2 Sheets. Sheet 1.

J. F. Thompson,

Hydraulic Apparatus.

No. 84,719. Patented Dec. 8. 1868.

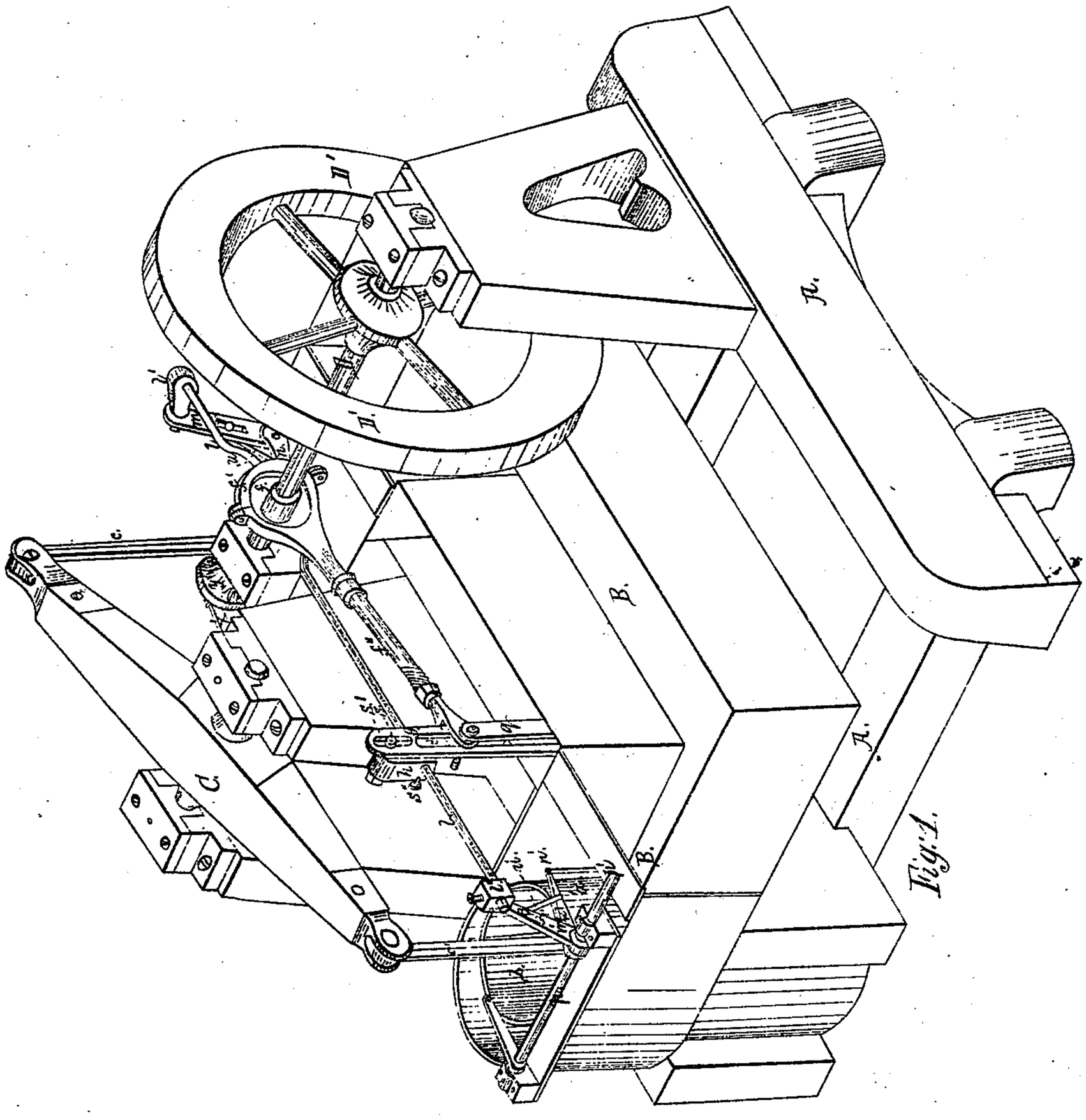

Fig: 1.

