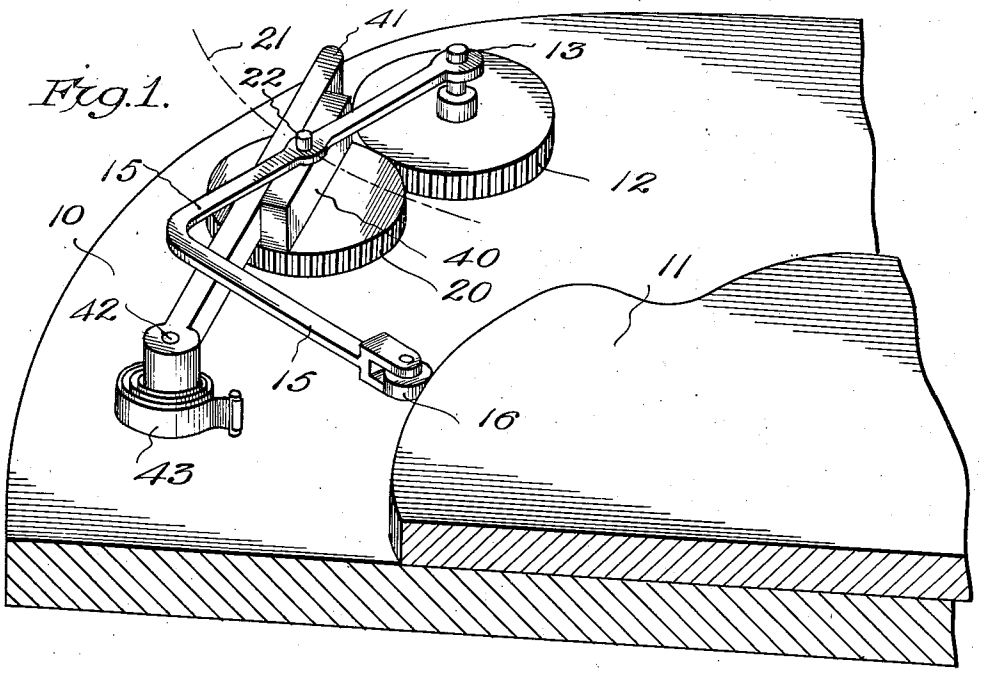
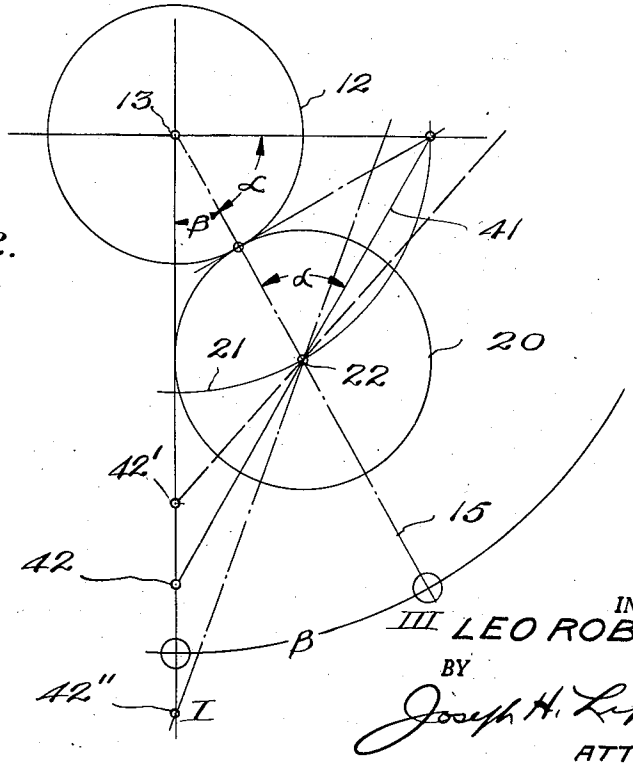


Fig. 2.



