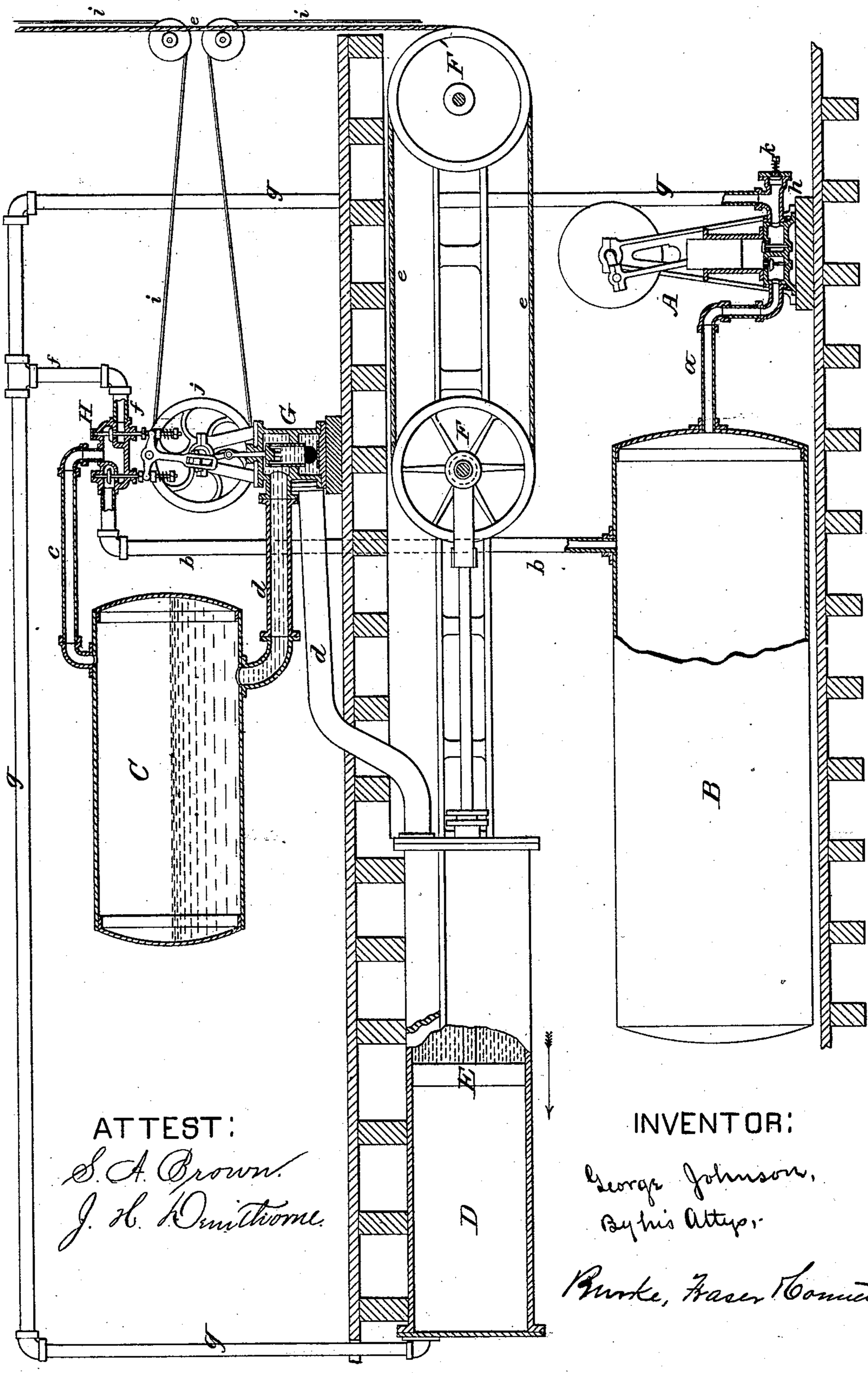
(No Model.)

G. JOHNSON.

Hydro Pneumatic Elevator.

No. 234,874. Patented Nov. 30, 1880.



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GEORGE JOHNSON, OF CINCINNATI, OHIO.

HYDROPNEUMATIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 234,874, dated November 30, 1880.

Application filed April 17, 1880. (No model.)

To all whom it may concern:

Be it known that I, GEORGE JOHNSON, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain Improvements in Hydropneumatic Lifts, of which the following is a specification.

My invention relates to that class of elevators or lifts wherein the load is lifted by compressed air operating through the medium of a liquid column, which acts upon a hydraulic piston.

The object of my invention is, in the main, to permit the air in the air and water vessel to flow into the hydraulic cylinder back of the piston when displaced by the water from said cylinder while the car is descending, and thus avoid such back-pressure as will occur if the air-compressor does not remove the air fast enough. I thus avoid the employment of a contingent exhaust-valve operated from the car, and am enabled to utilize all of the exhaust air instead of escaping a portion of it into the atmosphere, all as will be more fully hereinafter described.

The figure in the accompanying drawing is a side elevation, partly in vertical mid-section, of a hydropneumatic elevator embodying my invention.

