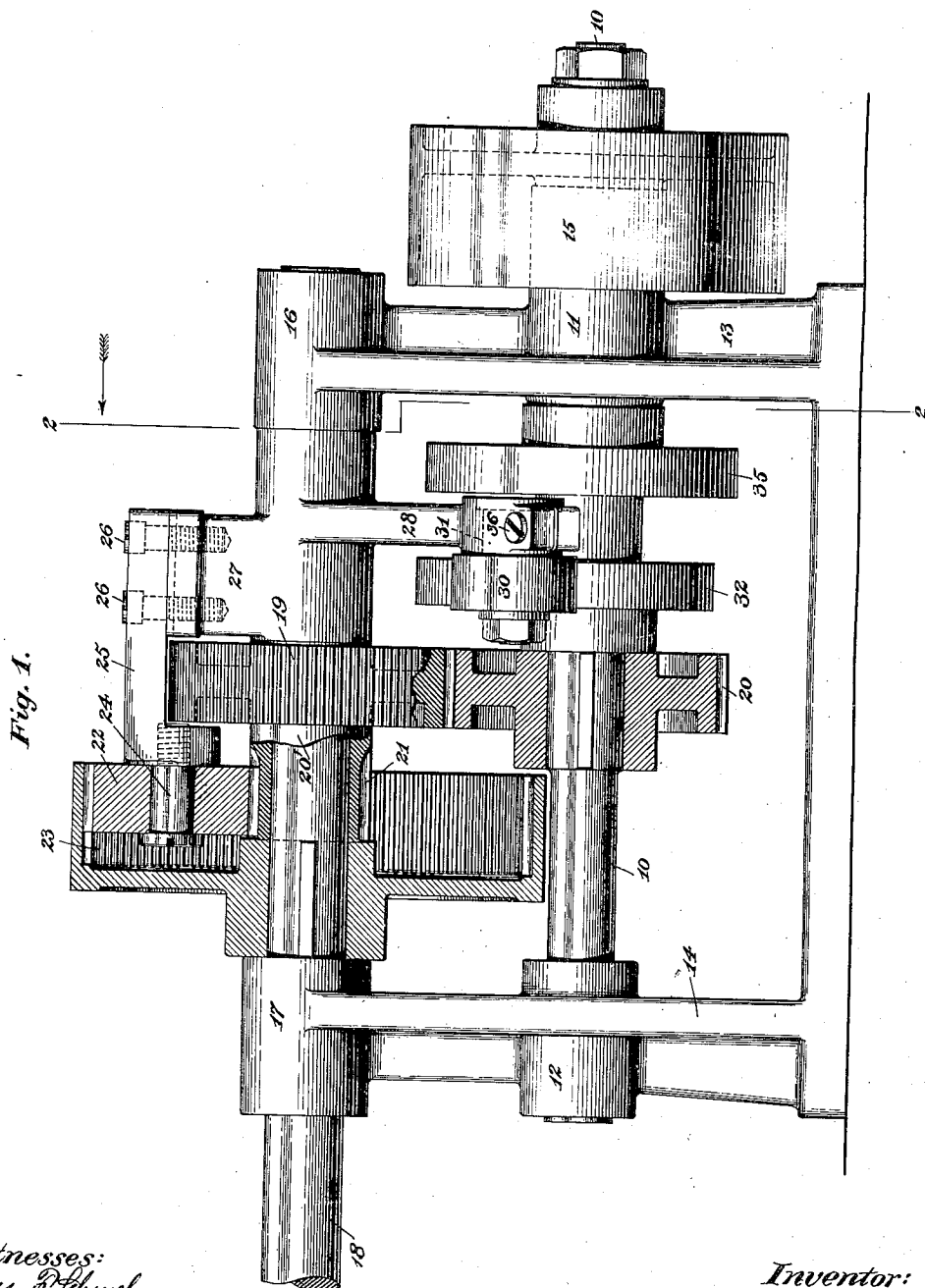


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MECHANICAL MOVEMENT.
APPLICATION FILED APR. 19, 1900.

3 SHEETS—SHEET 1.



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Fig. 3.

