R. J. McCARTY.

MULTIPLE PISTON MECHANISM.

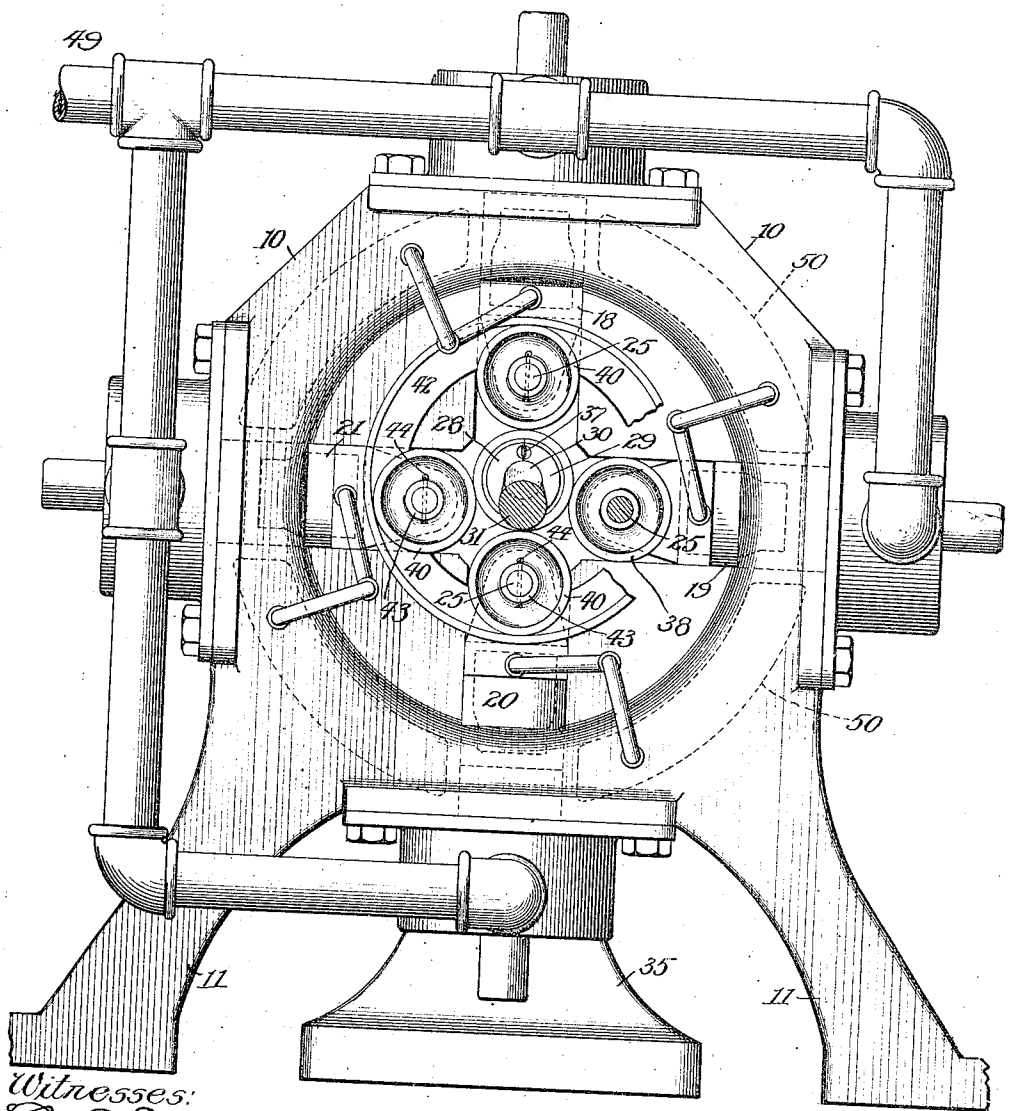
APPLICATION FILED APR. 20, 1909.

977,816.

Patented Dec. 6, 1910.

4 SHEETS—SHEET 1.

Fig 1.



Witnesses:

Geo. Dawson

Walter M. Fuller

Inventor:

Richard J. McCarty

By Offield Towle & Linthicum

Attys.

