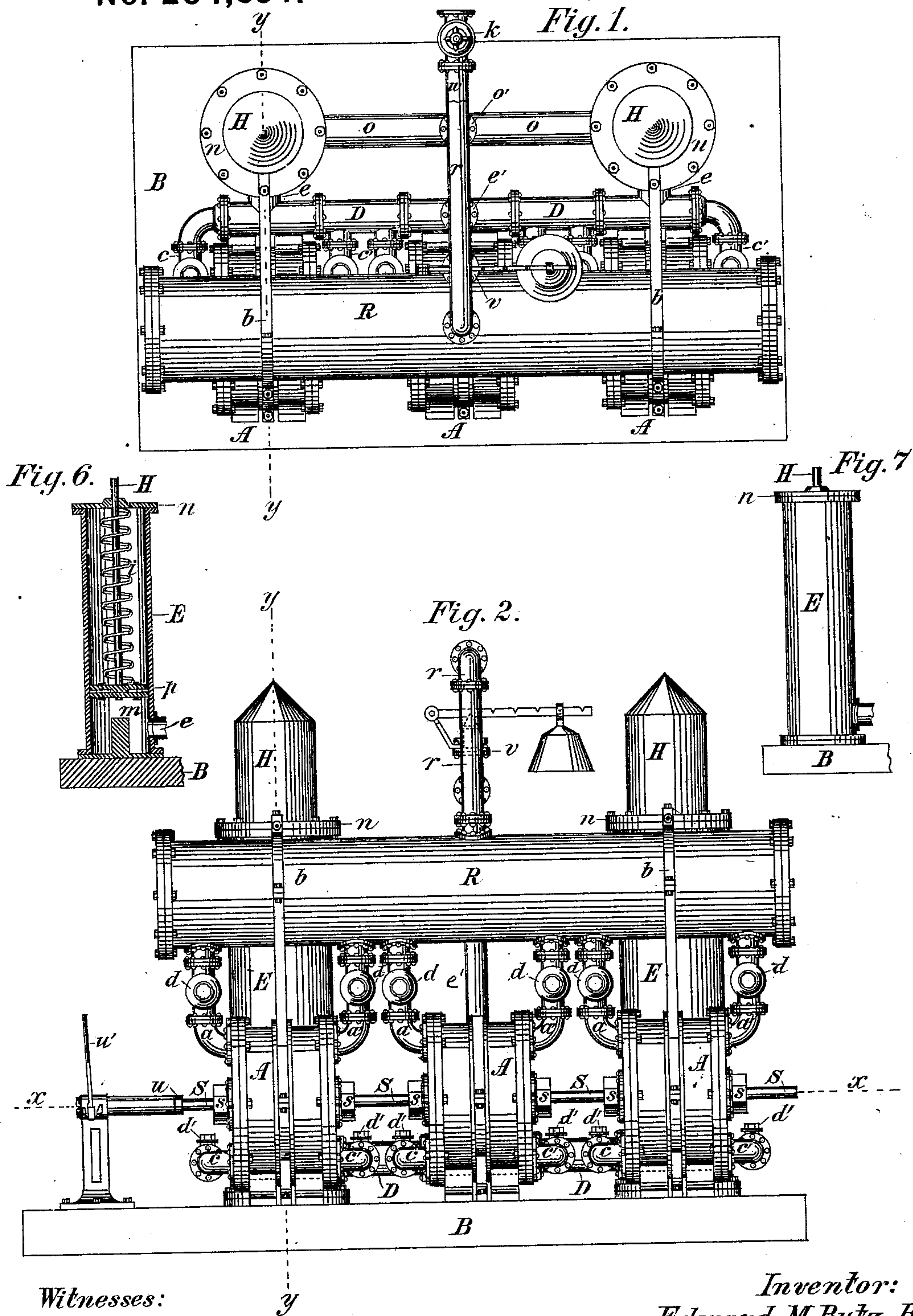


E. M. BUTZ.
Hydraulic Power Apparatus.
No. 204,654. **Patented June 11, 1878.**



Witnesses:

John M. Wilson
C. L. Parker

Inventor:
Edward M. Butz, By
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 Attorney.

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Fig. 4.

