(No Model.) 3 Sheets—Sheet 1.

J. J. KEENAN.

HYDRAULIC AIR COMPRESSOR.

No. 547,519. Patented Oct. 8, 1895.

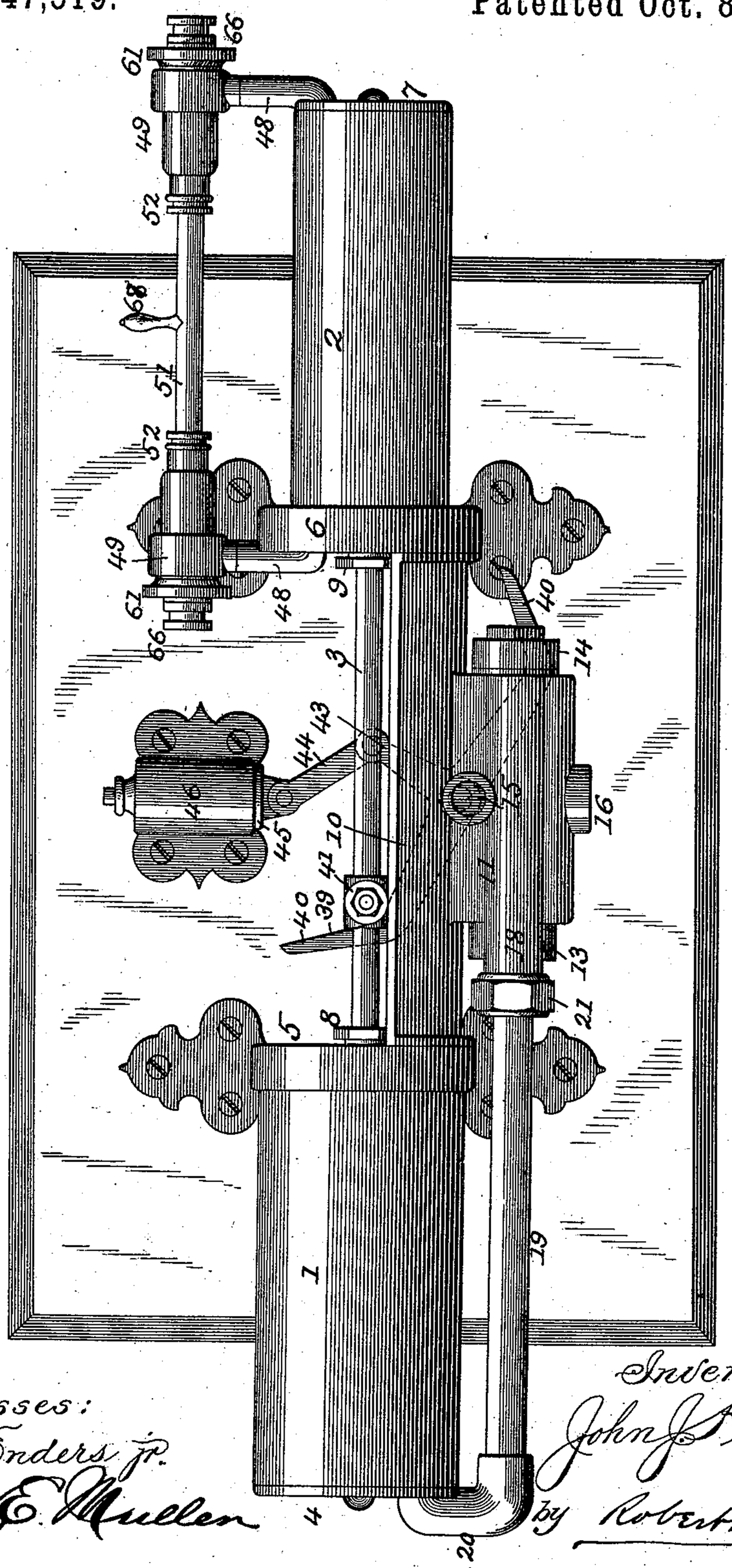

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