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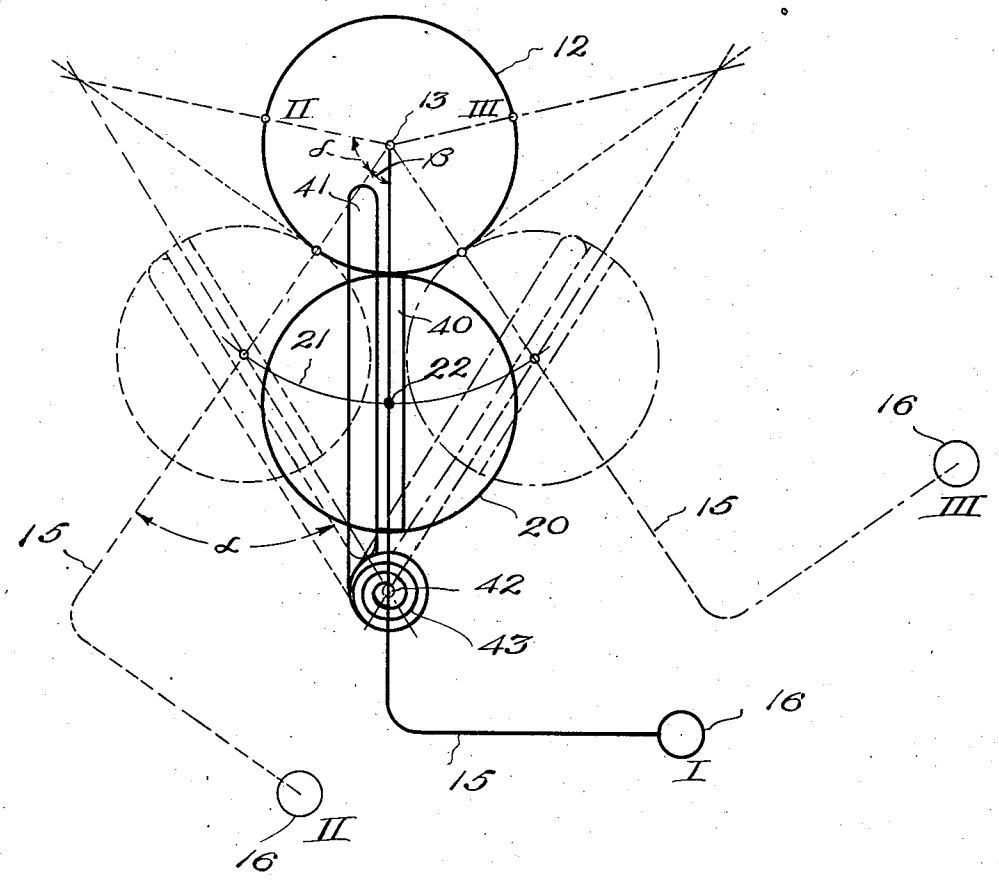


Fig. 3.

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MECHANICAL MOVEMENT

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9 Claims. (Cl. 74—54)

This invention relates to a mechanical movement, and has for its principal object the provision of means for amplifying or multipying the movement of a member. More particularly, this movement relates to that type of apparatus in which a cam operates a follower to rotate a gear or other member through an angular distance. The limitations which are inherent in such a system are well known, and consists principally in the fact that a cam cannot be employed for angular movement of a follower in excess of 90°, which is the theoretical limiting position. In practice this limit of movement is considerably smaller because the accuracy of the adjustment diminishes rapidly as the follower approaches the 90° angle. It frequently occurs, however, that there is need for adjustments of 90° and more in the case of various mechanisms, as for instance, where a chuck is carried by a turntable, and in the course of the rotation of the turntable it is desired to swing the chuck to various operating positions. Such a condition arises for example, in the case of machines for grinding hypodermic needles where the needle point must be ground from several widely divergent angles, necessitating adjustment of the chuck through large angles.

The cam adjustment of a member such as a chuck on a rotating table is the simplest and the most efficient, and therefore this invention seeks to retain this fundamental control of adjustment while at the same time permitting an amplification or multiplication of the movement of the cam follower.

Further objects and advantages of this invention will become apparent in the following detailed description thereof:

In the accompanying drawings,

Fig. 1 is a perspective view showing the elements comprising this invention.

Fig. 2 is a simplified diagram illustrating the theory of the invention.

Fig. 3 is a diagrammatic representation of the Fig. 1 device.

Referring to the drawings, it will be observed that my invention is illustrated mainly diagrammatically, and therefore no attempt has been made to illustrate the ordinary well known machine elements out of which the invention would ordinarily be constructed.