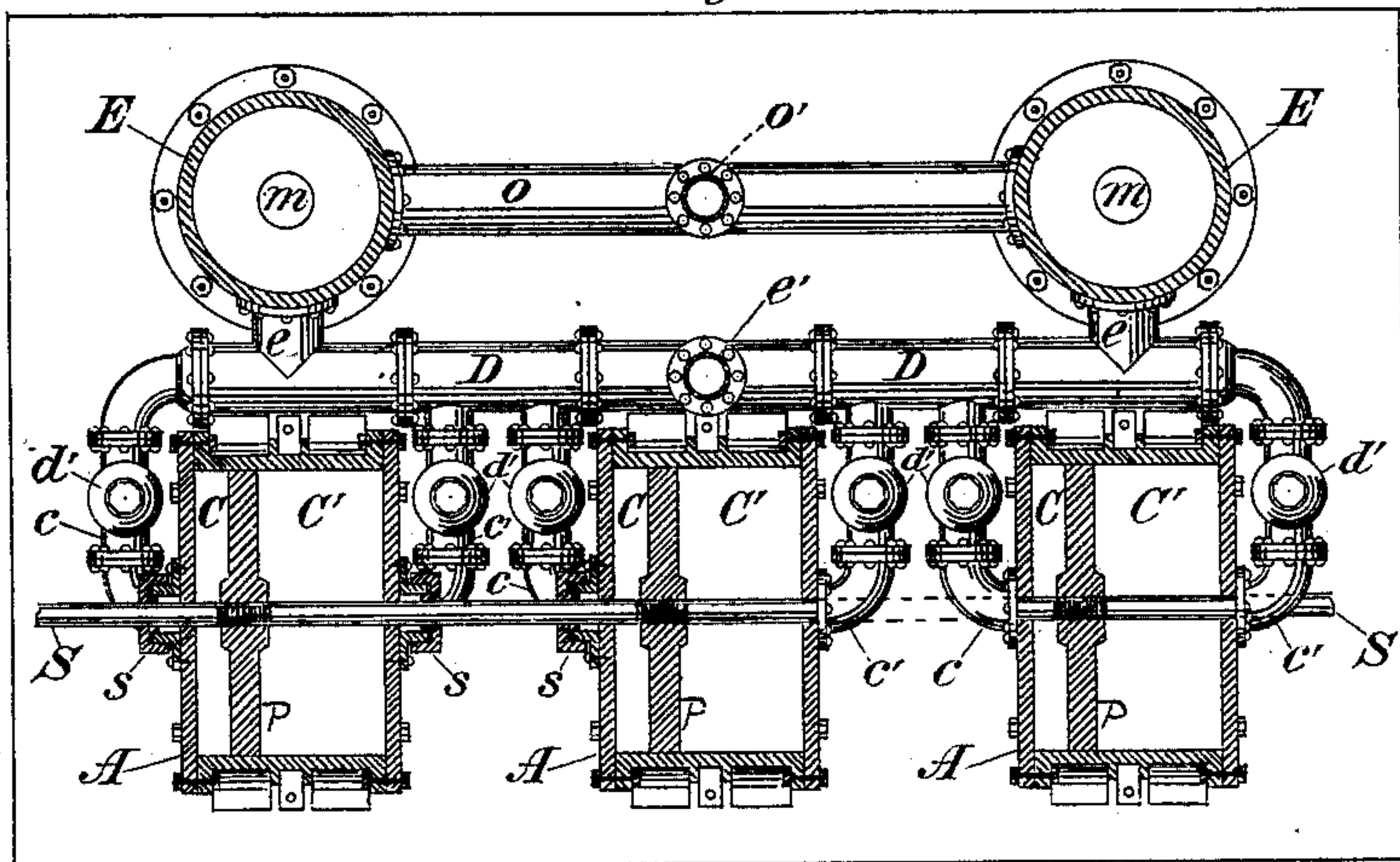


Fig. 5.

