No. 750,874. PATENTED FEB. 2, 1904.

F. V. MATHEWS.

VARIABLE SPEED MECHANISM.

APPLICATION FILED MAY 19, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

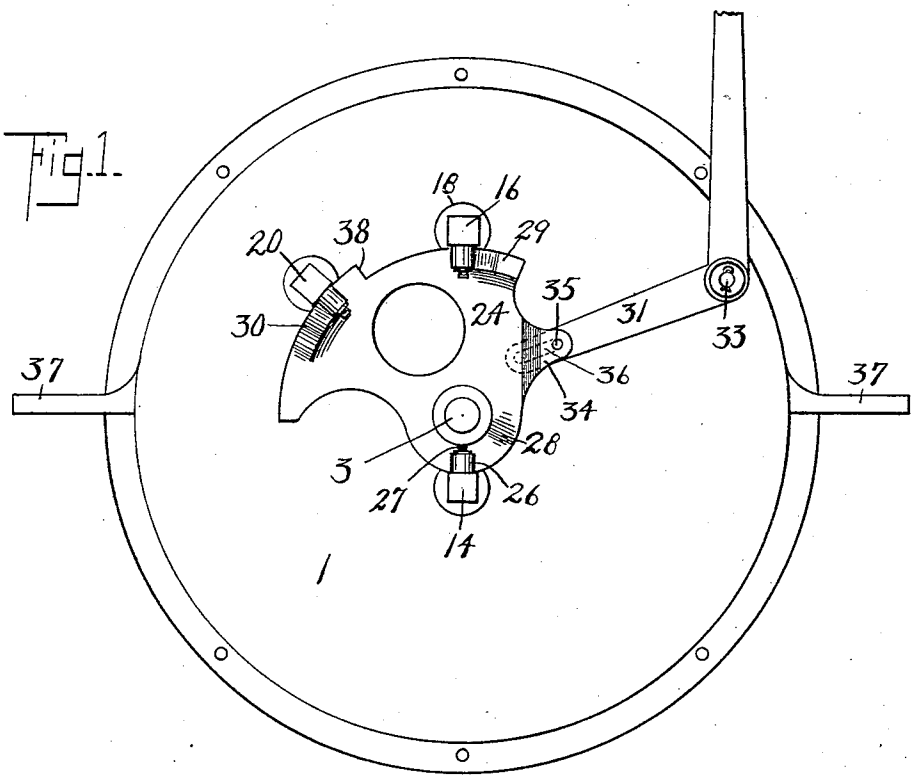
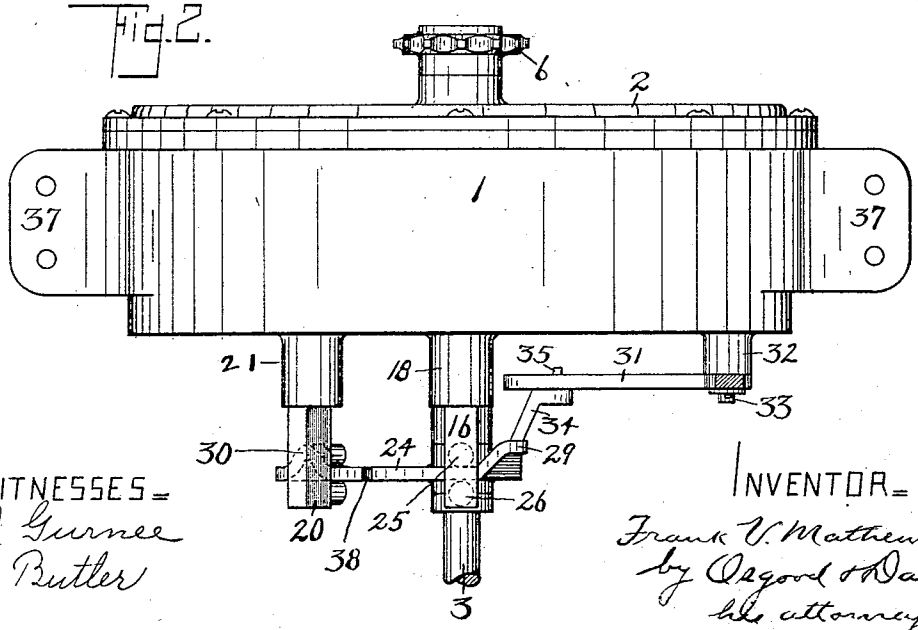


Fig. 2.