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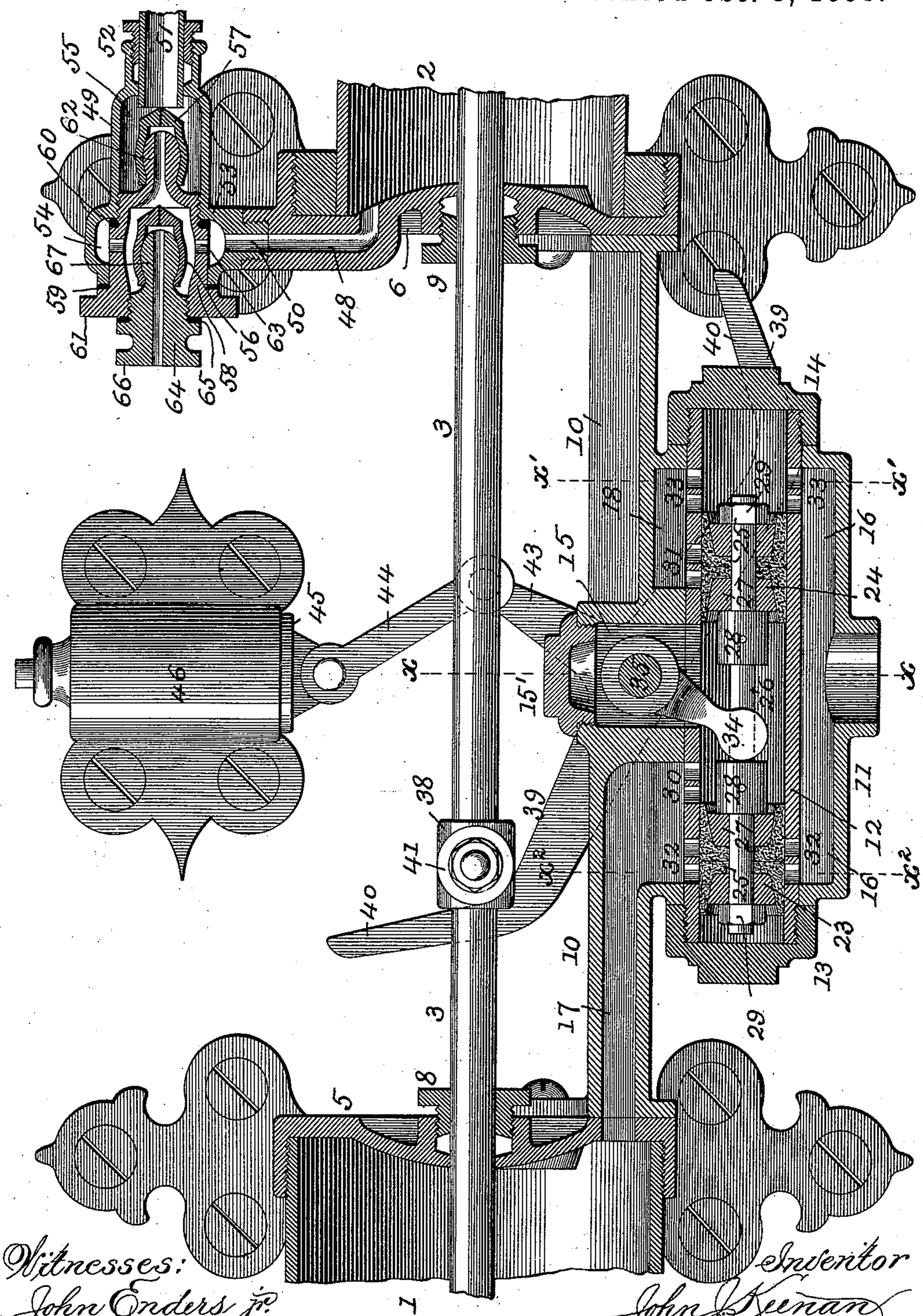

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Fig. 2.

(No Model.) 3 Sheets—Sheet 3.

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Fig. 4.