A turntable 10 operating around a given center of rotation moves relative to a stationary cam 11. The turntable carries a member 12 rotatably mounted thereon about an axis 13. The member 12 may be a chuck or any similar working device whose position is designed to be varied one or more times during a revolution of the turntable 10 for accomplishing various working operations as stated, for example, in the introduction hereto.

Normally the adjustment of the rotatable member 12 to the various positions would be achieved by fixing to the axis 13 of the chuck 12 a cam follower in the form of a crank 15 carrying a roller 16 designed to follow the contour of the cam 11. As the roller 16 moved along the face of the cam 11, the crank 15 would be swung around axis 13 to swing the rotatable member 12 around said axis to the various positions. This however, would give only the same angular movement to member 12 as is imparted to crank 15 by the cam, and as stated, such movements have a theoretical limit of 90° and an even lesser practical limit.

In order that the rotatable member 12 may be rotated through angles larger than angular movement of cam follower 15 I have provided the following amplification or multiplication mechanism between the cam follower and the rotatable member 12. For this purpose the cam follower 15 is not fixed to the axis 13 of rotatable member 12, but is merely loosely mounted for rotation about said axis, and provision is made whereby when the cam follower 15 is swung through a linear distance corresponding to a given angular distance, the rotatable member 12 will not only be swung through this angular distance, but will be given an additional rotation in the same direction, thus increasing the angular movement of member 12 corresponding to the angular movement of cam follower 15.

For this purpose an additional member 20 is carried by and rotatably supported in the cam follower 15 in meshing engagement with member 12. The member 20 is not connected to table 10, but has movement of translation along an arc 21 and also is capable of rotating around its own axis 22. As the cam follower 15 rotates around axis 13 it swings the axis 22 and the rotatable member 20 along the arc 21. The rotatable member 20 is geared to rotatable member 12 either frictionally or by teeth, so that when cam follower 15 is swung around axis 13 it will swing rotatable member 20 around axis 13, and by reason of the geared relation between member 20 and member 12 it will also swing member 12 around axis 13 through the same angular distance. Movement of the cam follower 15, therefore, through a predetermined angular distance,

will swing gears 20 and 12 as a unit around axis 13.

This however accomplishes merely the exact reproduction of angular movement by rotatable member 12 of the angular movement of the cam follower 15, and the object is to give the rotatable member 12 a multiplied or amplified angular movement in response to the angular movement of cam follower 15. Therefore I have provided means which becomes effective just as soon as cam follower 15 starts to move gear 20 linearly to cause said cam 20 also to rotate around its axis 22, and in such direction as to cause rotatable member 12 to move further in the same direction as the linear movement of cam follower 15 caused it to move. Thus, for instance, if the cam follower moves from position I in Fig. 3 to position II, gears 20 and 12 have also been moved as a unit clockwise through the same angular distance as the cam follower. But means are provided whereby in addition to this movement the gear 12 is further moved in the same clockwise direction to yield a multiplied or amplified distance relative to the distance through which the cam follower 15 has moved.

To accomplish the above, I cause the gear 20 to be set into rotation in a direction opposite to the direction of movement of the cam follower 15 so that the gear 12 will be set into rotation in the same direction as the movement of cam follower 15. This is accomplished by means of a projection 40 extending diametrically across the surface of gear 20 and projecting upwardly from the plane of the paper. The projection 40 abuts against a biasing member 41 pivoted about an axis 42 on table 10. Axis 42 is laterally displaced from axes 13 and 22 and normally pressed by a source of power, such as coil spring 43, in a direction to cause the biasing member to abut against the projection 40 in such manner as to exert no torque thereon. It will be seen that when, for instance, the cam follower moves clockwise from position I to position II, the projection 40 would also tend to move clockwise. This tends to displace the projection with respect to the biasing member 41 so that instead of said projection and biasing member being in alignment, they are now out of alignment so that the biasing member engages the lower end of the projection and tends to turn the projection 40, and hence the gear 20, counter-clockwise until the projection 40 is again in alignment with the biasing member 41. In position II it will be seen by the dash lines that the member 20 has been rotated counter-clockwise through the angle α. This means that the gear 12, in addition to being rotated through the angle β is also rotated through the angle α and in a clockwise direction, that is, through the same direction as the movement of the cam follower. Thus, when the cam follower moves from position I to position II, instead of the member 12 being moved only through the angle β, it is moved through the angle α plus β to give a multiplied movement of the member 12.

