J. H. AUBLE.

MECHANICAL MOVEMENT.

APPLICATION FILED JULY 21, 1909.

970,163. Patented Sept. 13, 1910.

Fig. 1.

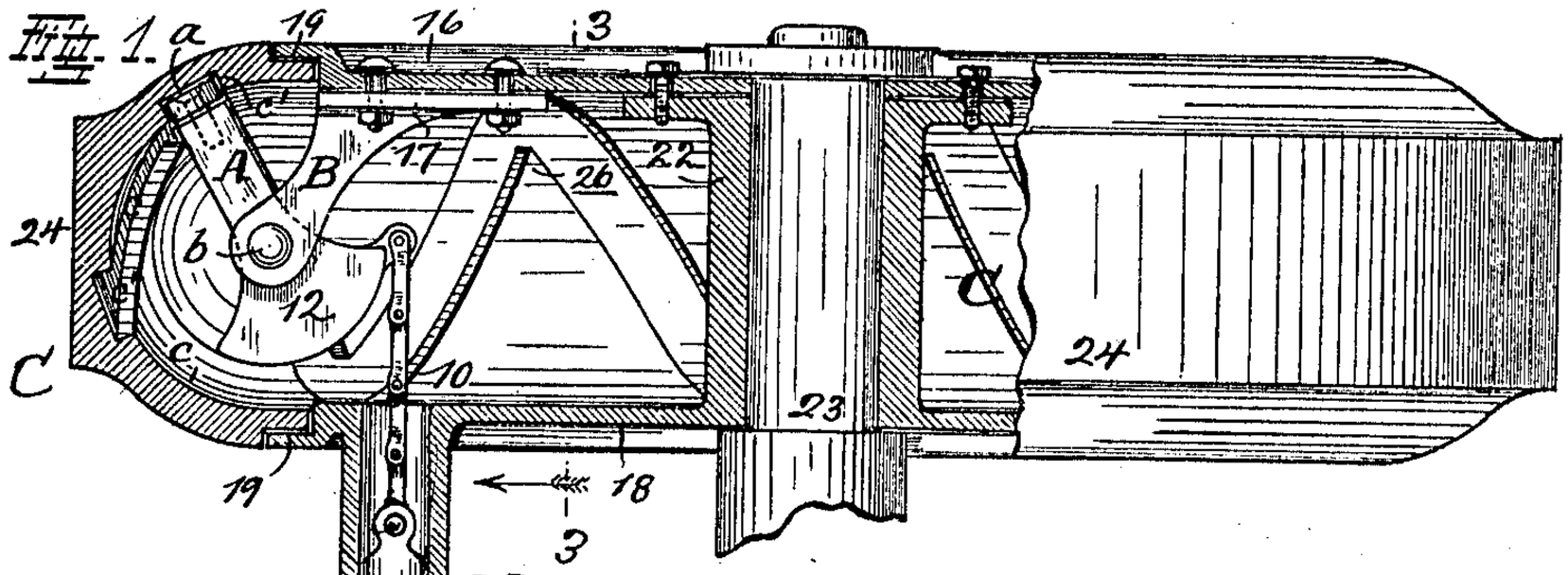


Fig. 2.