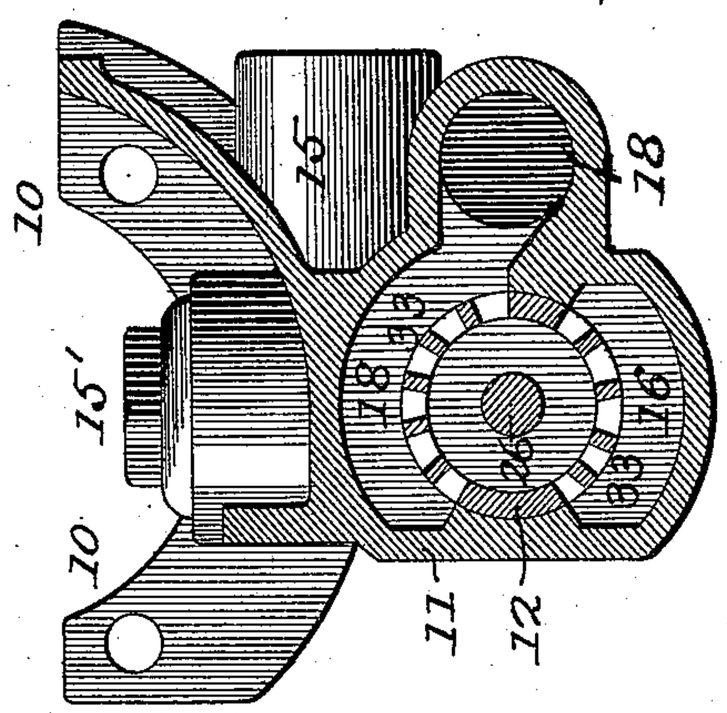


Fig. 3.

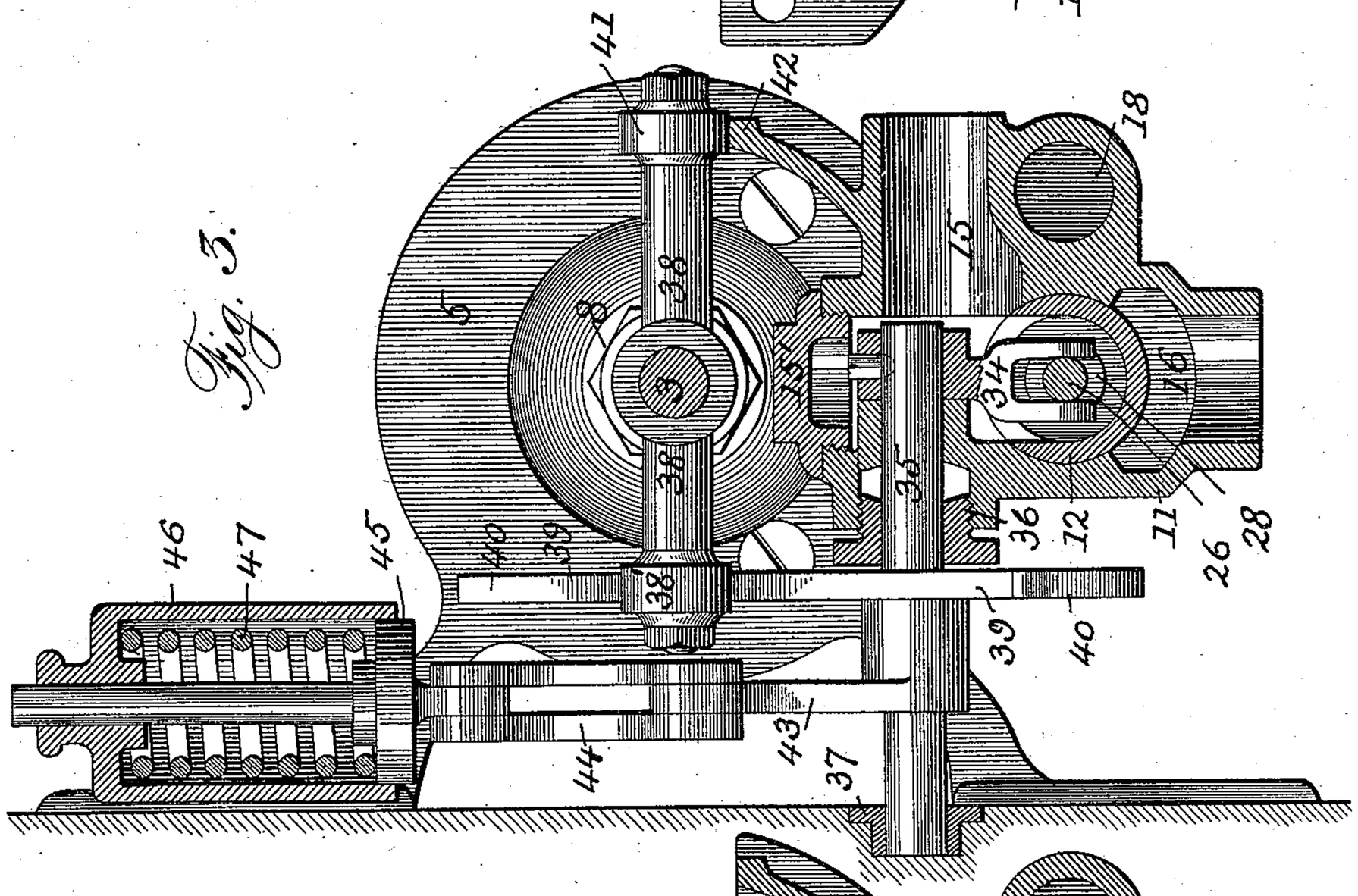
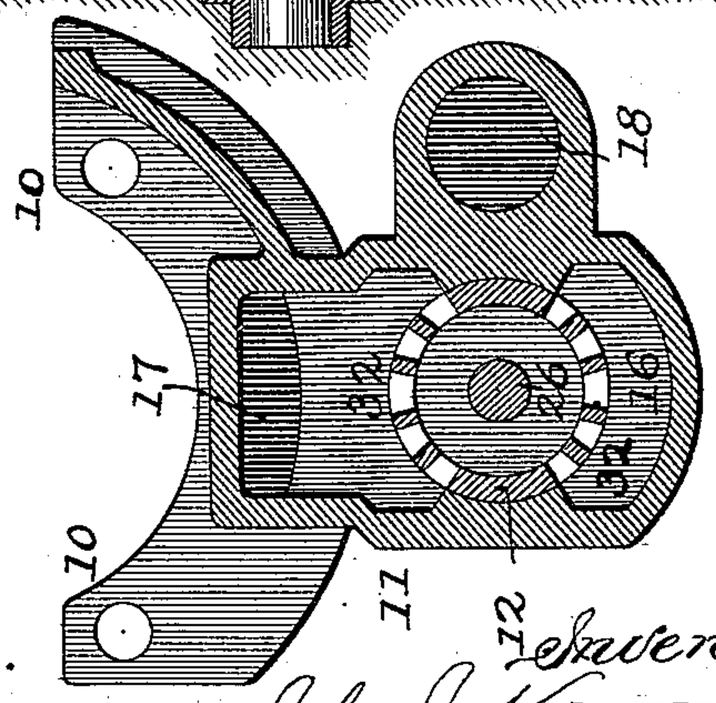


