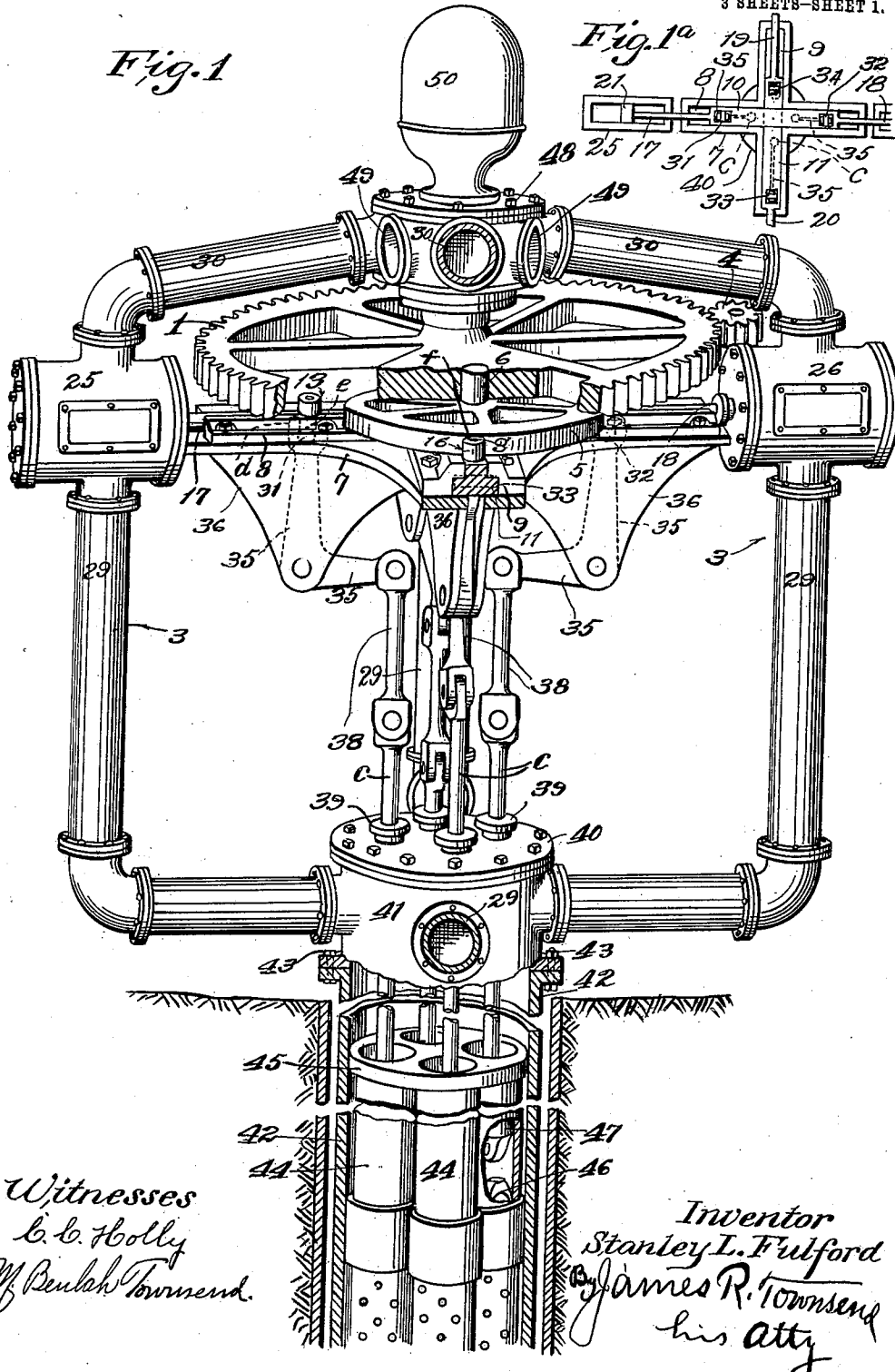


S. L. FULFORD.
 MULTIPLE PUMP.
 APPLICATION FILED JULY 9, 1909.

992,493.

Patented May 16, 1911.

3 SHEETS—SHEET 1.



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3 SHEETS-SHEET 2.