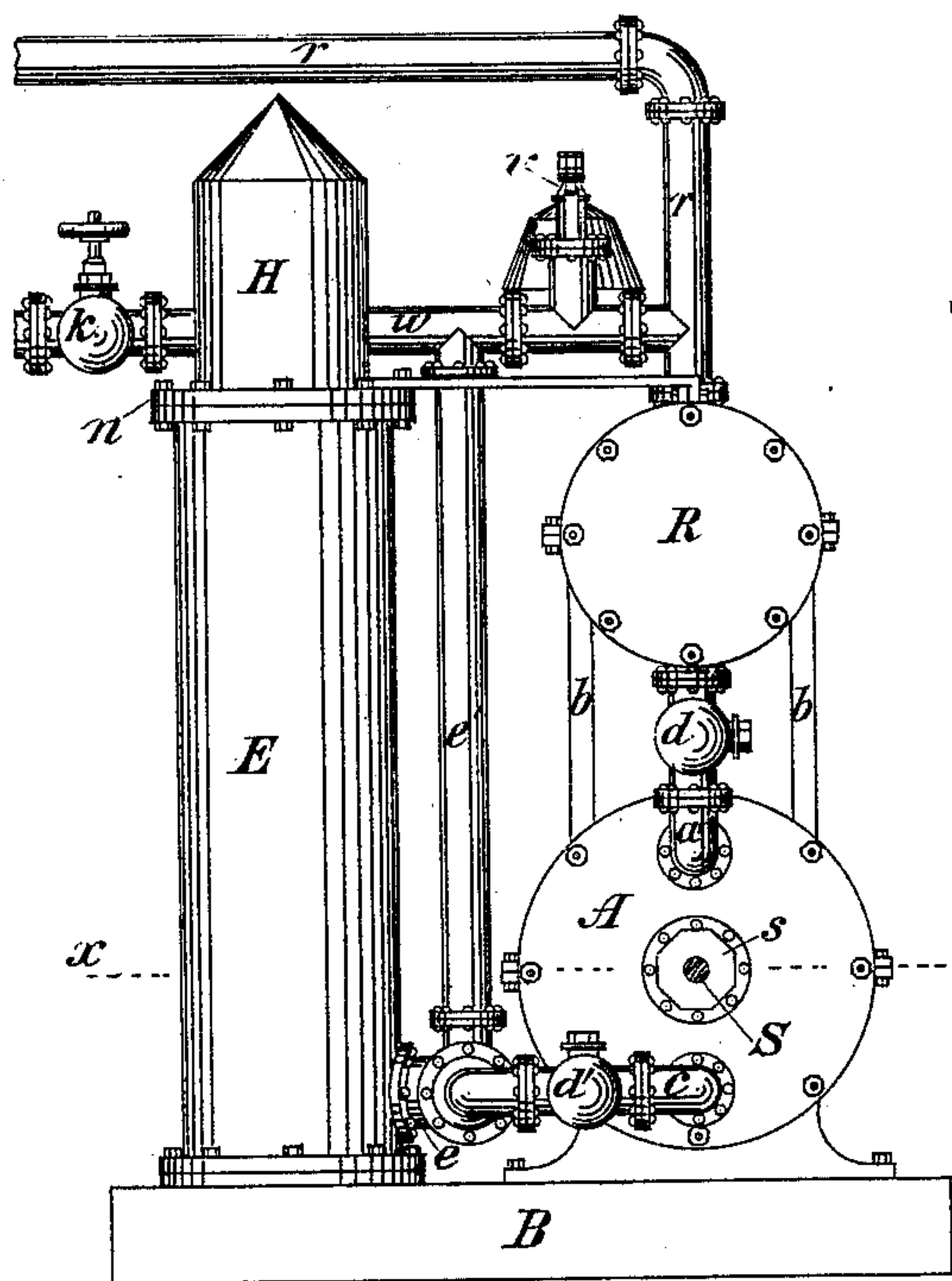