R. J. McCARTY.

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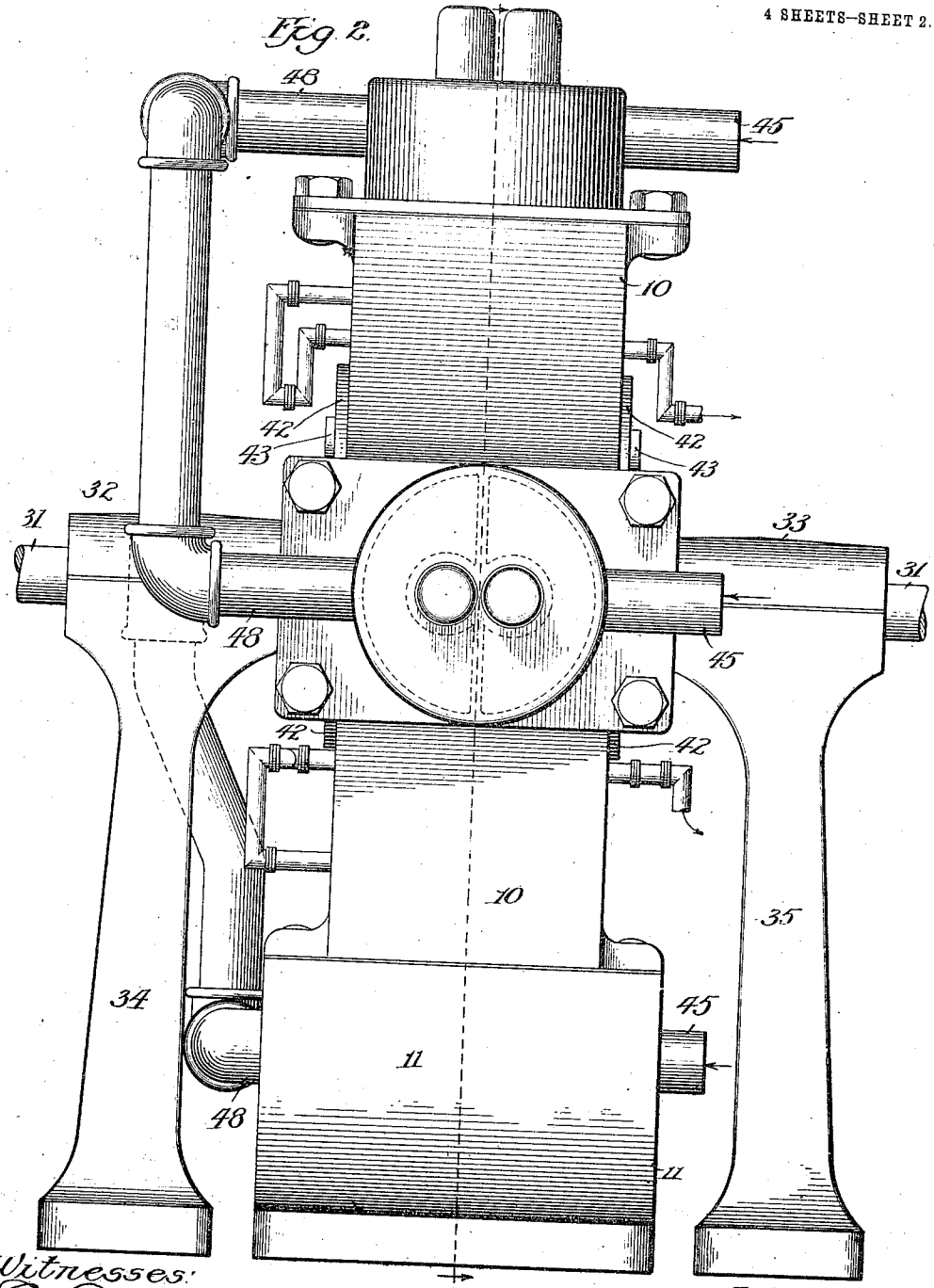
4 SHEETS—SHEET 2.

Fig. 2.



Witnesses:
Geo. C. Davison
Walter M. Fuller

Inventor
Richard J. McCarty
By Offield Towle & Linthicum
Attys.