Fig. 2

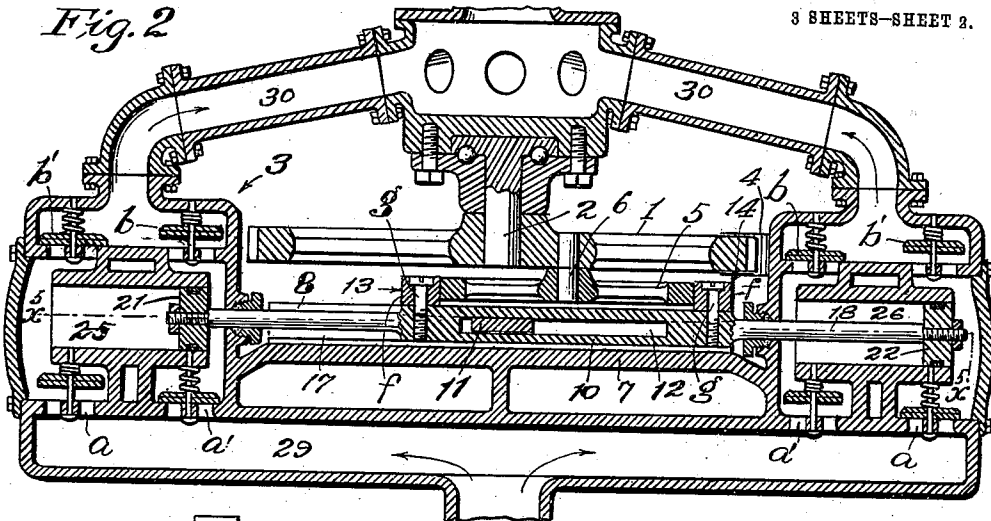


Fig. 4

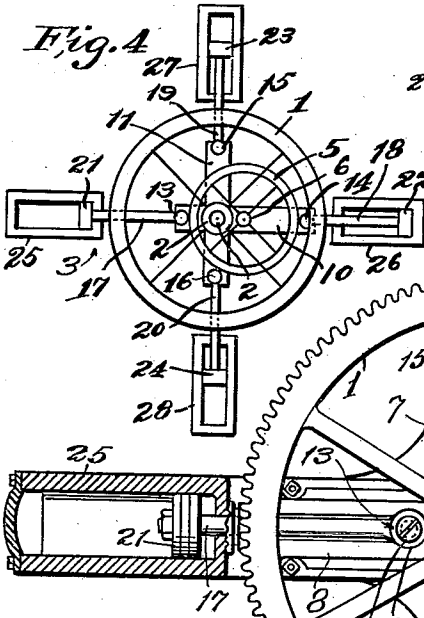


Fig. 5

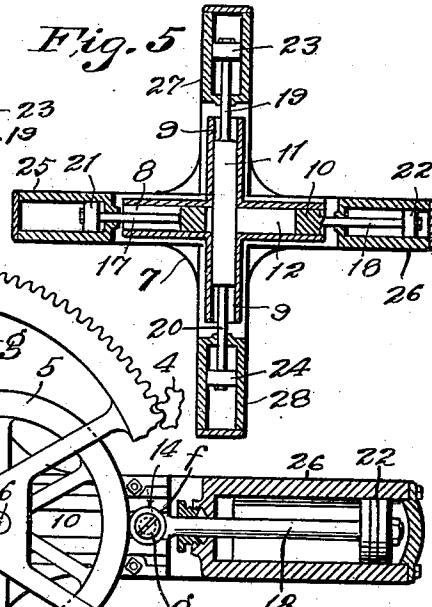
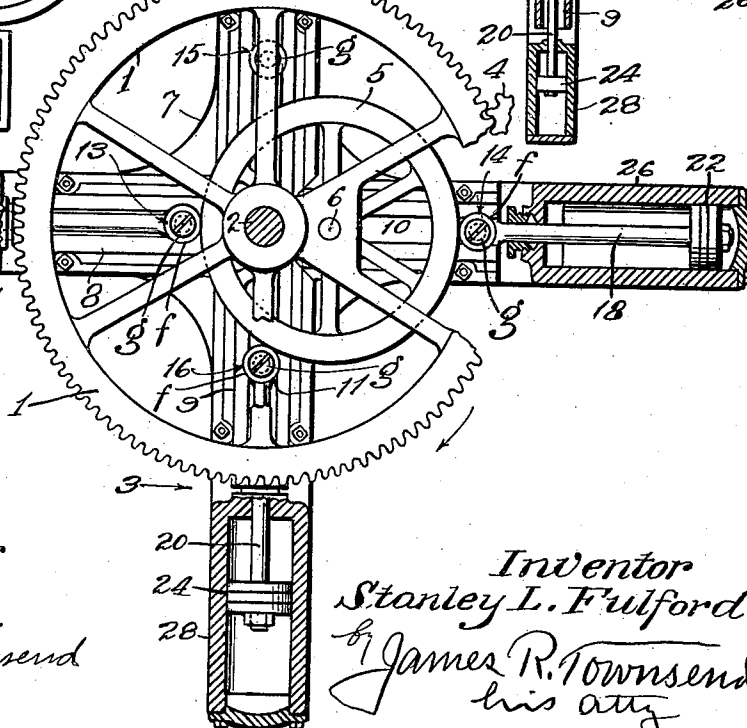