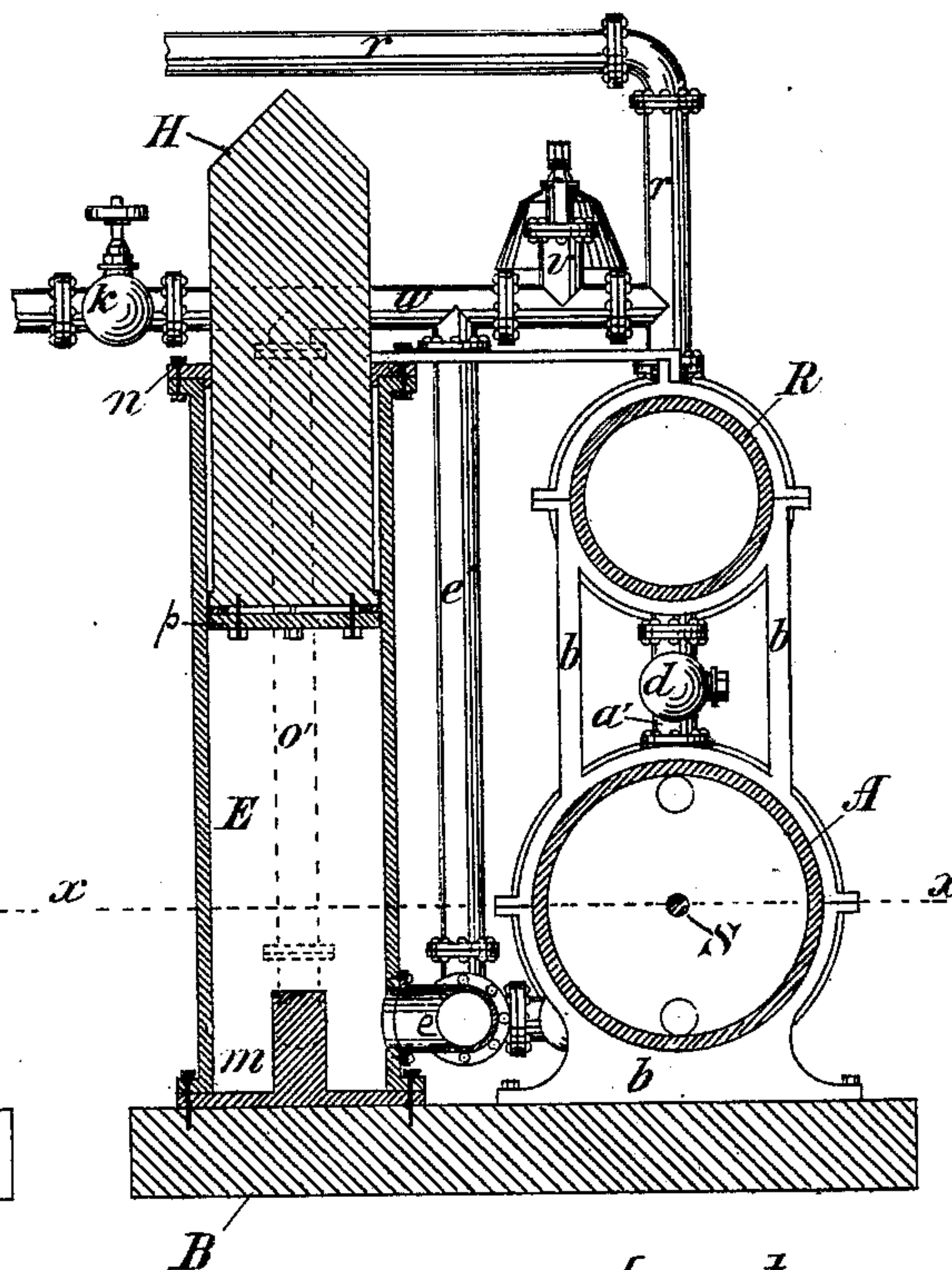


