Nov. 10, 1942. F. M. RODDY 2,301,642

MECHANICAL MOVEMENT

Filed July 29, 1941 2 Sheets-Sheet 1

Fig. 1.

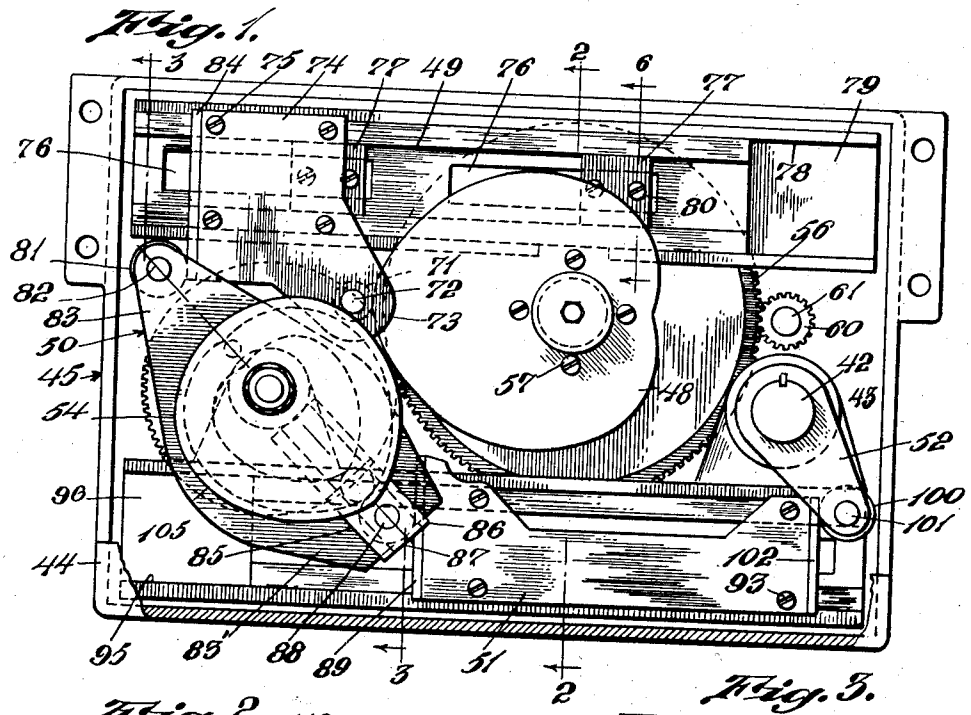


Fig. 2.

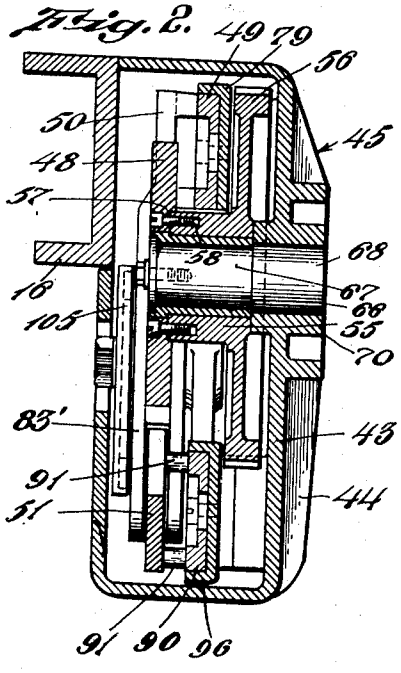
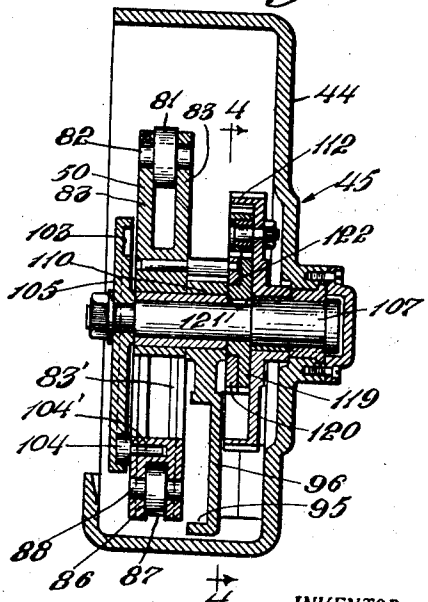


Fig. 3.