Witnesses,
Thos. B. Kerr.
R. Ellwrenshall.

Inventor.
John F. Thompson.
by Bakewell & Christy.
his Att'ys.

2 Sheets. Sheet 2.

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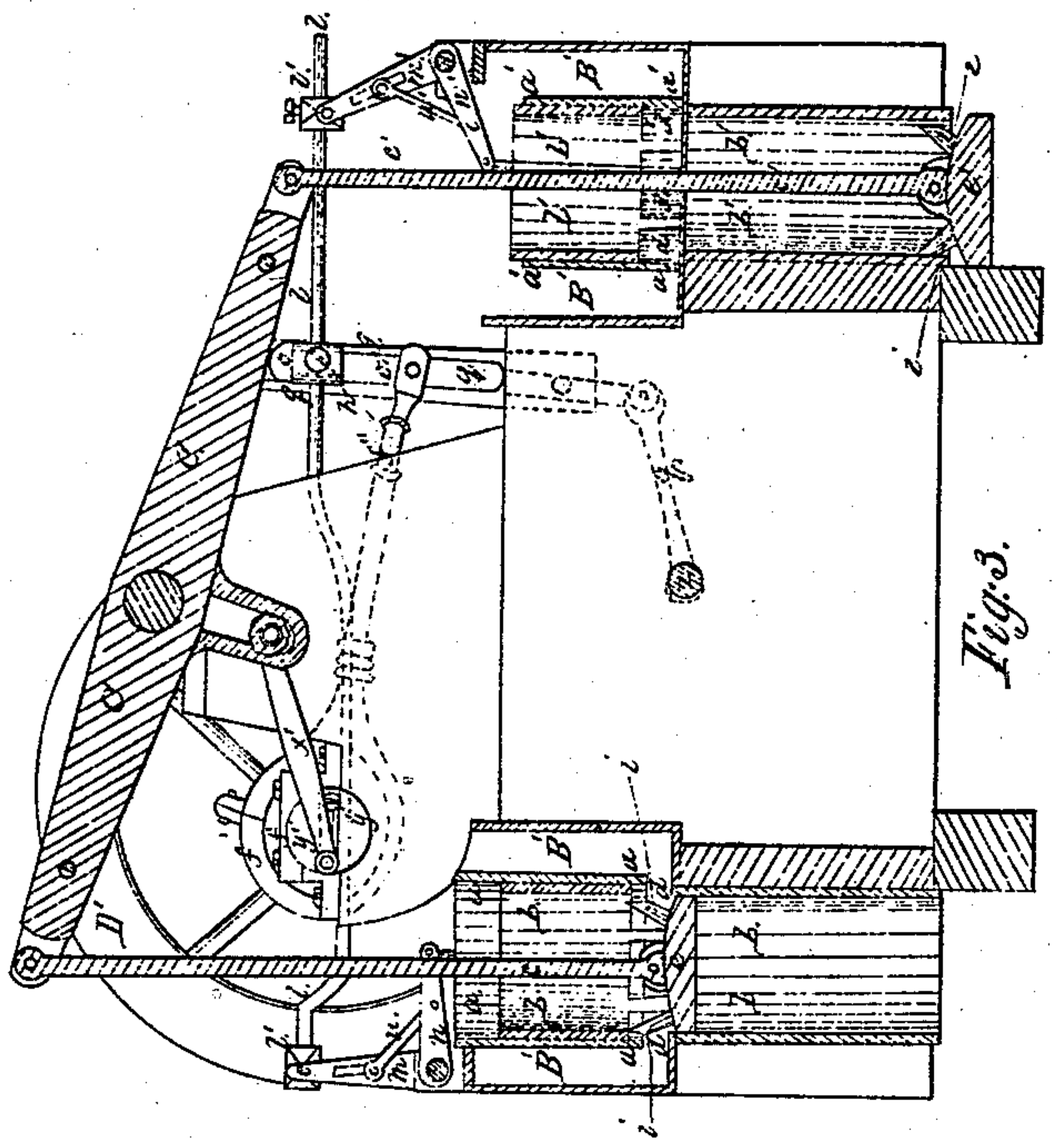

Fig. 3.