Fig. 5.



Witnesses:
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UNITED STATES PATENT OFFICE.

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HYDRAULIC AIR-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 547,519, dated October 8, 1895.

Application filed June 2, 1894. Serial No. 513,305. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. KEENAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Hydraulic Air-Compressors; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates more especially to that type of reciprocating air-compressors in which the pressure of city water-supply is employed to compress air for forcing beer and like uses; and the present improvements have for their objects, first, to provide a simple, durable, and efficient construction and arrangement of the reversing-valves and communicating ports or passages of the water-cylinder of such type of reciprocating air-compressors; second, to provide a positive and automatic mechanism for insuring a reversal of the valves of the water-cylinder at the end of each stroke; third, to provide a convenient and effective construction and arrangement of the air inlet and outlet valves for the air-cylinder of the compressor. I attain such objects by the construction and arrangement of parts illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of my improved air-compressor, illustrating the general arrangement of the same; Fig. 2, an enlarged detail longitudinal sectional elevation illustrating the pressure-reversing valves, valve-reversing mechanism, &c., of the apparatus; Fig. 3, a transverse section of the same at line $x\,x$, Fig. 2; Figs. 4 and 5, detail cross-sections at lines $x'\,x'$ and $x^2\,x^2$, respectively.

Similar numerals of reference indicate like parts in the different views.

