

No. 686,087.

Patented Nov. 5, 1901.

J. KLEIN, J. N. SHANNON & F. FOSHEE.

AIR MOTOR.

(Application filed Feb. 25, 1901.)

(No Model.)

2 Sheets—Sheet 1.

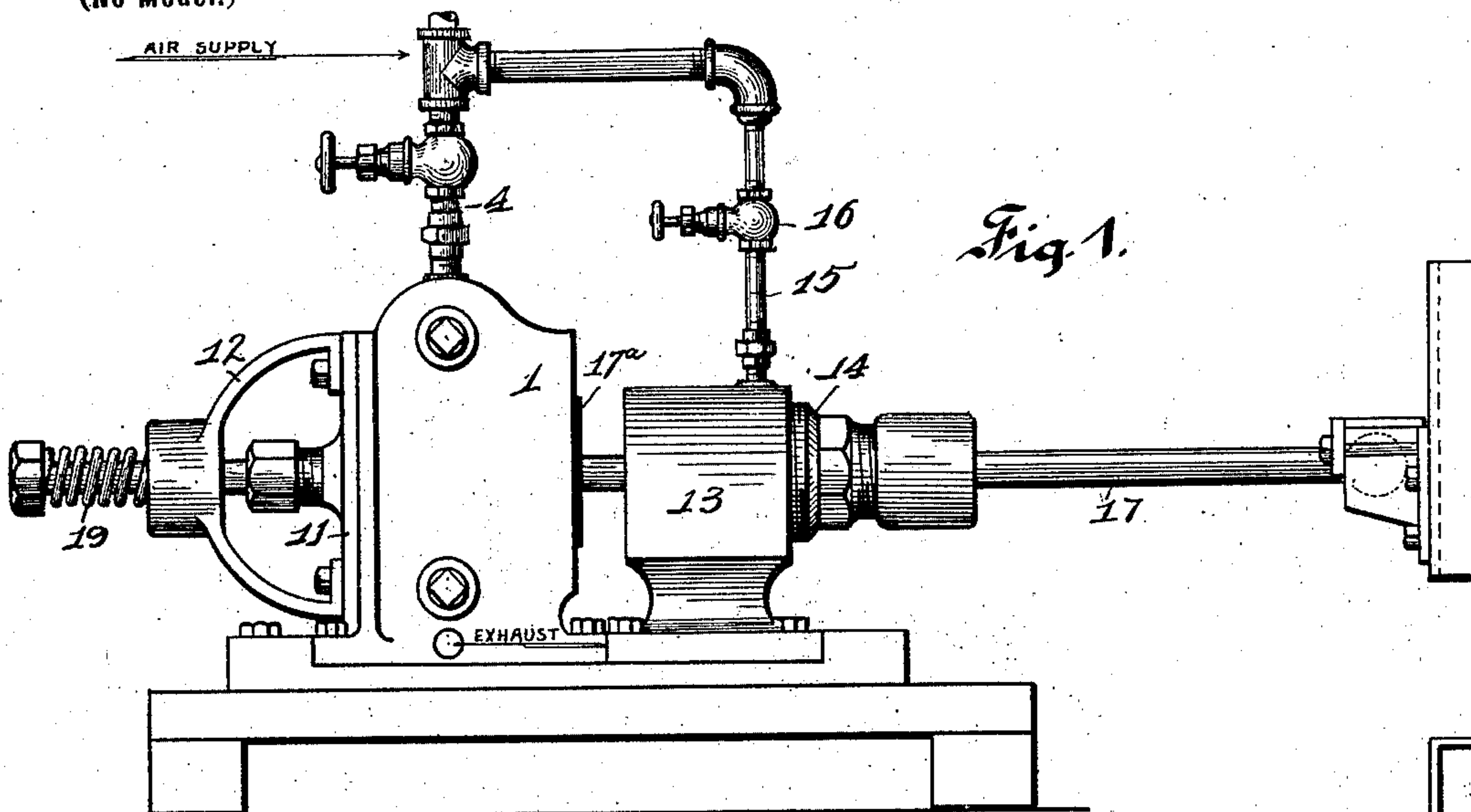


Fig. 1.