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Fig. 4.

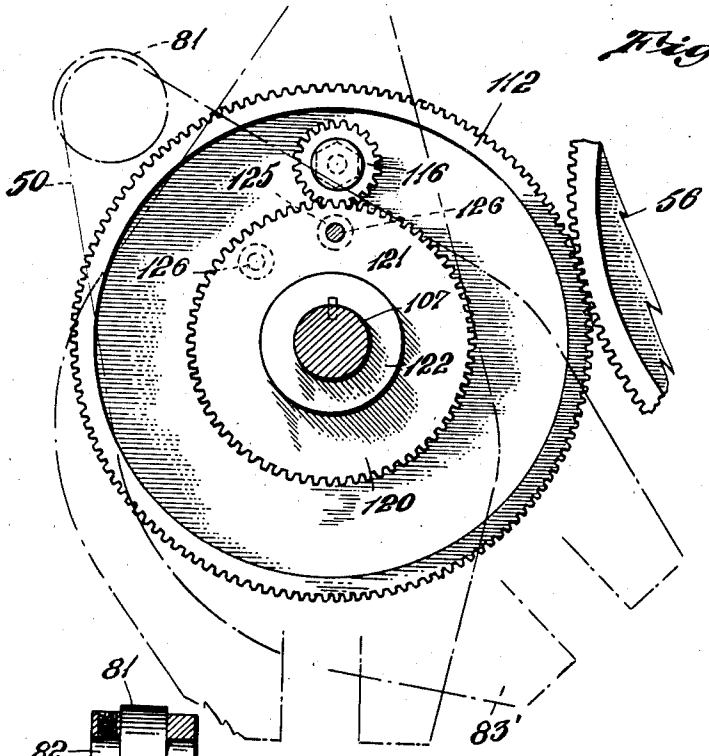


Fig. 5.

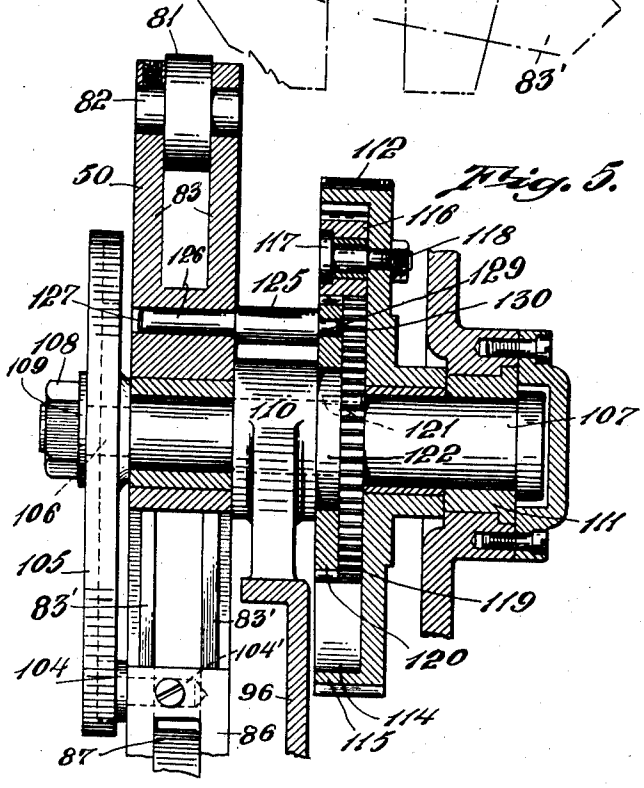
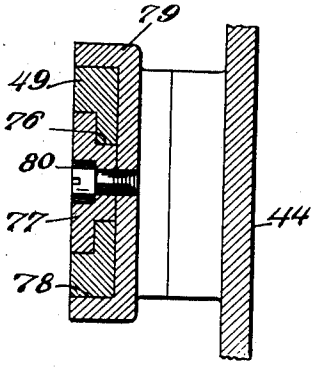


Fig. 6.



