

No. 841,445.

PATENTED JAN. 15, 1907.

F. H. RICHARDS.
 DEVICE FOR CONVERTING MOTION.

APPLICATION FILED APR. 8, 1902.

3 SHEETS—SHEET 1.

Fig. 1.

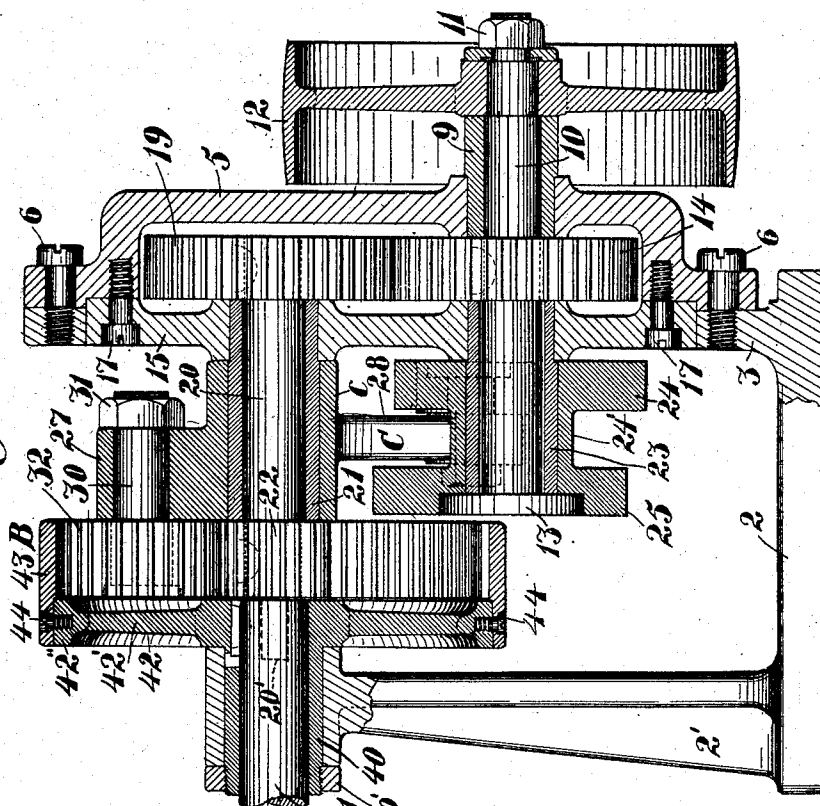
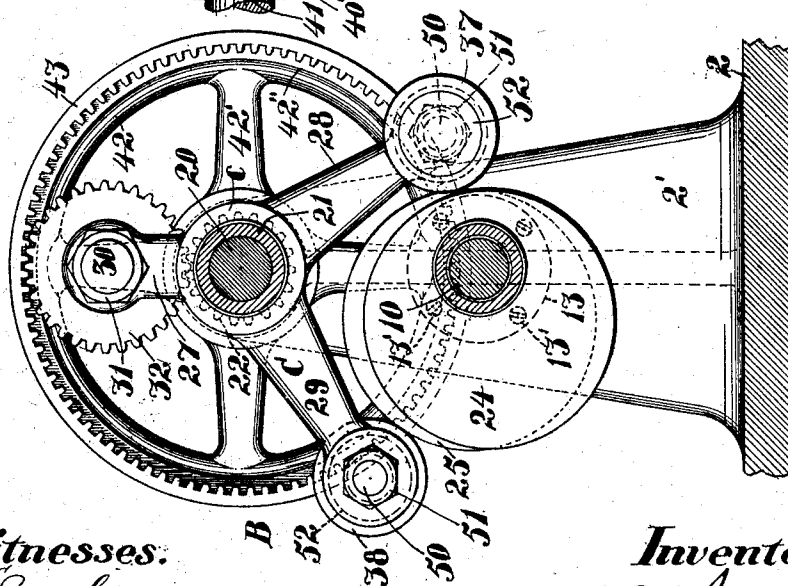


Fig. 4.



