No. 768,736. PATENTED AUG. 30, 1904.

W. D. CUSTEAD.

VARIABLE SPEED MECHANISM.

APPLICATION FILED JAN. 15, 1904.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

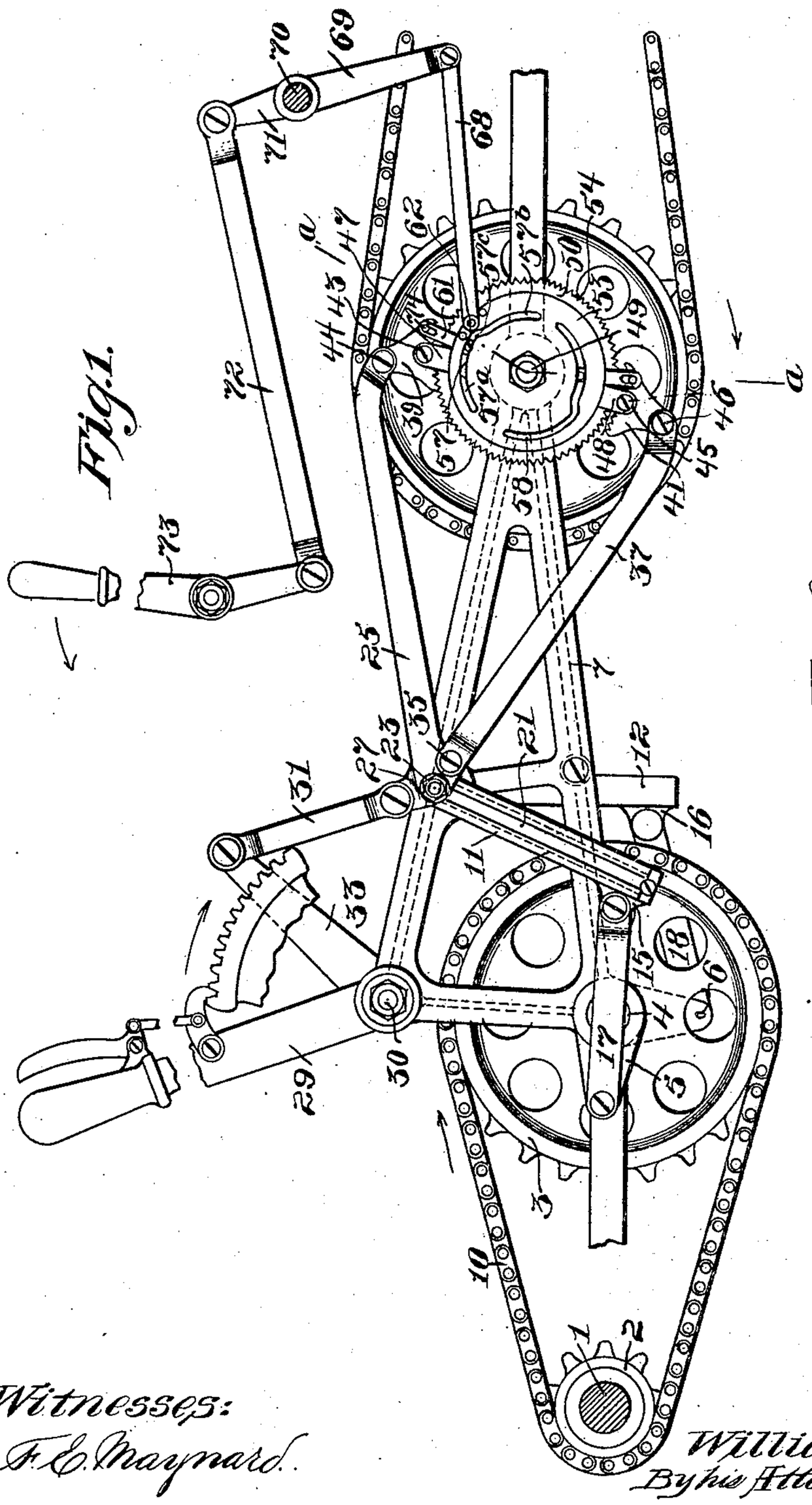
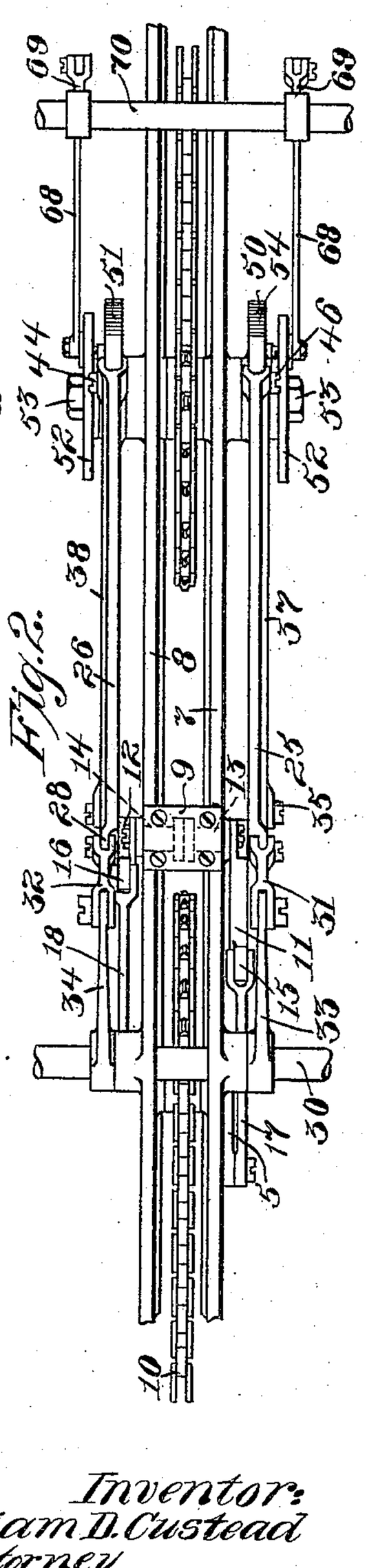