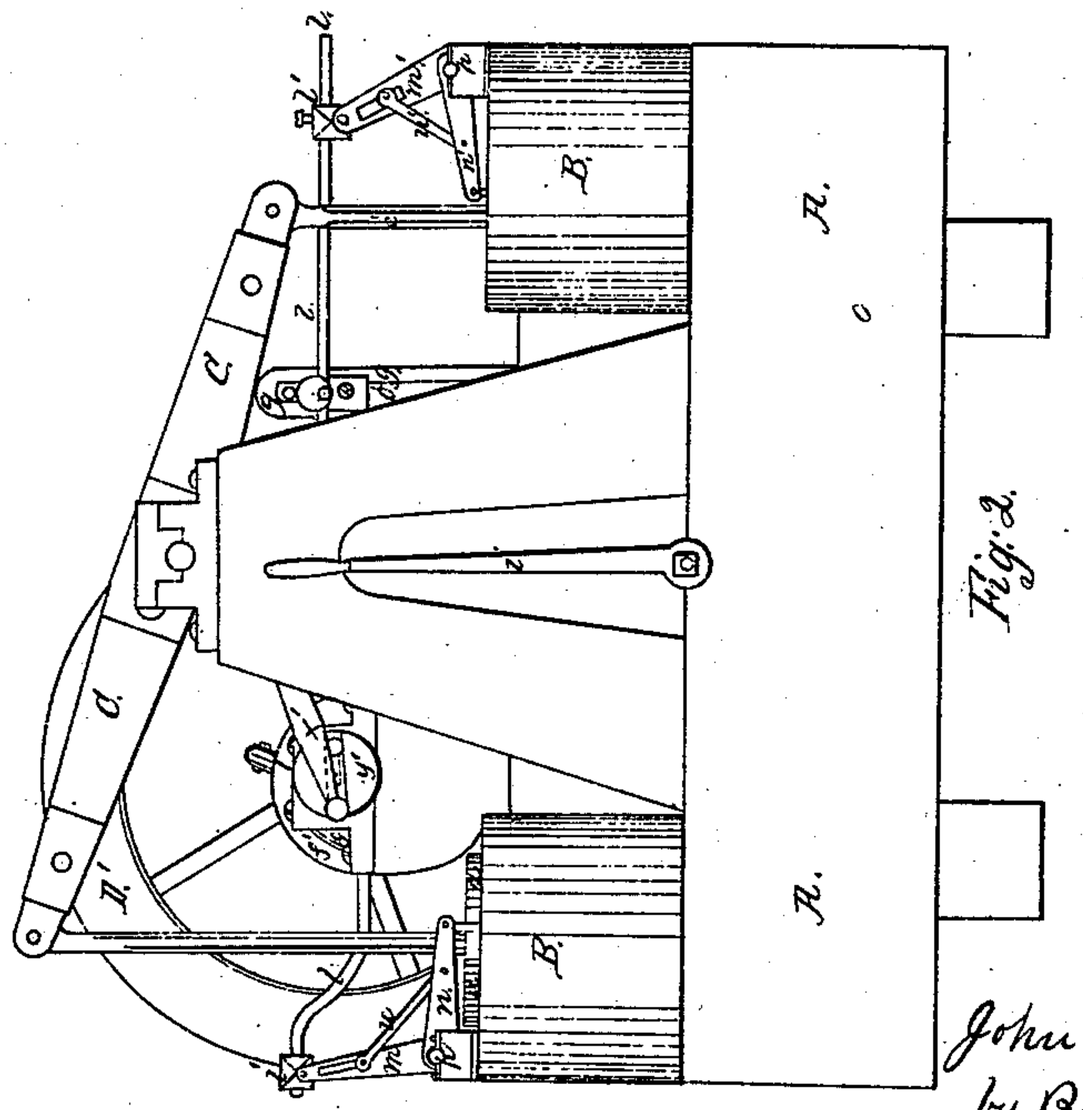

Fig. 2.