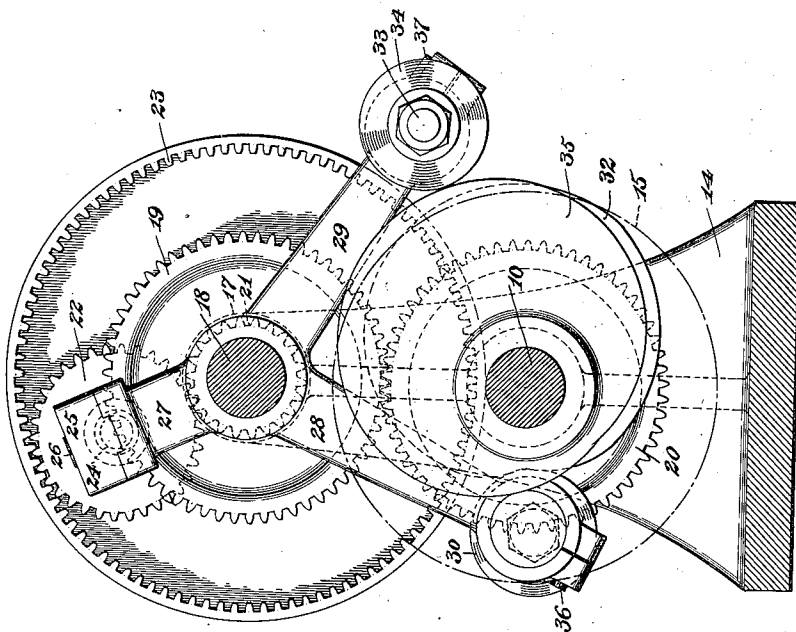
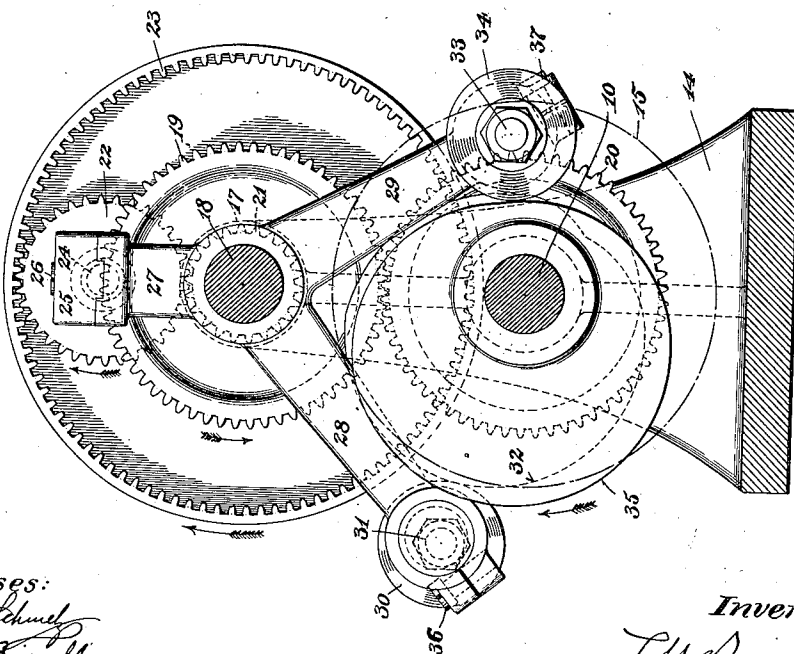


Fig. 2.



