No. 642,637. Patented Feb. 6, 1900.

W. W. SMALL.

DEVICE FOR CONVERTING RECIPROCATING MOVEMENT INTO ROTARY MOTION.

(Application filed July 6, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

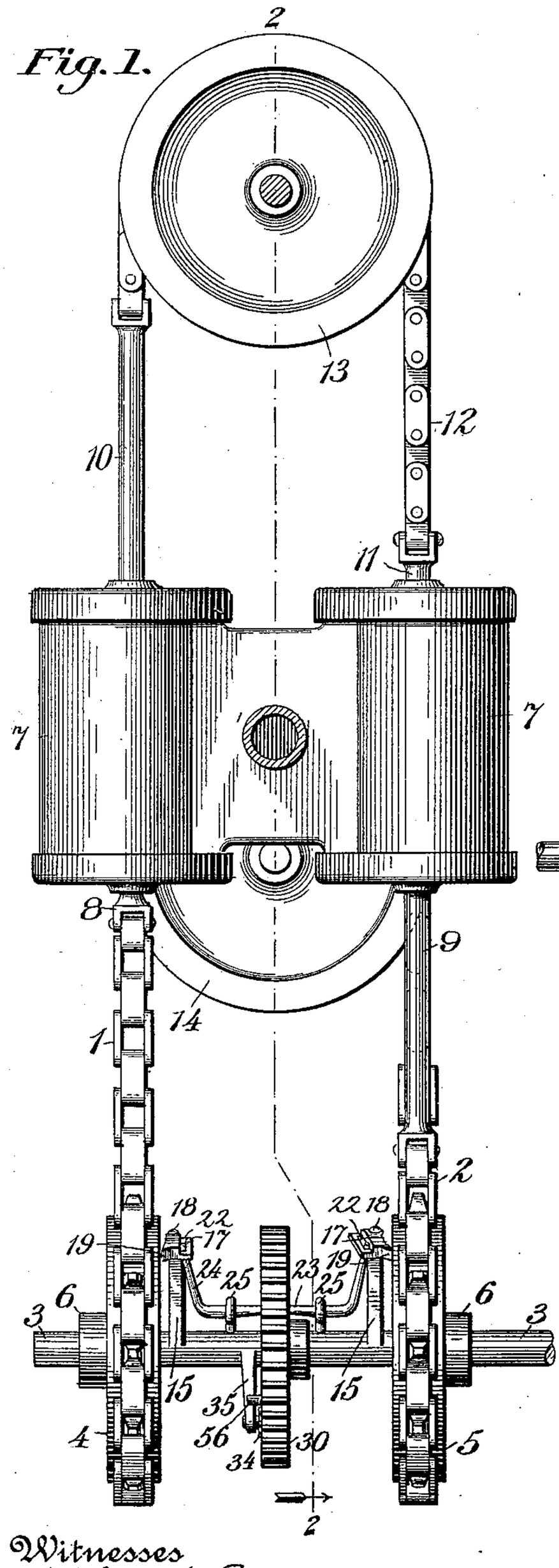
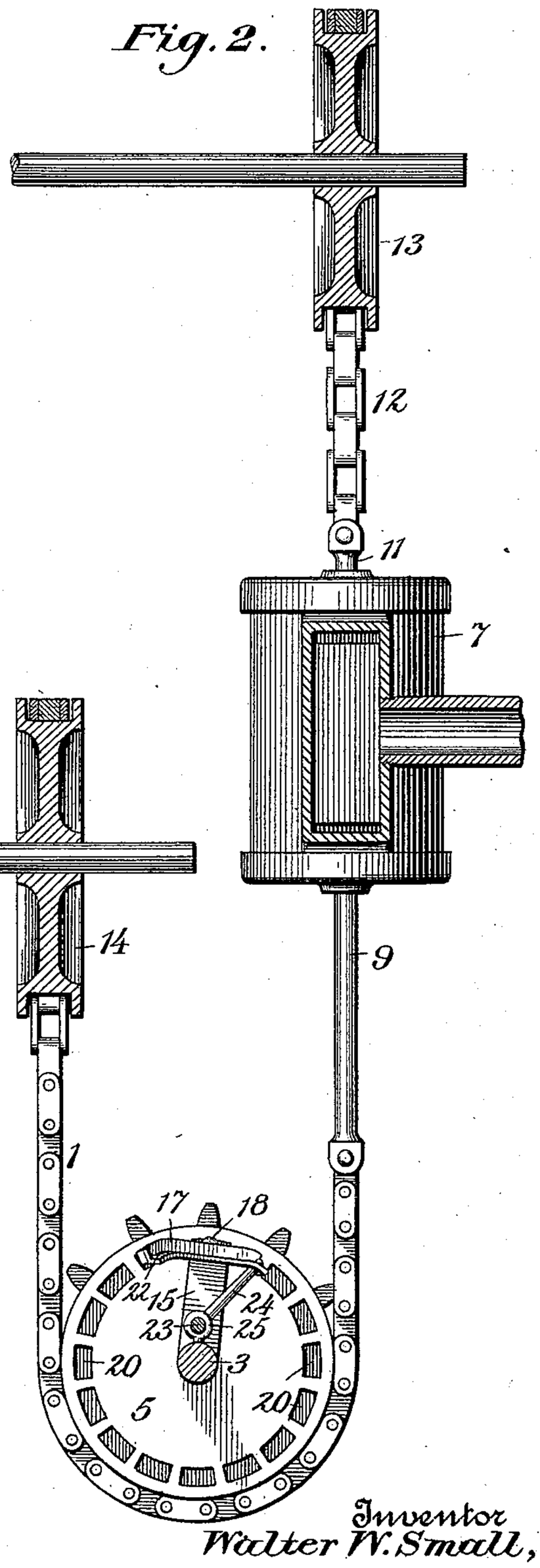