Fig. 2.



Witnesses:
F. E. Maynard.
E. G. Fuss.

Inventor:
William D. Custead
By his Attorney
F. H. Richards

No. 768,736. PATENTED AUG. 30, 1904.

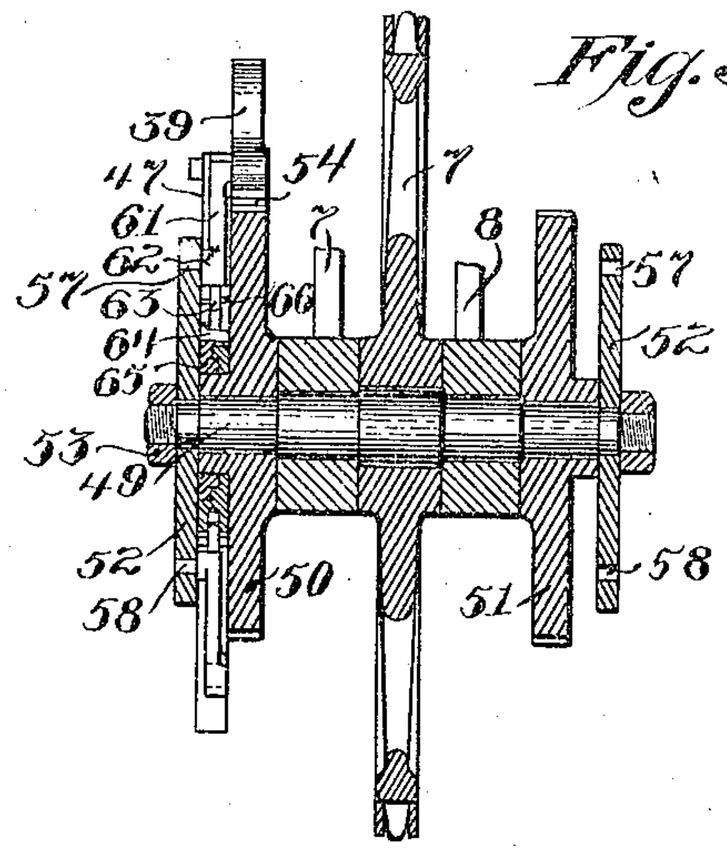
W. D. CUSTEAD.

VARIABLE SPEED MECHANISM.

APPLICATION FILED JAN. 15, 1904.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.