Fig. 3



Witnesses
 C. C. Holly
 M. Beulah Townsend

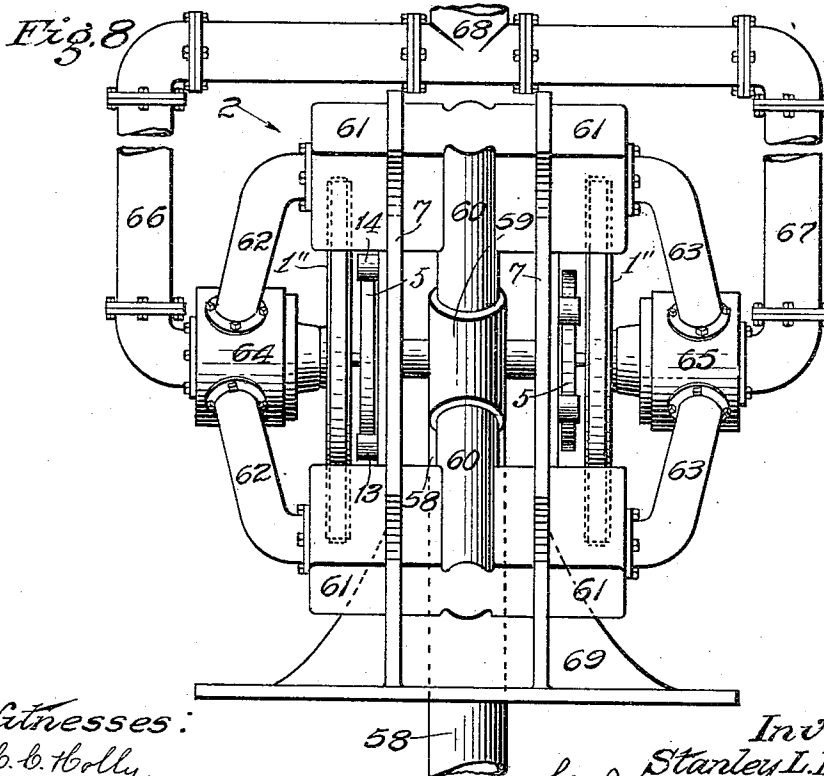
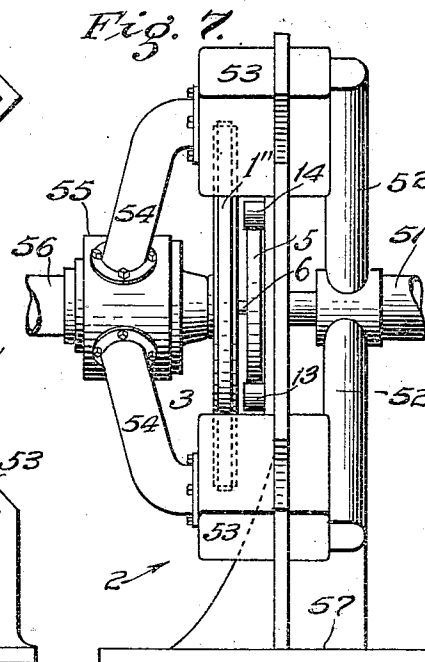
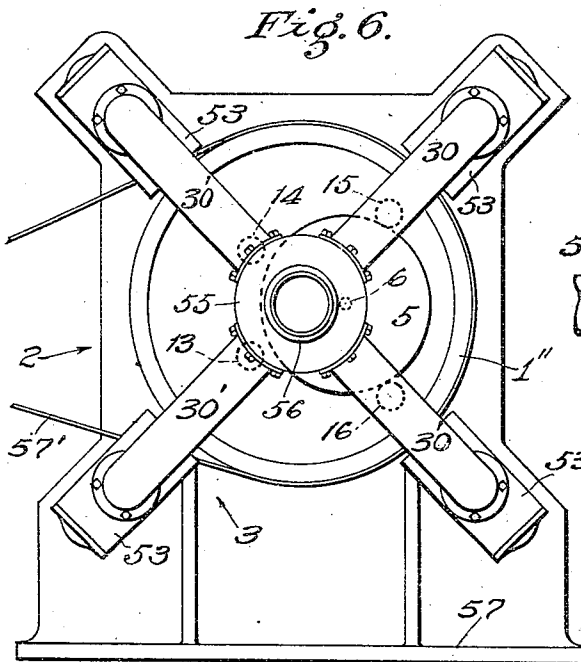
Inventor
 Stanley L. Fulford
 by James R. Townsend
 his atty