Fig. 2.



Witnesses
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R. G. Dexter.

Inventor
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By E. G. Siggers his Attorney

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(No Model.) 2 Sheets—Sheet 2.

Fig. 3

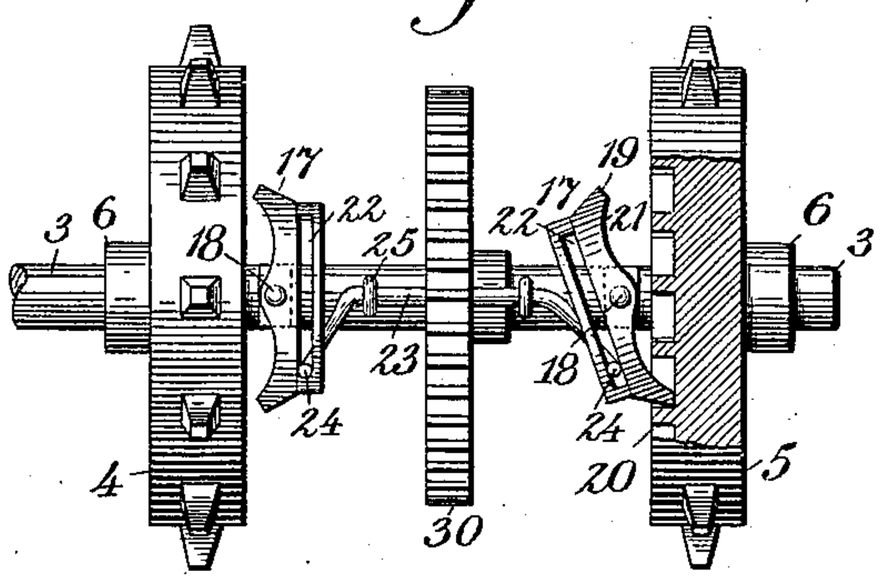


Fig. 4.

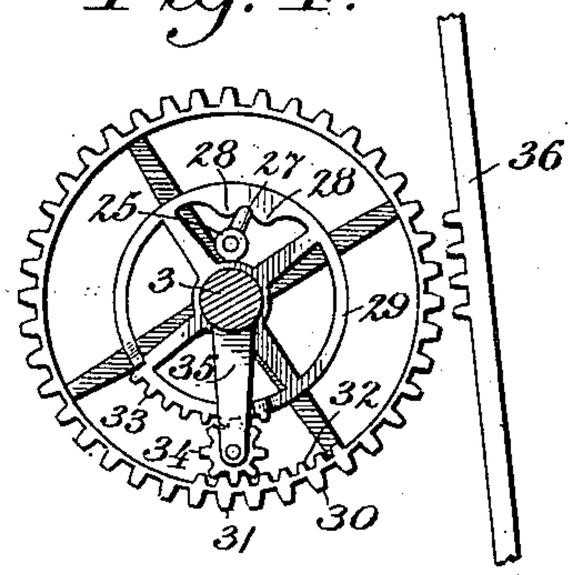


Fig. 5.