Witnesses:
H. Jacobs
F. C. Fiedner

Inventor:
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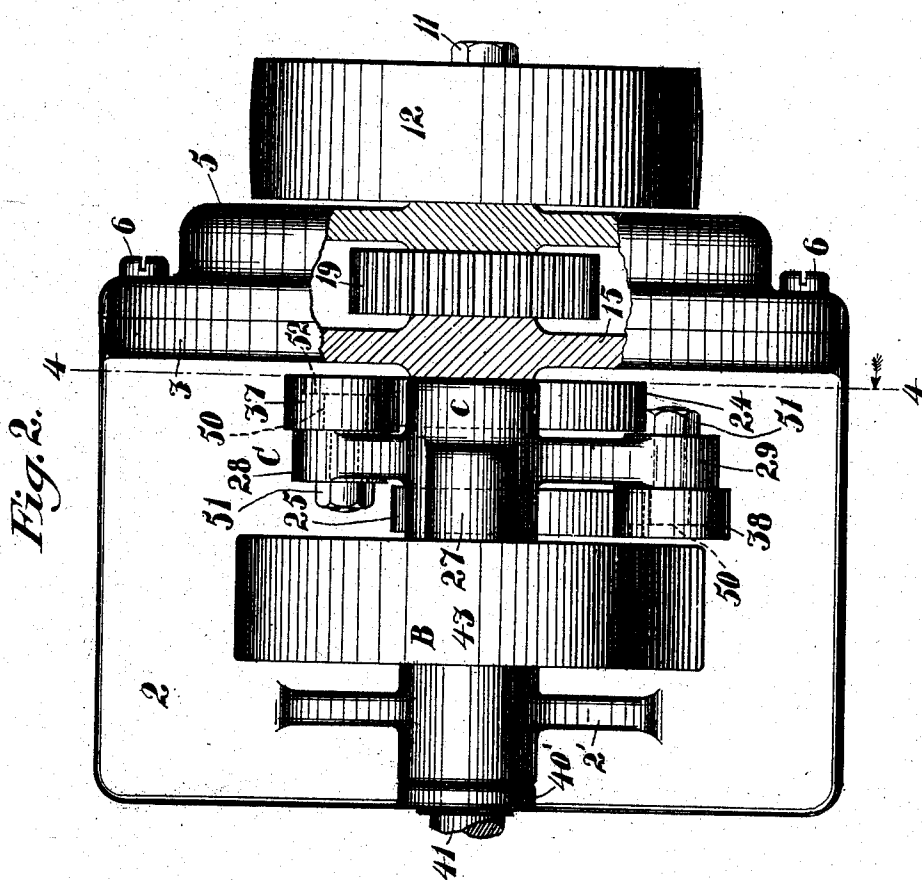
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3 SHEETS—SHEET 2.



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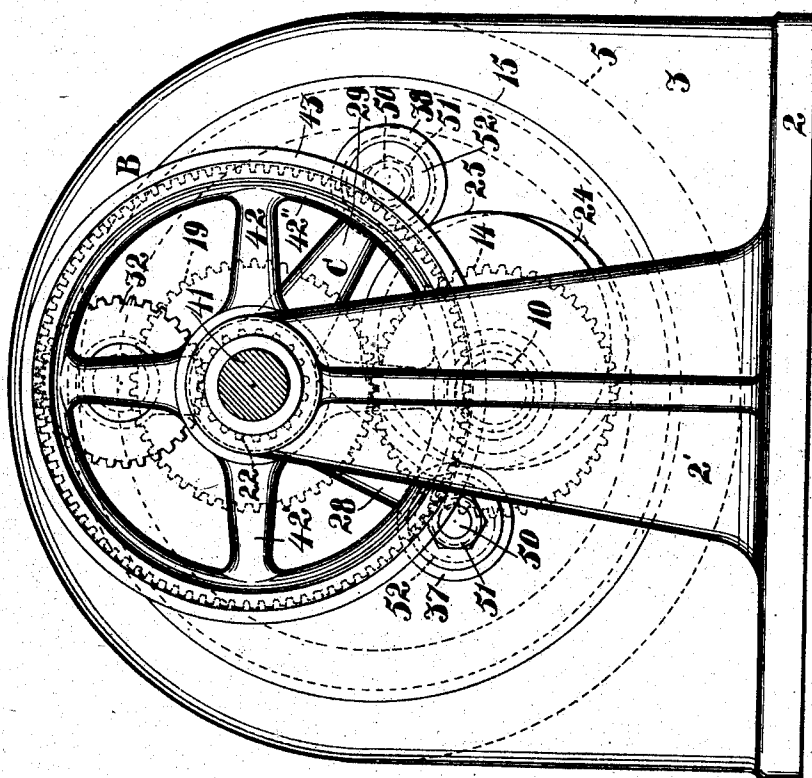
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3 SHEETS—SHEET 3.

