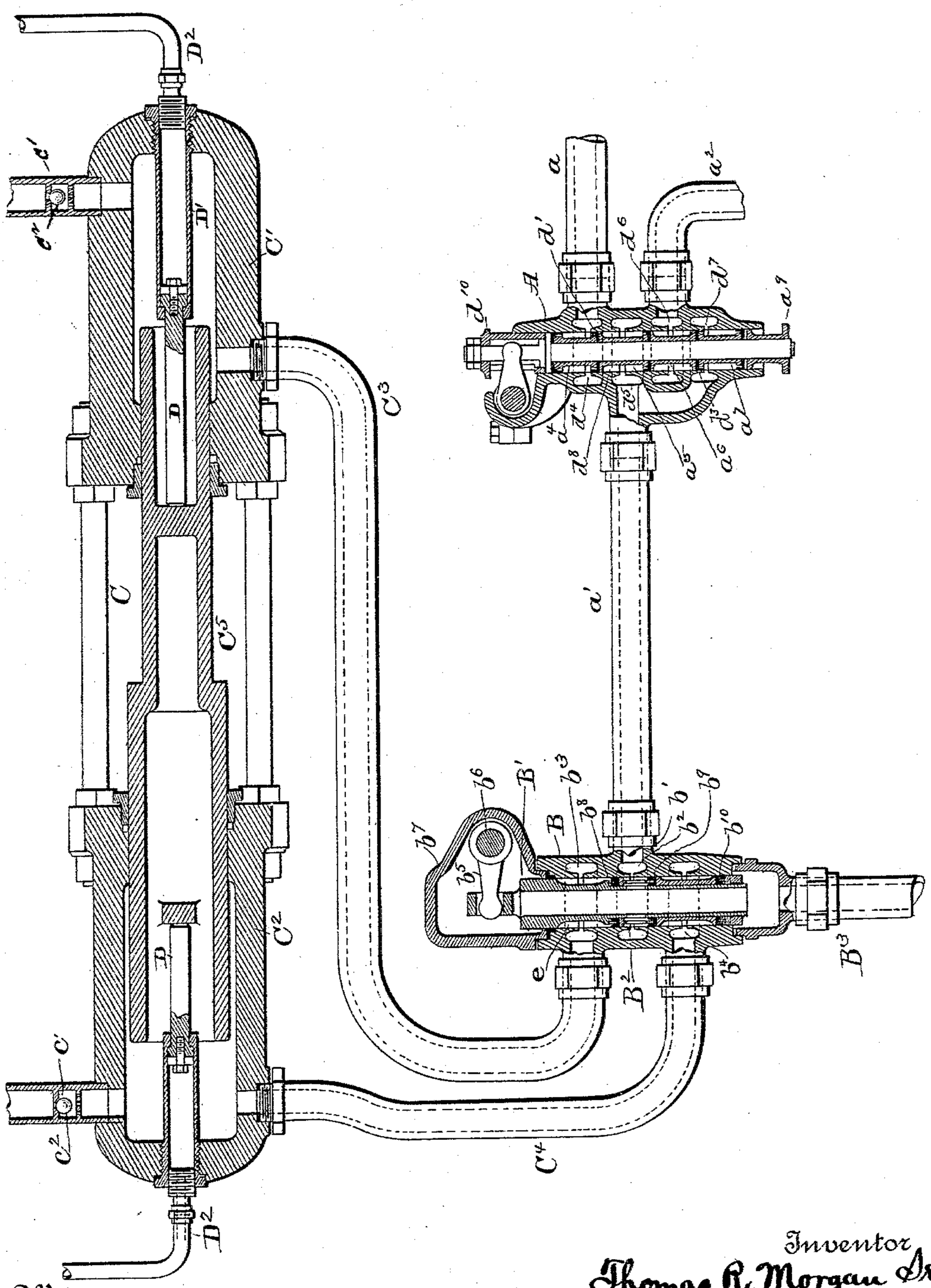
(No Model.)

T. R. MORGAN, Sr.

TRANSFORMER FOR HYDRAULIC MACHINES.

No. 565,014. Patented Aug. 4, 1896.



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THOMAS R. MORGAN, SR., OF ALLIANCE, OHIO.

TRANSFORMER FOR HYDRAULIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 565,014, dated August 4, 1896.

Application filed November 27, 1894. Serial No. 530,137. (No model.)

To all whom it may concern:

Be it known that I, THOMAS R. MORGAN, Sr., of Alliance, in the county of Stark and State of Ohio, have invented certain new and useful Improvements in Transformers for Hydraulic Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in devices for varying the pressure of the water supplied for actuating hydraulic machines.