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UNITED STATES PATENT OFFICE

2,301,642

MECHANICAL MOVEMENT

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Original application February 13, 1941, Serial No. 378,745. Divided and this application July 29, 1941, Serial No. 404,454

10 Claims. (Cl. 74—55)

This invention relates to mechanical movements, and is a division from my application Serial No. 378,745 filed February 13, 1941, for Builder mechanism.

It is the main object of this invention to provide a mechanical movement for converting the rotary movement of a uniformly rotated member to oscillatory movement of a driven member the extent of vibratory movement of which will be variable and controlled in amplitude from maximum to minimum automatically and according to a predetermined cycle of operation of the rotary member.

A further object of the invention is to accomplish this result with a minimum of mechanism.

To these ends my improvements comprise features illustrated in their preferred embodiment in the accompanying drawings wherein:

Fig. 1 is a front elevational view of a mechanical movement embodying my invention and showing the main traverse cam and the "creep" or auxiliary traverse-control cam in their extreme positions of rotary movement;

Fig. 2 is a detail sectional view taken on line 2—2 of Fig. 1 showing the arrangement of a main cam, the slides, and the gearing for driving the main cam;

Fig. 3 is a detail sectional view taken on line 3—3 of Fig. 1 showing the arrangement of the "creep" cam, the rocker arm, and the planetary driver for driving the "creep" cam;

Fig. 4 is a fragmentary detail end elevational view, on enlarged scale, of a portion of the mechanism illustrated in the lower left portion of Fig. 1 with the "creep" cam removed, showing the rocker arm, in dot and dash outline, in its two extreme positions of oscillatory movement and the planetary movement, in full lines, for driving the "creep" cam;

Fig. 5 is an enlarged detail sectional view of part of the mechanism shown in Fig. 3, but with some of the parts illustrated in full outline; and

Fig. 6 is an enlarged detail transverse sectional view of the upper slide and its mounting, taken on line 6—6 of Fig. 1.

Referring to Fig. 1, the shaft 42, which is to be positively oscillated and driven by the mechanism of the present invention, is shown as being suitably journaled in the upright wall 43 of the housing 44 of the unit device generally designated by the reference numeral 45 and containing my novel mechanical movement.

The mechanism of the unit 45 comprises as the principal elements thereof a main cam 48 of heart-shaped contour which is continuously rotated at uniform speed to effect the reciprocation of a slide 49 at a uniform rate of speed, a rocker arm 50 oscillated by the slide 49 in response to its reciprocatory movements, a reciprocable transfer bar 51 connecting the rocker arm 40 to rocker lever 52 and reciprocated in response to the oscillatory movements of the rocker arm to transmit the oscillations of the same to the rocker lever 52 to effect corresponding oscillatory motion of the shaft 42 and the arm 41 thereon, and an auxiliary mechanism to control the oscillatory motion of the shaft 42 by varying the extreme limit of the stroke of the reciprocable transfer bar 51 in one direction comprising an auxiliary cam 54 oscillatable with the rocker arm 50 and also independently rotatable relative thereto whereby said cam 54 will have a motion of precession relative to the rocker arm 50 during a definite predetermined cycle of oscillations of the rocker arm for progressively varying the leverage ratio of the connection means between the rocker arm 50 and the reciprocable transfer bar 51.

As illustrated in Figs. 1 and 2, the heart cam 48 is affixed to the end of the hub 55 of the drive gear 56 in a suitable manner, as by means of the threaded studs 57 which pass through suitable openings in the cam side and have their inner ends screwed into tight engagement with the tapped holes 58 provided in the end face of the hub 55. The main cam 48 is rotated continuously at constant speed by the drive gear 56 which is driven, preferably at a relatively slow speed, by suitable mechanism (not shown).