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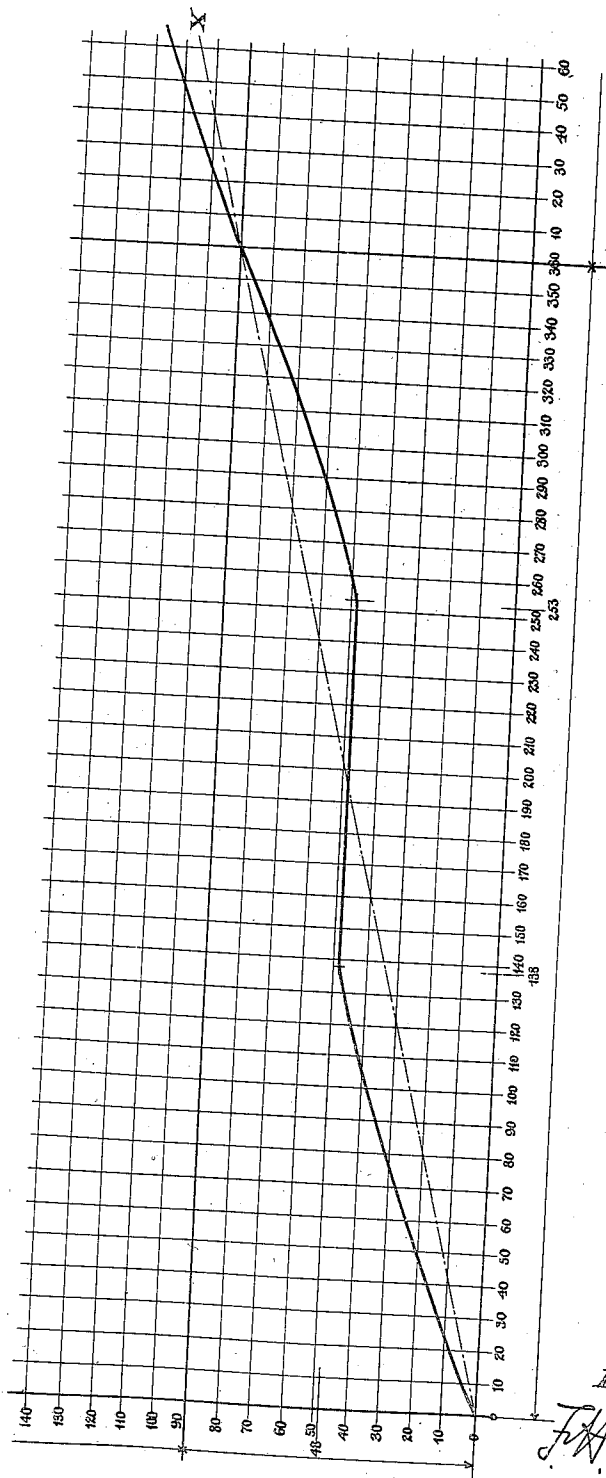
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3 SHEETS—SHEET 3.

Fig. 4.



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UNITED STATES PATENT OFFICE.

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MECHANICAL MOVEMENT.

No. 841,443.

Specification of Letters Patent.

Patented Jan. 15, 1907.

Application filed April 19, 1900. Serial No. 13,470.

To all whom it may concern:

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Mechanical Movements, of which the following is a specification.

This invention relates to mechanical movements; and it has for its object the provision of an improved organization of devices or elements whereby the movement imparted to the driving member of the mechanism may be converted into a variable movement of the driven member.

My invention includes as one of its features a movement-transmitter, the particular function of which is not only to serve as an intermediate between the driving and driven members of the mechanism, but to cause the movement of the driven member to be of a variable nature relative to that of the driving member, the transmitter being under the control of an actuator, which may be operatively connected with either the driving member or the driven member or may constitute an active element of some other mechanism.

In order clearly to illustrate my invention in the form of a self-contained mechanism of comparatively simple construction and to represent an embodiment thereof in its broader aspects as regards the possible variability in the character of the motion impartible to the driven member, the transmitter-actuator is represented in the accompanying drawings as being a cam, which may be mounted, as shown, directly on what I shall hereinafter designate as the "driving" member of the device, although the relation of the driving and driven members as to their respective functions may be reversed. The driving member is shown as a shaft the movement of which is transferred through a series of gears to a transmitter and by it to another shaft (designated herein as the "driven" member) in such a manner that each complete rotation of the driving member will produce a predetermined variable movement of the driven member, the character of which movements relative to that of the driving member depends upon the configuration of the transmitter-actuator.

In the drawings accompanying and forming part of this specification, Figure 1 is a sectional side elevation of a mechanism embodying my invention. Fig. 2 is a section of

the same on line 2 2, Fig. 1. Fig. 3 is a similar view representing the parts in another position, and Fig. 4 is a chart illustrating the manner in which the driven member is operated from the driving member and shows the resultant line of such movement.

Similar characters designate like parts in the different figures of the drawings.

In the drawings, 10 designates the driving member or shaft, journaled in bearings 11 and 12 in the uprights 13 and 14, respectively, and having mounted at one end thereof a pulley 15, to which rotary motion may be imparted from any convenient source of power by a belt. (Not shown.)