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3 SHEETS—SHEET 3.



Witnesses:

b. b. Holly
 H. N. Lathrop

Inventor

Stanley L. Fulford
 by James R. Townsend
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UNITED STATES PATENT OFFICE.

STANLEY L. FULFORD, OF LOS ANGELES, CALIFORNIA, ASSIGNOR OF ONE-FOURTH TO BENJAMIN ALLEN BROWN, OF LOS ANGELES, CALIFORNIA.

MULTIPLE PUMP.

992,493.

Specification of Letters Patent.

Patented May 16, 1911.

Application filed July 9, 1909. Serial No. 506,843.

To all whom it may concern:

Be it known that I, STANLEY L. FULFORD, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Multiple Pump, of which the following is a specification.

This invention includes an improvement on the pump-gearing patented to me on the 23rd day of May, 1893, by U. S. Patent No. 498,109.

An object of this invention is to provide a pump having a large number of cylinders operable with a minimum expenditure of power to pump a given amount of water under a given pressure.

The invention may be embodied in a combined deep-well and distributing pump, and may also be embodied in a compound steady, continuous-stream high-pressure pump.

The pump may comprise many pump cylinders and pistons; the pistons being simultaneously operable by a single driving-mechanism, and said pistons may be arranged in one or more sets, any of which sets may at will be disconnected from the driving-mechanism; each set being operable independently of any other.

The invention is not limited to the use of a specific number of cylinders and pistons, or to the means by which the apparatus is driven. In some instances the pump may be constructed with four cylinders, and in other cases with a greater number. The pump-gearing may in some instances receive power from a pinion meshing in either a spur or a bevel driving-wheel, and in other instances the mechanism may be driven by a belt.

The invention comprises the multiple pump, the novel pump-gearing, and the combinations and parts more particularly set forth in the subjoined, detail description.

The accompanying drawings illustrate the invention.

Figure 1 is a broken perspective view of a double-acting multiple-pump embodying the invention in one of its forms in which one set of four cylinders is at the bottom of a well and another set of four cylinders at the surface, the first set being vertical and supplying the second set which is horizontal. Fig. 1^a is a diagrammatic plan of the guide-frame and parts below the same. Fig. 2 is a fragmentary view sectioned through the axis of the master-wheel and through two pump-

cylinders and showing the apparatus as installed with but four cylinders. Fig. 3 is a broken plan view of the construction shown in Fig. 2. It also shows part of the mechanism of the upper set of pumps in Fig. 1. Fig. 4 is a diagrammatic plan showing the master-wheel, the traveling-wheel, the cylinders, the pistons and the reciprocating means for operating the pistons. Fig. 5 is a sectional detail on the irregular line x^5-x^5 . Fig. 6 is an elevation of another form of the apparatus. Fig. 7 is an elevation of the form shown in Fig. 6 at right-angles thereto. Fig. 8 is a view analogous to Fig. 7 showing an octuple cylinder-pump that is a practical doubling of the pump shown in Figs. 6 and 7.