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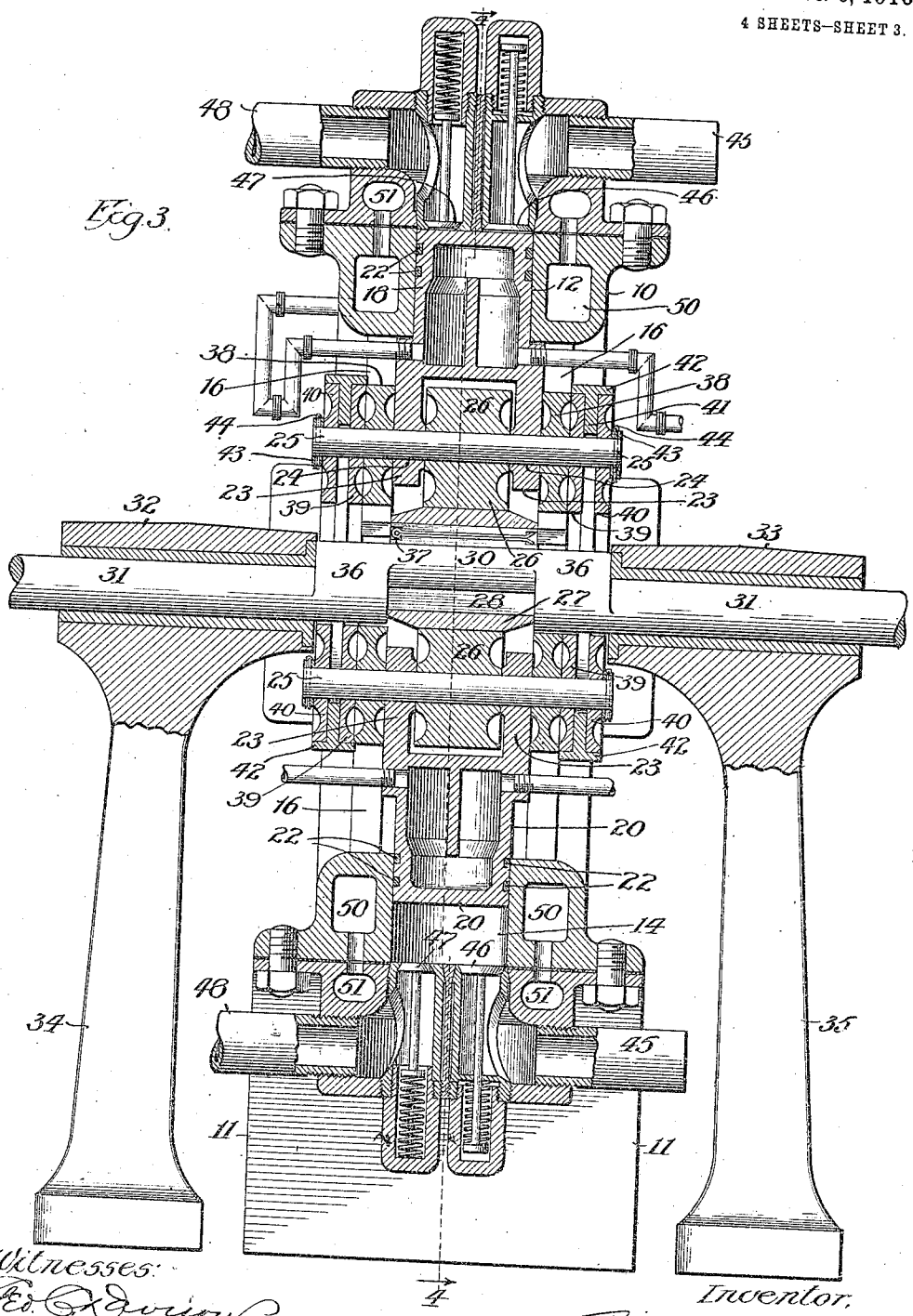
4 SHEETS—SHEET 3.

Fig. 3.



Witnesses:
Ed. C. Davison
Walter M. Fuller

Inventor.
Richard J. McCarty
By Offield Towle & Linthicum
Attys.