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VARIABLE SPEED MECHANISM.

APPLICATION FILED MAY 19, 1903.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.

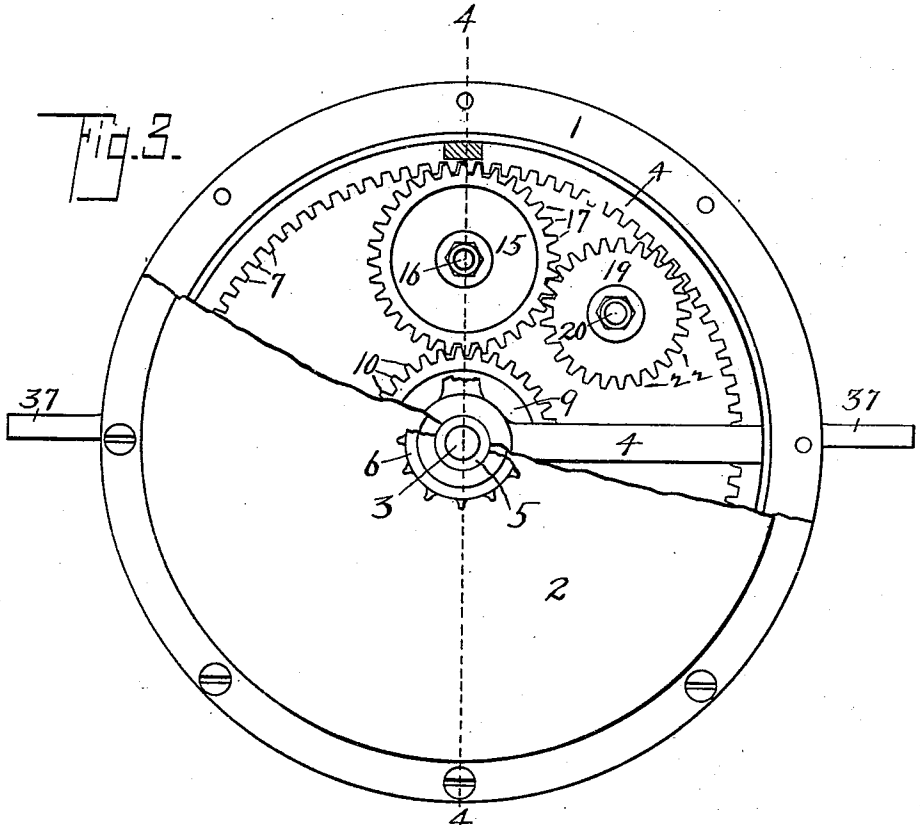
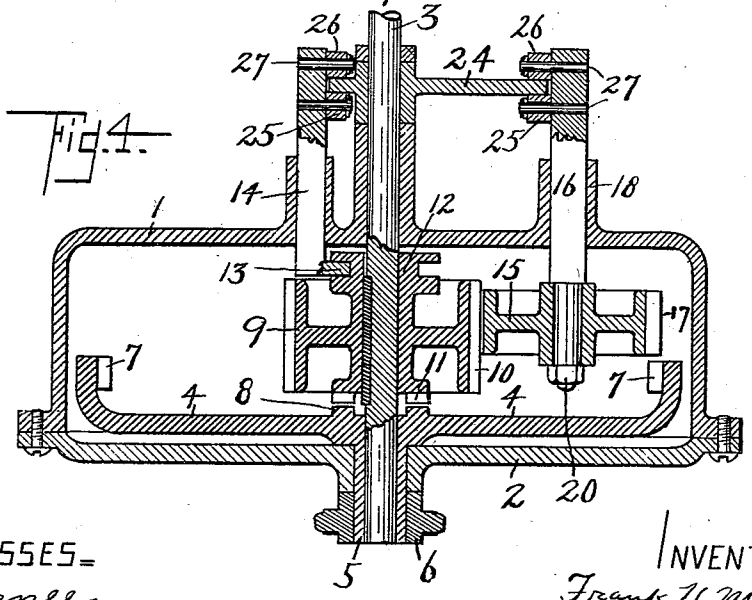