The master-wheel 1 is journaled by a sub-shaft 2 in a main frame 3 that may be formed partly of pipes for conveying the liquid to be pumped, and said master-wheel is driven by suitable power-applying means as the pinion 4. The traveling-wheel 5 is journaled on a crank-pin 6 of the master-wheel at one side of the guide-frame 7 that is provided with cross-guide-ways 8 and 9 in which are slides 10 and 11 arranged to reciprocate in directions at right angles to each other; one of said slides having a recess, as the longitudinal slot 12, to accommodate the other slide and to allow the two slides to be reciprocated across each other while their four ends are in a common plane and their intermediate portions are close to the path of the traveling wheel 5.

A pair of antifriction studs 13, 14 is mounted on one side of the slide 10, and a corresponding pair of antifriction studs 15, 16 is mounted on the corresponding side of the other slide 11, and the studs of each pair are spaced apart from each other a distance approximately corresponding to the diameter of the traveling-wheel 5, said traveling-wheel 5 being located in the open space between said studs, and said studs being on opposite sides of the intersection of the slides. The traveling wheel extends over or across the intersection of the slides, its radius being greater than the radius of the orbit of the pin upon which it is mounted. The axis of the master wheel and the center of said orbit is alined with the intersection of said slide.

Piston-rods 17 and 18 are connected with the ends of the slide 10, and other piston-

rods 19 and 20 are connected with the ends of the second slide 11. Double-acting pistons 21, 22, and 23, 24 are connected with the piston-rods respectively and are mounted in double-acting pump-cylinders 25, 26, 27, 28 that are respectively provided with the usual intake and discharge valves *a*, *a'*, *b*, *b'*.

The double-acting cylinders and the double-acting pistons are alined with the axes of the slides 10 and 11 to which they appertain respectively.

Suction and discharge pipes 29 and 30 admit liquid to and discharge it from the double-acting cylinders.

In the form shown in Figs. 1 and 1^a, the slide 10 is also provided with antifriction wrist-pins 31 and 32 mounted on opposite sides of the intersection of the slides. The second slide 11 is provided with like antifriction wrist-pins 33 and 34 correspondingly mounted on said second slide. Four bifurcated bell-crank-levers 35 mounted on hangers 36 are arranged in operative engagement with the antifriction wrist-pins 31, 32, 33 and 34 respectively, and pump-rods *c* are connected with the bell-crank-levers 35 respectively by links 38 and extend downward through stuffing-boxes 39 in a plate 40 of the pump-stock-head 41, which head is fastened onto the pump-stock or tubing 42 by bolts 43. Inside of said pump-stock or tubing 42 are provided working-barrels 44 nested together and carried by a working-barrel-head 45 that is fixed and hermetically fitted inside the pump-stock 42. Said working-barrels are provided with the usual foot-valves indicated at 46. Inside the working-barrels 44 are the lifting-pump-pistons 47. The suction-pipes 29 lead from the pump-stock-head 41 to the double-acting cylinders 25, 26, 27, 28, from which the discharge-pipes 30 lead to the manifold-head 48.

It will thus be seen that when the master-wheel is rotated the eight pistons will be operated to continuously pump into the manifold-head 48 from which the liquid will be discharged through one or more outlets 49. Said manifold-head 48 may be provided with an air-chamber 50 to prevent water-hammering.

The furcations of the bifurcated heads *d* of the bell-crank-levers 35 are spaced apart so as to form slots *e* that are just wide enough to accommodate the wrist-pins 31, 32, 33, 34 respectively, thus allowing the same to slide along the slots and to act on the bell-crank-levers to transmit motion from the slides to operate the piston-rods *c* vertically at the same time the piston-rods 17, 18, 19 and 20 are being reciprocated horizontally.