Fig. 3.



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UNITED STATES PATENT OFFICE.

FRANCIS H. RICHARDS, OF HARTFORD, CONNECTICUT.

DEVICE FOR CONVERTING MOTION.

No. 841,445.

Specification of Letters Patent.

Patented Jan. 15, 1907.

Application filed April 8, 1902. Serial No. 101,889.

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 Devices for Converting Motion, of which the following is a specification.

This invention pertains to the constructive organization of devices or mechanisms for effecting the conversion of motion; and it relates more especially to the design and details of construction of a device or appliance for converting the uniform motion of a uniformly-running driving-shaft into the motion of a driven shaft rotating with a varying velocity.

It is an object of the present invention to provide a simple, compact, and effective organization of elements susceptible when interposed between the shafts aforesaid of accomplishing an alteration of motion such as has been referred to.

In its broader aspect of organization and as respects the kinematic relation of its various component parts and devices a mechanism or appliance embodying the present invention and such as is illustrated in the drawings accompanying the present specification does not form the subject-matter of the present application, since the same is shown, described, and claimed in a separate application filed by me on April 19, 1900, Serial No. 13,470.

In the drawings attached hereto, Figure 1 is mainly a central longitudinal section of a device for converting motion and which is designed and constructed in accordance with my present improvements. Fig. 2 is a plan view thereof, a part of the frame being broken away the better to show parts lying within. Fig. 3 is an end elevation looking from the left in Fig. 2, and Fig. 4 is a cross-section on the plane of the line 4 4 in Fig. 2 looking in the direction of the arrow adjacent to that line.

Similar characters of reference designate corresponding parts in all figures.

In a general way the elements comprised in the present device for modifying the transmitted motion and for establishing the character of the resilient motion of the driven shaft as compared with that of the driving-shaft are a driving-pinion, a driven gear secured to the driven shaft, an oscillatory in-

termediate gear for transmitting motion from the driving-pinion to the said driven gear, and appropriate cam-actuators for oscillating the said intermediate gear while in continuous engagement with the pinion and the said driven gear.

In the particular mode shown in the drawings of supporting the various operative parts of the device they are illustrated as carried upon a base-plate 2. Obviously such supporting or base plate may form a separate element intended for the sole support of the device, or the same may constitute a portion of the framing of a machine with which the present device is combined.

Such support, whatever be its nature, is provided with suitable means for maintaining the journal-bearings of the driving and driven shafts in proper relative position. The latter of these two shafts is directly supported by an upright or member 2', while a proper support for the former shaft is afforded by an upright or member 3. This member 3 has at least superficial dimensions sufficient to permit an opening to be formed therein large enough to enable the entire mechanism to be bodily inserted in place after having been assembled or similarly withdrawn from position on the exterior face of this member 3 that is on that side thereof opposite the member 2', and over the opening therein is located a cap or cover plate 5, whose radially-extending edge is secured to the upright by proper means, such as screws 6. In the form shown this cover-plate is imperforate except where an opening is provided therein for the passage of the driving-shaft 10, which in this instance is rotatable in a bearing in the nature of a bushing 9, secured within the journal-opening in the cover-plate. The driving-shaft is here provided with a driving-pulley 12, a nut 11 being shown for the purpose of holding, in cooperation with an opposed shoulder, the pulley in position on the shaft.