Journaled in bearings 16 and 17 in uprights 13 and 14, respectively, is a shaft 18, which in this case constitutes the driven member of the mechanism and supports a gear 19, in mesh with a gear 20, conveniently made of the same size as the gear 19 and mounted on the shaft 10, above mentioned. The gear 19 is secured to or forms a part of the sleeve 20', which is loosely held upon the shaft 18 and is provided near one end thereof with gear-teeth 21, forming a pinion the rotary movement of which is transferred through a differential train comprising a transmitter or intermediate 22 and an internal gear 23 to the shaft 18, the latter gear being keyed to the shaft 18 and in the present embodiment of such a size relative to the pinion 21 as to have in comparison thereto a ratio of four to one, so that four rotations of the pinion will be required to cause one rotation of the internal gear 23.

In order to produce a variable movement of the internal gear 23, the intermediate 22, constituting, as previously stated, one element of a differential train, is mounted to swing to and fro in the annular space between the pinion 21 and the internal gear 23, being journaled in the present construction upon a stud 24, secured to an overhanging arm 25, fastened by screws 26 to a rocker 27, said rocker being adapted for oscillation about the axis of the shaft 18, and thus being operable for causing an advancing and retreating movement of the stud 24, and with it the intermediate 22, as will be readily understood.

It is evident that when the axis of the intermediate 22 is held stationary the internal gear 23 will be rotated by the pinion 21 tooth for tooth. When the axis of said intermediate, however, is caused to follow an arc-

shaped path around the axis of shaft 18, an increased or decreased proportionate movement of the gear 23 relative to the pinion 21 results, dependent upon the direction in which the intermediate is swung. For the purpose of shifting the axis of said intermediate the rocker 27, above mentioned, is provided, in the present organization of constructive details, with arms 28 and 29, the former of which carries a roller 30, journaled on a stud 31, and is in engagement with an actuator or cam, such as 32, while the arm 29 has a stud 33, carrying a roller 34 in engagement with a cam, such as 35, said cams being preferably so constructed and coacting in such a manner that while they serve to oscillate the differential train to and fro each also performs the function of preserving the contact between the other cam and its roller during each rotation of the shaft 10.

Each of the studs 31 and 33 may have an eccentric portion whereby the roller thereon may be adjusted into close contact with its particular cam as for taking up wear and also, if necessary, and by a proper manipulation of both eccentric portions for slightly adjusting the position of the rocker 27, and hence the position of the intermediate 22. The studs 31 and 33 are also advantageously adjustably held on the arms 28 and 29, the latter having their ends divided, as clearly shown in Figs. 1, 2, and 3, said divided ends being drawn together to bind the studs by screws 36 and 37, respectively.

By the employment of two cams, as described, a positively-controlled movement is obtained, the driven member being at all times under absolute and perfect control, whereby any overthrow of the same is prevented.

The movement of the rocker is of course controlled by the shape of the rocker-actuator, and by means of an actuator of the proper configuration the driven member may have imparted to it intermittent movements of a variable nature, as may be required in any particular case, while each rotation of the driving member will result in the advancement of the driven member by an amount equal to one-fourth of a rotation, provided the ratio of gearing, as above described and shown in the drawings, is maintained.

In the chart, (shown in Fig. 4,) which is a velocity and movement diagram for a certain definite configuration of cam-surfaces chosen for the purpose of illustration and description, the horizontal base-line is divided to represent the number of degrees of rotation of the driving member or of the pinion 21, which is driven from the driving member by one-to-one gearing, and therefore makes one rotation for each rotation of the driving-shaft. The internal gear 23 is driven from this pinion by the transmitter or intermediate 22, but at a ratio of one to four—in other