Witnesses.
Thos. B. Kerr.
R. Ellwenshall.

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Anited States Patent Office.

JOHN FINDLEY THOMPSON, OF GREENSBOROUGH, PENNSYLVANIA.

Letters Patent No. 84,719, *dated December* 8, 1868.

IMPROVED HYDRAULIC APPARATUS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, JOHN FINDLEY THOMPSON, of Greensborough, in the county of Greene, and State of Pennsylvania, have invented a new and useful Improvement in Hydraulic Apparatus; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, in two sheets, making a part of this specification, in which—

Figure 1 is a perspective view of my improvement;

Figure 2 is a rear elevation of the same; and

Figure 3 shows a section, as formed by a plane passing vertically and longitudinally through the walking-beam.

Like letters of reference indicate like parts in each.

In the ordinary overshot water-wheel, the force exerted on the wheel by the water is advantageously applied only at those points at which a line passing from the bucket to the axis of the wheel is exactly or nearly at right angles to a perpendicular; consequently the water in the buckets, at or near the top of the wheel, and at or near the bottom, has but small leverage power, and exerts but little force in producing motion.

My invention has for its object the more economical and efficient application of water-power to the propulsion of machinery, such that the water will, through the whole extent of its fall, operate on the machinery to which it is applied with almost its maximum of leverage power.

The nature of my invention consists—

First, in the construction of upright cylinders, with suitable ports and valves, whereby the weight of falling columns of water shall act in producing motion alternately on pistons arranged in such cylinders, and attached to the opposite ends of a walking-beam.

Second, in combining, with such cylinders, tubular balanced valves, for opening and closing the ports by which the water is admitted into the pistons.

Third, in the construction of devices by which to render such valves adjustable, so as to cut off the supply of water at any desirable part of the stroke.

Fourth, in such construction of devices, that, while a single motion shall operate both valves, the open ports of one cylinder may be closed before the completion of the downward stroke of its piston, without opening the ports of the other cylinder till the upward stroke of its piston shall be complete.

Fifth, in the construction of devices by which a greater or less length of throw is given to the valves, whereby the ports are more or less completely uncovered, for the admission of water to the pistons.

Sixth, in the construction and combination of devices, by which the power thus generated may be economically applied, and so regulated in its application as to be adapted to the amount of work to be done; and

Seventh, in the use of a mechanism thus constructed as a fluid-meter.

To enable those skilled in the art to make and use my invention, I will proceed to describe its construction and mode of operation.

A is a suitable bed or foundation.

B is a tank or reservoir, or may represent a head-race, by which water is supplied to the hollow cylinders, *b b′*. These hollow cylinders *b b′* are so situated with reference to the reservoir B, that the water may flow all around them, and be admitted into them through ports on all sides, as presently to be explained.

C is a walking-beam, the ends of which are connected by shafts or piston-stems *c c′* with pistons *e e′*, one in each of the cylinders *b b′*, such pistons being so fitted therein, with or without packing, as to operate closely though freely.

From the walking-beam C, motion is communicated by an arm, *x*, pitman *x′*, and crank *y*, or other like devices, to a shaft, D, on which is hung the fly-wheel D′; thence the power is applied to other machinery in any known way.

In the sides of the cylinders *b b′*, above the bottom of the reservoir B, and also above the top of the pistons *e e′*, at their highest point of throw, are the water-ports *d d′*. Through these, water is allowed to enter the cylinders *b b′*, and, by its weight, give to the pistons *e e′* alternately a downward throw. But to secure the proper supply and cut-off, I surround each of the cylinders *b b′* with close-fitting tubular valves *a a′*. These valves *a a′* open and close the ports *d d′* respectively, opening alternately to allow the water to flow into the cylinders *b b′* and operate the pistons *e e′*, and closing alternately to cut off the supply of water at any desirable point of the downward stroke of the pistons.

On the main shaft D, is an eccentric, *f*, which operates in a yoke, *f′*, the latter being connected by a rod, *f″*, to a slotted lever, *g*, the shaft-pin *o* operating in the slot *o′* of the lever *g*.