Fig. 4.



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No. 750,874. Patented February 2, 1904.

UNITED STATES PATENT OFFICE.

FRANK V. MATHEWS, OF ROCHESTER, NEW YORK.

VARIABLE-SPEED MECHANISM.

SPECIFICATION forming part of Letters Patent No. 750,874, dated February 2, 1904.

Application filed May 19, 1903. Serial No. 157,773. (No model.)

To all whom it may concern:

Be it known that I, FRANK V. MATHEWS, a citizen of the United States, and a resident of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Variable-Speed Mechanism, of which the following is a specification.

This invention relates to variable-speed mechanism, and has for its object to provide a simple and easily-operated gearing whereby a driven wheel may be made to revolve at the speed of the driving-shaft or at another speed or reversed by the manipulation of a single lever.

This invention is particularly adapted for automobiles and launches that are driven by gas and vapor engines.

In the drawings, Figure 1 is an end view of the device, also showing in part a lever for operating it. Fig. 2 is a top elevation of the same. Fig. 3 is a view of the opposite end, part of the casing being broken away; and Fig. 4 is a section on the line 4 4 of Fig. 3.

1 is the casing within which the gearing is inclosed. 2 represents the plate that closes the outer end of said casing. 3 is the driving-shaft, which is located centrally within said casing and which is driven at the speed of the engine. A gear 4, having the extension-hub 5, is loosely journaled upon the said shaft 3, the hub 5 extending outwardly from the casing 1 through the plate 2. A sprocket-wheel 6 is rigidly attached to the extension 5 of the said hub and is adapted to be connected by a suitable chain or belt with the wheel that is to be driven. The gear-wheel 4 has a ring of inwardly-projecting teeth 7 at its periphery and clutch-teeth 8 near its hub, as shown in Fig. 4.

The direction in which the sprocket 6 is rotated and also the rate of speed at which it is rotated is determined by regulating the gearing connection between the gear 4 and a spur-gear 9, which is splined to the said shaft 3, as represented in Fig. 4, so that it rotates with said shaft and is movable longitudinally on it. The said gear-wheel 9, besides having the external gear 10, has also clutch-teeth 11 upon its outer face, that mesh with the clutch-teeth 8 on the gear-wheel 4. Said gear 9 has a collar 12, in which there is an annular groove adapted to receive the yoke 13, whereby said gear 9 can be moved longitudinally upon said shaft 3. It is obvious that when said gear 9 is moved toward the internal gear by means of the said yoke its clutch-teeth 11 will engage with the clutch-teeth 8 on the inner face of the gear 4 and that said gear 4, and consequently the sprocket 6, will be driven at the speed at which the shaft 3 is being driven. The spur-gear 15 is revolubly attached to a shaft 16, that is supported within the casing. The cog-teeth 17 are adapted to engage both with the teeth 10 upon the gear 9 and also with the teeth 7 upon the gear 4. The said shaft 16 is movable longitudinally in suitable bearings 18 in the casing by means hereinafter to be described, and the relative width of the gears 9 and 15 is such that said gear 15 can be drawn out of engagement with the teeth 7 on the gear 4 while remaining in engagement with the gear 9, as represented in Fig. 4.