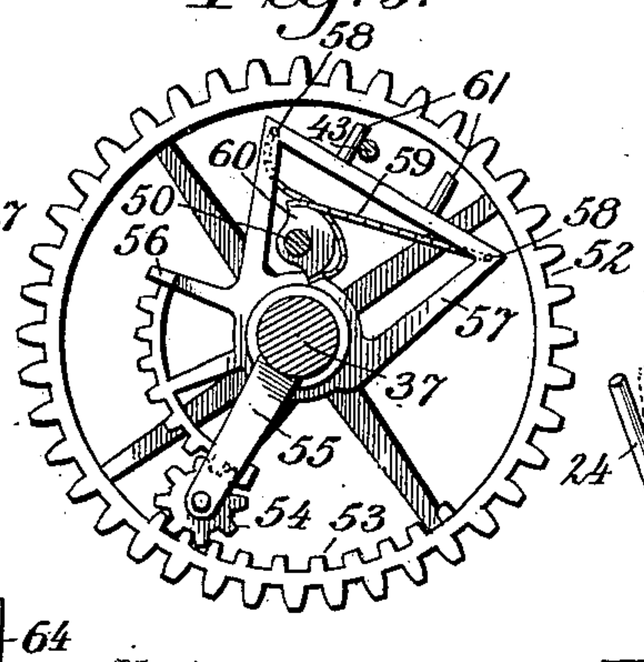


Fig. 8.

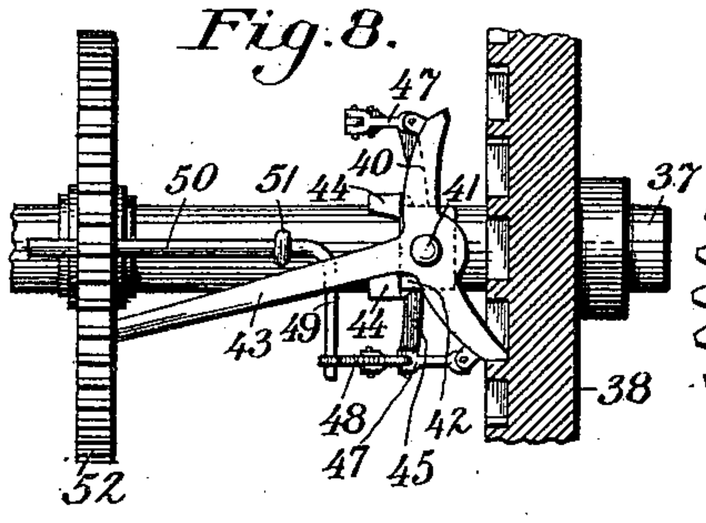


Fig. 9.

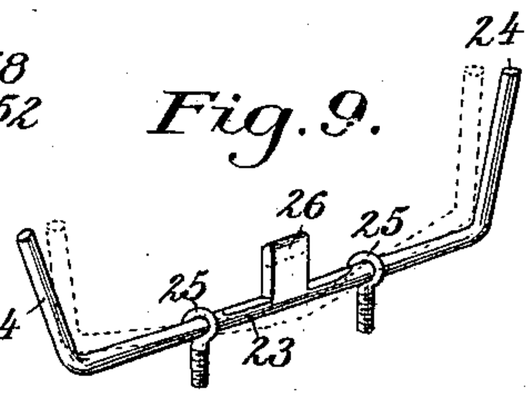


Fig. 6.