On the opposite side of the cover-plate there is a driving-gear 14, which is attached to the driving-shaft and meshes with a second gear 19, affixed to a shaft 20, at whose opposite end there is carried a driving-pinion 22.

It may sometimes be desirable to have the gears 14 and 19 run in oil. I may therefore, and this is the form and construction shown, give to the cover-plate 5 a shape such that a

pocket is formed therein, the closure on the opposite side of the pocket being made by a plate 15, which is preferably secured to the aforesaid cover-plate 5—as, for instance, by screws 17—thus permitting it to be removed with the cover-plate when the latter is unfastened and taken off. This plate 15 is also utilized for supporting the bearing of the shaft 20, which bearing is shown formed in a bushing 21, having a length substantially equal to the distance between the adjacent faces of the gear 19 and pinion 22 and the bushing being held fixedly in an opening in the plate 15.

The driven shaft, already mentioned and designated by 41 on the figures of the drawings, is disposed in its bearings (one of which, as already mentioned, is supported by the member 2') in axial alinement with the aforesaid shaft 20. The driven shaft terminates close to the adjacent end of the shaft 20, and in order to steady the end of the latter shaft it may be provided with an extension 20', fitting into and adapted to rotate in a journal-recess in the end of the driven shaft.

Affixed to the driven shaft 41 is an internal gear, designated in a general way by B and comprising, for facility and cheapness of construction, a web 42, made up in the form here shown of a series of arms 42', whose outer ends are connected by a circular rim 42'', and further comprising an internally-toothed shell 43, connected by means such as screws 44 to the rim 42''. In order to position the shaft 41 endwise in the journal-opening in the member 2', and hence place the internal gear in correct relation to the driving-pinion 22, the web 42 is extended to the left (see Fig. 1) in the form of a sleeve 40, through whose bore the shaft 22 extends and which exteriorly is fitted to rotate in the journal-opening of the member 2'. Suitable means are provided for holding the web of the internal gear snugly up against the end face of the bearing in this member, the means here shown consisting of a nut 40', which engages with a screw-thread on the sleeve 40.

The toothed portion of the internal gear B is disposed in such relation to the driving-pinion 22 as to permit motion to be transmitted from the latter to the former by means of an intermediate gear 32, whose axis, however, does not remain fixed relatively to the fixed portions of the device during the operation of the device. The construction is such as to cause this axis of rotation of the intermediate or transmitting gear to be shifted to and fro in the arc of a circle whose center coincides with the axes of the shafts 20 and 41, thereby effecting a similar rocking movement of the intermediate gear back and forth in the annular space between the driving-pinion and the internal gear.

For this purpose the intermediate gear is

mounted upon a rocker, designated in a general way by C and having a hub portion *c* through whose bore the aforesaid bushing 21 extends, this hub portion being of sufficient axial length to properly position the gear 32 relatively to the pinion 22 and internal gear B. In an arm 27 of this rocker is suitably journaled the shaft 30 of the intermediate gear, which shaft in the construction herein shown has a nut 31 at its outer end for preventing any undesirable longitudinal movement thereof.

Referring now to the means for effecting the oscillation of the rocker, this means is herein the form of a pair of cam-actuators 24 and 25, respectively, which in point of concurrent operation function alternately as actuators and as members for insuring the reliable operation of that cam serving as an actuator for the time being. These cams are in the present construction made integral with a connecting-hub 24', and they are driven from the driving-shaft 10. For this purpose this shaft extends through the bore of a bushing 23, fixed in an opening of the aforesaid closure-plate 15, and carries at its outer end a disk 13, through whose peripheral portion pass screws 13', by which the cam-actuators are secured to the disk, and hence to the shaft. The hub 24' of the cam-actuators is bored to fit the outer cylindrical surface of the bushing 23, and hence during the rotation of the driving-shaft the cams rotate about this bushing.