It is obvious that when the clutch-teeth 11 of the gear 9 are drawn out of engagement with the clutch-teeth 8 on the gear 4 and the teeth 17 of the gear 15 are placed in engagement with the teeth 7 of the gear 4 said gear 4, and consequently the sprocket 6, will be driven by the shaft 3 through the gears 9 and 15 and that the sprocket 6 will be revolved in the opposite direction from that in which the shaft 3 revolves.

A third spur-gear 19 (see Fig. 3) is revolubly secured to a shaft 20, which also is represented as supported in bearings 21 in said casing, (see Fig. 2,) having cog-teeth 22, that are adapted to mesh with the teeth 7 at the periphery of the wheel 4 and that are always in mesh with the teeth 17 on the gear 15, as shown in Fig. 3. The shaft 20 is moved longitudinally by means hereinafter described. It is obvious that when said gear 19 is moved toward the driven gear 4 its teeth mesh with the teeth 7 at the periphery of said gear 4, and as they are also in mesh with the teeth 17 on

the gear 15, as shown in Fig. 3, the gear 4, and consequently the sprocket 6, is driven by the shaft 3 through the gears 9, 15, and 19. This is a slower speed than the other speed for forward driving. The rate of speed at which the gear 4 is driven through said gears 9, 15, and 19 is dependent upon the relative sizes of said gears, and said gears may be proportioned to give any desired speed. Thus by the means described it is possible not only to drive the shaft forward at the speed at which the shaft is driven, but also at another speed, and that it is furthermore possible to reverse the revolution of the sprocket without reversing the driving-shaft.

For moving the gear in and out of engagement a cam-plate 24 is rotatably secured upon the shaft 3 adjacent to the casing, as represented in Figs. 2 and 4. The shafts 16 and 20, to which the gears 15 and 19 are attached, respectively, and the shaft 14, to which the yoke 13 is attached, are moved parallel with the shaft 3 through their engagement with said cam 24. Said shafts are all represented as attached to said cam in the same way—namely, by rollers 25 and 26, one of which lies at the left and the other at the right of said cam and all of which are represented as attached to said shafts by pins 27. Cam-like projections 28, 29, and 30 are represented on the inner face of the cam-plate 24, which may be formed by indenting said cam at these points. The shafts 14, 16, and 20, carrying, respectively, the gears 8, 15, and 19, are accordingly forced toward the driven gear when the rollers 25 and 26, by which said shafts are connected with said cam 24, move along the inclinations of the projections 28, 29, and 30, respectively.

When the cam 24 is in the position represented in Fig. 1, the gears 9 and 15 are in the position represented in Fig. 4—that is to say, both of said gears are out of engagement with said gear 4. Said gear 19 is also out of engagement with said gear 4, but is in engagement with the gear 15, for, as stated above, the gears 9 and 15 are represented in the drawings as being always in engagement with each other. In this position of the parts the shaft 3 revolves without driving the sprocket.

If the cam 24 is rotated to the right in Fig. 1 by means hereinafter to be described, the shaft 20, and consequently the gear 19, will be forced inwardly, because the rollers 25 and 26, attached to its end, follow along the projection 30 on the inside of the cam. In this position of the cam the gears 9 and 15 are out of engagement with the gear 4. When, therefore, the cam is in this position, the gear 4, and consequently the sprocket 6, is driven by the shaft 3, through the gears 9, 15, and 19, at a different rate of speed from that at which the shaft is revolving. The relative proportions in which the gears are shown gives a lower speed than that of the shaft. If now the cam is rotated still farther to the right in Fig. 1, the rollers 25 and 26 on the shaft 20 will descend the other side of the projection 30, and the said shaft 20, and consequently the gear 19, is drawn out of engagement with the gear 4. Then the rollers 25 and 26, attached to the shaft 14, mount the projection 28 on the inner side of the cam 24, so that said shaft 14, and consequently the gear 9, is forced in toward the left in Fig. 1 into engagement with the teeth 8 on the gear 4. In this position of the cam the gear 15 is out of engagement with the teeth 7 on the gear 4. When, therefore, the cam is in this position, the gear 4, and consequently the sprocket 6, is driven by the shaft 3 through the gear 9, whose clutch-teeth 11 engage the clutch-teeth 8 on said gear 4, and said shaft is driven at the speed of the engine.