The rod *f″* is threaded at either end with right and left-hand screw-threads, which ends are inserted in tapped sockets, so that the rod *f″* may be lengthened or shortened at pleasure.

The lever *g* is fastened at the lower end to some fixed point which serves as a fulcrum; and at its other end, through the intervention of a block, *h*, with wrist *s*, playing in a slot, *s′*, it drives back and forth the reciprocating shaft *l*.

The block *h* is adjustable on the shaft *l*, and is fastened at any desirable point by a screw, *s″*.

The reciprocating shaft *l*, by blocks *l′* at either end, actuates the levers *m m′*, which last operate loosely on the rocking shafts *p p′* respectively.

The valve-lifters *n n′* are rigidly attached to the rocking shafts *p p′*.

The supports *u u′* extend each one from a slot in one lever, *m* or *m′*, to the corresponding valve-lifter *n n′*, a wrist on each support *u u′* playing in a slot, *r*.

The valve-lifters *n n′* are so jointed together, and so connected, each to its valve *a* or *a′*, as to move such valve up and down in the line of the axis of its cylinder.

One or both of the blocks *l'* are adjustable on the reciprocating shaft *l*.

It will be observed that the arm *x* on the walking-beam C is slotted, so that the rear end of the pitman *x'* is adjustable therein.

The crank *y* is likewise made adjustable by a slot in the circular head *y'*, so as to bring the forward end of the pitman *x'* nearer to or more remote from the centre of motion.

The forward end of the eccentric rod *f'''* is carried by a support, *q*, and by it is raised or lowered along the slot, *o'*.

This support is connected by a lifter, *q'*, with a rocking shaft, *z*, and this, in turn, is operated by a lever, *z'*.

The operation of the machine described is as follows:

The devices being, for example, in the position shown in figs. 2 and 3, water flows through the port *d* into the cylinder *b*, and the weight of it on the piston *e*, gives the latter a downward throw.

During the descent of this piston *e*, the water continues flowing in, filling the upper end of the cylinder *b* to the level of the water in the reservoir or forebay B', till it is cut off by the downward throw of its valve *a*. The water thus resting on the piston *e*, exerts its whole power on the end of the walking-beam C, in a direction nearly or exactly at right angles to the beam.

The descent of the piston *e* through the walking-beam C, arm *x*, pitman *x'*, and crank *y*, operates the axle D. Through the eccentric *f*, rod *f'''*, lever *g*, reciprocating shaft *l*, and the devices connecting them to the tubular valves *a a'*, the valve *a* is slid down over the port *d* at the time, or a little before the piston *e* has completed its downward throw. By this the supply of water is cut off. The piston *e* passes below the lower end of the cylinder *b*, or below suitable ports in the cylinder *b*, and the water is discharged.

If, as shown in fig. 3, the piston descends below the lower end of its cylinder *b*, it should be kept centred in the axial line of its cylinder by guides *i*.

In the mean time, the same motion of the reciprocating shaft *l*, which closed the valve *a* down over the port *d*, raises the opposite valve *a'*, and uncovers the ports *d'* in the other cylinder *b'* Its piston, *e'*, then being at the highest point of its stroke, water is thus admitted into this cylinder, with the result already described.

Thus water is admitted and discharged alternately into and from the opposite cylinders, exerting in each the maximum of power on the walking-beam.

The objects in view, in the various adjustments referred to, are as follows:

First. By the slotted arm *x* and slotted crank *y*, I adapt the power to the resistance, or, in other words, to the work to be done, the amount of water being often variable, as well as the resistance. The principles on which such adjustments should be made are well known.

Second. The eccentric, *f*, is adjustable in its yoke, *f'*, so as to give the reciprocating shaft *l* a throw earlier or later in the revolution of the shaft D, and open and close the valves at any time desired.

Third. By the lever *z'*, shaft *z*, lifter *q'*, and support *q*, I raise or lower the forward end of the rod *f'''* in the slot *o'*. By raising or lowering it, I increase or decrease the length of the throw of the shaft *l*, and consequently the height to which the valves *a a'* are lifted, and the extent to which the ports *d d'* are uncovered.