words, for each movement of three hundred and sixty degrees of the pinion there will here be only ninety degrees of movement of the internal gear. It is therefore evident that while, as represented in the chart, the base-line is divided to indicate three hundred and sixty degrees (representing one rotation of the pinion) the vertical line at one end thereof should represent the corresponding ninety-degree movement of the internal gear, and the line indicating the resultant angular movement of the internal gear during one rotation of the pinion shows that the accelerated movement of the internal gear takes place only during certain periods of the rotation of the pinion, the extent and location of such periods being determined graphically, experimentally, or in any other desired manner and the results plotted on the diagram—as, for instance, as follows: Reading from the left end of the base-line the pinion advances one hundred and thirty-eight degrees, and during such travel the internal gear will have, as the device is here proportioned, an angular movement of forty-eight degrees, (to be read on a vertical line.) On the succeeding movement of the pinion between the last-mentioned point on the horizontal line and a determined point, here found to be the degree-point “253,” the resultant line of movement runs in parallelism with the base-line and without any rise vertically, thereby indicating that between the degree-points “138” and “253” no advancing angular movement of the internal gear takes place, or, in other words, that said gear is substantially at a standstill. Again, starting from the last-mentioned point “253” on the horizontal line and up to the last degree of rotation of the pinion the resultant line indicates that a further advancing movement of the internal gear takes place, the amount of such angular movement being again read on the vertical line between the degree-marks “48” and “90” thereof, the proportional movements of the pinion and the internal gear, respectively, being thus clearly shown in the chart. It will be evident, since the actuator-cams have now made one complete rotation, that if the movement of the pinion is continued for another one hundred and thirty-eight degrees a proportionate movement of the internal gear, and consequently the same rise of the resultant line that is shown in the beginning of the diagram, will result, the second rotation of the pinion affording a line on the velocity and movement diagram for the angular movement of the internal gear through the next ninety degrees identical with that already described, which relative movement will be repeated through the successive rotations of the driving-pinion.

The horizontal portion of the resultant line is due to the swinging of the transmitter or intermediate 22 bodily around the axis of

the shaft 18, which action may be explained as follows: When the intermediate is held with its axis stationary, it is evident that during a regular rotary movement of the pinion for three hundred and sixty degrees a regular rotary movement of the internal gear for ninety degrees will take place, the resultant rising line of which will of course be straight, as indicated by the dotted line on the chart. On the other hand, it is evident that when the intermediate is permitted to travel freely and no obstacle is presented to its revolution around the axis of the shaft 18 the rotation of the latter will have no effect whatever on the internal gear, which will therefore remain stationary, such an idle period of the internal gear resulting in this case from the swinging movement of the intermediate 22 about the axis of the shaft 18 during that particular period and in the manner above explained through the operation of the properly-shaped actuator or cam on the rocker. Hence it follows that, according to the shape of the cam operating on said rocker and intermediate, a constant advancing rotary motion of the pinion may be transformed into an irregular, advancing, or even into a retreating movement of the internal gear, it being evident, however, that the resultant ratio of movement of pinion and internal gear under the given relations will always be the same—that is, a rotation of three hundred and sixty degrees of the pinion will produce a rotation of ninety degrees of the internal gear.

Having described my invention, I claim—

1. The combination of a driving and a driven member, relatively fixed supports on which said members are mounted with their respective axes of rotation disposed substantially parallel to each other, an intermediate for transmitting motion to the driven member, means between said intermediate and driving member for transmitting motion to the intermediate, and cam-actuated means controlled by the driving member for moving the intermediate to and fro while in its operative position.

2. The combination of a driving and a driven member, relatively fixed supports on which said members are mounted with their respective axes of rotation disposed substantially parallel to each other, an intermediate in mesh with the driven member, gearing between said intermediate and driving member for imparting motion to said intermediate, cam mechanism mounted on said driving member, and means actuated thereby for moving the intermediate to and fro.

3. The combination of a driving and a driven member, relatively fixed supports on which said members are mounted with their respective axes of rotation disposed substantially parallel to each other, an intermediate driven from the driving member and through

which motion is transmitted to the driven member, and cam-controlled mechanism for moving the intermediate to and fro in a plane parallel with the plane of movement of the driven member.

4. The combination of a driving and a driven member, relatively fixed supports on which said members are mounted with their respective axes of rotation disposed substantially parallel to each other, an intermediate for transmitting motion to the driven member, means between said intermediate and driving member for imparting motion to the former, and a cam-actuated rocker for moving the intermediate to and fro in the plane of movement imparted to the driven member.