In order to reverse the rotation of the gear 4, and consequently the sprocket 6, the cam 24 when in the position represented in Fig. 1 is moved to the left until the rollers 25 and 26, that are attached to the shaft 16, mount the projection 29 on the inner face of said cam, when said shaft 16, and consequently the gear 15, attached to it, is forced to the left in Fig. 4 into engagement with the teeth 7 on the gear 4. When the cam is in this position, the shafts 14 and 20 are both held away from the driven gear, so that the gears 9 and 19, attached to them, respectively, are both out of engagement with the gear 4. In this position of the cam, therefore, the gear 4, and consequently the sprocket 6, is driven by the shaft 3 through the gears 9 and 15 and will be driven in the reverse direction from that in which the shaft 3 revolves. A shoulder 38 is shown on the cam to prevent it from being turned to the right beyond the proper point.

The parts are so arranged that when the cam 24 is turned to the right from the position in which there is no operative engagement between the driven shaft and the driven gear the gears are connected for the lower speed before they can be put into engagement for the higher speed and must again be turned back into the first-mentioned position before the revolution of the driven gear can be reversed.

Any suitable means may be employed for rotating the cam 24. In the drawings a bell-crank lever 31 is shown for that purpose, which is pivotally connected with a post 32 on the casing, as by means of the pin 33. An arm 34 (see Fig. 2) is rigidly secured to the cam 24 and has a pin 35, that lies in the slot 36 in the end of said lever.

Ears 37 are shown for the purposes of attaching the casing to a suitable support.

What I claim is—

1. In a driving mechanism the combination with a driving-shaft, of a driving-gear, revo-

luble with said shaft, and a driven gear adapted to be thrown in and out of engagement with each other, two engaging, intermediate, free, speed-changing gears, one of which is adapted to engage said driving-gear, and the other of which is adapted to engage said driven gear; means for interposing said intermediate gears between said driving-gear and said driven gear; and means for throwing said driving-gear and said driven gear in and out of direct engagement.

2. In a driving mechanism the combination with a driving-shaft, of a driving-gear, revoluble with said shaft, and a driven gear adapted to be thrown in and out of engagement with each other; two engaging, intermediate, free gears, one of which is adapted to be interposed between said driving-gear and said driven gear, and the other of which is adapted to engage the driven gear; means for throwing said driving-gear and said driven gear in and out of direct engagement; means for interposing said first-mentioned intermediate gear between said driving and said driven gear; and means for moving said other intermediate gear in and out of engagement with said driven gear.

3. In a driving mechanism the combination with a driving-shaft, of a driven gear having a clutch-surface, and driving-gear revoluble with said shaft and having a clutch-surface adapted to engage said clutch-surface on the driven gear, said gears being adapted to be thrown in and out of engagement with each other; an intermediate, free, reversing-gear adapted to be interposed between said driving-gear and said driven gear; means for throwing said driving-gear and said driven gear in and out of engagement with each other; and means for interposing said reversing-gear between said driving-gear and said driven gear so as to engage them both when they are not in engagement with each other.

4. In a driving mechanism the combination with a driving-shaft, of a longitudinally-movable driving spur-gear revoluble with said shaft, and having a clutch-surface; a driven gear concentric with said shaft and having a clutch-surface adapted to engage with said clutch-surface on the driving-gear; an intermediate, free, reversing spur-gear; means for moving said driving-gear in and out of engagement with said driven gear; and means for interposing said reversing-gear between said driving and said driven gears, so as to engage them both when they are out of engagement.