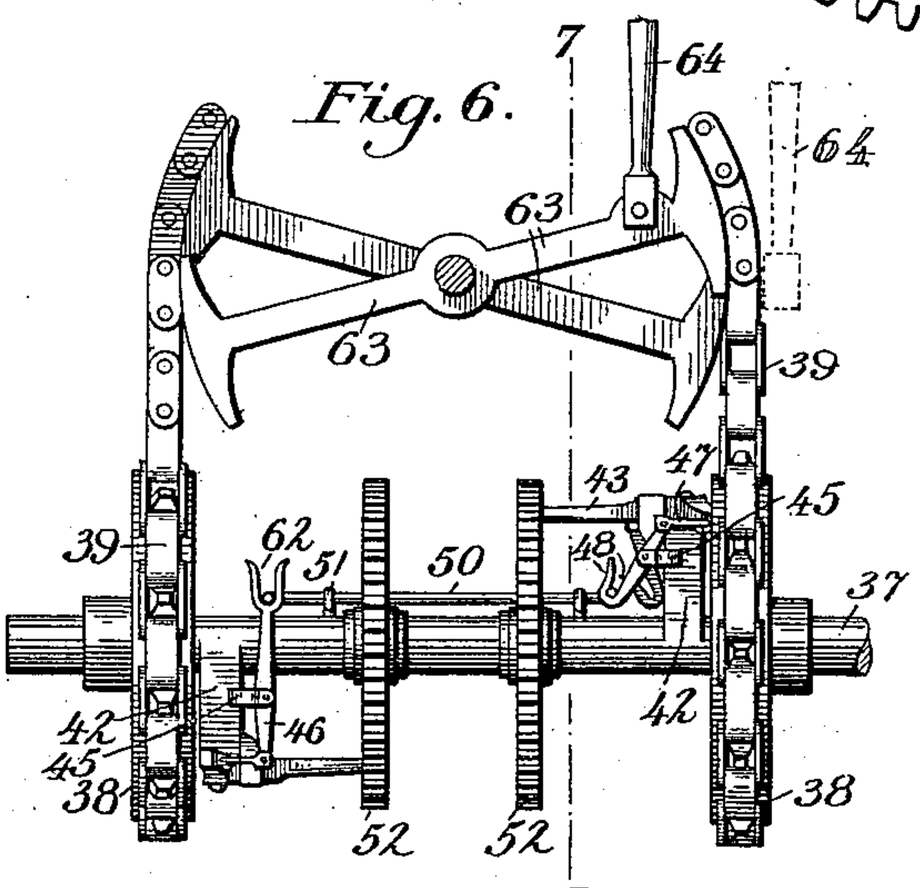
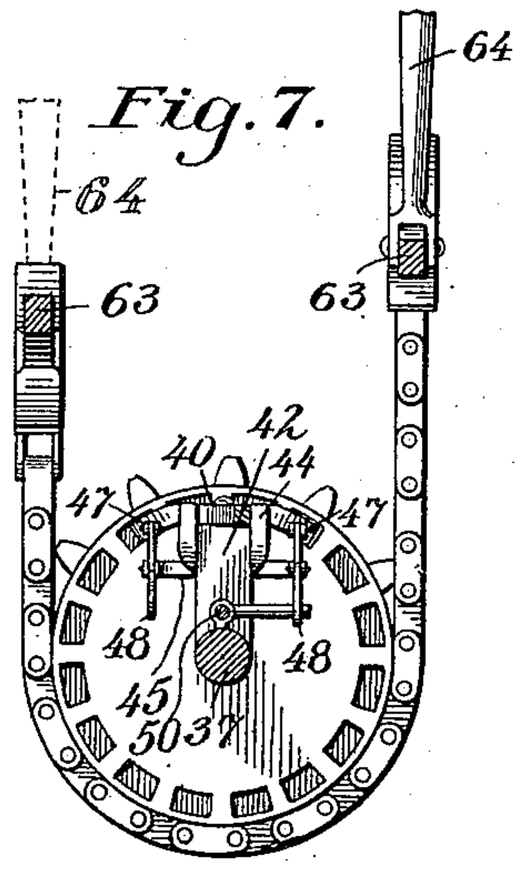


Fig. 7.



7

Witnesses
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B. G. Foster.

Inventor
Walter W. Small,
By: E. G. Siggers his Attorney

UNITED STATES PATENT OFFICE.

WALTER W. SMALL, OF CHERRYFIELD, MAINE.

DEVICE FOR CONVERTING RECIPROCATING MOVEMENT INTO ROTARY MOTION.

SPECIFICATION forming part of Letters Patent No. 642,637, dated February 6, 1900.

Original application filed May 4, 1898, Serial No. 679,743. Divided and this application filed July 6, 1899. Serial No. 722,985.

(No model.)

To all whom it may concern:

Be it known that I, WALTER W. SMALL, a citizen of the United States, residing at Cherryfield, in the county of Washington and State of Maine, have invented a new and useful Device for Converting Reciprocating Movement into Rotary Motion, of which the following is a specification.

This invention relates to devices for converting reciprocating movement into rotary motion, and is in the nature of a modification of the construction and arrangement set forth in another application, filed by me May 4, 1898, Serial No. 679,743.

The present invention relates particularly to the adaptation of the mechanism such as is described in said divisional application to machines or motors in which by reason of their size and the large amount of space necessarily occupied thereby it is necessary to employ oscillating members which are located a considerable distance apart upon the driven rotary member. It will be obvious that under this condition it is necessary to employ mechanism of an essentially different character for automatically engaging the oscillating members with and disengaging the same from the rotary member, as clutch mechanism consisting of clutch-dogs alone will not suffice without the interposition of suitable connections, whereby one dog when shifted will automatically shift the other dog. It also becomes necessary in connection with such an arrangement to employ reversing mechanism of an essentially different character in order that the dogs may be shifted for throwing their opposite ends into operative relation with the oscillating members for the purpose of reversing the direction of rotation of the final member of the mechanism. These and other objects and advantages of the invention will be pointed out in the course of the ensuing description.