Heretofore the water supplied to hydraulic machines has been conveyed from the accumulator to the machine at accumulator pressure, and as practically all machines are constructed for light as well as heavy work it follows that when the machine is on light work the same power is not required as for heavier work. Hence the excess of power over and above the power actually required for the work is wasted.

My devices are designed to be interposed between the accumulator and the machine actuated by the water for varying the pressure of water taken from the accumulator, whereby water at or above or below accumulator pressure may be supplied to the machine, thus effecting a saving in water and consequently power; and it consists in the parts and combinations of parts, as will be more fully described, and pointed out in the claims.

The accompanying drawing is a diagrammatic view in section of the several parts constituting the invention.

A represents an operating-valve, B a pressure-changing valve, and C the double-cylinder ram, which I have termed a "transformer."

The valve A is of the construction ordinarily employed in hydraulic machinery and is connected by pipe a with an accumulator and provided with a pipe a', leading to the pressure-changing valve B, and with an exhaust-pipe a^2, through which the water is discharged after having passed through the machine. This valve A consists of a casing having a central bore and four annular chambers surrounding the bore and communicating therewith, one of said chambers being in communication with supply-pipe a, two with pipe a', and one with exhaust-pipe a^2. Located within the bore is a longitudinally-movable stem having a series of spool-like sleeves or distance-pieces a^4, a^5, a^6, and a^7 thereon, each sleeve being of sufficient length to overlap the openings of two adjacent chambers, thus establishing communication between said chambers. Cup-leather packings are inserted between the several sleeves for preventing the water from passing the joint.

When the parts are in the position shown in the drawing, water can neither flow to nor from the machine.

By raising the stem until the stop-nut a^9 strikes the casing, packing d' will have been carried above the annular chamber d^4, thereby allowing the water to flow from the accumulator through pipe a, annular chamber d^4 into the annular space d^8, and from thence into chamber d^5 to pipe a'. By reversing the movement to the position indicated in the drawing the supply of water from the accumulator is cut off. By continuing the downward movement of the stem until the positive stop d^{10} at the upper end of the stem strikes the cylinder, the packing d^3 will have descended below the annular chamber d^7, thereby allowing the water from the machine to exhaust through the chamber d^7, into chamber d^6, into exhaust-pipe a^2. This valve is of the construction ordinarily employed on hydraulic machinery and its function is simply to regulate the supply of water at accumulator pressure to the parts to be now described, which are employed for varying the pressure. The water as it leaves this valve passes through pipe a' to the pressure-changing valve B. This valve consists of a casing having a coupling-stem b', to which inlet-pipe a' is coupled. Coupling-stem b' is in direct communication with the annular chamber b^2, which latter, with the chambers b^3 and b^4, surrounds the central bore of the valve and communicates therewith. Located within the central bore of the valve is the stem B', which latter is hollow throughout its length and is connected at its upper end to the arm b^5 on the valve-operating shaft b^6. The upper end of the bore of the valve is covered by a water-tight cap b^7, the arm b^5 being located within the cap. The stem B' is provided with the cup-shaped packing b^8, b^9, and b^{10}, and the

stem immediately between packing b^9 and b^{10} is reduced in size to permit the water to pass from one annular chamber to another.

Interposed between packings b^9 and b^8 is a ring B^2, provided with an opening or series of openings, and the portion of the stem immediately within the ring B^2 is also provided with an opening or openings. Hence it will be seen that when the valve-stem is in the position shown in the drawing water direct from the accumulator can pass through coupling-stem b' into annular chamber b^2, through ring B^2 into stem B', and from thence downward into pipe B^3, leading to the machine, thus supplying the machine with water at accumulator pressure.

Before describing the movements of the valve for varying the pressure I will describe what I have termed the "transformer." This transformer C consists of two cylinders C' C^2, suitably mounted and braced, with their open ends facing and in line with each other. Cylinder C' has a bore smaller in diameter than the bore of cylinder C^2, and each is provided with an inlet-pipe c', having an upwardly-closing check-valve c^2. Cylinder C' communicates with the chamber b^3 of valve B by pipe C^3, while cylinder C^2 communicates with chamber b^4 of valve B by pipe C^4.

C^5 is the double plunger, the larger end of which fits cylinder C^2, while the smaller end fits cylinder C'.