As illustrated in Fig. 2, the gear 56 is provided with a suitable bearing sleeve 66 pressed into the hub 55 of the gear 56 for rotating of the gear about the fixed pin 67 which is nonrotatably secured in the hub 70 of the housing 44 in a suitable manner such as, for example, by means of a key or a set screw (not shown).

Referring to Figs. 1 and 2, the main cam 48 is shown with its peripheral face in an operative engagement with the periphery of the cam follower roller 71 rotatable on the pin 72 carried by the end portion of the depending arm 73 of the bracket 74 which is offset from and secured to the outer side face of the upper slide 49 near one end thereof in a suitable manner, as by machine screws 75. As shown in Figs. 1, 2, and 6, the upper slide 49 consists of a long, narrow, U-shaped plate provided with two spaced slotted openings 76 through which extend the shanks of the T-shaped blocks 77 the heads of which are accommodated within the channel por-

tion of the slide and hold the slide in the channel-way 78 of the horizontally disposed U-shaped guide member 79 for free sliding movement therein. Screws 80 secure the blocks 77 to the back wall of the channel member 79 which in turn is suitably fixed to the housing 44 of the unit 45.

In order that the reciprocatory motion of the slide 49 may be transferred to the rocker arm 50 to impart oscillatory motion thereto, I provide a hardened roller 81 which is freely rotatable on the pin 82 between and at the outer ends of the arms 83 of the rocker arm 50, and this roller engages and rolls back and forth along the surface of the hardened face plate 84 secured on one end of the bracket 74, whereby the normal uniform rotary movement of the cam 48 effects reciprocation of the slide 49 and thus, through the rolling connection of the roller 81 with the bracket 74, serves to oscillate the rocker arm 50 back and forth in response to the movement of the slide.

In order that this oscillatory motion of the rocker arm 50 will be transmitted by the transfer bar 51 to the rocker lever 52, I form the other end of the rocker arm 50 of a bifurcated construction (see Fig. 3) having spaced arms 83'; and the outer end of these arms is provided with a rectanguluar slot 85 (see Fig. 1) within which is mounted the slide block 86 which bridges the arms and has mounted therein a cam follower roller 87 freely rotatable on a pin 88. The roller 87 engages and rolls back and forth along the outer surface of a hardened face plate 89 affixed to the adjacent end of the transfer bar 51 thereby imparting reciprocating movement thereto in response to the oscillatory movements of the rocker arm as the roller 87 rolls up and down on face plate 89 during oscillatory movement of the rocker arm 50. As shown in Fig. 2, the transfer bar 51 is held offset from the U-shaped slide 90 by the spaced studs 91 provided on the back of the bar, and the bar is fixedly secured to the slide in any known manner in the art, such as by screws 93. The lower slide 90 is of similar construction to the upper slide 49 and is held in the channel-way 95 of the U-shaped guide member 96 by T-shaped blocks (not shown) whereby the slide 90 has free sliding movement in the lower guide member 96, which in turn is fixed to the housing 44.

A cam roller 100 pinned to the arm 52 by a pin 101 and freely rotatable thereon contacts the hardened sleeve 102 attached to the transfer bar 51. Thus, the longitudinal reciprocating motion of the transfer bar 51 will therefore be converted into oscillatory motion of the rocker lever 52 which in turn is keyed to and oscillates the shaft 42 and through it by means of appropriate linkage (not shown) effect reciprocatory motion of a member in a desired direction. For example in my copending application, Serial No. 378,745, above referred to, this movement is disclosed and claimed in conjunction with a winding device in a textile machine for the production of a variable and cyclic traversing motion of a ring rail wherein the vertical traverse of the rail is progressively shortened and lengthened in accordance with a predetermined law, governed by the equation of the curve employed for the "creep" cam contour, and the cycle of variable traverse of the ring rail is repeated over and over again to form the desired build of yarn on the bobbins.