Bearing against the cam-actuator 24 is a cam-roll 37 and against the cam-actuator 25 is a cam-roll 38. These cam-rolls are mounted on respective arms 28 and 29, which extend from the hub portion of the rocker toward opposite sides of the driving-shaft 10. In the particular construction herein shown each cam-roll is mounted upon a corresponding shouldered stud 50, which after the cam-roll is slipped over it is fastened, as by a nut 51, in an opening at the outer end of its proper arm, the roller being held from undesirable movement lengthwise of the stud by a flange 52, which fits into a recess in the radial face of the roll.

These cams are complementary to each other—that is to say, they are so proportioned and related to each other that while one is working and the distance between the axis of about which it rotates and the point of contact with the actuated roll is increasing the corresponding distance with respect to the other set is correspondingly decreasing, thus preserving and insuring contact with the cam then functioning as an actuator.

The character as respects the speed, extent, and duration of the oscillatory movement of the rocker may be variously modified by properly modifying the contour of the cam-actuators and the character of the resultant motion of the driven shaft, assum-

ing a uniform rotation of the driving-shaft be made, as desired, within the limits of the capacity of the device, of course.

The invention is, furthermore, not limited in its scope to any particular proportion of the gears or other parts embraced in the construction.

A design and construction such as shown and hereinbefore described is peculiarly compact, economical in the number of parts required, and capable of being readily assembled and disassembled as a completed device, since the entire mechanism, with the exception of the driven shaft and the internal gear, may be withdrawn intact upon removing the cover-plate 5.

Having described my invention, I claim—

1. The combination with a driving and a driven shaft, of a removable part by which one of said shafts is carried, and a train of gears mounted in and incased by said removable part, the removal of said part serving to disconnect said gears and shafts from operative connection.

2. The combination with a driving and a driven shaft, of a double-walled removable plate by both of which walls one of said shafts is carried and the chamber between which constitutes an oil-bath for gears which may be mounted therein, and a train of gears mounted between said walls, the removal of said plate serving to disconnect said gears and shafts from operative connection with the other parts of the mechanism.

3. The combination with a driving and a driven shaft operatively connected by intermeshing gears, of said intermediate gears, a removable part by which the driving-shaft and gears are carried and the removal of which path serves to disconnect the two shafts from operative connection, and incasing instrumentalities for the gears carried by the removable part.

4. The combination with a driving and a driven shaft, of a removable plate by which the said driving-shaft is carried, a train of gears carried also by said plate, the removal of said plate serving to disconnect the two shafts from operative connection, and incasing means for the gears carried by said plate.

5. The combination with a driving and a driven shaft, of an intermediate train of planetary gears for transmitting power from one to the other of said shafts, and a removable part by which one of said shafts and a portion of said planetary gears are carried and the removal of which part serves to disconnect the supported shafts, and a portion of said planetary gears from operative connection with the other shaft, and protecting means for the gears carried by said plate.

6. The combination with a driving and a driven shaft, of an intermediate train of planetary gears for transmitting power from one to the other of said shafts, and a removable

plate by which one of said shafts and a portion of said planetary gears are carried and the removal of which part serves to disconnect the supported shafts and a portion of said planetary gears from operative connection with the other shaft, and a cover for the gears carried by the plate.

7. The combination with a driving and a driven shaft, of an intermediate train of planetary gears for transmitting motion from one to the other, a member by which said driving-shaft and a portion of said planetary gears are supported, and a plate carrying the said driving-shaft and said planetary gears and which is removably secured to said member and over an opening therein, and by its removal serving to disconnect the supported shaft and the said train from operative connection with the other shaft.

8. The combination with a driving and a driven shaft, of a gear secured to one of the shafts, mechanism intermediate said gear and the other shaft, a member by which said gear-provided shaft and said mechanism is supported, a plate removably secured to said member and over an opening therein and having a journal-opening for the portion of said shaft, an auxiliary plate secured to the first-mentioned plate, and having a journal-opening for the position of said shaft on the opposite side of said gear.