Fig. 5.



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IMPROVEMENT IN HYDRAULIC-POWER APPARATUS.

Specification forming part of Letters Patent No. **204,654**, dated June 11, 1878; application filed March 21, 1878.

To all whom it may concern:

Be it known that I, EDWARD M. BUTZ, of Allegheny city, county of Allegheny, State of Pennsylvania, have invented or discovered a new and useful Improvement in Hydraulic-Power Apparatus; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawing, making a part of this specification, in which—like letters indicating like parts—

Figure 1 is a top-plan view of my improved hydraulic-power apparatus. Fig. 2 is a side elevation of the same, with a like view of a hydraulic jack attached to the piston-stem. Fig. 3 shows an end elevation of the apparatus. Fig. 4 is a transverse longitudinal sectional view taken in the line *x x*, Figs. 2, 3, and 5, the piston-stem being broken away in part. Fig. 5 is a transverse vertical sectional view taken in the line *y y*, Figs. 1 and 2. Fig. 6 is a vertical sectional view of one of the expanding cylinders or accumulators employed, showing a modification in construction; and Fig. 7 shows the same in elevation.

My improved hydraulic-power apparatus is designed for use in connection with what are commonly known as "hydraulic jacks." By means of these jacks a slow but powerful movement of considerable range may be secured in the ram-head by means of a series or succession of short light strokes in the operating-lever, and, when used in connection with my improvement, this immense but slow-moving power may, at each stroke of the ram-head, be made to move and store under pressure, or raise to a higher elevation, a large body of water. This water, when so stored, may be used for driving machinery or otherwise used in the arts or for domestic purposes.

In the drawing, B represents any suitable bed or foundation, on which are arranged in line a series of two or more hydraulic cylinders, A. These cylinders may be constructed and secured to the base B in any suitable way. Pistons P are arranged one in each of the cylinders, and these pistons are carried on a common stem, S, which passes through suitably-packed stuffing-boxes *s* in the cylinder-heads. The pistons P may also be packed in any suitable way to prevent leakage from one side to

the other. The cylinders A are thus divided by the pistons into two chambers, C and C'.

A reservoir, R, having a feed or supply pipe, *r*, is supported, preferably, above the cylinders A on brackets or supports *b*, and pipes *a a'* lead from the reservoir to the cylinders. As shown, two of these pipes lead to each cylinder, the pipes *a* opening to the chambers C, and the pipes *a'* to the chambers C'. Check-valves *d*, of any suitable construction, are arranged in the pipes *a a'*, so as to open and permit water to flow from the reservoir to the cylinders, but to close and prevent passage in the opposite direction.

Outflow-pipes *c c'* lead from the chambers C C', respectively, to a common trunk-pipe, D. Suitable check-valves *d'* are arranged in these outflow-pipes, so as to open and permit water to pass from the cylinders to the trunk D, but to close against pressure in the opposite direction. From the trunk D a stand-pipe, *e'*, leads to a discharge-pipe, *w*, or to any suitable reservoir, into which water is to be elevated; or, if desired, the trunk D may open to one or more accumulators, E, by means of connecting-pipes *e*. Any desired construction of accumulators may be employed. In that shown in the drawings the cases E are supported on end on the base B. Pistons *p*, suitably packed, move up and down within the cases, and are guided by the stems H, which may also serve as weights to give the requisite pressure to the water within; or, if preferred, a powerful spring, *i*, Fig. 6, may be arranged between the pistons *p* and head *n* for giving the desired pressure, the stem H working through the head *n*, as before, to guide the pistons. With this latter construction the accumulators may be arranged horizontally or otherwise, as desired.

Blocks *m* are placed on the bottom of the accumulator-cases to prevent the pistons from descending so low as to cut off the inflow and outflow ports.

The two accumulators shown are connected by a pipe, *o*, from which a pipe, *o'*, may lead to any desired place of use. If desired, these accumulators may be used as expanding-cylinders to prevent jar or shock when the apparatus is employed for raising water to an elevated reservoir. I also prefer to extend the

pipe *w* across from the stand-pipe *e'* to the feed-pipe *r*, as shown, and arrange a safety-valve, *v*, between the two, so that in case the pressure in the stand-pipe or its connections should become too great, the valve *r* will open automatically and complete a circuit through the cylinders *A* and inflow and outflow pipes, thus relieving the pressure and allowing the apparatus to continue in operation without injury.

Any known or suitable construction of safety-valve may be employed, and it may be adjusted by means of a weighted lever, as shown, or in other convenient way.

I have shown in Fig. 2 a hydraulic jack, of which the ram or piston-head *u* is formed on or connected directly with the end of the piston-stem *S*, so that the motion given to this head *u* of the jack will be the motion of the stem *S* and pistons *P*. As before stated, this motion, though slow, is very powerful, and it is secured by a succession of comparatively light strokes of the operating-lever *u'*. I do not deem it necessary to show or describe the internal construction of this jack, as I make no claim to it separately considered, but employ such ones as are in common use for other purposes.