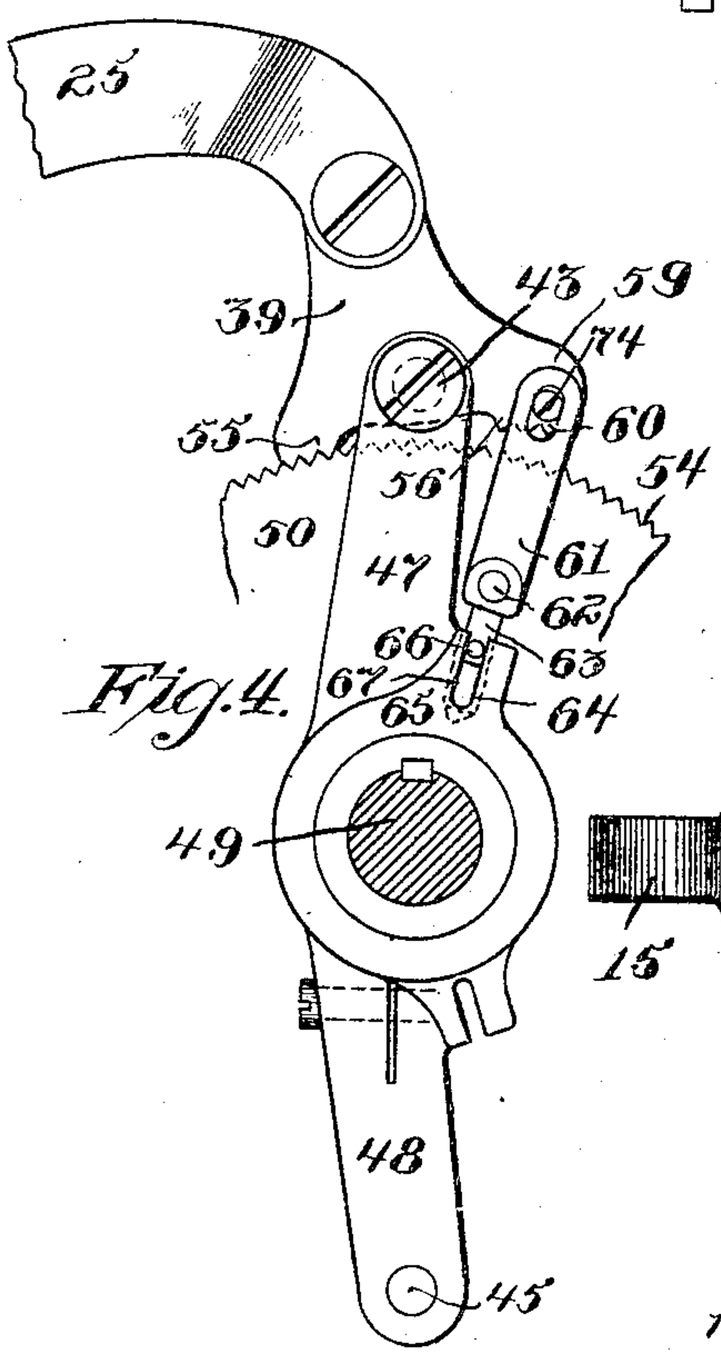
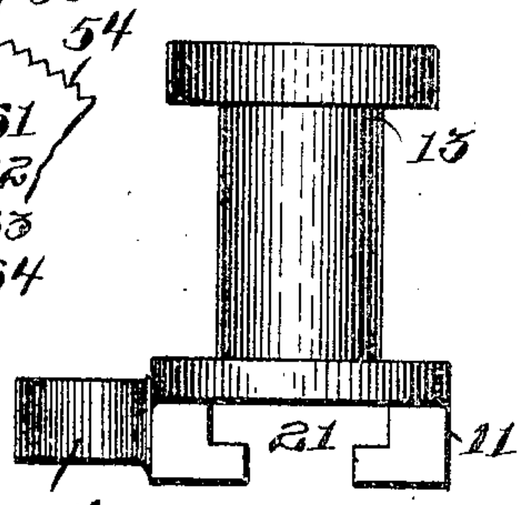


Fig. 4.

Fig. 6.