The movement to the right of the central position shown in Fig. 1 operates similarly as the cam follower moves from position I to position III, that is, counter-clockwise to move member 12 counter-clockwise. It will be seen that in this position the biasing member 41 has moved the projection 40, and hence the gear 20 clockwise, and hence moved member 12 counter-clockwise to add the two movements in the same direction.

The diagram in Fig. 2 gives a simplified illustration of the theory of the invention. Thus, if the cam follower moves from position I to position III counter-clockwise through the angle β, the rotatable element 12 would ordinarily also be rotated through the angle β because elements 20, 12 and 15 move as a unit around the axis 13. However, in moving from position I to position III, the projection 40 on member 20 has also tended to rotate in a counter-clockwise direction, but this has been prevented by the biasing member 41, which causes the projection to be turned through the angle α in a clockwise direction. This causes rotation of gear 20 in a clockwise direction through angle α, which causes rotation of gear 12 in a counter-clockwise direction through the angle α, and hence gear 12 has been moved through a total of α plus β, whereas the cam follower has been moved only through the angle β. By moving the pivot 42 nearer to or further from pivot 22 and pivot 13, a greater or lesser multiplication may be obtained. Thus, as 42 is moved to position 42' nearer to pivots 22 and 13, the multiplication increases as shown by the dash line, while if the pivot 42 is moved to position 42'' further away from the pivots 13 and 22 the multiplication decreases as shown by the dot and dash line.

In accordance with the provisions of the patent statutes, I have herein described the principle and operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other equivalent means. Also, while it is designed to use the various features and elements in the combination and relations described, some of these may be altered and others omitted without interfering with the more general results outlined, and the invention extends to such use.

Having described my invention, what I desire and claim to secure by Letters Patent is:

1. In a device of the class described, a member mounted for rotation about its axis, an operating element, means for actuating said element, and means whereby movement of said element through an angular distance rotates said member through a multiple of said distance, said last named means comprising a second rotatable member geared to said first member and having its axis displaced laterally with respect thereto, said second member being mounted for movement of both translation and rotation, means whereby movement of said element through an angular distance moves said second member linearly through said distance to rotate said first member through said distance, and a source of power independent of said actuating means and adapted to be rendered effective when said second member moves linearly for rotating said second member about its axis to rotate said first member.

2. In a device of the class described, a member mounted for rotation about its axis, an operating element, means for actuating said element, and means whereby movement of said element through an angular distance rotates said member through a multiple of said distance, said last named means comprising a second rotatable member geared to said first member and having its axis displaced laterally with respect thereto, said second member being mounted for movement of both translation and rotation, means whereby movement of said element through an angular distance moves said second member

linearly through said distance to rotate said first member about its axis through said distance in a given direction, and a source of power independent of said actuating means and adapted to be rendered effective when said second member is moved linearly for rotating said second member about its axis in such direction that said first member is rotated further about its axis in said given direction.

3. In a device of the class described, a member mounted for rotation about its axis, an operating element, means for actuating said element, and means whereby movement of said element through an angular distance rotates said member through a multiple of said distance, said last named means comprising a second rotatable member geared to said first member and having its axis displaced laterally with respect thereto, said second member being mounted for movement of both translation and rotation, means whereby movement of said element through an angular distance moves said second member linearly through said distance to rotate said first member about its axis through said distance in a given direction, and a source of power independent of said actuating means and adapted to be rendered effective when said second member is moved linearly for rotating said second member about its axis in a direction opposite to said given direction whereby said first member is rotated further about its axis in said given direction.

4. In a device of the class described, a member mounted for rotation about its axis, an operating element movable about said axis, and means whereby movement of said element through an angular distance rotates said member through a multiple of said distance, said last named means comprising a second rotatable member geared to said first member and having its axis displaced laterally with respect thereto, said second member being mounted for movement of both translation and rotation, a connection between said element and said second member whereby movement of said element through an angular distance moves said second member linearly through said distance to rotate said first member about its axis through said distance in a given direction, and means rendered effective when said second member is moved linearly for rotating said second member about its axis in a direction opposite to said given direction of movement of said first member, whereby said first member is rotated further about its axis in said given direction, said last named means comprising a projection carried by said second member, a biasing device mounted for movement about a fixed axis laterally displaced from the axis of said members, and a source of power for causing said projection to maintain a fixed angular relationship with respect to said device.