5. In a driving mechanism the combination with a driving-shaft, of a longitudinally-movable, driving spur-gear, revoluble with said shaft, and having a clutch-surface; a driven gear concentric with said shaft and having a clutch-surface adapted to engage with said clutch-surface on the driving-gear; two engaging intermediate, free, speed-changing spur-gears, one of which engages with the driving-gear, and the other of which is adapted to engage with the said driven gear, and means for moving said last-mentioned gear and said driving-gear in and out of engagement with said driving-gear and said driven gear respectively.

6. In a driving mechanism the combination with a driving-shaft of a longitudinally-movable driving spur-gear revoluble with said shaft and having a clutch-surface; a driven gear, concentric with said shaft and having a clutch-surface adapted to engage with said clutch-surface on the driving-gear; two engaging intermediate, free spur-gears; one of which is adapted to be interposed between said driving-gear and said driven gear, and the other of which is adapted to engage the driven gear; means for throwing said driving-gear and said driven gear in and out of engagement; means for interposing said first-mentioned intermediate gear between said driving and said driven gear; and means for moving said other intermediate gear in and out of engagement with said driven gear.

7. In a driving mechanism the combination with a driving-shaft, of a longitudinally-movable, driving spur-gear upon said shaft, revoluble therewith, and having a clutch-surface; a driven gear concentric with said shaft and having a clutch-surface adapted to engage with the clutch-surface on the driving-gear; a longitudinally-movable shaft parallel with said driving-shaft; an intermediate, free, reversing spur-gear upon said last-mentioned shaft; a lever; and connections between said lever and both said driving-gear and the shaft supporting said intermediate gear, whereby said driving-gear and said reversing-gear are respectively thrown in and out of engagement.

8. In a driving mechanism the combination with a driving-shaft, of a longitudinally-movable, driving spur-gear upon said shaft, revoluble therewith, and having a clutch-surface; a driving-gear concentric with said shaft and having a clutch-surface adapted to engage with the clutch-surface on the driving-gear; two longitudinally-movable shafts parallel with said driving-shaft; two engaging, intermediate, free, speed-changing, spur-gears upon said shafts, respectively, one of which said gears is adapted to engage said driving-gear and the other of which is adapted to engage said driven gear; a lever; and connections between said lever and both said driving-gear and the shaft of one of said speed-changing gears, whereby said driving-gear is thrown in and out of engagement with said driven gear, and said intermediate gears are interposed between said driving and said driven gears.

9. In a driving mechanism the combination with a driving-shaft, of a longitudinally-movable driving spur-gear upon said shaft, revoluble therewith, and having a clutch-surface;

a driving-gear concentric with said shaft and having a clutch-surface adapted to engage with the clutch-surface on the driving-gear; two longitudinally-movable shafts parallel with said driving-shaft; two engaging, intermediate, free, spur-gears upon said shafts, respectively, one of which gears is adapted to be interposed between said driving-gear and said driven gear, and the other of which is adapted to engage the driven gear; and connections between said lever and said driving-gear and both of said shafts that separate the said intermediate gears, whereby said driving-gear is thrown in and out of engagement with said driven gear, said first-mentioned intermediate gear is interposed between said driving-gear and said driven gear, and said second-mentioned intermediate gear is thrown in and out of engagement with said driven gear, respectively.

10. In a driving mechanism the combination with a driving-shaft, of a driving-gear revolubly attached to said shaft; a driven sprocket; freely, revoluble, intermediate gears adapted to be interposed between said shaft and said gears; a movable plate having cam-like projections; longitudinally-movable shafts connected with said intermediate gears, respectively, and adapted to engage said projections, respectively; whereby said gears are thrown in and out of engagement; and means for moving said plate to cause said projections to engage said shafts, respectively.