The invention consists in certain novel features and arrangement of parts, as hereinafter fully described, illustrated in the drawings, and incorporated in the claims.

In the accompanying drawings, Figure 1 is a front elevation of mechanism for converting reciprocating into rotary motion constructed in accordance with the present invention. Fig. 2 is a central longitudinal section on the line 2 2 of Fig. 1. Fig. 3 is a plan view of the rotary member, oscillating members, and the clutch mechanism. Fig. 4 is a transverse section through the same, taken at one side of the reversing-wheel, showing also the reversing device in the form of a rack-bar. Fig. 5 is a view similar to Fig. 4, showing a modified form of reversing mechanism. Fig. 6 is an elevation similar to Fig. 1, showing walking-beams substituted for the pulleys and the clutch mechanism and the reversing mechanism arranged on opposite sides of the rotary member. Fig. 7 is a longitudinal section on the line 7 7 of Fig. 6. Fig. 8 is an enlarged detail plan view of a portion of the clutch and reversing mechanism shown in Figs. 6 and 7. Fig. 9 is a detail perspective view of the shipper-rod and its mountings.

Similar numerals of reference designate corresponding parts in all the figures of the drawings.

Referring to the drawings, 1 and 2 designate the reciprocating elements, which are shown for convenience in the form of sprocket-chains, and 3 the rotary member, to which rotary motion is to be communicated by means of devices interposed between it and the reciprocating elements. The rotary member 3 is illustrated in the form of a shaft, having mounted thereon a pair of oscillating members 4 and 5, which are in the form of sprocket-wheels, the same being normally loose on the shaft 3 and held in place by means of collars 6. The sprocket-wheels 4 and 5 are adapted to be intermittently and alternately engaged with and disengaged from the shaft 3 by means of the clutch mechanism, hereinafter described, interposed between said wheels and mounted upon said shaft.

A practical method of actuating the reciprocating elements 1 and 2 is illustrated in Figs. 1 and 2 of the accompanying drawings, the same consisting of a pair of steam-cylinders 7, having reciprocating pistons mounted therein and provided with piston-rods 8 and 9, connected to the opposite ends of the parts 1 and 2. The pistons are also provided with stems 10 and 11, which extend in opposite

directions from the rods 8 and 9, passing outward through the opposite ends of the cylinders. The stems 10 and 11 are coupled together by means of a flexible connection 12, shown in the form of a chain, which passes over a pulley or wheel 13, whereby when one of the pistons and its stem move in one direction the other piston and stem are caused to move in the opposite direction. The chain, flexible driver, or reciprocating element is attached at one end to the piston-rod 8, passing thence around the sprocket-wheel 4, returning therefrom and passing around a pulley or wheel 14, thence around the remaining sprocket-wheel 5 on the shaft 3, and connecting to the extremities of the piston-rod 9, as clearly illustrated in Figs. 1 and 2. By reason of the arrangement just described it will be seen that as the pistons, together with their rods and stems, are reciprocating simultaneously in opposite directions the oscillating members or sprocket-wheels 4 and 5 will be correspondingly and at the same time turned or partially rotated in opposite directions.

I will now proceed to describe the clutch mechanism by means of which each of the sprocket-wheels 4 and 5 is alternately engaged with and disengaged from the shaft 3 and by means of which one or the other of said wheels is always engaged with the shaft for imparting to said shaft a continuous rotary movement in the same direction. In carrying out this part of the invention the rotary member or shaft 3 is provided with rigid arms 15 of slightly less length than the radius of the sprocket-wheels 4 and 5, and upon the outer ends of said arms 15 double-ended clutch-dogs 17 are mounted, the said dogs being pivoted, as at 18, about centrally, so that they can turn or oscillate upon the ends of the arms 15 for bringing either end or engaging portion 19 of each dog into engagement with a circular series of teeth or shoulders 20 on the inner adjacent faces of the wheels 4 and 5. Each clutch-dog is also provided at each end with a beveled portion 21, which is acted upon by the teeth or shoulders 20 for forcing the dog out of engagement with the sprocket-wheel when the latter is moving backward or in a direction the reverse of that in which the shaft 3 is being driven. Each of the dogs 17 is also provided with a longitudinal slot or way 22, in connection with which the opposite ends or extremities of a shipper-rod 23 work. As illustrated in Figs. 1 and 3, two of these clutch-dogs 17 are employed, arranged adjacent to the inner toothed faces of the wheels 4 and 5, and the shipper-rod 23 extends longitudinally of the shaft 3 and has its end portions bent outward obliquely to form spring-fingers 24, the extremities of which work in the slots or ways 22. The central or body portion of the rod 23 is journaled and also slidingly mounted in a pair of eye-bearings 25 on the shaft 3, the shipper-rod 23 being thus held at a sufficient distance from the shaft to enable its central portion to be sprung inward toward the shaft and its end portions to be sprung inward toward each other, as clearly illustrated in dotted lines in Fig. 9.