R. J. McCARTY.

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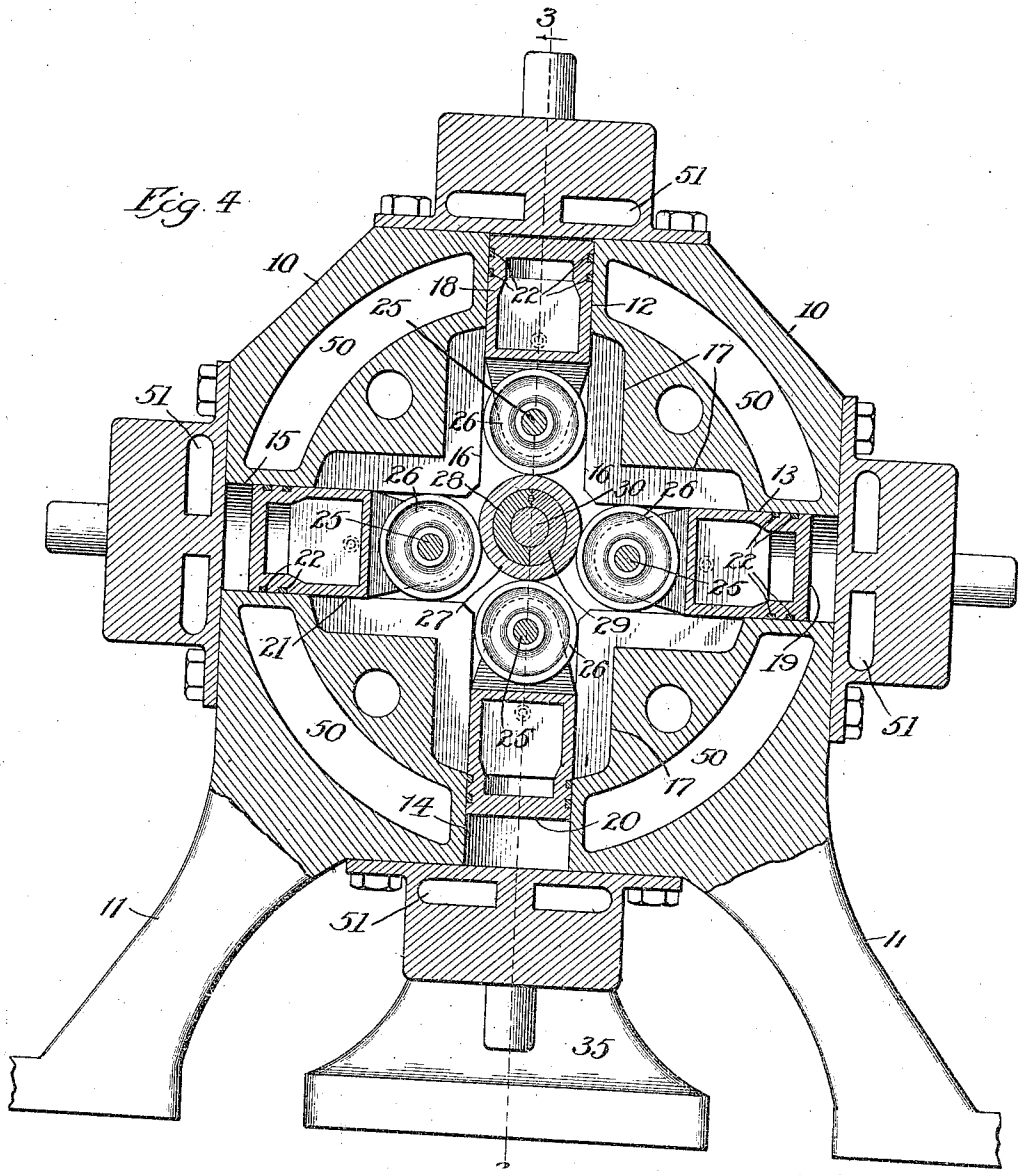
4 SHEETS—SHEET 4.

Fig. 4



Witnesses:
Ed. D. Dixon
Walter M. Fuller

Inventor
Richard J. McCarty
By Offield Towle & Linthicum
Attys.

UNITED STATES PATENT OFFICE.

RICHARD J. McCARTY, OF KANSAS CITY, MISSOURI.

MULTIPLE PISTON MECHANISM.

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Application filed April 20, 1909. Serial No. 491,186.

To all whom it may concern:

Be it known that I, RICHARD J. McCARTY, a citizen of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Multiple Piston Mechanisms, of which the following is a specification.