By making the slides rigid as shown, and extending the same across the traveler 5, and providing each slide with a pair of studs between which the traveler is arranged, a more satisfactory and positive operation

with less friction and lost motion than with the former construction, is secured, and at the same time it becomes possible to operate a greater number of pistons in an economical manner.

The guide-frame 7 may be rigidly fixed to the main frame, and in some instances may be cast integral with portions of the frames of the cylinders 25, 26, 27, 28; and as the master-wheel rotates, the traveler 5 acts on the studs to slide the slides in the guide-ways and move the pistons in said cylinders which are thus held rigidly stationary relative to each other.

In the form shown in Figs. 6 and 7 the liquid is taken in through the suction-pipe 51 and leaders 52 to the cylinders 53 which correspond to the cylinders 23, 24, 25, 26 of Figs. 2 to 5, and is thence discharged through the pipes 54 to the manifold 55 and thence through the discharge-pipe 56. In this form the machine may be mounted on a base 57, and power is applied to the master-wheel 1' in any way as by a belt 57', the rim of the wheel 1' being formed as a band-wheel to receive a belt.

In Fig. 8 two machines such as shown in Fig. 7 are mounted with their intakes adjacent to each other, the liquid being received through the suction-pipe 58 which corresponds to the suction-pipe 51 of Fig. 7. Thence the liquid flows into the manifold 59 and thence through the distributing-pipes 60 to the cylinders 61, and thence through the pipes 62, 63 to the manifolds 64, 65 respectively, and thence through the branch-discharge-pipes 66 and 67 to final discharge-pipe 68. In this form the feed or suction pipe 58 may pass directly through the base 69 to the central manifold 59. In this form each set of cylinders and pistons will be provided with a master-wheel and each master-wheel with a traveling-wheel operating through the antifriction-studs as before. The antifriction-studs may be of any suitable construction, as for instance, a roller *f* mounted on a pin *g*.

I claim:—

1. The combination of a frame having two crossed guide-ways, two slides arranged to slide in the guide-ways and each provided with studs spaced apart on opposite sides of the intersection of the axes of the slides, a master-wheel traveling on the frame, its axis being at right angles to the slides and alined with said intersection of the slides, a crank-pin on the master-wheel at one side of the axis thereof, a traveling-wheel journaled on the crank-pin and arranged between the studs to engage the studs to slide the slides in their ways, wrist-pins on the slides at opposite sides of said intersection, bell-cranks pivotally mounted on the frame and operably engaging the wrist-pins, pump-cylinders alined with the slides, pistons working

in the cylinders and connected with the slides, a pump-stock provided with a head-plate, guides in the head-plate, a working-barrel head in the pump-stock, working-
 5 barrels in the head, foot-valves for the working-barrel, pump-pistons in the working-barrel, pump-rods connected with the pump-pistons, means connecting the pump-rods to the bell-cranks, means to convey liquid from
 10 the pump-stock to the cylinders, and means to conduct the liquid from the pump-cylinders.

2. The combination of a frame having slides, a master-wheel journaled thereon, a
 15 traveling-wheel journaled eccentrically on said master-wheel, two slides arranged in the ways transversely of each other, studs, each slide being provided with a pair of said studs, and the traveling-wheel being ar-
 20 ranged between the studs of each pair, wrist-pins, each of the slides being provided with a pair of said wrist-pins, bell-crank-levers for the wrist-pins, one arm of each of said levers being provided with a fork to engage
 25 its pin, and pumps having pistons opera-

tively connected with the other arms of the bell-crank-levers.

3. The combination of a frame having two crossed guide-ways, two slides arranged to slide in the guide-ways and each provided
 30 with studs spaced apart on opposite sides of the intersection of the axes of the slides; a master-wheel journaled on the frame, its axis being at right angles to the slides and alined with said intersection of the slides, a
 35 crank-pin on the master-wheel at one side of the axis thereof, a traveling-wheel journaled on the crank-pin and arranged between the studs to engage the studs to slide
 40 the slides in their ways, wrist-pins on the slides at opposite sides of said intersection, and bell-cranks pivotally mounted on the frame and operably engaging the wrist-pins.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this
 45 3rd day of July, 1909.

STANLEY L. FULFORD.

In presence of—

JAMES R. TOWNSEND,
 L. BELLE RICE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