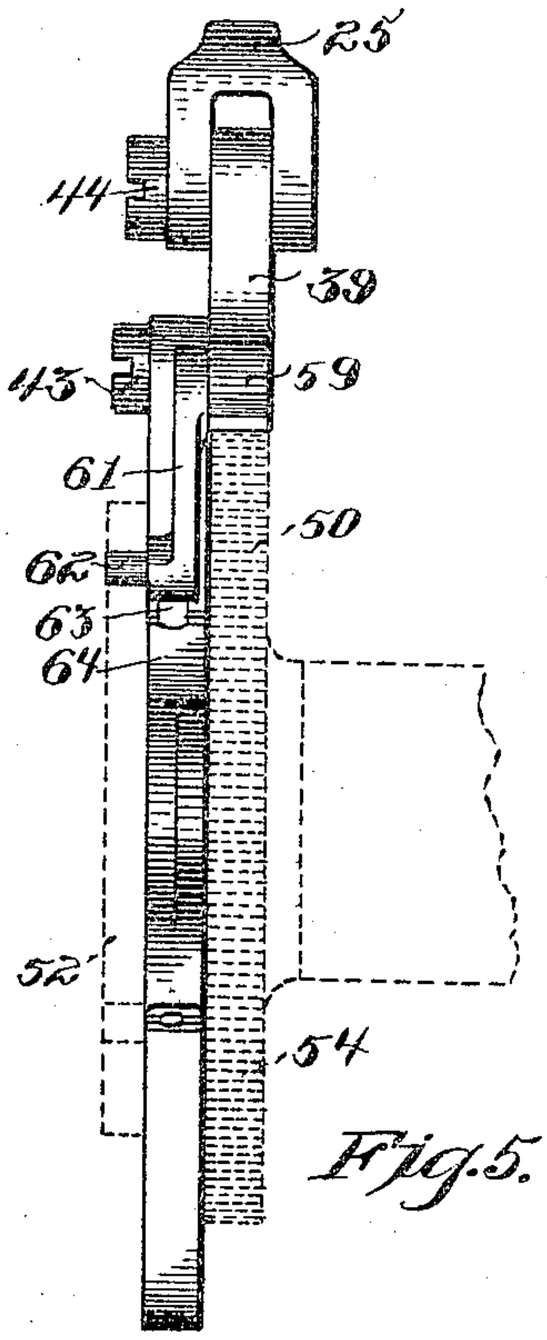
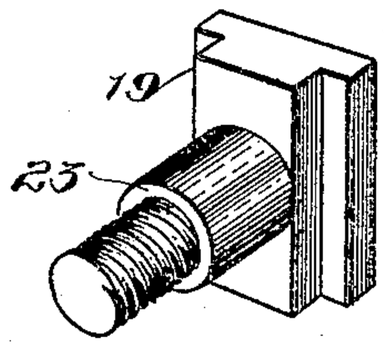


Fig. 5.

Fig. 7.



Witnesses:
F. E. Maynard.
C. G. Fuss.

Inventor:
William D. Custead
By his Attorney,
F. W. Richards

No. 768,736. Patented August 30, 1904.

UNITED STATES PATENT OFFICE.

WILLIAM D. CUSTEAD, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO EDWARD MANRARA, OF NEW YORK, N. Y.

VARIABLE-SPEED MECHANISM.

SPECIFICATION forming part of Letters Patent No. 768,736, dated August 30, 1904.

Application filed January 15, 1904. Serial No. 189,098. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM D. CUSTEAD, a citizen of the United States, residing in Manhattan borough, New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Variable-Speed Mechanisms, of which the following is a specification.

This improvement relates to variable-speed mechanism, and more particularly to that class of such mechanisms in which the speed may not only be varied in one direction, but reversed and varied in the other direction.

One object of my improvement is to furnish a simple and reliable mechanism for transforming continuous uniform rotary motion in one direction into continuous uniform rotary motion in either direction and at speeds varying from nothing to full speed.

A further object of my improvement is to furnish a hand-controlled mechanism of the class specified, particularly adapted for the government of power in automobiles.

This mechanism comprises in a general way means—such, for instance, as crank mechanism—for converting rotary motion into reciprocating motion, connected to means—such, for instance, as crank-and-link mechanism—for varying the amount of such reciprocating motion, associated with means—such, for instance, as ratchet-and-reversible-pawl mechanism—for converting reciprocating motion into rotary motion in either direction.