Let A designate a suitable air-compressor arranged to be driven by steam or other power; B, a compressed-air reservoir, connected with the compressor by a pipe, *a;* C, a reservoir intended to contain both compressed air and water, the former being supplied to it from the reservoir B through air-pipes *b* and *c;* and D, a hydraulic cylinder, supplied with water from the reservoir C through a pipe or pipes, *d d*. The piston E, which plays in this cylinder, is connected, through its rod, with a set of sheaves, F, which serve to communicate motion to the car or platform (not shown in the drawing) through other sheaves, F′, and a rope, *e*, in the usual manner. The lift-engine may, however, be connected with and operate the car or platform in other known ways.

The passage of water through the pipe *d* is controlled by a valve, G; and the passage of air from the reservoir B to C is controlled by a valve, H, arranged between the pipes *b* and *c*. This valve H is a two-way valve, being connected with the pipes *b c* and with an outlet pipe or orifice, *f*. An ordinary two-way cock may be substituted for the valve H, if desired, it being arranged to connect either of the pipes *b* or *f* with the pipe *c* or to cut off both therefrom at will.

It will be observed that both ends of the cylinder D are closed, and the end to the left, which I denominate the "air end," is connected by a pipe, *g*, with the suction or inlet *h* of the compressor A. This pipe *g* is also tapped by the pipe *f*, whereby the said compressor is at times connected with the reservoir C.

The water-valve G and air-valve H may be operated independently from the car or platform; but I prefer to connect them together and operate them through one rope, *i*. The peculiar construction and arrangement of the said valves G and H form no part of my present application, and therefore will not be minutely described.

Having thus described the mechanism, I will now explain its operation.

The car is supposed to be ascending and about half-way up, the piston E moving in the direction of the arrow. The air-valve H is so set that the reservoir B is open to the reservoir C through the pipes *b c*, and the water-valve G is open, so that the water may be forced by the compressed air in C through the pipe *d* into the cylinder D, as shown. The air end of the cylinder D is open to the suction of the compressor, but is cut off from the reservoir C. Thus in the ascent of the car the air is forced from D through the pipe *g* to the compressor, which, in turn, forces it into the reservoir B. When the car has ascended far enough the water-valve G is closed through the medium of the rope *i* and wheel *j*, thus cutting off communication between the cylinder D and the reservoir C and stopping the car. At the same time the air-valve H is closed, cutting off B from C. The car is caused to descend by continuing the rotation of the wheel *j* far enough to throw open the water-valve G and the other part of the air-valve, so as to connect the air-space in C, through the pipe *c*, with the outlet *f* and pipe *g*. The descending car thus forces the water from D into C, and the air from the latter passes through the pipe *c*, valve

H, outlet *f*, and pipe *g* to the air end of the cylinder D, thus more or less perfectly balancing the pressure in the engine-piston.

Ordinarily the same air as well as the same water will be used over and over in my apparatus; but to provide against leakage of air I furnish the inlet *h* of the compressor with an automatic or spring valve, *k*, arranged to admit air, should any be required to supply a deficiency.

By my arrangement I take air into the compressor at a tension corresponding to the load lifted and force it into the reservoir B; but as the compressor will not usually be able to remove the air from the vessel C with sufficient rapidity as the car descends and forces the water back into said vessel, I provide for the displaced air (which would otherwise be compressed and act to retard the descent of the car) by allowing it to pass over into the air end of the hydraulic cylinder. From thence it will be removed by the compressor as the car ascends.

The compressor in elevators of this character is usually arranged to compress the air up to a predetermined point and then to cease compressing automatically. Consequently it will not usually be in active operation as the car descends, and some means of relieving the vessel C of air at once is necessary. In a pending application whereto I am a party this is accomplished by means of a contingent exhaust-valve operated from the car; but, of course, in such a construction the air-compressor will not utilize all of the exhaust.

By connecting the air-space in the reservoir C with the air end of the cylinder D, I am enabled to lower the car and force the water from the cylinder into the reservoir whether the compressor is working or not, as the displaced air in the reservoir flows into the cylinder.

Where one compressor and air-reservoir is employed to operate two or more elevators the arrangement will be substantially as herein represented, except that check-valves should be placed in the pipes that are common to both or all of the elevators, to prevent them from interfering with one another.

Having thus described my invention, I claim—

1. A hydropneumatic elevating apparatus constructed with an air and water reservoir, a lifting cylinder and piston, a compressed-air reservoir, an air-compressor, and suitable air and water valves, the compressor arranged to take the exhaust air from the air and water reservoir and the air end of the hydraulic cylinder and force it into the compressed-air reservoir, substantially as set forth.

2. A hydropneumatic elevating apparatus constructed with an air-compressor, a compressed-air reservoir, an air and water reservoir, air and water valves, a hydraulic engine the cylinder of which is closed at both ends, a water-pipe leading from one end of the engine-cylinder to the air and water reservoir, an air-pipe leading from the air-reservoir to the air and water reservoir, and pipes leading from the air end of the engine-cylinder and the air and water reservoir to the suction or inlet of the air-compressor, substantially as set forth.

3. The combination, in a hydropneumatic elevating apparatus, of the hydraulic engine having its cylinder D closed at both ends, the reservoir C, the water-pipes *d d*, water-valve G, air-pipes *g* and *f*, two-way air-valve H, or its substantial equivalent, the compressed-air reservoir B, and the air-pipe *b*, the whole being arranged, as described, in such a manner that the air may flow from the reservoir C into the air end of the cylinder D when the car descends, as sets forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

GEORGE JOHNSON.

Witnesses:
HENRY CONNETT,
ARTHUR C. FRASER.