From the foregoing description it will be seen that as the shipper-rod 23 is rocked or turned in one direction the ends of the spring-fingers 24 will move toward the ends of the slots 22 at one side of the shaft and, by reason of their resiliency and the spring action of the central portion of the rod, force the corresponding ends of the clutch-dogs away from each other, as shown in Fig. 3. The relative arrangement of the dogs and shipper-rod is such that the distance between the outwardly-pressed ends of the dogs will be greater than the distance between the adjacent faces of the wheels 4 and 5, the effect of which will be to cause the end of one of the dogs to engage the teeth 20 of the adjacent wheel 4 or 5, as the case may be. When the direction of movement of the reciprocating element or flexible driver is reversed, the engaging portion of the dog just referred to will be thrown outward by the action of the teeth 20 thereon, and simultaneously therewith the corresponding end of the other clutch-dog will be thrown into engagement with the teeth 20 of the other sprocket-wheel or oscillating member, thereby effecting an engagement of said sprocket with the shaft and the disengagement of the first-named sprocket-wheel from the shaft. In this operation of shifting the dogs the shipper-rod 23 slides in the eye-bearings 25. Should the flexible driver be stopped or brought to a rest, the shaft 3 may continue its rotation, owing to the fact that the resiliency of the shipper-rod will permit both clutch-dogs to move out of engagement with the wheels 4 and 5 on account of the coöperation of the teeth 20 with the beveled faces 21 of the dogs, the engaging portions of the dogs thus slipping by and passing the teeth 20 as said dogs are carried around with and by the shaft 3. It will also be seen that by rocking or partially turning the shipper-rod 23 in its bearings and forcing the spring-fingers 24 to the opposite ends of the slots or ways 22 the opposite and corresponding ends of the clutch-dogs will be forced apart by the spring action of the shipper-rod and its fingers. The effect produced by thus shifting the positions of the clutch-dogs is to cause the rotary member or shaft 3 to be actuated or driven in the opposite direction.

In order to rock or partially turn the shipper-rod 23, and thereby reverse the direction in which the shaft 3 is driven, said shipper-rod is provided at a point intermediate its ends with a projection or tooth 26, which is engaged in a notch 27, formed between shoulders 28 on an oscillating rim or wheel 29, journaled on the axle 3 in line with and preferably within the plane of a reversing-wheel 30, which is also loosely mounted on the shaft 3 at a point about midway between the wheels 4 and 5, as shown in Figs. 1 and 3. By reference to Fig. 4 it will be seen that the re-

versing-wheel 30 is provided with outer peripheral teeth 31 and also with teeth 32 upon the inner face of its rim. The smaller rim or wheel 29 is provided on its exterior surface or periphery with teeth 33, and these teeth, as also the teeth 32, mesh with a spur-pinion 34, which is journaled on and carried by the outer end of an arm 35, fast on the shaft 3. The requisite amount of rotary movement is imparted to the reversing-wheel 30 by means of a reversing device 36 in the form of a rack-bar mounted in any suitable manner upon the machine.

From the foregoing it will be seen that by partially revolving the reversing-wheel 30 the wheel 29, through the medium of the pinion 34, will be partially and correspondingly revolved in the opposite direction, and as said wheel 29 is turned the shoulders 28 will engage the projection 26 on the shipper-rod and rock or partially turn said shipper-rod, thereby causing the spring-fingers or end portions of said rod to traverse the slots 22 of the clutch-dogs and pass from one end of said slots to the opposite end, thereby reversing the position of the dogs and causing a reversal of the direction of rotation of the rotary member 3.

The reversing mechanism hereinabove described is designed for use where the power applied to the reversing-wheel acts in a direction opposite to that in which the shaft or axle 3 is being driven. Where the power is applied in the same direction as that in which the shaft or axle is being driven, the essentials of the wheels 30, 34, and 33 may be embodied in a single wheel in a manner that will be readily understood.