Referring to the drawings, 1 represents the water-cylinder, and 2 the air-cylinder, each provided with the usual piston connected together, so as to move in unison, by the usual piston-rod 3, fixedly connected to both pistons. Both cylinders will consist of the cylindrical body portions and end caps or heads 4, 5, 6, and 7, closing the respective ends of the cylinders, the inner or adjacent heads 5 and 6 being provided with stuffing-boxes 8 and 9 for the passage of the piston-rod.

In the present improvement the cylinders 1 and 2 are connected together in proper relative position by means of the intermediate casting 10, flanged at each end, as shown, and screwed or bolted to the respective end caps 5 and 6, such castings preferably forming a part of the casing of the reversing-valve of the water-cylinder.

The valve-casing consists of an outer casing 11, arranged longitudinally with its bore formed by a cylindrical lining 12, secured in place by the cap-nuts 13 and 14 at each end, as shown in Figs. 1 and 2. The casing 11 is cored or chambered out to form at its mid-length the laterally-extending water-inlet port or passage 15, the counterpart outlet ports or passages 16, at each side of the passage 15, and which are combined in a single main outlet port or passage, and the longitudinally-arranged ports or passages 17 and 18, that connect with the respective ends of the water-cylinder 1, the port 17 extending in the form of a cored passage in the intermediate casting 10, and through the water cylinder cap or head 5, as shown in Fig. 2, while the passage 18 is connected by a section of pipe 19 with the hollow neck 20 of the outer cap or head 4 of the water-cylinder, as shown in Figs. 1 and 2. In the construction shown the pipe section 19 is shown connected in place at its outer end by a screw-joint with the hollow neck 20, and its other end by a packing-gland connection 21 with the valve-casing, as shown in Figs. 1 and 2. With this construction a very ready attachment and detachment of such pipe-section can be effected when required. Within the bore of the cylindrical lining 12 the reversing-valve has a reciprocating movement to reverse the currents of water in the operation of the apparatus, and to this end said valve will consist of counterpart piston-heads 23 and 24, each formed of a pair of cup-leathers 25, clamped together upon the piston-rod 26 by means of the spreader-collars 27 and the fixed collar 28 and attaching-nut 29. The piston-heads 23 and 24 are some distance apart, as shown, so that they will lie at either side of the centrally-arranged water-in-

let port or passage, the wall of the lining 12 at such point being cut away, so that the interior of the said cylindrical lining between the two pistons will be in communication with the water-inlet port, as shown. The cylindrical lining 12 is also perforated or cut away along the path of the pistons to form the communicating-passages 30 31 between the water-inlet 15 and the ports 17 and 18, extending to the respective ends of the water-cylinder, and communicating-passages 32 33 between the aforesaid passages 17 and 18 and the outlet port or passage 16, the construction being such that with the inlet open and outlet closed at one end of the valve-chamber, the inlet will be closed and the outlet open at the other end of the chamber.

Motion is communicated to the valve by means of a rock-arm 34, arranged within the water-inlet port 15, upon a transverse rock-shaft 35, with its free end adapted to bear against the collars 28 to impart intermittent rectilinear reciprocation to the reversing-valve, the collars 28 being arranged some distance apart, as shown, so as to allow of some independent movement of the rock-arm 34, for the purpose hereinafter set forth. The rock-shaft 35 extends out at the side of the inlet-port through a stuffing-box 36 in the side wall of said port, and may extend back and be supported also by the bearing-bushing 37 in the main supporting-base of the apparatus.

15′ is a cap closing an opening in the top of the inlet-chamber 15, through which access may be had on the removal of said cap to the valve mechanism inclosed in said water-inlet chamber. Motion is communicated to this rock-shaft 35 by means of a cross-head 38, secured on the main piston-rod 3 and carrying at one end a roller 38′, that in the movement of said piston-rod alternately bears against and depresses a longitudinally-extending beam or lever 39, that is connected at its mid-length with the rock-shaft 35, the ends 40 of such beam being upturned, as shown, so as to be in the path of the roller 38′ on the main piston-rod. At its opposite end the cross-head 38 carries a roller 41, that moves upon a track 42, formed on the casting 10, and adapted to hold the cross-head in proper horizontal position during its action of imparting movement to the rock-lever 39.

43 is the lower member or arm of a toggle mechanism secured to the operating rock-shaft 35 of the reversing-valve either directly or as an integral part of the operating-beam 39.