It will be seen from the description of the mechanism thus far described that the main cam 48 in normal operation rotates continuously at uniform speed, and there will be produced oscillatory movement of the shaft 42 at uniform speed from one extreme extent of movement to the other with no dwell at the ends thereof when the direction of oscillation of the shaft 42 is reversed.

A further feature of this invention resides in the construction and arrangement of the mechanism for changing the amplitude or extent of oscillatory movement of the shaft 42; and for this purpose I provide means for progressively varying the extent of the stroke of the transverse bar 51 in one direction during a predetermined cycle of the operation of the cam 48. In the illustrated embodiment of the invention, I show an auxiliary cam 105 which I have termed the "creep" cam, since it is constructed and arranged to have progressive rotational movement relative to the rocker arm 50 and to vary its angular position with respect to the arm 50 by a slight amount for each cycle of swinging movement with the rocker arm 50, and I utilize this "creeping" action or progressive rotational motion of the cam 105 to progressively move the slide block 86 from one end of the slot 85 to the other end thereof. Thus, I provide in the inner face of the cam 105 a groove 103 which receives a cam follower roller 104 loosely rotatable upon the pin 104' fixed to the slide block 86. The groove 103 is made of such shape or contour as to vary the fulcrum length between the reciprocable pin 104', as it moves with the block 86, and the axis about which the cam 105 rotates, in accordance with whatever rule or law according to which the cam 105 must necessarily move to produce the desired motion of the shaft 42. It will thus be seen that by this arrangement I effect a progressively varying change in the leverage ratio of the lever arm 83' or in other words, vary the leverage distance of the line of contact of the roller 87 with respect to the transfer bar 51 by causing the slide block 86 to progressively vary its position and to move up and down in the slot 85 and thus advance or retract the roller 87 progressively to vary the outer extreme limit of the stroke of the transfer bar 51 and the slide 90 without altering the inner limit or starting position of the transfer bar 51. In other words, the slide 90 and transfer bar 51 will be moved to their maximum outward position as shown in Fig. 1, and the rocker arm 50 will assume the angularly inclined position there shown, with the upper lever arm 83 of the rocker arm 50 carrying the cam follower 81, also upwardly inclined, to the left of the figure. However, when the transfer bar 51 has been reciprocated to the left of the figure and restored to its original starting position, the rocker shaft and the rollers 81 and 87 will all lie on the same vertical line of centers. Thus, the inner or starting position of the transfer bar will always remain the same at the start and finish of each reciprocation.

In order to impart the progressive rotary or "creeping" motion of the auxiliary cam 105 during the simultaneous rocking motion of this cam and the rocker arm 50, I have provided a system of planetary gearing to turn the cam 105 whereby it will make one rotation on its own axis during the predetermined cycle of oscillations which it undergoes with the rocker arm 50. In the embodiment illustrated, the rocker arm 50 makes about 48 cycles of oscillation to each revolution of the "creep" cam 105. To this end

I mount the oscillatory "creep" cam 105 on the reduced portion 106 of the short shaft 107 and securely clamp the cam in place thereon by means of a nut 108 and a washer 109. The shaft 107 is rotatably mounted in the bearings 110 and 111 respectively integral with the channel member 96 and the housing 44 of the builder unit. Mounted intermediate of the bearings 110 and 111 is a gear 112 which has intermeshing engagement with the driving gear 56 which drives the main cam 48. Provided in the outer side face of the gear 112 is a large circular recess 114 which forms a rim 115 on this side face of the gear, and mounted on the inner wall of this recess is a pinion gear 116 which is freely rotatable on a stud 117 fixedly secured by screw threads to a threaded hole in the side wall of the gear 112 and locked in place by means of a nut 118 on the projecting threaded end of the stud. The pinion 116 has intermeshing engagement with a pair of gears 119 and 120, which gears are of substantially equal width, and their combined width substantially equals that of the pinion 116. As shown in Fig. 3, the gear 119 is keyed to the shaft 107 by means of a key 121, and this gear has a hub 122 on which is loosely mounted the other gear 120. The gear 120, however, oscillates with the rocker arm 50; and to attain this result, a pin 125 of stepped formation extends between the rocker arm 50 and the gear 114 and is connected to the rocker arm by the reduced end portion 126 which is received in an opening 128 in the rocker arm 50. The other end portion of the pin 125 is of more reduced size than the end portion 126 and forms a small short cylindrical plug 129 which is inserted within a hole 130 formed in the side face of the gear 120. Thus, the pin 125 serves to bridge the gap between the rocker arm 50 and the gear 120 to couple these parts together for oscillatory motion in unison. The gears 119 and 120, while of equal pitch diameter, differ, however, in their respective number of teeth, the gear 120 having one more or one less tooth than the gear 119.