In the drawings accompanying and forming part of my specification, Figure 1 is a side elevation, partly in section, of a mechanism illustrating my improvement. Fig. 2 is a plan view of the same with the hand-levers and some of their connecting parts omitted. Fig. 3 is a view, substantially in section and on an enlarged scale, of a portion of the ratchet-and-pawl mechanism, the section being taken on line *a a* of Fig. 1 and looking in the direction indicated by the arrow. Fig. 4 is a side elevation, partly in section and on a still more enlarged scale, of a portion of the ratchet-and-pawl mechanism. Fig. 5 is a front elevation with some of the parts dotted, corresponding with Fig. 4. Fig. 6 is an enlarged plan view of one of the links. Fig. 7 is an enlarged view in perspective of a sliding block for such a link, as shown in Fig. 6.

Similar characters of reference refer to similar parts in all the figures of the drawings.

A shaft 1 is rotated at substantially uniform speed in either direction from a suitable source of power. (Not shown.) Power is conveyed from said shaft by any suitable means, herein illustrated as chain-and-sprocket mechanism. This mechanism comprises sprocket 2, fast on shaft 1, sprocket 3, fast on shaft 4, power being transmitted from sprocket 1 to sprocket 3 by means of chain 10. Said shaft 4 is mounted for rotation in suitable bearings in side frames, indicated in a general way by 7 and 8. Two crank-arms, 5 and 6, oppositely disposed to and exterior of said side frames, are mounted, preferably quartering to each other, upon shaft 4 for rotation therewith. From suitable bearings 9, secured to frames 7 and 8, depend slotted links 11 and 12. Said links are provided with trunnions 13 and 14, respectively, and are adapted to oscillate thereon in bearings 9. The lower ends of said links are provided with ears 15 and 16, respectively, which, by means of connecting-rods 17 and 18, are connected to cranks 5 and 6, respectively. Adapted to slide in a tongued groove 21 of link 11 is a tongued pivot-block 19, provided with a stem, as 23, on which stem is mounted one end of a connecting-link 25. From stem 23 or at some part of connecting-link 25—as, for instance, ear 35—depends another connecting-link 37 similar to link 25. To the right-hand ends of connecting-links 25 and 37 are pivoted pawls 39 and 41, respectively, which pawls are supported for oscillation on studs 43 and 45, respectively. From an ear 27 on link 25 and adjacent to bearing for stem 23 connection is made through coupling 31 to arm 33, fixed on shaft 30. Also fixed on shaft 30 is a lever, as 29, provided with a suitable latching device consisting, as illustrated, in a notched segment and means for engaging

therewith. Link 12 is provided with a sliding pivot-block 20, on which is pivotally mounted a connecting-link 26, provided with an ear 28. Said ear is connected, by means of link 32, with arm 34, fixed upon shaft 30. Also pivotally connected to link 26 is link 38, and at the right-hand end of said links are pivoted pawls, which pawls are supported for oscillation on studs 44 and 46, respectively, all similar, respectively, to the block 19, connecting-link 25, &c., as to link 11, already described more fully.

By means of the sprocket mechanism shaft 4 is rotated, and by means of cranks 5 and 6 and connecting-rods 17 and 18 oscillatory motion is transmitted to links 11 and 12, respectively. By means of lever 29, shaft 30, arms 33 and 34, couplings 31 and 32, slides 19 and 20, respectively, may be moved up and down in their respective slots in links 21 and 22, thereby enabling said links to communicate to the two sets of oppositely-disposed connecting-links 25 and 37 and 26 and 38, respectively, a greater or less length of stroke, according as whether the slides 19 and 20 are moved downward or upward.

The principles of the mechanism thus far herein set forth are well known and, except for their specific construction, old in the art, there being, however, novelty in their arrangement, and my improvement resides more particularly in those parts more fully hereinafter set forth. Those parts of the mechanism about to be described are substantially in duplicate, being disposed right and left and external of the frames 7 and 8. The description of the left-hand mechanism (shown nearest the eye in Fig. 1) will therefore suffice for a clear understanding of both.

