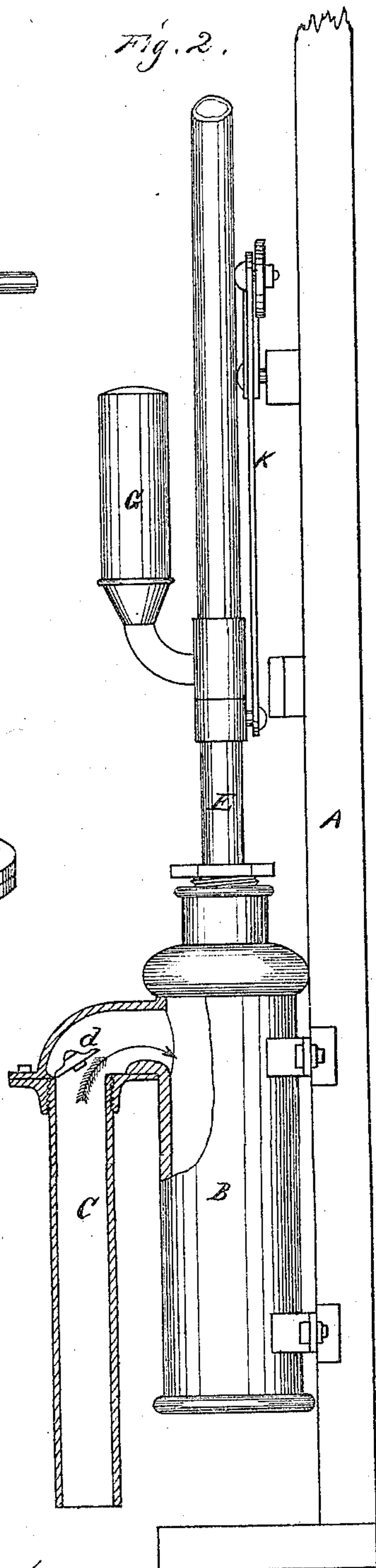
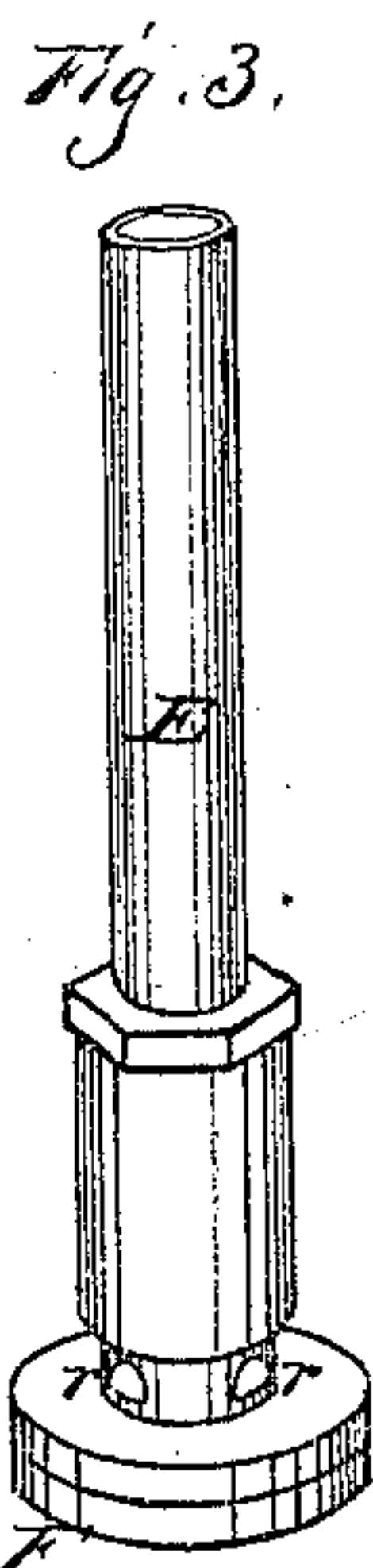
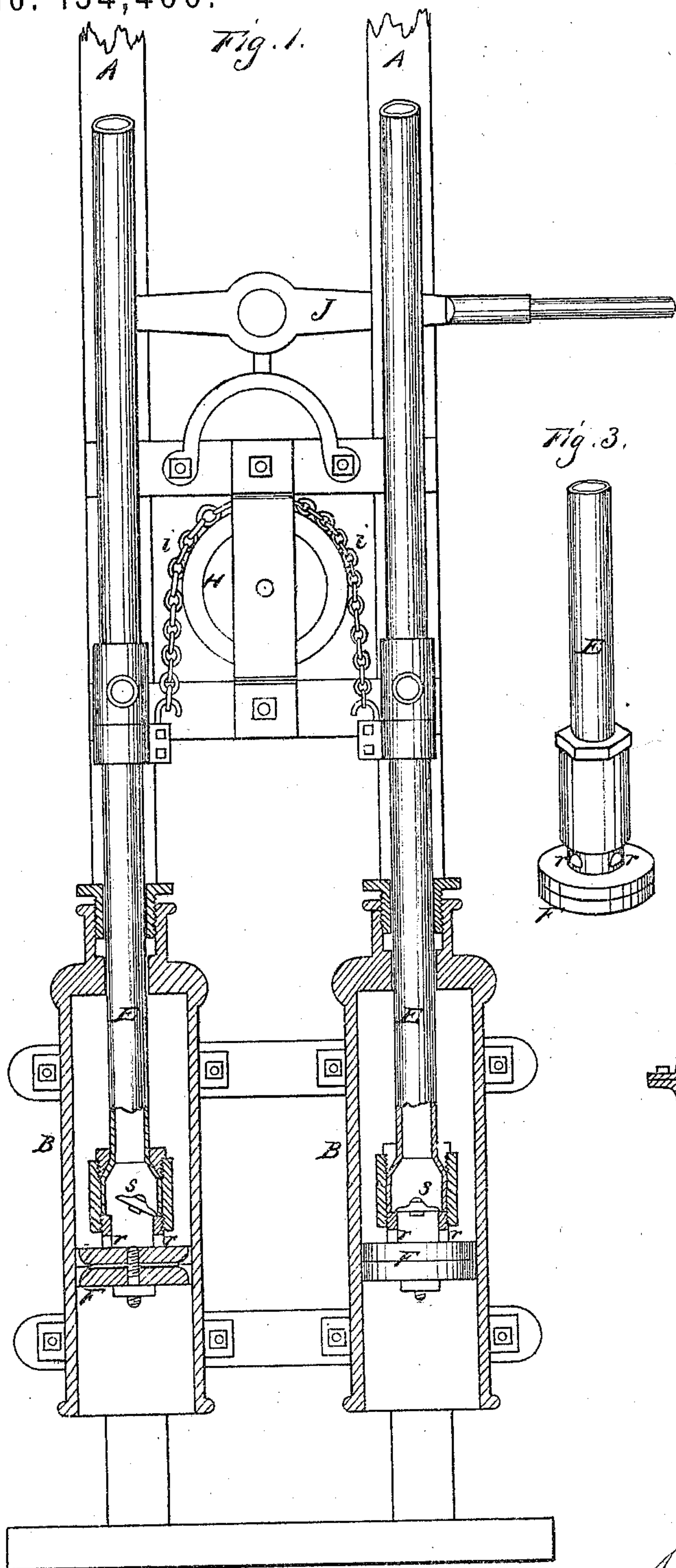