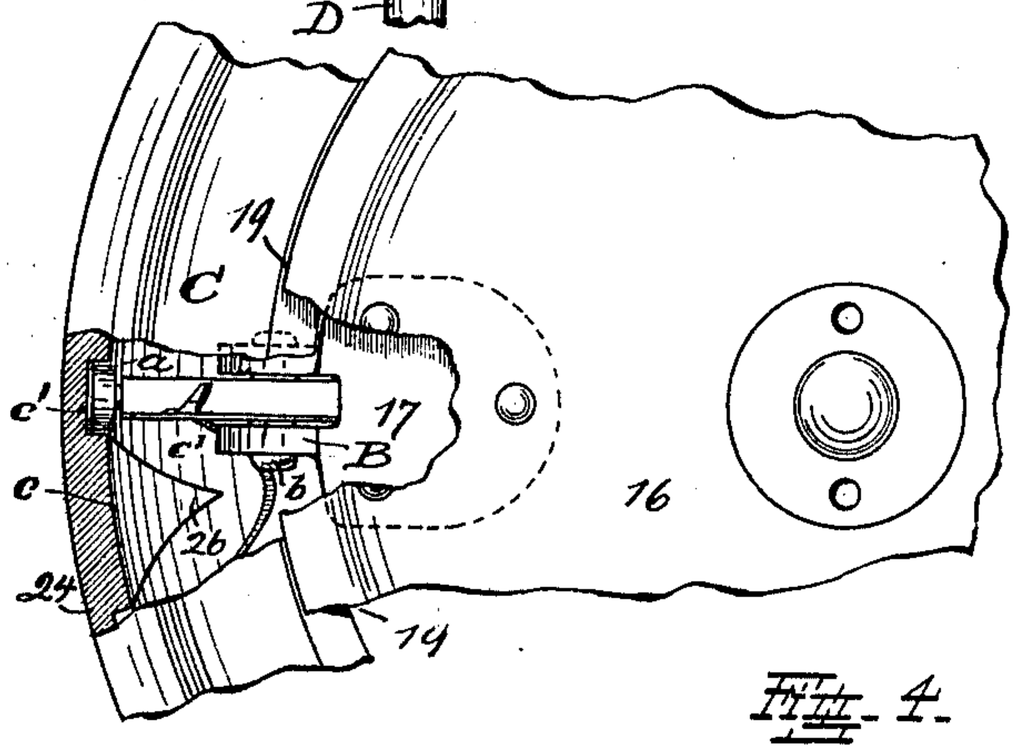


Fig. 3.

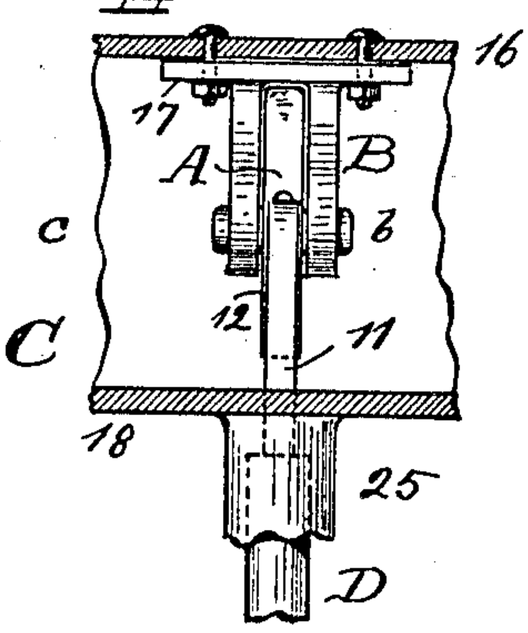


Fig. 4.

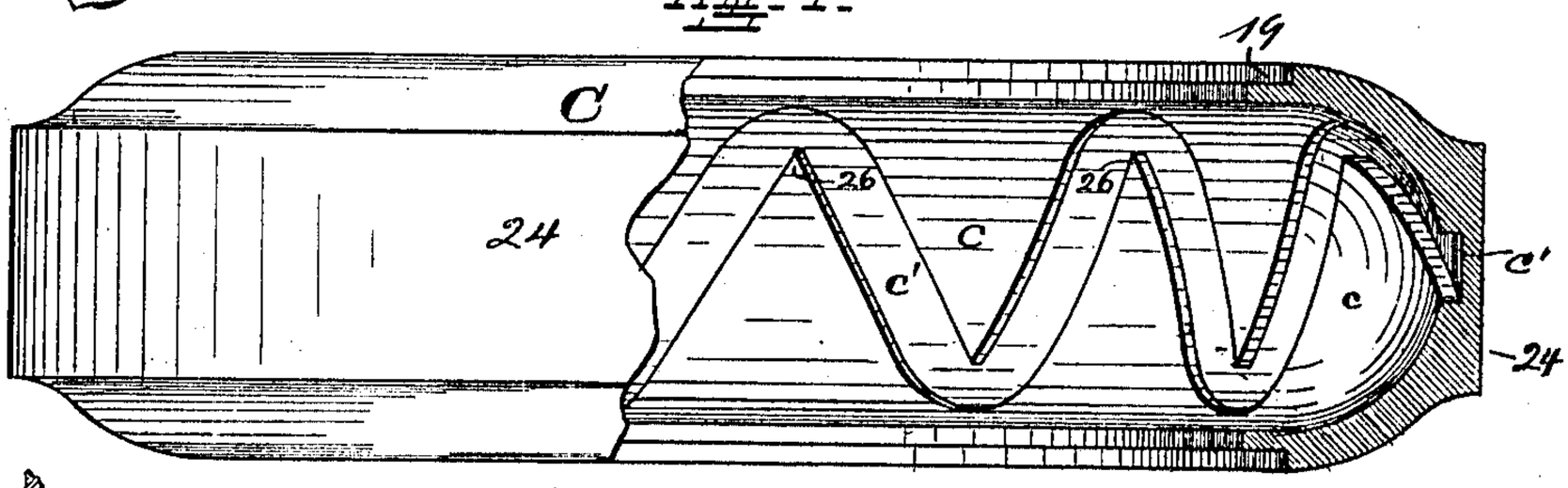


Fig. 5.