44 is the upper member or arm of such toggle, one end of which connects with the end of the arm 43 and the other end with the sliding spring-head 45, arranged to move in a stationary housing 46, with a spring 47 interposed, and which is brought under compression by an upward movement of the head 43, due to a straightening of the toggle mechanism in the operation of the compressor.

48 48 are lateral air inlet-outlet necks formed on the respective end caps 6 and 7 of the air-cylinder 2.

49 49 are counterpart valve-casings containing the respective air inlet and outlet valves for the different ends of the air-cylinder, such casings being arranged longitudinally and connected by lateral necks 48 with the air-cylinder and with the main outlet-pipe 51, common to both valve-casings, by the packing-glands 52 or other equivalent connections on the adjacent ends of such valve-casings. Each valve-casing is divided into two chambers 54 and 55, that communicate, respectively, with the inlet-outlet neck of the air-cylinder and with the main outlet-pipe 51, as shown in Fig. 2. The air-inlet valve 56 is arranged in the chamber 54 and the air-outlet valve 57 in the chamber 55, and each valve will usually consist of a cylindrical rubber nipple having a cone-shaped end that is slitted across to form a pair of lips that open outwardly with pressure from the interior of the valve and close tightly with a pressure external to the valve.

58 is a hollow plug screwing into the valve-casing and packed against the outer edge of the same by a packing-ring 59 and against the wall 53 by a packing-ring 60. This plug at its outer end is provided with a milled head 61, by which it is screwed into place, and at its opposite end with a shank 62, on which the rubber outlet-valve 57 is secured, as shown. 63 represents cross ports or passages connecting the interior of such plug with the chamber 54 of the valve-casing.

64 is a tubular plug screwed into the bore of the plug 58 and packed against the outer edge of the same by a packing-ring 65. The plug is also provided at its outer end with a milled head 66 and at its opposite end with a shank 67, on which the rubber inlet-valve 56 is secured, as shown in Fig. 2.

68 is an outlet-nipple midway of the main outlet-pipe 51 and to which hose connection is made to carry away the supply of compressed air.

The operation of my improved air compressor is as follows, the parts being in the position illustrated in Fig. 2 of the drawings: Water under pressure flows from the main inlet 15, through the ports 30 and 17, into the right-hand end of the water-cylinder 1, and the piston is forced to the left, the escape or waste from the other end of said cylinder taking place through the neck 20, pipe 19, passage 18, port 33, and main outlet-port 16. Such position of the parts is maintained until the piston nearly reaches the end of its stroke, when the roller 38′ depresses the left-hand end 40 of the lever 39 to straighten the toggle mechanism 43 44 and compress the spring 47 within the casing 46. During this compression of the spring 47 no movement of the reversing-valve takes place and its ports remain in a fully open condition, the rock-arm 34 moving independently during such period from one collar 28 to the other. A further

continued movement of the main piston carries the toggle mechanism over its center and at the same time begins an initial reversal movement of the valves, which is completed in an independent manner by the spring 47 acting upon the toggle-levers to force them down into a position opposite to that shown in Fig. 2 and cause a movement of the valve to the right, closing the port 30 to the water-pressure and the port 33 to the waste and opening the port 31 to water-pressure and the port 32 to the waste, when a reverse movement of the main piston will take place to the right until an automatic reversal is effected in a similar manner as it nears the end of its stroke.

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

1. In a reciprocating air compressor, the combination of the water and air cylinders, a reversing valve mechanism for the water cylinder consisting of a longitudinally arranged outer casing, 11, formed with a centrally arranged inlet port 15, end outlet ports 16, a tubular lining 12, formed with ports 30, 31, 32 and 33, a pair of piston valves 23 and 24, and means for operating said valves in an automatic manner, substantially as set forth.

2. In a reciprocating air compressor, the combination of the water and air cylinders, a reversing valve mechanism for the water cylinder consisting of a longitudinally arranged outer casing 11, formed with a centrally arranged inlet port 15, and end outlet ports 16, a tubular lining 12, formed with ports 30, 31, 32, and 33, end caps 13, and 14, securing the lining in place, a pair of piston valves 23 and 24, moving in the tubular lining, and means for operating said valves in an automatic manner, substantially as set forth.