I. D. CROSS.  
Pumps.

No. 134,466.

Patented Dec. 31, 1872.



Witnesses  
Geo. H. Strong  
O. M. Richardson

Ira Davis Cross  
By his Attys  
Dewey & Co.



# UNITED STATES PATENT OFFICE.

IRA D. CROSS, OF PETALUMA, CALIFORNIA.

## IMPROVEMENT IN PUMPS.

Specification forming part of Letters Patent No. 134,466, dated December 31, 1872.

*To all whom it may concern:*

Be it known that I, IRA D. CROSS, of Petaluma, Sonoma county, State of California, have invented an Improved Pump; and I do hereby declare the following description and accompanying drawing are sufficient to enable any person skilled in the art or science to which it most nearly appertains to make and use my said invention or improvements without further invention or experiment.

My invention relates to what I call a balance-pump; and it consists in constructing the pump with two hollow piston-rods or pipes, into which the water is forced on the upward stroke of the piston, and which pipes are so connected together and suspended from a pulley or other common pivot that the weight of one pipe with its column of water will counterbalance the weight of the other pipe with its column of water, thus permitting the water to be lifted in the pipes to any desired height with very little power. To accomplish this a novel arrangement of the cylinder and induction-pipes with their ports and valves is necessary, a full and complete description of which is appended hereto, in which reference is had to the accompanying drawing.