Referring more particularly for clearness of illustration to Figs. 3, 4, and 5, studs 43 and 45, on which pawls 39 and 41 are mounted for oscillation, are fixed in the outer and free ends of arms 47 and 48, respectively, which arms in their turn are supported for oscillation on the hub of ratchet 50. Said ratchet 50 and the oppositely-disposed ratchet 51 are secured to shaft 49 for revolution therewith. A cam-disk 52 is mounted for oscillation on shaft 49, and one of its functions is to retain arms 47 and 48 in place on said shaft, and it in turn is held in place by nut 53.

Ratchet 50 is provided on its periphery with teeth, as 54, preferably symmetrical in profile, so that it may be operated with equal facility in either direction. Pawls 39 and 41 are counterparts of each other, and a description of pawl 39 will answer for both. Said pawl is double-acting, being trunnioned at 43 and provided with teeth 55 and 56, oppositely disposed, respectively, to said trunnion. Said pawl is operable to move ratchet 50 in either direction by means of connecting-link 25. The direction of such movement of ratchet 50 is governed by means of cam 52 and its connecting mechanism. Said cam is provided with two oppositely-disposed and oppositely-effective cam-slots 57 and 58. Slot 57 pertains to pawl 39 and consists in three portions, the two end portions 57^a and 57^b of which are concentric to shaft 49, but at different radial distances therefrom. Said end portions are connected by a third portion 57^c, which is substantially ogee in shape.

At 59, near the right-hand end of pawl 39, is a stud or pivot 74, which is limited in movement by slot 60 in slide 61. Said slide is provided with a pin 62 for engagement with slot 57 of cam 53 and with a guide-stem 63 for engagement with socket 64 in a portion of the hub 65 of arm 47. Guide-stem 63 is furnished with a cross-pin 66 for engagement with slot 67 in hub 65. Said cross-pin tends to retain slide 61 always in one plane. Pawl 41 is provided with similar governing mechanism to that just described in connection with pawl 39. Cam-disk 52 is shiftable into either of two working positions by means of a suitable lever mechanism, comprising connecting-link 68, arm 69, rock-shaft 70, arm 71, link 72, and hand-lever 73. Ratchet 51 is provided with an operating mechanism the counterpart of that above described in connection with ratchet 50 and is governed by the same hand-lever 73 through link 72, arm 71, and rock-shaft 70.

While ratchets 50 and 51 and their impelling-pawls are illustrated as having teeth for engagement with each other, respectively, such teeth are not a requisite of my improvement, but may be omitted and the pawls made in the form of toggles or clutches to impinge the periphery of the ratchets or grip suitable flanges formed thereon.

The operation of my improvement, which I will trace through the action of one pawl only, as such description will answer for all, is as follows: Shaft 1 being rotated in, for instance, a clockwise direction, motion is imparted through chain 10 to sprocket 3, shaft 4, and cranks 5 and 6 in the same direction. Through said cranks and links 17 and 18 oscillatory motion is imparted to links 11 and 12. As illustrated in Fig. 1 of the drawings, lever 29 is in its extreme forward position, thereby retaining, through the connecting parts, block 19 in its upper position, with its pivot 23 directly in line and concentric with trunnion 13, on which link 11 oscillates. Therefore no motion is communicated to links 25 and 37 by the oscillation of link 11. If now, however, lever 29 be thrown backward, (in the direction of the arrow,) block 19 will be forced downwardly in slot 21 of link 11 and vibratory motion communicated therethrough to connecting-links 25 and 37. Said motion will increase in amount according to the distance block 19 is

moved downward in link 11. An oscillatory motion is thereby communicated to pawl 39. As illustrated in Fig. 1, part 57^a of cam-slot 57 is at a greater distance from the center of shaft 49 than part 57^b of said slot, and pin 62 of slide 61 is engaged with said part 57^a, thereby affording pin 74 such freedom of upward movement in slot 60 of said slide 61 as to permit the engagement of teeth 55 of the pawl, Fig. 4, with the teeth of the ratchet during the forward movement of connecting-link 25, and during the rearward or return movement of said link by means of the bottom of slot 60 in slide 61, so limiting the downward movement of pin 74 as to prevent the engagement of teeth 56 of the pawl with the teeth of the ratchet and yet allowing sufficient movement of said pawl to enable teeth 55 thereof on said backward stroke to lift free of the teeth of the ratchet. The ratchet 50 will therefore be moved in a forward or anticlockwise direction.