This invention pertains to devices in general employing a plurality of power pistons sliding in their respective chambers in combination and coöperative relation with an off-set, or cranked shaft, with power transmitting means between the shaft and pistons, it being quite immaterial whether the shaft drives the pistons, as in an air compressor or pump, or the pistons rotate the shaft, as in a steam, hydro-carbon, or similar engine. Heretofore, as far as I am advised, no one has been able to produce or provide a suitable device of this character wherein the plurality of pistons are radially-arranged in a single plane, the crank or off-set part of the shaft being in the same plane, and the appliance having power transmitting means between the same. In a device embodying my invention I not only successfully attain these desired results, but I am also able to reduce the friction to a minimum by the employment of rolling contacts wherever permissible or possible. In place of the usual sliding cross-head I employ rollers or guide-wheels co-acting with suitable guides, and in place of the customary connecting rods or pitmen used to translate rectilinear into rotary motion or the reverse, I provide contacting rollers free to turn, thereby reducing the friction as much as possible. One of such rollers or driving rings is mounted on the cranked part of the shaft and coöperates or contacts with individual rollers or anti-friction wheels, one of which is rotarily mounted on each piston. The crank roller or driving ring acts somewhat as a universal connecting rod for all of the pistons.

By the employment of these means I am enabled to provide a mechanism of this character which is extremely simple in construction, comparatively inexpensive to manufacture, and quite unlikely to get out of order or require material repairs. Some of its leading and principal features are, however, its compactness and the minimum of friction produced during the operation of the mechanism.

Succinctly stated, this invention relates to improved and simple means for translating rectilinear motion into rotary or the reverse.

In the accompanying drawings I have illustrated a preferred and desirable embodiment of this invention, throughout the various views of which like reference characters refer to the same parts.

In these drawings—Figure 1 is an elevation of the device, certain parts being in section and partially broken away to more clearly indicate the construction; Fig. 2 is an end elevation of the device on a somewhat larger scale; Fig. 3 is a vertical section on line 3—3 of Fig. 4; and Fig. 4 is a vertical section at right angles to that shown in Fig. 3, being taken on line 4—4 of Figs. 2 and 3.

Referring to these drawings, it will be noted that the main frame 10 of the machine is supported on a pair of legs 11, 11 and is provided with a plurality, in the present instance four, of radially-arranged cylinders or piston chambers 12, 13, 14 and 15, disposed 90 degrees apart and all located in the same plane. On opposite sides of each of these chambers or cylinders, and extended inwardly therefrom toward the center of the main casting, is a pair of guides 16, 16 having adjacent flat, parallel, guiding surfaces, it being understood, as is clearly shown in Fig. 4, that the casting or main frame is recessed or cored out at 17 between these guides on the opposite portions thereof. Slidable in the four cylinders or piston chambers above referred to, I employ a like number of pistons or plungers 18, 19, 20 and 21, each supplied with suitable packing rings 22 to maintain the usual desirable tight connection with the inner cylindrical walls of the chambers. Each of these pistons or plungers, as is clearly illustrated, has projecting inwardly of the machine a pair of spaced ears 23 cylindrically apertured in alinement at 24, such holes being adapted to accommodate a pin or shaft 25 transversely disposed with relation to its piston or plunger and projecting outwardly some distance from the outer faces of the ears or lugs 23 through the open spaces in casting 10 between the guides 16, as is clearly indicated in Figs. 1, 3 and 4. Between the ears 23 of each piston I loosely mount on the shaft or pin 25 a cylindrical power roller 26, all four of which bear against the outer

cylindrical surface of a driving ring 27 rotatable with a divided sleeve or bushing, the two parts of which are characterized 28 and 29, mounted on the cylindrical, cranked, or off-set portion 30 of a main power shaft 31 supported and rotatable in a pair of companion bearings 32 and 33, supported and held in place in any suitable manner as by the standards 34 and 35, respectively. As is indicated in Fig. 3, the driving ring 27, since it is of substantially the same length as the distance between the inner faces of the crank arms 36 of the off-set portion of shaft 31, is prevented by these arms from shifting lengthwise or longitudinally of the shaft. Correspondingly, the two parts 28 and 29 of the bushing or sleeve between the ring and shaft are prevented from similar shifting, being held together by the removable cotter-pin 37, the round head and split ends of which are housed within and protected by suitable cavities or recesses in the ends of the bushing parts, it being understood that comparatively long registering grooves in the meeting faces of the bushing form a hole or aperture for the reception of the main body of such retaining cotter. In assembling these parts the driving ring 27 is slipped lengthwise over the shaft, and when it registers with the cranked or off-set portion thereof it is shifted laterally, as indicated, for example, in Fig. 3, in which position the two parts of the bushing or sleeve 28, 29 may be put in place and held against relative longitudinal movement by the cotter-pin.