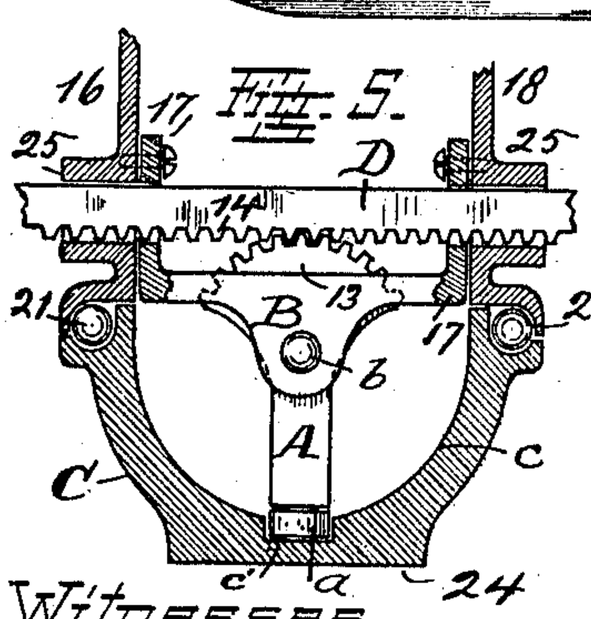
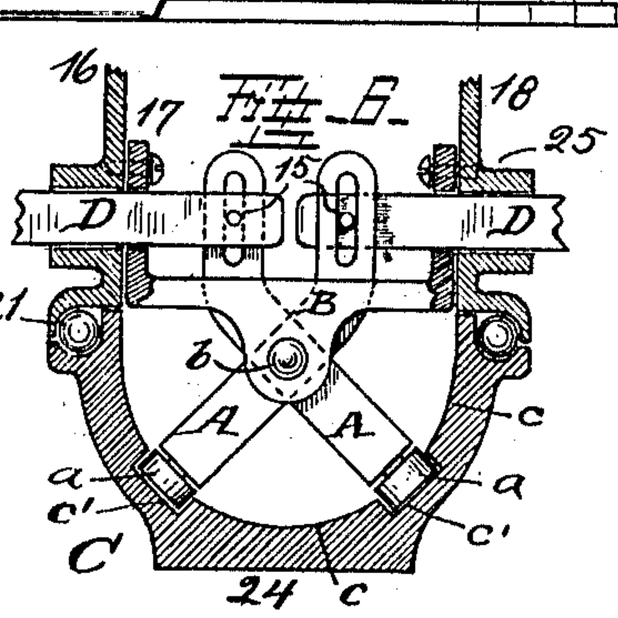


Fig. 6.



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UNITED STATES PATENT OFFICE.

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MECHANICAL MOVEMENT.

970,163. Specification of Letters Patent. **Patented Sept. 13, 1910.**

Application filed July 21, 1909. Serial No. 508,712.

To all whom it may concern:

Be it known that I, JAMES H. AUBLE, a citizen of the United States, and residing at Cincinnati, Hamilton county, State of Ohio, have invented certain new and useful Improvements in Mechanical Movements; and I do declare the following to be a full, clear, and exact description thereof, attention being called to the accompanying drawing, with the reference characters marked thereon, which forms also a part of this specification.

This invention relates to a mechanical movement whereby rotary motion is converted into reciprocatory motion.

The invention consists of the particular construction as hereinafter described and claimed and as illustrated in the accompanying drawing, in which:—

Figure 1, illustrates one form of my invention in a side-elevation partly in vertical section. Fig. 2, is a top-view of a part of this figure, portions being broken out. Fig. 3, is part of a vertical section of Fig. 1, taken on line 3—3 and viewed in the direction of the arrow. Fig. 4, is a side-elevation, partly in section of one of the complementary inter-acting members. Figs. 5 and 6, in vertical cross-sections illustrate modified constructions of my invention.