The work to be performed by the jack is measured by the pressure of the water moved against the pistons *P*. This pressure may be varied by increasing or diminishing the size of the cylinders *A* and pistons *P*, or their number, and the moving power may also be varied in like manner by using a greater or less number of jacks. When the wants of any particular case are known these relations of size and number can readily be determined by any one skilled in the art.

By means of this apparatus a large body of water can be elevated or stored under pressure at each stroke of the pistons, since the combined capacity of all the cylinders will be filled and emptied at each such stroke, and in this way and by this arrangement I secure a maximum of effect desired at a minimum of cost of construction and strain upon the apparatus when in use.

The operation of my improved apparatus is as follows: As the pistons *P* begin their stroke in one direction, as shown in Fig. 4, there will be a tendency to form a vacuum in the chambers *C* on the rear side of the moving pistons. This tendency will cause the check-valves in the pipes *a* to open, and those in the pipes *c* to close, when water will flow from the reservoir *R* to fill these chambers.

Upon the reverse or back stroke of the pistons the check-valves in the pipes *a* will be closed by the pressure caused by the moving pistons, and the valves in the pipes *c* will be opened by the same force, and the contents of the chamber *C* forced into the trunk-pipe *D* or its connections. While this is being done a suction is created on the side *C'* of the moving pistons, which suction will close the valves

in the pipes *c'* and open those in the pipes *a'*, and water will flow from the reservoir *R* to the chambers *C'*. The contents of these chambers are in turn forced into the trunk *D* by the next stroke of the pistons, and so the operation continues, each stroke forcing, in turn, the whole, or nearly the whole, and combined contents of the cylinders into the trunk *D* and its connections.

When the contents of the trunk *D* are under pressure such pressure will close the valves in the pipes *c* and *c'* independent of any suction caused by the moving pistons, and in order then to open these valves and empty the contents of the cylinders a greater pressure must be secured in the cylinders than exists in the trunk. So, too, if the feed-water be under pressure, such pressure will open the valves *d* when the opposing pressure in the cylinders is removed, and in such case it is not essential that the reservoir *R* be placed above the cylinders *A*, as the pressure in the feed-pipe will of itself cause the water to fill the cylinders at the proper time.

As before stated the pressure in the trunk *D* and connections may be regulated by means of the safety-valve *v*; also, the contents of the trunk may be directed either to the accumulators *E* by closing the valve *k*, or by opening this valve and closing one in the pipes *o* or *o'* the contents may be directed to an elevated reservoir or other place of use, and in this case the accumulators may be used as cushioning or expanding cylinders.

I claim herein as my invention—

1. In a hydraulic-power apparatus, the combination of two or more pumping-cylinders, a corresponding number of pistons, one for each cylinder, arranged on a single stem, and at each end of each cylinder valved inflow and outflow pipes leading from a common supply and to a common receptacle or discharge, substantially as set forth.

2. In a hydraulic-power apparatus, the combination of two or more pumping-cylinders with their pistons arranged upon a common stem, a common inflow-pipe leading to both ends of each cylinder, a common outflow-pipe leading from both ends of each cylinder, and a pipe-connection between the inflow and outflow pipes, which is opened and closed by an automatically-operating valve, substantially as and for the purpose described.

3. The combination of a hydraulic-power apparatus having two or more pumping-cylinders, a corresponding number of pistons, one to each cylinder, arranged on a common stem, and a hydraulic jack, with suitable connections between the piston-stem and the ram-head of the jack, substantially as described, whereby a series of short strokes in the operating-lever of the jack may be made to give a single and common stroke of greater range to the pistons.

4. The combination of a hydraulic-power apparatus having two or more pumping-cyl-

inders with their pistons arranged upon a common stem, a common supply leading to both ends of each cylinder, a common discharge leading from both ends of each cylinder, an automatic valve-connection between the discharge and supply pipes, and one or more accumulating or expanding cylinders opening to the common discharge, substantially as described.

In testimony whereof I have hereunto set my hand.

EDWARD M. BUTZ.

Witnesses:

WEST McMURRAY,
CLAUDIUS L. PARKER.