5. The combination of a driving-gear and a driven gear having their respective axes of rotation disposed substantially parallel to each other, relatively fixed supports for said gears, an intermediate driven from the driving-gear and in engagement with the driven gear, and cam-actuated means controlled by the driving-gear for moving the intermediate to and fro.

6. The combination of a driving-shaft, a gear fixed thereto, a driven shaft, an internal gear fast thereon, a gear in mesh with the gear on the driving-shaft a pinion carried thereby, an intermediate in mesh with said pinion and said driven gear, a rocker upon which the intermediate is mounted, and an actuator for oscillating the rocker to and fro.

7. The combination, with driving and driven members and relatively fixed supports in which said members are mounted, of an intermediate between said members; means for imparting motion to said intermediate a rocker supporting said intermediate and movable about the axis of one of said members; and a pair of actuators controlling the movements of the rocker in opposite directions.

8. The combination, with a driving member, a gear mounted thereon, a driven member, and a gear mounted thereon, of an intermediate between said gears; gearing in mesh with said intermediate and driving member for imparting motion to the intermediate a rocker supporting said intermediate and pivoted concentrically with one of said members; and a rocker-actuator carried by the other member.

9. The combination, with a driving member, a driven member, and relatively fixed supports in which said members are mounted, of an intermediate between said members; means for imparting motion to said intermediate from said driving member, a rocker supporting said intermediate and having a pair of actuating-arms; and means for engaging said arms at opposite sides and positively controlling the movement of the rocker.

10. The combination, with a driving mem-

ber and with a driven member, of an intermediate between said members; means for imparting motion to said intermediate from said driving member, a rocker supporting
 5 said intermediate and having a pair of arms disposed on opposite sides of the driving member; and means carried by the driving member and engaging said arms at all points in the movement thereof.

10 11. The combination, with a driving member and with a driven member, of an intermediate between said members; means for imparting motion to said intermediate from said driving member, a rocker supporting
 15 said intermediate and having a pair of arms disposed on opposite sides of the driving member; and a pair of cams carried by the driving member and engaging said arms for positively governing the movement of said
 20 rocker at all points therein.

12. The combination with a driving member and a driven member and relatively fixed supports in which the driver and the driven member are mounted, of an intermediate
 25 driven from said driving member; a rocker supporting said intermediate and having a pair of arms disposed on opposite sides of the driving member; a pair of cam-rollers mounted on said arms; and a pair of cams carried by
 30 the driving member and engaging with said rollers for actuating said rocker and said intermediate.

13. The combination with a driving member and a driven member, of an intermediate
 35 driven from said driving member; a rocker supporting said intermediate and having a pair of arms disposed on opposite sides of the driving member; a pair of adjustable cam-rollers mounted on said arms; and a pair of
 40 cams carried by the driving member and engaging with said rollers for actuating said rocker and said intermediate.

14. The combination with a driving member and a driven member, of an intermediate
 45 driven from said driving member; a rocker supporting said intermediate and having a pair of arms disposed on opposite sides of the driving member; a pair of cam-rollers eccentrically mounted on said arms; and a pair of
 50 cams carried by the driving member and engaging with said rollers for actuating said rocker and said intermediate.

15. The combination with a driving-shaft, a gear-wheel fast upon it, of a driven shaft, a
 55 larger gear-wheel fast upon it, a gear in mesh with the gear on the driving-shaft and carrying a pinion, and a gear between the said pinion and the gear on the driven shaft; and means to rotate the said gear about the axis
 60 of said pinion.

16. The combination of a driving and a driven member, a gear fast on each, one of said gears having greater diameter than the other, a gear of a diameter equal to that of

the smaller of said gears and in mesh there- 65
 with, a pinion fast therewith, a gear in mesh with said pinion and the larger of said gears, and means to reciprocate the gear in mesh with the pinion to neutralize the drive and to
 70 accelerate the same.

17. The combination of a driving and a driven member, with a pair of cams carried by one of them and having oppositely-disposed cam-faces, a pair of arms disposed on
 75 opposite sides of said cams and carried by the other of said members.

18. The combination with a driving and a driven member, of a pair of cams carried by one of said members, said cams having oppositely-disposed cam-faces, a pair of arms disposed
 80 on opposite sides of said cams and carried by the other of said members, and rollers eccentrically mounted on said arms for engaging said cams.