The instants of heaviest duty for pawls 39 and 41 are at the commencements of their respective working strokes, and with the various parts of the mechanism coacting, as just described, link 11 at the commencement of its rearward stroke, which is synchronous with the commencement of the working stroke of pawl 41, is at substantially right angles to connecting-link 37, which is the position of maximum efficiency. Also link 12 at the commencement of its forward stroke, which is synchronous with the commencement of the working stroke of pawl 39, is at substantially right angles to connecting-link 25, which is the position of maximum efficiency. Also when said links 11 and 12 are at right angles to their respective connecting-links 25 and 37, respectively, the tendency of blocks 19 and 20 to "dodge"—that is, to be forced up or down in their respective slots 21 and 22—is minimized. It will therefore be seen that in my improvement I have a maximum of power at command at the instant of maximum duty. If now hand-lever 73 be moved rearwardly in the direction of its arrow—its proper stroke—cam-disk 53 will be rotated in an anticlockwise direction and part 57^b of cam-slot 57 brought into position for engagement with pin 62 in slide 61. Slide 61 will thereby be drawn inwardly toward the center of shaft 49 a sufficient distance to cause slot 60 to so limit the upward movement of pin 74 of pawl 50 as to prevent teeth 55 of said pawl from engagement on the forward stroke of the pawl with the teeth of the ratchet and on the rearward or return stroke of said pawl will allow sufficient downward movement of pin 74 as to enable teeth 56 of the pawl to engage the teeth of the ratchet. If then the several parts are caused to coact within the limitation set forth, ratchet 50 will be rotated in a clockwise direction. Pawl 41 is governed in the same manner as that just described in connection with pawl 39, but is caused to act in an opposite direction, so that said pawls alternate in their coaction with ratchet 50, impelling the opposite sides thereof in opposite directions, thereby causing said ratchet to revolve in one direction. By setting cranks 5 and 6 quartering, as shown, the right and left hand mechanisms supplement one another, and thereby communicate a constant rotary motion in either direction desired to shaft 49. By means of any suitable mechanism—as, for instance, a chain-and-sprocket mechanism—as illustrated, uniform rotary motion in either direction may be imparted to any suitable shaft or device—as, for instance, the driving-axle of an automobile.

I claim—

1. Two oppositely-disposed cranks set substantially quartering to each other and suitably mounted for rotation; two links mounted for oscillation; connecting-rods connecting the cranks and links respectively; pivot-blocks adapted to be moved lengthwise of said links and means for such movement; two ratchets, fixed to a revoluble shaft; four reversible-acting pawls, mounted for oscillation and adapted for engagement in pairs with each of the ratchets respectively; four connecting-links, operatively connecting each pivot-block with each two of the pawls respectively; means consisting of cam disks and slides to cause the pawls to engage their respective ratchets to impel said ratchets in one direction, and means to shift the cam-disks to cause the pawls to engage their respective ratchets to impel said ratchets in the other direction.

2. A reversible ratchet mechanism comprising a ratchet, a reversible-acting pawl mounted for oscillation both about a self-contained axis and about the axis of the ratchet, and adapted to engage the ratchet to impel it in either direction; means consisting of a cam-disk, a slide adapted to engage therewith, said slide operatively connected to said pawl and adapted to restrain one end of said pawl from engagement with the ratchet and yet permit the other end of the pawl to engage with the ratchet, means to shift the cam-disk to cause the slide to reverse the action of the pawl and means to drive the pawl alternately in opposite directions.

3. The combination of a link mounted for oscillation adjacent to one end thereof, means to oscillate the link, a sliding pivot-block adapted to be moved lengthwise in said link, and means for such movement, a ratchet mounted for revolution, two reversible-acting pawls each mounted for oscillation, both about a self-contained axis and about the axis of the ratchet and adapted to engage the ratchet and impel it in either direction; two connecting-

links operatively connecting the pivot-block with two pawls respectively; means for governing the direction of the coaction of the pawls and ratchet, said parts so arranged that when at the commencement of the oscillation of the link in one direction said link will be substantially at right angles to one of the connecting-links and at the commencement of its oscillation in the other direction substantially at right angles to the other connecting-link.

Signed at Nos. 9 to 15 Murray street, New York, N. Y., this 14th day of January, 1904.

WILLIAM D. CUSTEAD.

Witnesses:

FRED. J. DOLE,

JOHN O. SEIFERT.