I will now proceed to describe a modified form of clutch mechanism and reversing mechanism which, while embodying the same principles hereinabove set forth, are especially designed for use in connection with oscillating members or sprocket-wheels which by reason of the size of the machine or owing to other conditions beyond control are located at a considerable distance from each other. The construction to be described will be found illustrated in Figs. 5 to 8, inclusive. In these figures, 37 designates the rotary member, which corresponds to the shaft 3, above described. 38 represents the oscillating members or sprocket-wheels, and 39 the reciprocating element or flexible driver in the form of a chain. By reference more particularly to Figs. 5 and 8 it will be seen that I employ a double-ended clutch-dog 40 for engagement with the teeth of the wheel 38, said dog being pivotally mounted at 41 on the rigid arm 42, extending outward from the shaft 37. The dog is provided with a central rearwardly-extending tailpiece 43, which operates between a pair of spaced stop-lugs 44, extending laterally from the arm 42, said stops arresting the outward movements of the engaging portions of the dog, so as to maintain a proper engagement between said engaging portions and the adjacent wheel 38. It will be understood that two of these dogs are employed, one for each wheel 38 or 4 and 5 of Fig. 3, and in order to operate said clutch-dogs for throwing them alternately into and out of engagement with their respective wheels the arm 42 is provided with a cross-head or oppositely-extending portions 45, to the outer ends of which are pivotally connected dog-levers 46, said levers being fulcrumed intermediate their ends, as clearly shown in Figs. 6 and 7. The outer ends of the levers 46 are connected operatively to the engaging extremities of the dogs by means of interposed pivotal links 47, and the inner ends of said levers are bent to form spring-hooks 48, designed to receive the bent ends or spring-fingers 49 of a rocking or sliding shipper-rod 50, similar to that 23, hereinabove described.

It will now be seen that when one of the wheels 38 is moved backward, causing it to throw the dog out of engagement therewith, the corresponding end of the other clutch-dog will be thrown into engagement with the adjacent wheel by reason of the shipper-rod 50 sliding in its eye-bearing 51 on the shaft 37, the coöperation of said parts being otherwise the same as that previously described in connection with Figs. 1 and 3.

The mechanism for reversing the disposition of the clutch-dogs 40 comprises a reversing-wheel 52, toothed upon its outer surface, to be engaged by a reversing device similar to that 36, hereinabove described. Said wheel is also provided with teeth 53 upon the inside of its rim for engagement with a pinion 54, journaled on and carried by the outer end of an arm 55, rigid with the shaft 37. The wheel 52 is loosely mounted on the shaft 37, and there is also loosely mounted on said shaft a toothed segment 56, arranged within the plane of the wheel 52 and meshing with the pinion 54, so that as the wheel 52 is revolved partially in one direction the toothed segment 56 is correspondingly moved in the opposite direction. Formed integrally with the segment 56 is a yoke or triangular-shaped frame 57, having attached to its outer corners at the points 58 flexible connections or chains 59, which extend inward and cross each other and have their opposite ends connected to a pulley-segment 60, fast on the shipper-rod 50. By this construction as the segment 56 is oscillated the flexible connections 59 operate upon the pulley-segment 60 and correspondingly rock or turn the shipper-rod 50 in the opposite direction. The outer bar or portion of the yoke 57 is provided with a pair of outwardly-extending pins 61, which are spaced a suitable distance apart and which receive between them and operate upon the extremity of the tailpiece 43 of the adjacent clutch-dog, so that it will now be apparent that by operating the reverse-wheel 52 it, through the medium of the connections just hereinabove described, will vibrate the tailpiece of the clutch-dog and reverse the position of said dog, car-

rying the disengaged extremity thereof into engagement with the adjacent sprocket-wheel, and simultaneously with this operation the shipper-rod 50 is rocked, so that its end portions move out of engagement with the hooks 48 of one pair of dog-levers into engagement with the hooks of the dog-levers on the opposite side of the shaft, thereby enabling said clutch-dogs to actuate one another for throwing them alternately into and out of engagement with their respective wheels.

The mechanism just hereinabove described is designed for reversing the positions of the dogs where the power is applied in a reverse direction to that in which the rotary member or shaft 37 is driven. Where the power to reverse the levers is applied in the same direction as that in which the shaft 37 is driven, the parts 52, 54, and 56 may be combined in one.