3. In a reciprocating air compressor, the combination of the water and air cylinders, a reversing valve mechanism for the water cylinder consisting of a longitudinally arranged outer casing 11, formed with ports or passages 15, 16, 17 and 18, a packing gland at the end of the port 18, a hollow neck on the cylinder head of the water cylinder 4, a connecting section of pipe 19, a pair of longitudinally moving reversing valves for the water cylinder arranged within the casing 11, and means for operating said valves in an automatic manner, substantially as set forth.

4. In a reciprocating air compressor, the combination of the water and air cylinders, a reversing valve mechanism for the water cylinder consisting of a longitudinally arranged outer casing 11, formed with ports or passages 15, 16, 17 and 18, a pair of connected piston valves arranged to move longitudinally in said casing, a rock arm 34, arranged to move in the water pressure port 15, upon a rock shaft, and means for automatically operating said rock shaft and arm, substantially as set forth.

5. In a reciprocating air compressor, the combination of the water and air cylinders, a reversing valve mechanism for the water cylinder consisting of a longitudinally arranged outer casing 11, formed with ports or passages 15, 16, 17 and 18, a pair of connected piston valves arranged to move longitudinally in said casing, a rock arm 34, arranged in the water inlet passage a rock shaft 35, a lever 39, actuated by the movement of the main piston rod, a toggle mechanism, and an elastic means tending to force said toggle mechanism into a bent position, substantially as set forth.

6. In a reciprocating air compressor, the combination of the water and air cylinders, a reversing valve mechanism for the water cylinder consisting of a longitudinally arranged outer casing 11, formed with ports or passages 15, 16, 17 and 18, a pair of connected piston valves arranged to move longitudinally in said casing, a rock arm 34, arranged in the water inlet passage, a rock shaft 35, a lever 39, a toggle mechanism consisting of links 43, 44, and head 45, a spring 47, and a fixed housing 46, substantially as set forth.

7. In a reciprocating air compressor, the combination of the water and air cylinders, a valve mechanism for the air compressor cylinder consisting of an air inlet-outlet neck on the cylinder head, valve casing 49, connected therewith and divided into chambers 54 and 55, hollow plug 58, screwing endwise into the casing and provided with a head 61, and a shank 62, and a valve 57, arranged on said shank 62, substantially as set forth.

8. In a reciprocating air compressor, the combination of the water and air cylinders, a valve mechanism for the air compressor cylinder consisting of an air inlet-outlet neck on the cylinder head, valve casing 49, connected therewith, and divided into chambers 54 and 55, hollow plug 58, screwing endwise into the casing and provided with a head 61, and a shank 62, a valve 57, arranged on said shank 62, and packing rings 59 and 60, substantially as set forth.

9. In a reciprocating air compressor, the combination of the water and air cylinders, a valve mechanism for the air compressor cylinder consisting of an air inlet-outlet neck on the cylinder head, valve casing 49, connected therewith, and divided into chambers 54 and 55, hollow plug 58, screwing endwise into the casing and provided with a head 61, a shank 62, and orifice 63, a valve 57 arranged on said shank, a secondary tubular plug screwing into the bore of the hollow plug 58, and carrying the valve 56, substantially as set forth.

10. In a reciprocating air compressor, the combination of the water and air cylinders, a valve mechanism for the air compressor cylinder consisting of an air inlet-outlet neck on the cylinder head, valve casing 49, connected therewith, and divided into chambers 54 and 55, hollow plug 58, screwing endwise into the casing and provided with a head 61, a shank 62, and orifice 63, a valve 57, arranged on said shank, a secondary tubular plug screwing into the bore of the hollow plug 58, provided with

a head 66, and shank 67, the valve 56, secured to said shank, and a packing ring 65, substantially as set forth.

11. In a reciprocating air compressor, the combination of the water and air cylinders, a reversing valve mechanism for the water cylinder, a rock shaft and arm operating said valve, a cross head on the main piston rod having two arms, an operating lever on the rock shaft actuated by one arm of the cross head, and a stationary guide track, guiding the other arm of the cross head, substantially as set forth.

In testimony whereof witness my hand this 28th day of May, 1894.

JOHN J. KEENAN.

In presence of—
ROBERT BURNS,
JOHN E. MULLEN.