As is clearly shown, the power rollers 26 are of substantially the same length and thickness as the distance between the arms 23, whereby their displacement is obviously prevented. Loosely rotatable on each pin or shaft 25 and bearing against the outer flat faces of the arms 23 I provide a pair of guide wheels 38, 38 of the same diameter as the distance between the guiding surfaces of the guides 16, 16 on which these wheels are adapted to travel to maintain the proper rectilinear reciprocation of the pistons or plungers; in other words, these guiding wheels or rollers perform the function of and correspond to the cross-heads of engines, compressors, or pumps.

Outside of each of the guide-wheels 38 on each of the shafts or pins 25, I provide a pair of secondary rollers 39 and 40 spaced apart a suitable distance to accommodate between them the inwardly-projected fin 41 of a floating piston-retracting ring 42 against the inner surface of which the rollers 39 and 40 of the four shafts 25 contact, it being understood that one of such rings and its complement of secondary rollers is provided at each side of the machine. In order to maintain in proper position the various wheels and rollers on the shaft 25, each end of each of such shafts is supplied with a collar 43 pinned to the shaft by a cotter 44 passed through registering apertures in the two parts. By this means all of the freely-rotatable rollers and wheels on the shaft are maintained in proper relation and position.

It is to be understood that a multiple piston mechanism of this character is susceptible of a variety of uses and employments, and in order that one of such may be herein indicated, I have illustrated this invention as applied to an air compressor. Its various features concerning the air admission and discharge, the valve control, the water cooling for the cylinders, and the hollow pistons or plungers, have been clearly illustrated in the drawings, but inasmuch as this invention relates more particularly to the plurality of pistons, the crank shaft, the transmission mechanism between the two, and the floating rings employed for retracting the pistons, a detailed description of these parts of the compressor is not deemed necessary. Suffice it to state that the air is admitted to the cylinders through the inlet pipes 45 and admission valves 46, being discharged through the outlet valves 47 and pipes 48 connected to the common discharge pipe 49, whereas the cooling water for the cored-out chambers 50 and 51 of the main casting 10 is admitted to and discharged from these interior cavities and the hollow interiors of the pistons by suitable piping, parts of which are indicated in the drawings.

The operation of the device is practically as follows: Assuming that the shaft 31 is rotated by any suitable means, not shown, it will be apparent that as the eccentric or off-set part 30 travels around, the driving ring 27, freely rotatable thereon and bearing against the power rollers 26 of the various pistons, will force these pistons or plungers outwardly gradually and in succession, acting, if this operating mechanism is employed in an air compressor, to compress and discharge the air from the chambers, and if desired such chambers may be compounded so that the air compressed in one will be further compressed in another one. It is obvious that this eccentric shaft of itself will not draw these pistons inwardly after having forced them radially outwardly, and consequently the piston-retracting floating rings 42 are used in combination with the secondary rollers 39 and 40 to pull the pistons inwardly after they have completed their outward travel, it being apparent that the pistons which are being forced outwardly act through this ring to draw in the other pistons ready for another outward travel for further compression. The pair of rings 42 will be maintained concentric to the crank part 30 of the shaft 31, although they have no direct con-

nection with the same. By means of the parts described, and especially the floating rings 42, the power rollers of the plurality of pistons are at all times maintained in intimate contact with the driving ring so that the device will not be subject to jar and shock of the driving ring engaging any of these power rollers. As has been fully explained above, each of the pistons is guided in its movement by its pair of guide wheels 38 co-acting with and traveling on the parallel guides 16. Obviously, then, this improved device, though simple in construction, effectively and efficiently transforms the rotary motion of the shaft 31 to the reciprocatory motion of the various pistons, the driving ring acting as a sort of universal pitman or connecting rod for the entire series of power rollers and pistons. The device can be worked just as readily in the opposite manner; that is, the power may be supplied to the pistons or plungers to cause their reciprocation, as by means of steam or explosive compounds admitted to the chambers, which reciprocatory movement is changed by means of this improved mechanism into the rotary movement of the shaft 31, whose rotation the actuation of the series of pistons accomplishes.

Whereas I have herein shown and described in detail the various features and elements of an air compressor, it is to be understood that the heart of this invention resides in the improved means employed for transforming the sliding movement of the pistons into the rotary movement of the shaft, or the reverse. It should be further understood that many minor mechanical changes may be made in the structure set forth herein without departure from the essence of this invention, and without sacrificing any of its benefits and advantages.