19. The combination with a driving and a 85
 driven member, of a pair of cams carried by one of them, a pair of arms carried by the other of them and disposed on opposite sides of said cams, and adjustable rolls on said
 90 arms for contacting with the cams.

20. In a mechanical movement the combination with a driven shaft of an internal gear fast thereon, a pinion loose on said shaft, a
 95 gear-wheel in mesh with said pinion and said internal gear, a gear-wheel fast with said pinion, a driving-shaft, a gear carried thereby and in mesh with said last-mentioned gear, a pair of cams upon said driving-shaft, and means connected to said intermediate gear
 100 and controlled by said cams for rocking the same about said pinion.

21. The combination of a driving-gear and a driven gear, a pair of shafts supported in parallelism and each carrying one of said
 105 gears, an intermediate driven from the driving gear and in engagement with the driven gear, a rocker on which said intermediate is mounted, and an actuator comprising cam mechanism carried by the driving-shaft for
 110 oscillating the rocker to and fro.

22. The combination of a driving-gear and a driven gear, a pair of shafts supported in parallelism and each carrying one of said
 115 gears, an intermediate driven from the driving-gear and in engagement with the driven gear, a rocker on which said intermediate is mounted, and an actuator comprising cam mechanism carried by the driving-shaft for
 120 oscillating the rocker to and fro and formed to alternately neutralize the drive and accelerate the same.

23. The combination of a driving and a driven shaft, a gear carried by each of said
 125 shafts, an intermediate between said gears and in mesh with one of them and driven from the other, a rocker supporting said intermediate and movable about the axis of one of said shafts, and an actuator carried by

the other of said shafts and comprising cam mechanism for controlling the movements of said rocker.

24. The combination of a driving-shaft, a driven shaft in parallelism therewith, a gear mounted on each of said shafts, a gear in mesh with the driving-gear and a gear rotatable therewith, an intermediate in mesh with said last-mentioned gear and with the driven gear, a rocker, and cam mechanism carried by the driving-shaft for actuating said rocker.

25. The combination of a driving-shaft, a driven shaft in parallelism therewith, a gear mounted on each of said shafts, a gear in mesh with the driving-gear and a gear rotatable therewith, an intermediate in mesh with said last-mentioned gear and with the driven gear, a rocker movable on the driven shaft, and cam mechanism carried by the driving-shaft for actuating said rocker.

26. The combination of a driving-shaft, a driven shaft in parallelism therewith, a gear mounted on each of said shafts, a gear in mesh with the driving-gear and a gear rotatable therewith, an intermediate in mesh with said last-mentioned gear and with the driven gear, a rocker supported in axial alinement with said pair of rotatable gears, and cam mechanism carried by the driving-shaft for actuating said rocker.

27. The combination of a driving-shaft, a driven shaft in parallelism therewith, a gear carried by each of said shafts, a pinion mounted on the driven shaft, a gear for transmitting motion from said driving-gear to said pinion, an intermediate for transmitting motion from said pinion to said driven gear, means for rolling the transmitter back and

forth over said pinion while in mesh therewith and comprising a rocker and cam mechanism, the latter carried by the driving-shaft.

28. The combination of a driving-gear and a driven gear supported with their axes in parallelism, an intermediate driven from the driving-gear and in mesh with the driven gear, a rocker carrying said intermediate, and cam mechanism supported in axial alinement with the driving-gear for actuating said rocker.

29. The combination of a driving-gear and a driven gear supported with their axes in parallelism, an intermediate driven from the driving-gear and in mesh with the driven gear, a rocker carrying said intermediate and supported in axial alinement with the driven gear, and cam mechanism supported in axial alinement with the driving-gear for actuating said rocker.

30. The combination with a driving and a driven shaft, of an intermediate transmission-train, comprising a web secured to the driven shaft and carrying an internal gear, a pair of cams mounted on the driving-shaft and having oppositely-disposed faces, a pinion meshing with said internal gear, a gear in mesh with said pinion, a gear rotatable with said last gear, a gear-wheel fast on the driving-shaft and meshing therewith, and a rocker having a pair of cam-engaging faces in engagement respectively with said cam-faces and actuated by one of these and limited in its free movement by the other and carrying said pinion.

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