A indicates an arm, supported by a pivot *b* in a bearing B.

C is an annular rim concave transversely on its inner side as shown at *c*, the concave surface assuming substantially the shape of an internal annular groove or gutter, the bottom line of which forms part of a circle which is concentric with pivot *b*. An endless groove, forming a cam-way *c'* is provided in this concave surface and formed to pass alternately back and forth in zig-zag shape from one side of it to the other and all around the same. The free end of arm A extends into this cam-way and terminates therein, it being so fitted as to be capable of passing through and clearing the same at all points. To reduce friction, this free end of arm A is preferably formed by a roller *a*. It is obvious now, if either rim C or bearing B, with arm A is rotated, one with reference to the other, about a center coincident with the axis of rim C, and if the center of pivot *b* is located to coincide with the center of curvature of the rim taken in a plane passing at right angles through the axis about which rim C rotates, that arm A will be caused to oscillate on its pivot, because its free end is actuated by the zig-zag shaped cam-way into which it extends. There will be as many oscillations, as there are complete zig-zag turns of the cam-way from one side of the rim to the other and there being a number of them, it follows that one rotation of rim C produces a number of oscillations of arm A. This oscillating movement and the power derived therefrom may be utilized for purposes wherever conditions favor its application. It is rendered available in a practical manner by operatively connecting to it a reciprocating member D for instance, which either directly, or by other connected means may perform the useful work whatever that may be. The operative connection between arm A and member D, may be accomplished in various equivalent ways.

In Fig. 1, rim C is arranged in a horizontal plane and member D reciprocates in a vertical plane, the connection to arm A being made by means of a flexible link, which may be a chain 10 as shown in Fig. 1, or a flexible band 11 as shown in Fig. 3. Arm A is enlarged to form a segmental pulley as shown at 12 with a rim of an extent sufficient to accommodate the length of the link required in view of the stroke.

In Figs. 5 and 6, member C is vertically disposed and member D reciprocates in horizontal direction.

In Fig. 5, the operative connection between member D and arm A is by toothed gearing, arm A being provided with the segmental gear 13 which engages teeth 14 in member D.

In Fig. 6 direct connection by pins 15 is made, one of the connected members being slotted to accommodate the variation due to the motion of the oscillating member.

In Fig. 6 the possibility of using more than one arm A is shown. By supporting them in positions so spaced on the circular axis of the concave surface *c*, that their free ends may simultaneously occupy extreme positions, transversely furthest apart in the cam-way, the reciprocating members D D are caused to reciprocate in opposite directions.

In order to obtain the expected results as described, that is the reciprocatory movement of member D, it becomes necessary to

support rim C and bearing B for arm A in a manner that one may move with reference to the other as contemplated. This support must be so, that as already pointed out, the pivotal center of arm A remains at all times in the center of curvature of concave surface *c*. This condition being complied with, each member may be supported independently, or one may be supported in a fixed position and the other may be supported on it.

Bearing B may be supported on a bracket, or on a member which may assume the shape of a disk 16, the former being provided with flanges 17 for its attachment. This disk, in connection with a similar disk 18, may also serve as a support for rim C, unless the same is independently supported, the two being suitably fitted against each other for instance as indicated at 19 and in a manner to permit one to rotate with reference to the other. In Figs. 5 and 6, this support is shown in form of annular ball-bearings, balls 21 being interposed between the edges of the rim and the edges of the disks. When two of such disks are used, bearing B may be connected to both as shown in Figs. 5 and 6, thus promoting the rigidity of the structure.

The disks may be supported by means of a hub 22, from which they project and which is mounted upon a post 23. This latter may also be a shaft driven to rotate the disks and bearing B supported thereby, in case the initiation of the motion proceeds from arm A and its bearing B, rim C being supported stationary in this case. If the motion proceeds from rim C, then arm A and the means which support it are immovable with reference to the rim which is moved. This movement may be accomplished in any suitable manner, it might be a belt applied to face 24 of this rim, or this face might be in contact with a friction-wheel, or it might be provided with gear-teeth.