5. In a device of the class described, a member mounted for rotation about its axis, an operating element movable about said axis, and means whereby movement of said element through an angular distance rotates said member through a multiple of said distance, said last named means comprising a second rotatable member geared to said first member and having its axis displaced laterally with respect thereto, said second member being mounted for movement of both translation and rotation, a connection between said element and said second member whereby movement of said element through an angular distance moves said second member linearly through said distance to rotate said first member about its axis through said distance in a given direction, and means rendered effective when said second member is moved linearly for rotating said second member about its axis in a direction opposite to said given direction of movement of said first member, whereby said first member is rotated further about its axis in said given direction, said last named means comprising a projection carried by said second gear along a diameter thereof, a biasing device mounted for movement about a fixed axis laterally displaced from the axis of said members, and a source of power for causing said projection to maintain a fixed angular relationship with respect to said device.

6. In a device of the class described, a turntable rotatable about its axis, said turntable having a member rotatably mounted thereon, an operating element carried by said turntable, a fixed cam with which said element cooperates to move said element through predetermined angular distances as said turntable rotates relative to said cam, and means whereby movement of said element through a predetermined angular distance rotates said member through a multiple of said distance, said last named means comprising a second rotatable member geared to said first member and having its axis laterally displaced with respect thereto, said second member being movable with said turntable and mounted for both translation and rotation, means whereby movement of said element through an angular distance moves said second member linearly through said distance to rotate said first member linearly through said distance to rotate said first member about its axis through said distance in a given direction, and means rendered effective when said second member is moved linearly for rotating said second member about its axis in a direction opposite to said given direction of movement of said first member, whereby said first member is rotated further about its axis in said given direction.

7. In a device of the class described, a turntable, a cam, said turntable and said cam being relatively movable, a member mounted on said turntable for rotation about the axis of the member, a cam follower pivotally mounted at one end on said turntable for movement about the axis of said member and having its other end in engagement with the cam, and means whereby movement of said follower through an angular distance rotates said member through a multiple of said distance, said last-named means comprising a second rotatable member geared to said first member and having its axis displaced laterally with respect thereto, said second member being rotatably mounted on said follower whereby movement of said follower through an angular distance moves said second member linearly through said distance to rotate said first member through said distance, and a source of power independent of the means which actuates said follower and adapted to be rendered effective when said second member moves linearly for rotating said second member about its axis to rotate said first member.

8. In a device of the class described, a turntable, a cam, said turntable and said cam being relatively movable, a member mounted on said turntable for rotation about the axis of the member, a cam follower pivotally mounted at one end on said turntable for movement about the axis of said member and having its other end in en-

gagement with the cam, and means whereby movement of said follower through an angular distance rotates said member through a multiple of said distance, said last-named means comprising a second rotatable member geared to said first member and having its axis displaced laterally with respect thereto, said second member being rotatably mounted on said follower whereby movement of said follower through an angular distance moves said second member linearly through said distance to rotate said first member through said distance, and a source of power independent of the means which actuates said follower and adapted to be rendered effective when said second member moves linearly for rotating said second member about its axis in such direction that said first member is rotated further about its axis in said given direction.

9. In a device of the class described, a turntable, a cam, said turntable and said cam being relatively movable, a member mounted on said turntable for rotation about the axis of the member, a cam follower pivotally mounted at one end on said turntable for movement about the axis of said member and having its other end in engagement with the cam, and means whereby movement of said follower through an angular distance rotates said member through a multiple of said distance, said last-named means comprising a second rotatable member geared to said first member and having its axis displaced laterally with respect thereto, said second member being rotatably mounted on said follower whereby movement of said follower through an angular distance moves said second member linearly through said distance to rotate said first member through said distance, and a source of power independent of the means which actuates said follower and adapted to be rendered effective when said second member moves linearly for rotating said second member about its axis in a direction opposite to said given direction whereby said first member is rotated further about its axis in said given direction.

LEO ROBBINS.