In some cases it may be desirable to locate the clutch-dogs on opposite sides of the axle 37, as shown in Fig. 6, in which event it will only be necessary to extend one set of dog-levers 46 across the shaft or partially around the opposite sides thereof and provide spring-forks 62 at their ends, in which one of the end portions or spring-fingers 49 of the shipper-rod is received. Under any of the arrangements hereinabove described it will be seen that the shipper-rod is slid longitudinally and reciprocated as the dogs are alternately thrown into and out of engagement with the respective wheels, and it will be appreciated that this operation is entirely automatic, and as a result continuous rotary motion in the same direction is applied to the final or rotary member; also, that by turning or rocking the shipper-rod the positions of the clutch-dogs are reversed and the rotary member adapted to be driven continuously in the opposite direction.

Instead of connecting the reciprocating elements or flexible drivers as shown in full lines illustrated in Figs. 1 and 2 they may be connected to walking-beams 63, as shown in Fig. 6, and the actuating or power-imparting device 64 may be connected to one of such walking-beams, as shown in full lines in Fig. 6, or at a convenient point to one of the chains or flexible drivers, as shown in dotted lines in the same figure.

From the foregoing description it will be seen that I have provided simple and reliable means for converting reciprocating movement into rotary motion. The mechanism described may be with advantage applied in the propulsion of bicycles and kindred foot-propelled vehicles. The use of the mechanism is, however, not restricted to such vehicles; but the mechanism may be employed in any way and at any place where it is desirable to convert reciprocatory into rotary motion.

From the foregoing it is thought that the construction, operation, and many advantages of the herein-described device for converting reciprocating movement into rotary motion will be apparent to those skilled in the art without further description, and it will be understood that changes in the size, shape, proportion, and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a device for converting reciprocating movement into rotary motion, in combination, a reciprocating member, a rotary member, oscillating members normally loose on the rotary member, and clutch mechanism comprising a pair of clutch-dogs arranged between the oscillating members, and a sliding shipper-rod in engagement with said dogs and alternately operated thereby, whereby the oscillating members are alternately engaged with and disengaged from the rotary member, substantially as described.

2. In a device for converting reciprocating movement into rotary motion, in combination, a reciprocating element, a rotary member, oscillating members normally loose thereon, and clutch mechanism interposed between said oscillating members and comprising a pair of clutch-dogs, and a sliding shipper-rod having a yielding engagement with both clutch-dogs, substantially as described.

3. In a device for converting reciprocating movement into rotary motion, in combination, a reciprocating element, a rotary member, oscillating members normally loose thereon, a pair of clutch-dogs carried by the rotary member, and a sliding shipper-rod having a yielding and detachable engagement with said dogs, substantially as described.

4. In a device for converting reciprocating movement into rotary motion, in combination, a reciprocating element, a rotary member, oscillating members normally loose on said rotary member and actuated by the reciprocating element, double-ended clutch-dogs coöperating with the oscillating members and carried by the rotary member, and a shipper-rod forming a connection between said dogs and adapted to be thrown into engagement with either end of each dog for reversing the positions of the dogs, substantially as described.

5. In a device for converting reciprocating movement into rotary motion, in combination, a reciprocating element, a rotary member, oscillating members, normally loose on the rotary member and actuated by the reciprocating member, double-ended clutch-dogs carried by the rotary member and cooperating with the oscillating members, a shipper-rod journaled on the rotary member, and having its end portions in engagement with said clutch-dogs, and means for rocking said shipper-rod to cause its end portions to pass from one side of the pivotal connection of the dogs to the opposite side, substantially as and for the purpose specified.

6. In a device for converting reciprocating movement into rotary motion, in combination, a reciprocating element, a rotary member, oscillating members loose thereon and actuated by the reciprocating element, double-ended clutch-dogs pivotally mounted on the rotary member, a shipper-rod journaled on the rotary member and having spring end portions for engagement with the dogs, a projection on the shipper-rod intermediate its ends, and means coöperating therewith for rocking the shipper-rod, substantially as and for the purpose described.

7. In a device for converting reciprocating movement into rotary motion, in combination, a reciprocating element, a rotary member, oscillating members loose thereon and actuated by the reciprocating element, double-ended clutch-dogs carried by the rotary member and coöperating with the oscillating members, a shipper-rod journaled on the rotary member and operatively connected to said dogs, and a reversing-wheel journaled on the rotary member and coöperating with the shipper-rod for rocking the latter, substantially as and for the purpose specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

WALTER W. SMALL.

Witnesses:
MABEL P. SMALL,
E. D. LEIGHTON.