9. The combination with a driving and a driven shaft, of a gear secured to said driving-shaft, mechanism intermediate said gear and the other shaft and embodying an intermediate shaft, a gear mounted on a portion of said intermediate shaft and meshing with said gear secured to the driving-shaft, a driving-pinion mounted on another portion of said intermediate shaft, a member by which said driving-shaft and intermediate mechanism are supported, a plate removably secured to said member and over an opening therein and having a journal-opening for the portion of the driving-shaft on one side of said gear, and an auxiliary plate secured to the first-mentioned plate and having a journal-opening for the portion of the driving-shaft on the opposite side of the gear and also a journal-opening for said intermediate shaft.

10. The combination with a driving and a driven shaft, of a gear secured to said driving-shaft, mechanism intermediate said gear on the other shaft and embodying an intermediate shaft, a gear at the end of said intermediate shaft and meshing with said gear secured to the driving-shaft, a driving-pinion at the opposite end of said intermediate shaft, a member by which said driving-shaft and intermediate mechanism are supported, a plate removably secured to said member and over an opening therein, and having a journal-opening for the portion of the driving-shaft on one side of said gear, and a plate secured to said first-mentioned plate and hav-

ing a journal-opening for the portion of the driving-shaft on the opposite side of the gear and also a journal-opening for said intermediate shaft.

5 11. The combination in mechanism for transmitting and varying motion, of a driving-shaft having a flange, a gear mounted on said shaft, a train of gears operatively connected to said gear, a cam carried by said flange, and mechanism operated by said cam
10 and designed to vary the velocity.

12. The combination in mechanism for transmitting and varying motion, of a driving-shaft having a flange at one end and combined with a gear secured to the shaft, an actuator secured to said flange, a member by which such shaft is supported, a plate removably secured to said member and over an opening therein and having a journal-opening for the portion of said shaft on one side of said gear and speed-changing mechanism operated by said actuator.
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13. The combination with a driving and a driven shaft of a removable part by which one of said shafts is carried and the removal of which part serves to disconnect the two shafts from operative connection, a train of planetary gears mounted on and carried by said removable part and an auxiliary plate secured to the removable part.
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14. The combination with a driving and a driven shaft, one whereof is provided with a flange and gear, of said gear, a removable part by which one of said shafts is carried and which removable part protects said gear and the removal of which part serves to disconnect the shafts from operative connection, and an auxiliary plate secured to said removable part and having a journal-opening for the encircling shaft between said cam and gear.
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15. The combination with a driving-shaft of a member by which said shaft is supported, a gear secured to said shaft and inclosed by said member, a plate removably secured to said member and disposed on one side of the gear, an auxiliary plate secured to the member and disposed on the opposite side of the gear, and bushings secured in said plate and member and extending therebeyond and in which said shaft is journaled.
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16. The combination with a driving-shaft, of a framing member, a gear secured to the shaft, a plate removably secured to said member, an auxiliary plate secured to the first-mentioned plate and with it incasing said gear, said plates having openings and bushings secured in said openings and extending beyond the respective plates, and in which bushings said shaft is journaled, a driving-pulley secured to one end of the shaft and an actuator secured to the opposite end, and an intermediate shaft, a gear thereon and housed between said plates, and a shaft and intermediate gear-train driven and controlled by said actuator and intermediate shaft cooperatively.
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shaft cooperatively.