Fourth. By shifting the adjustable block *l'*, and so increasing or lessening the length of the shaft *l* between the blocks *l' l'*, and shifting the position of the block *h* to correspond, I accomplish the result last stated, and also secure an adjustable cut-off.

By shortening the shaft *l* between the heads *l' l'*, I give the valves *a a'* a quicker downward throw, thereby closing the ports *d d'*, and cutting off the water before the completion of the downward stroke of the piston. If the shaft *l* be lengthened, the reverse is the case.

By the construction shown for operating the valves *a a'*, I am enabled to secure their full and effective operation, with but a part of the motion usually given to other valves.

With the throw of the reciprocating shaft *l*, the valve at its rear end drops, covers the ports, and as it would be a waste of motion to throw it further, as well as occasion a loss by friction, I let it rest on the bottom of the reservoir or forebay, and, by a slot, *r*, in the levers *m m'*, allow the ends of the supports *u u'* to play up and down during the remainder of the forward throw of the shaft *l* and its return to the same point. The supports *u u'* then come into requisition, and the valves receive an upward throw or lift, as already described.

By extending the forebay B' around the valves *a a'*, I secure a uniform pressure of water on all sides, and thus perfectly balance them. Loss of power from friction, and wear and tear, are thus reduced to a minimum.

If the fall be considerable, the walking-beam can be lengthened, so that the water will always act in a line never varying but a few degrees from a right angle with the walking-beam.

The cylinders can be made of any desired capacity, so as to utilize the entire volume of water. Then, by adjusting the length of the arm or crank, so as most effectually to adapt the power and motion thus produced to the resistance, I construct an economical cheap, and effective water-power.

Ordinarily, only the weight of the water is used, but the cylinders may be covered, and connected with a head of water, whereby the force of an escaping current or rush of water may be made available for the purposes named.

The apparatus described is useful as a fluid-meter, as well as a water-power. For such use, the valves *a a'* may be set so as to cut off when the cylinders are full, or before, if so preferred. Then the capacity of the cylinders, up to the point of cut off, being known, the quantity of fluid run through them may be easily ascertained. In connection with water-works for supplying a city with water, the apparatus described would be of great value.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A pair of upright stationary cylinders, having ports for the admission of water from the forebay, in combination with valves *a a'*, which open and close such ports, and pistons *e e'*, which operate inside the cylinders, and are attached to the opposite arms of a walking-beam, substantially as and for the purposes above set forth.

2. A reciprocating shaft *l*, when used for actuating the valves of water-power cylinders *b b'*, and constructed with adjustable connections, *h* and *l'*, for securing an adjustable or variable cut-off, and giving any desirable lift to the valves, substantially as above set forth.

3. Imparting to the reciprocating shaft *l* a greater or less length of throw, by raising or lowering in a slot, *o'*, the forward or operating-end of an eccentric rod, *f'''*, the devices being constructed and operated substantially in the manner and for the purposes hereinbefore set forth.

4. The slotted levers *m m'*, when connected by supports *u u'* with the valve-lifters *n n'*, in such way that the open port of one cylinder may be closed before the completion of the downward stroke of its piston, without opening the ports of the other cylinder till the upward stroke of its piston shall be nearly or quite complete, substantially as and for the purposes hereinbefore expressed.

5. The slotted arm *x*, on the walking-beam C of a water-power, and the slotted circular head *y'*, or its

equivalent, connected together by a pitman, *x'*, adjustable at each end, the parts being arranged and operating substantially as and for the purposes hereinbefore set forth.

6. The upright cylinders *b b'*, with valves, ports, and pistons, as a fluid-meter, constructed and operated substantially as and for the purposes hereinbefore set forth.

In testimony whereof, I, the said JOHN FINDLEY THOMPSON, have hereunto set my hand.

JNO. FINDLEY THOMPSON.

Witnesses:

ELL TORRANCE,

G. H. CHRISTY.