Means to guide the reciprocating member may be provided to form a part of the device as shown at 25. In order to have the motion of the reciprocating member uniform, and to prevent the same from moving slower at the turning points of motion, where movement in one direction changes to one in opposite direction, I shape at the turns of the cam-way that particular part of one of the sides, which in that particular place is innermost, pointed as shown at 26, so as to cause the end of arm A to turn abruptly from one part of the way into the other. The result is that the reciprocating member enters from movement in one direction upon movement in reverse direction without drag in its motion. Furthermore the sides of the cam-way should each be shaped on a true helical curve which follows like a screw-thread the various positions which the end of arm A assumes. For such purpose the opposite sides of the way are so shaped as to be always parallel with the side of the roller where they are tangent therewith at contact points diametrically opposite in the periphery thereof and in all positions of the roller within said way, whereby the end of arm A moves freely through the same and follows all the turns thereof without binding at any point. One method of forming the cam-way so that its sides have this shape is by first cutting a mutilated female screw-thread into surface *c* with a milling tool of a size equal to roller *a* and while supported on a center which would correspond to the center of pivot *b* of the device. After that the same operation would be repeated by cutting a similar mutilated thread in opposite direction and so that the mutilated or half threads last formed meet and run into the ends of the half threads first formed, thus completing the continuous zig-zag shaped cam-way. It is obvious that the sides of a way so formed will assume true helical curves so that a roller fitted in between them will pass through this way just as the tool did which produced this shape. While this illustrates the formation of the sides by describing means and a particular method of producing it, I do not limit myself to this method and I may form these ways by other methods and means.

Having described my invention, I claim as new:

1. In a mechanical movement for converting rotary motion into reciprocating motion, the combination of a circular rim having on its inner side an annular groove with a transversely concaved bottom, said groove being provided in its bottom with a cam-way which is zig-zag shaped and extends alternately from one side of the groove to the other, an arm, one end of which extends into this cam-way and a pivot on which it is supported in the space surrounded by the rim and opposite the groove with the cam-way therein in a manner that when the rim is rotated with respect to this pivot, one rotation of it produces a number of oscillations of the arm.

2. In a mechanical movement for converting rotary motion into reciprocating motion, the combination of a circular rim having on its inner side an annular groove with a transversely concaved bottom, said groove being provided in its bottom with a cam-way which is zig-zag shaped and extends from one side of the groove to the other, a support on which the rim is mounted for rotation and an arm pivotally connected to this support and extending with one of its ends into the cam-way of the groove in the inner side of the rim whereby rotation of this latter causes said arm to oscillate.

3. In a mechanical movement for converting rotary motion into reciprocating motion, the combination of a circular rim having on its inner side an annular groove with a transversely concaved bottom, said groove being provided in its bottom with a cam-way which is zig-zag shaped and extends from one side of the groove to the other, a support within the space surrounded by the rim on which it is supported for rotation and an arm pivotally connected to this support and extending with one of its ends into the cam-way of the groove in the inner side of the rim whereby rotation of this latter causes said arm to oscillate.

4. In a mechanical movement for converting rotary motion into reciprocating motion, the combination of a circular rim having on its inner side an annular groove with a transversely concaved bottom, said groove being provided in its bottom with a cam-way which is zig-zag-shaped and extends from one side of the groove to the other, a support on which the rim is mounted for rotation, an arm pivoted to this support and extending with one of its ends into the cam-way of the groove mentioned and a reciprocating member connected to the other end of this arm, the operation being so that rotation of the rim causes oscillation of the arm and linear movement of the reciprocating member on it, in a direction parallel to the axis of rotation of the rim.

5. In a mechanical movement for converting rotary motion into reciprocating motion, the combination of a circular rim having on its inner side an annular groove with a transversely concaved bottom, said groove being provided in its bottom with a cam-way which is zig-zag shaped and extends from one side of the groove to the other, a support for this rim within the space surrounded by it, a lever pivoted to this support and extending from its pivot in opposite direction, one end occupying the cam-way of the internal groove of the rim, a reciprocating member connected to the other end of this lever and means on the rim-support to guide the reciprocating-member to move parallel to the axis of rotation of the rim when this latter causes oscillation of the lever.

6. In a mechanical movement for converting rotary motion into reciprocating motion, the combination of a circular rim having on its inner side an annular groove with a transversely concaved bottom, said groove being provided in its bottom with a cam-way which is zig-zag shaped and extends from one side of the groove to the other, means on which this rim is supported for rotation, and a lever pivotally supported in the space surrounded by this rim and stationary with reference to it, one end of said lever extending into the cam-way of the groove mentioned.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

JAMES H. AUBLE.

Witnesses:
HARRY A. BARRETT,
C. SPENGEL.