In the planetary gear system just described, it will be observed that the motion of the gear 119 is dependent upon the revolving motion of the gear 112 and the oscillatory motion of the gear 120, and that the gear 119 will oscillate back and forth with the rocker arm 50 and will at the same time progressively advance or "creep" around the reduced portion 106 of the shaft 107 and through relative to the rocker arm 50 because of the different number of teeth present in the gears 119 and 120. Since the gear 119 and the cam 105 are both keyed to the shaft 107 the "creep" cam 105 will therefore participate in exactly the same movement as the gear 119. If desired, it will be obvious that different increments of "creepage" of the oscillatory cam 105 may be obtained as desired by providing various desired tooth differences in the number of teeth on the gears 119 and 120.

I claim:

1. A mechanical movement comprising a movable main cam, a first slide, a cam follower movable with said first slide operatively engaging said main cam to reciprocate the said slide, a rockable member to be oscillated by said first slide, a second slide, a pair of rollers rotatably mounted on said rockable member, one of said rollers having its axis at a fixed distance from the pivot axis of said rockable member and being in operative engagement with said slide, and the other roller being adjustable and movable toward and from the pivot axis of the said rockable member for varying the distance between the axis of the adjustable roller and the pivot axis of the rockable member, and also being operatively engageable with said second slide in all the adjusted positions of the adjustable roller, in combination with means oscillatable with said rockable member and also having independent movement relative thereto during the oscillatory motion of said rockable member to effect progressive adjusting movement of said adjustable roller on said rockable member into different adjusted positions at varied distances relative to the pivot axis from maximum to minimum positions, and vice versa, which are repeated for a definite cycle of oscillations of said rockable member.

2. A mechanical movement comprising a movable main cam, a first slide, a cam follower movable with said first slide operatively engaging said main cam to reciprocate the said slide, a rockable member to be oscillated by said first slide, a second slide, a pair of rollers rotatably mounted on said rockable member, one of said rollers having its axis at a fixed distance from the pivot axis of said rockable member and being in operative engagement with said slide, and the other roller being adjustable and movable toward and from the pivot axis of the said rockable member for varying the distance between the axis of the adjustable roller and the pivot axis of the rockable member, and also being operatively engageable with said second slide in all the adjusted positions of the adjustable roller, in combination with an auxiliary cam oscillatable with said rockable member and also having independent rotary movement relative thereto during the oscillatory movement of said rockable member to effect progressive adjusting movement of said adjustable roller on said rockable member into different adjusted positions at varied distances relative to the pivot axis from maximum to minimum positions, and vice versa, which are repeated for a definite cycle of oscillations of said rockable member, and means including planetary gearing for rotating said auxiliary cam one complete revolution for a cycle of a predetermined oscillations of said rockable member.

3. A mechanical movement comprising a rotatable main cam, a rockable member, reciprocable connector means driven by said main cam operatively arranged to impart uniform oscillatory motion to said rockable member, an auxiliary cam mounted to be oscillatable bodily with said rockable member and to be rotated relative thereto, means to rotate said auxiliary cam to impart a motion of precession thereto relative to said rockable member, a cam follower mounted for reciprocation on said rockable member and to be moved by said auxiliary cam into different adjusted positions to vary the effective leverage of said rockable member, a shaft to be oscillated, a lever fixedly secured to said shaft, a reciprocable connector member driven by said cam follower and operatively connected to said lever for imparting oscillatory motion of varying amplitude to said lever and the shaft.