From the foregoing it will be seen that with the parts in the position shown in the drawing if valve-stem be moved upwardly until packing b^{10} rested below the horizontal opening in chamber b^4, packing b^9 would be above the opening in chamber b^2 and water from the accumulator would pass from chamber b^2 into chamber b^4, and from thence through pipe C^4 into cylinder C^2, and exert its pressure against the larger end of the plunger. Cylinder C' has in the meantime been filled with water taken from any source through pipe c', and the plunger which is forced toward cylinder C' subjects the water therein to a pressure in excess of accumulator pressure and forces same out through pipe C^3 into chamber b^3 in valve B. From thence it passes upwardly alongside of the stem into cap b^7, and from thence down through the stem into pipe B^3, which, as before stated, leads to the machine. With the water from the accumulator passing into the larger cylinder the water as it leaves the smaller cylinder is under greater pressure than the water from the accumulator.

Valve B remains in the position last described as long as the high pressure is required, the supply being controlled and the machine operated by valve A. After the machine has performed its work or finished its stroke, valve A is shifted to exhaust the water from cylinder C^2, the exhaust water passing through pipe a' to valve A.

When a reduced pressure of a pressure less than accumulator pressure is sufficient for the work to be performed, valve-stem B' is moved downwardly until packing b^8 is below the opening in chamber b^2. This brings the upper portion of the reduced section e or valve-stem B' just above the opening in chamber b^3. This permits the water from the accumulator to pass from chamber b^2 into chamber b^3, through pipe C^3 into cylinder C'. Cylinder C^2 has in the meantime been filled with water from any source of supply and as the plunger moves toward cylinder C^2 the water therein is subjected to pressure and forced through pipe C^4 into chamber b^4. Packing b^{10} is now below the bore of the valve B, and the water has a free passage from chamber b^4 to pipe B^3 and from thence to the machine.

To restore plunger C^5 to its central or normal position, I have provided each cylinder with a push-back D, which is in effect a plunger. These push-backs are mounted in the cylinders D', which latter are attached to the heads of the cylinders C' C^2, and each is supplied with water by a pipe D^2, leading from the accumulator. The heads of the push-backs are slightly enlarged, and at their limit of outward stroke engage the heads of cylinders D'. The pressure on either end of the plunger is of course sufficient to force the push-back at the other end into its cylinder, but as the pressure against the push-backs is constant as soon as the pressure in the cylinders C' C^2 is relieved the push-backs restore the plunger to its central position and hold it there.

By the above arrangement and construction of parts I am enabled to operate a machine, such as a flanging-press, shears, and the like, with water direct from the accumulator and at the accumulator pressure, or by means of the water from the accumulator can subject water to a pressure above or below accumulator pressure, thus enabling me to supply water at or near the pressure required for the work, and thus effect not only a saving of water but a material saving of power.

If desired, a second transformer can be added receiving varying pressures from the first transformer, thus giving nine varying pressures, and so on indefinitely.

It is evident that many slight changes might be resorted to without departing from the relative arrangement of parts herein shown and described. Hence I would have it understood that I do not care to confine myself to the exact construction of parts shown and described; but,

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

1. In an apparatus operated by hydraulic pressure, the combination with a pipe for supplying water under pressure, a pipe leading to a machine, and a transformer consisting of two cylinders of different sizes and a plunger for each, the plungers being connected, of an operating-valve connected to the supply-pipe, and a single-pressure changing-valve having

a hollow stem and a series of ports whereby the water can be passed through the valve direct to the machine or to either cylinder of the transformer, the construction being such that when one port of the pressure-changing valve is open to one of the cylinders of the transformer, a port communicating with the other cylinder is open to the pipe leading to the machine, substantially as set forth.

2. In an apparatus operated by hydraulic pressure, the combination with a pipe for supplying water under pressure, a pipe leading to a machine, an exhaust-pipe and a pressure-changing device consisting of two cylinders of different sizes and a plunger for each, the said plungers being connected, of an operating-valve connected with the supply and exhaust pipes, and a pressure-changing valve having a hollow stem and a series of ports whereby the water can be passed through the valve direct to the machine or to either cylinder of the transformer, the construction being such that when one port of the pressure-changing valve is open to one of the cylinders of the pressure-changing device a port communicating with the other cylinder is open to the pipe leading to the machine, substantially as set forth.

3. In an apparatus operated by water under pressure the combination with a pipe for supplying water under pressure, of a double-cylinder ram, the cylinders being of different diameters, a push-back in each cylinder for centering the plunger, a valve having a series of ports and a hollow stem, a pipe connecting each cylinder with the valve, a water supply for each cylinder, and a pipe leading from the valve to the machine to be actuated all of said parts designed to operate substantially as and for the purpose set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

THOMAS R. MORGAN, SR.

Witnesses:
W. C. LLOYD,
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