Figure 1 is a front elevation, showing a section of cylinder. Fig. 2 is a side elevation. Fig. 3 is a perspective view of a plunger and valve-case.

Let A A represent a frame, which can be erected either in or above a well or other reservoir of water from which it is desired to lift the water. B B are two short cylinders, which are secured vertically to the frame A A, and parallel with each other, at a distance not greater than thirty-three feet above the surface of the water. The lower ends of these cylinders are open, and an induction-pipe, C, communicates with them at or near their upper ends, and extends down into the water, as shown. Inside of these pipes C at some convenient point, and preferably near the upper end, is an upward-lifting valve, *d*, through which the water can pass into the cylinder on the down-stroke of the piston, but which will close when the piston moves up. E E are two vertical pipes or tubes, which are parallel with each other, and serve as piston-rods, the solid pistons F being secured to their lower ends. The pistons F work in the usual way inside of

the cylinders B B below the point at which the induction-pipes C C communicate with the cylinder. The pipes or piston-rods E E pass through a suitable stuffing-box in the upper end of the cylinders, and thence extend upward to any desired distance. One or more air-chambers, G, are connected with the pipes E at some suitable point to provide a pressure for forcing the water upward. H is a pulley, which is secured to the frame at a suitable height midway between the two pipes E. A chain or cord, *i*, passes over the pulley, and has its opposite ends attached to each of the pipes, so that the weight of the pipes will be sustained by the pulley in such a manner that they counterbalance each other. A lever, J, has its middle pivoted to the frame A midway between the upright pipes, and a link, K, connects it with the pipes upon each side of the pivot, so that by raising and lowering one end of the lever the pipes will be given an alternately-reciprocating motion. The pistons F are properly packed, so that a tight joint is preserved between them and the sides of the cylinder at all times. Just above each of the pistons openings *r r* are made in the lower end of the pipes or tubes E, which communicate with the hollow interior, through which the water can pass into the pipes, and just above these openings an upward-lifting valve, *s*, is secured, which serves to retain the water in the pipe on the downward stroke of the pistons.

Now, it is evident that as either of the pistons F are forced downward in the cylinders B a vacuum is created which draws the water through the induction-pipe C and valve *d* into the cylinders above the piston, and as the pistons move up the induction-valve *d* is closed and the water forced through the openings *r* and valve *s* into the vertical pipes or tubes E. On the downward stroke the valve *s* closes so as to retain the water in the pipes, thus keeping them full at all times.

The pipes E being reciprocated alternately, and being suspended by the chain *i* from the pulley H or other common point, naturally counterbalance each other, and consequently the weight of the one with its inclosed column of water sustains the other one with its weight of water, notwithstanding the height to which the pipes are carried, so that all that is nec-



essary to raise the water is to exert sufficient power to overcome the friction and lift the water which is being discharged at the upper end of the pipes.

By this means I provide a double-acting suction, lift, and force pump, which is especially adapted for raising water out of mines and other places where the water has to be lifted to a great height, and which requires but a small addition of power to increase the lift on account of the balancing principle upon which the pump is constructed.

The special arrangement of the parts of this pump may be modified in some particulars, such as the employment of two sustaining-pulleys for supporting the pipes, or the substitution of a walking-beam or rocking-lever for the pulleys; but I consider these as mere mechanical equivalents.

The main features of this pump, and that part which I consider as absolutely essential to the successful application of the balancing principle, are, first, connecting the induction-pipes C with the cylinder above the pistons; second, leaving the lower end of the cylinders

open, so that the water below can follow the pistons in their movements without interfering with their operations; and thirdly, the valve *s* in the pipes for retaining the column of water in the pipes during the downward stroke of the pistons.

I am aware that two reciprocating pipes or hollow piston-rods have been heretofore employed for lifting water; but their application and arrangement were different.

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

The cylinders B with their induction-pipes C having the valves *d*, and communicating with said cylinder above the pistons, in combination with the solid pistons F with their hollow piston-rods E, openings *r r*, and valve *s*.

In witness whereof I hereunto set my hand and seal.

IRA DAVIS CROSS. [L. S.]

Witnesses:

GEO. H. STRONG,

C. M. RICHARDSON.