4. A mechanical movement comprising a rotatable heart cam, a rockable member having an arm formed with a long narrow opening therethrough, reciprocable connector means driven by said heart cam operatively arranged to impart uniform oscillatory motion to said rockable member, an auxiliary cam mounted to be oscillatable bodily with said rockable member and to be rotated relative thereto, means to rotate said

auxiliary cam to impart a motion of precession thereto relative to said rockable member, a cam roller mounted in the opening in said arm to be reciprocated therein relative to said rockable member and to be moved by said auxiliary cam into different adjusted positions to vary the effective leverage of said rockable member, a shaft to be oscillated, a lever fixedly secured to said shaft, a reciprocable connector member driven by said cam roller and operatively connected to said lever for imparting oscillatory motion of varying amplitude to said lever and the shaft, said reciprocable connector member having outward movement of variable extent corresponding to the changes in leverage of said rockable member, the inner position of said connector member being the same at all times.

5. A mechanical movement comprising a shaft to be oscillated, a reciprocable member, a guide for said reciprocable member, movable connections from one end of said reciprocable member to said shaft, a rockable member mounted to swing on a pivotal axis, means to uniformly oscillate said rockable member on its pivot, a connection member from said rockable member to the other end of said reciprocable member, a support on which said connection member is mounted reciprocable on said rockable member toward and from the pivotal axis of the rockable member, and means to reciprocate said support repeatedly on said rockable member to progressively move said connection member first in one direction and then in the opposite direction relative to the pivotal axis of the rockable member in accordance with a predetermined cycle of oscillation of said rockable member, thereby alternately shortening and lengthening the effective leverage of said connection element with respect to said reciprocable member.

6. A mechanical movement comprising a shaft to be oscillated, a reciprocable member, a guide for said reciprocable member, movable connections from one end of said reciprocable member to said shaft, a rockable member mounted to swing on a pivotal axis, means to uniformly oscillate said rockable member on its pivot, a connection member from said rockable member to the other end of said reciprocable member, a block on which said connection member is mounted, guideways on said rockable member in which guideways said block is mounted for reciprocating movement toward and from the pivotal axis of the rockable member, and means to reciprocate said block repeatedly on said rockable member to progressively move said connection member first in one direction and then in the opposite direction relative to the pivotal axis of the rockable member in accordance with a predetermined cycle of oscillation of said rockable member, thereby alternately shortening and lengthening the effective leverage of said connection element with respect to said reciprocable member.

7. A mechanical movement comprising a shaft to be oscillated, a reciprocable member, a guide for said reciprocable member, movable connections from one end of said reciprocable member to said shaft, a rockable member mounted to swing on a pivotal axis, means to uniformly oscillate said rockable member on its pivot, a connection member from said rockable member to the other end of said reciprocable member, a block on which said connection member is mounted, guideways on said rockable member in which guideways said block is mounted for reciprocating movement toward and from the pivotal axis of the rockable member, a cam to reciprocate said block repeatedly in said guideways, said cam being mounted on said rockable member for swinging movement bodily therewith and for rotary movement relative thereto, and means to slowly rotate said cam during swinging movement of said rockable member to cause said block and the connection member thereon to be given one complete reciprocation during a predetermined cycle of complete oscillation of the rockable member thereby progressively shortening and lengthening the effective leverage of said connection element with respect to said reciprocable member.

8. The combination in a mechanical movement as set forth in claim 7 in which the cam has progressive rotational movement on said rockable member and makes one complete revolution relative thereto for a predetermined cycle of complete oscillation of the rockable member.

9. The combination in a mechanical movement as set forth in claim 7 in which the inner limit of travel of said reciprocable member remains fixed and unaffected by the variations in leverage distances of the block and the change in the extent of the successive movements of said reciprocable member.

10. The combination in a mechanical movement as set forth in claim 7 in which planetary gearing is provided for imparting progressive rotary movement of said cam whereby the cam will make one complete revolution for a predetermined cycle of complete oscillation of said rockable member.

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