17. The combination with a driving-shaft, of a member by which such shaft is supported, a gear secured to the shaft, a plate removably secured to said member, an auxiliary plate secured to the first-mentioned plate and cooperative therewith for incasing the gear, said plate being provided with openings, bushings secured in said openings and extending beyond the respective plates and in which said shaft is journaled, a driving-pulley and a cam secured to said shaft, a driven shaft, an intermediate shaft, gearing connecting said shafts, and means controlled by said cam for shifting one of said gears for varying the motion imparted to the driven shaft.
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18. The combination with a driving-shaft, of a member by which said shaft is supported, a train of gears, one gear of which is secured to the shaft, a plate removably secured to the member, an auxiliary plate secured to the first-mentioned plate, said plates inclosing the train of gears, bushings secured in openings in said plates and extending beyond the respective plates and in a set of which bushings said shaft is journaled, a driving-pulley fast on one end of the shaft and an actuator secured on the opposite end and journaled on one of the said bushings, a shaft for the other of said gears mounted in another of said bushings, and a driven shaft controlled by the combined action of said latter shaft and the actuator.
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19. The combination with a driving-shaft, of a framing member, a train of gears, one of which is secured to the shaft, an actuator for one of said gears, an intermediate shaft to which another of said gears is secured, a driven shaft driven thereby, a plate removably secured to the said member, an auxiliary plate secured to the first-mentioned plate, both of said plates incasing the said gears, a bushing secured in an opening in one of said plates and in which bushing one of said shafts is journaled, a driving-pulley secured to the driving-shaft and a cam also carried thereby and cooperative with said actuator for modifying the action of the train of gears upon the driven shaft.
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20. The combination with a driving-shaft of a member by which said shaft is supported, a gear secured to the shaft, a plate removably secured to the member, an auxiliary plate secured to the first-mentioned plate, both plates incasing the gear and a series of other gears also carried by said first-mentioned plate and adapted to be removable thereby, bushings secured in openings and extending beyond the respective plates and in which said shaft and a driven shaft are journaled, a driving-pulley secured to one end of the driving-shaft, and an actuator embodying a pair of alternating reciprocal
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actuating and retarding cams secured to the opposite ends, and means controlled by said actuators to modify the drive imparted to the driven shaft.

5 21. 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 internally-toothed shell, cams fast with said driving-shaft, an interme-
10 diate shaft, a pinion on the intermediate shaft, a gear fast on the intermediate shaft, a gear fast with the driving-shaft and in mesh therewith, a rocker actuated by said cams, and a pinion carried by said rocker and mesh-
15 ing with said toothed shell and with the pinion on said intermediate shaft.

22. The combination with a driving, a driven shaft, and an intermediate driven shaft, of a member in which the driving-shaft
20 is journaled and an intermediate transmission-train comprising a web secured to the driven shaft and having a lateral sleeve-like extension reaching to the opposite side of said member, and in which the driven shaft is car-
25 ried, a toothed shell secured to said web, an actuator secured to said driving-shaft, a rocking member, a pinion carried thereby and having operative connection with said toothed shell, said rocking member being operated by
30 said cam, said member being adapted to inclose and carry a portion of the intermediate transmission-train.

23. The combination with a driving and a driven shaft of a member by which the driv-
35 ing-shaft is supported, a plate removably secured to said member and having a journal-opening for the driving-shaft, an auxiliary plate secured to the first-mentioned plate, a gear secured to the driving-shaft, a gear mesh-
40 ing therewith and whose shaft is disposed in alinement with the said driven shaft, a driv-

ing-pinion secured to the shaft to which said second gear is secured, a gear secured to the driven shaft, an oscillatory gear for transmit-
45 ting motion from said pinion to the gear secured to the driven shaft, a rocker for oscillating said oscillatory gear and an actuator secured to said driving-shaft for actuating the rocker.

24. The combination with a driving, a 50 driven and an intermediate shaft, of a member by which said driving and intermediate shafts are supported, a plate removably secured to said member and having a journal-
55 opening for the driving-shaft, an auxiliary plate secured to the first-mentioned plate and having journal-openings for the driving and the intermediate shafts; bushings secured in said journal-openings in which said shafts ro-
60 tate, gearing for transmitting motion from the driving to the intermediate shaft, a pinion secured to the intermediate shaft, an internal gear secured to the driven shaft, an oscillatory intermediate gear meshing with said
65 pinion and said internal gear, a rocker on which said intermediate gear is carried and which works on the bushing surrounding the intermediate shaft and a pair of actuators for effecting the oscillatory movement of said
70 rocker.

25. The combination of a driving and a driven shaft, a gear on each of said shafts, a removable part by which one of these shafts
75 is carried, and a train of gears in mesh with said driving and driven gears and one of which is together with the driving-gear mounted in and incased by said removable part.

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