Whereas in this application and the drawings forming a part thereof I have described and shown a driving ring rotatable on the cranked or off-set portion of the power shaft, it is to be understood that the device can be constructed with such a ring or actuating part turned up or formed integral on the crank portion of the shaft. It is furthermore to be understood that this invention is not limited to the floating piston retracting rings herein set forth, since many other constructions will occur to those skilled in the art which will perform satisfactorily the function intended.

I claim:

1. A mechanical movement comprising in combination, a plurality of reciprocatory power pistons arranged in the same plane, a rotary power shaft having a crank portion in said plane, rolling power transmitting means between said pistons and said crank portion of the shaft including an anti-friction power roller on each of said pistons co-operating with the crank part of said shaft, a secondary roller on each piston, and a ring encircling and common to said secondary rollers and adapted by co-action therewith to maintain all of said power rollers in contact with the crank part of said shaft, substantially as described.

2. A mechanical movement comprising in combination, a plurality of reciprocatory power pistons arranged in the same plane, a rotary power shaft having a crank portion in said plane, rolling power transmitting means between said pistons and said crank part of the shaft including a power roller on each of said pistons contacting and co-operating with the crank part of said shaft, a floating ring T-shaped in cross-section, and a pair of secondary rollers on each of said pistons engaged and encircled by said ring, the latter by co-action with said secondary rollers operating to maintain the power rollers in contact at all times with the crank part of said shaft.

3. A mechanical movement comprising in combination, a reciprocatory power piston, a rotary power shaft having a crank portion in the plane of said piston, a power roller on said piston co-acting with the crank part of said shaft, guides, and a freely-rotatable guide wheel on said piston coöperating with said guides to assist in maintaining the straight line travel of the piston, substantially as described.

4. A mechanical movement comprising in combination, a plurality of reciprocatory power pistons arranged in the same plane, a rotary power shaft having a crank portion in said plane, a power roller mounted centrally of each of said pistons, all of said rollers coöperating with the crank part of said shaft, guides on opposite sides of each of said pistons, guide wheels on each piston co-acting with said guides, and means to maintain said power rollers in contact with the crank part of said shaft, substantially as described.

5. A mechanical movement comprising in combination a rotary power shaft having a crank part, a driving ring freely rotatable on the crank part of said shaft, a piston, a roller on said piston having continuous contact with said driving ring, and means to maintain said roller and driving ring in contact, substantially as described.

6. A mechanical movement comprising in combination a power shaft having a crank part, a driving ring freely rotatable on the crank part of said shaft, a piston provided with a roller, said roller contacting with the periphery of said driving ring, means to maintain said roller and ring in contact, guides for the piston, and guide wheels co-acting with said guides carried by the piston, substantially as described.

7. A mechanical movement comprising in

combination a circular series of power pistons, a rotary power shaft having a crank part, rolling power transmitting means between said pistons and said crank part, said means including a roller on each piston cooperating with said crank part, and means coöperating with and common to all of said rollers and maintaining the latter in contact with the crank part of the shaft, substantially as described.

8. A mechanical movement comprising in combination a rotary power shaft having a crank part, a driving ring rotatably mounted on said crank part, a series of pistons, pins carried by said pistons, said pins being parallel to said shaft, rollers on said pins having operative contact with the periphery of said driving ring, other rollers on said pins, and a piston retracting ring the inner surface of which is contacted by said other rollers, substantially as described.

9. In a mechanical movement, the combination of a reciprocatory power piston, a transverse pin carried by said piston, a power roller on said pin, and a guide roller carried by the piston in axial alinement with the power roller, substantially as described.

10. In a mechanical movement, the combination of a reciprocatory power piston, a transverse pin carried by the piston, a guide roller, and a power roller on said pin and in axial alinement with one another, substantially as described.

11. In a mechanical movement, the combination of a reciprocatory power piston, a transverse pin carried by the piston, a guide roller carried by the piston, and fixed guides for said roller, said guides being straight and located substantially parallel to the axis of the piston, substantially as described.

12. In a mechanical movement, the combination of a reciprocatory piston, a transverse pin carried by the piston, a power roller on said pin, a guide roller carried by the piston in axial alinement with the power roller, and a retracting roller carried by the piston also in axial alinement with the power roller, substantially as described.

RICHARD J. McCARTY.

Witnesses:
F. W. MEYER,
L. J. HENSLEY.