11. In a driving mechanism the combination with a driving-shaft 3, of the driving spur-gear 9, revolubly attached to said shaft, movable longitudinally thereon, and having a clutch-surface; the driven internal gear 4 having a clutch-surface adapted to engage the clutch-surface on driving-gear 9; a longitudinally-movable shaft 16, parallel with said shaft 3; means for supporting said shaft 16; the reversing spur-gear 15 revolubly attached to said movable shaft, and adapted to engage both said driving-gear and said driven gear; means for moving said driving-gear in and out of mesh with said driven gear; and means for moving said movable shaft longitudinally to interpose said reversing-gear between said driving-gear and said driven gear.

12. In a driving mechanism the combination with casing 1, of the driving-shaft 3, driving spur-gear 9 revolubly attached to said driving-shaft movable longitudinally thereon and having a clutch-face; the driven internal gear 4 concentric with said driving-shaft, having a clutch-face adapted to engage with the clutch-face of the driving-gear; the longitudinally-movable shaft 16 parallel with said driving-shaft and supported in said casing; the reverse spur-gear 15 revolubly attached to said shaft 16 and adapted to engage both with said driving-gear 9 and said driven gear 4; and means for moving said shaft 16 to interpose said reversing-gear between said driven gear and said driving-gear.

13. In a driving mechanism the combination with a driving-shaft 3, of the driving spur-gear 9 revolubly attached to said driving-shaft, movable longitudinally thereon, and having a clutch-face; the driven internal gear 4, concentric with said driving-shaft, and having a clutch-face adapted to engage said driving-gear, the longitudinally-movable shaft 16 parallel with said driving-shaft; the spur-gear 15 revolubly attached to said shaft 16 and adapted to engage with both said driving-gear and said driven gear; the longitudinally-movable shaft 20 parallel with said driving-shaft; a spur-gear 19 revolubly attached to said shaft 20, and adapted to engage both with said gear 15 and said driven gear 4; and means for moving longitudinally said driving-gear and said shafts 16 and 20, respectively, whereby said driving-gear is thrown in and out of engagement with said driven gear, said gear 15 is interposed between said driving-gear and said driven gear, and said gear 19 is interposed between said gear 15 and said driven gear.

14. In a driving mechanism the combination with the casing 1 of the driving-shaft 3; the driving-gear 9 revolubly attached to said driving-shaft, and movable longitudinally thereon, and having a clutch-surface; the driven internal gear 4 concentric with said driving-shaft, and having a clutch-surface adapted to engage the clutch-surface on the driving-gear; the longitudinally-movable shaft 16 parallel with said shaft 3, and supported by said casing; the spur-gear 15 revolubly attached to said shaft 16, and adapted to be interposed between said driving-gear and said driven gear; a longitudinally-movable shaft 20 parallel with said driving-shaft, and supported in said casing; the spur-gear 19 revolubly attached to said shaft 20 and adapted to be interposed between the gear 15 and the driven gear; means for throwing said gear 9 in and out of engagement with said driven gear; means for interposing said gear 15 between said driving-gear and said driven gear; and means for interposing said gear 19 between said gear 15 and said driven gear.

15. In a driving mechanism the combination with the casing 1, of the driving-shaft 3; the driving-gear 9 revolubly attached to said shaft, movable longitudinally thereon, and having a clutch-surface; the driven internal gear 4, concentric with said driving-shaft, and having a clutch-surface adapted to engage the clutch-surface on the driving-gear; a longitudinally-movable shaft 16 parallel with said shaft 3, and supported by said casing; the spur-gear 15 revolubly attached to said shaft 16, and adapted to be interposed between said driving-gear and said driven gear, a longitudinally-movable shaft 20 parallel with said driving-shaft and supported in said casing;

the spur-gear 19 revolubly attached to said shaft 20, and adapted to be interposed between the gear 15 and the driven gear; the cam 24 eccentrically supported upon said driving-shaft having the internal projections 28, 29 and 30; rollers 25 and 26 attached to said shafts 14, 16 and 19, respectively, on either side of said cam, and means for rotating said cam.

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Witnesses:
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