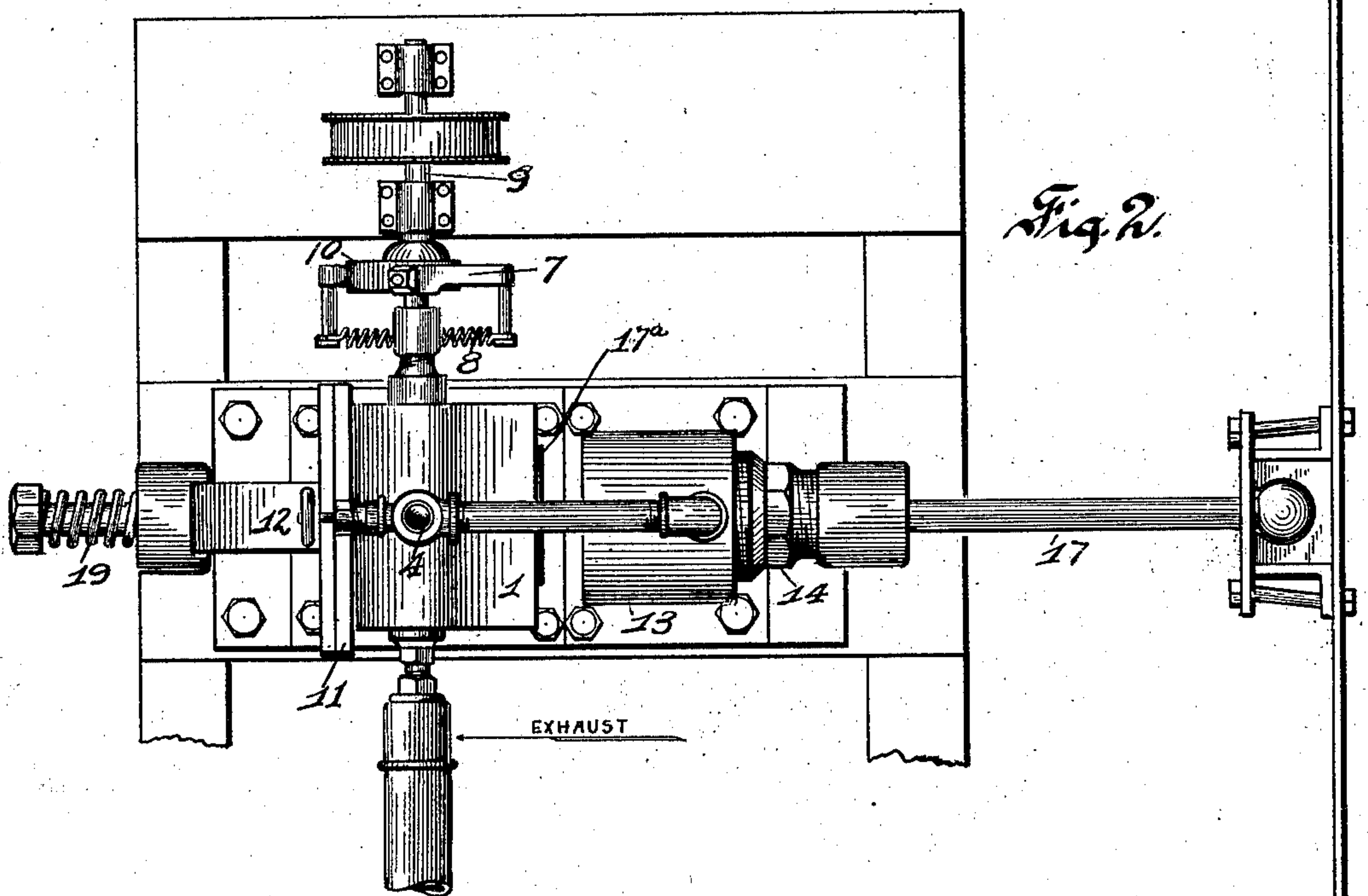


Fig. 2.

Witnesses  
Alfred A. Eicher  
J. D. Rippey.

Inventors  
John N. Shannon  
Frank Foshee  
John Klein.  
By Higdon & Longan, Attys.

No. 686,087.

Patented Nov. 5, 1901.

J. KLEIN, J. N. SHANNON & F. FOSHEE.

AIR MOTOR.

(Application filed Feb. 25, 1901.)

(No Model.)

2 Sheets—Sheet 2.

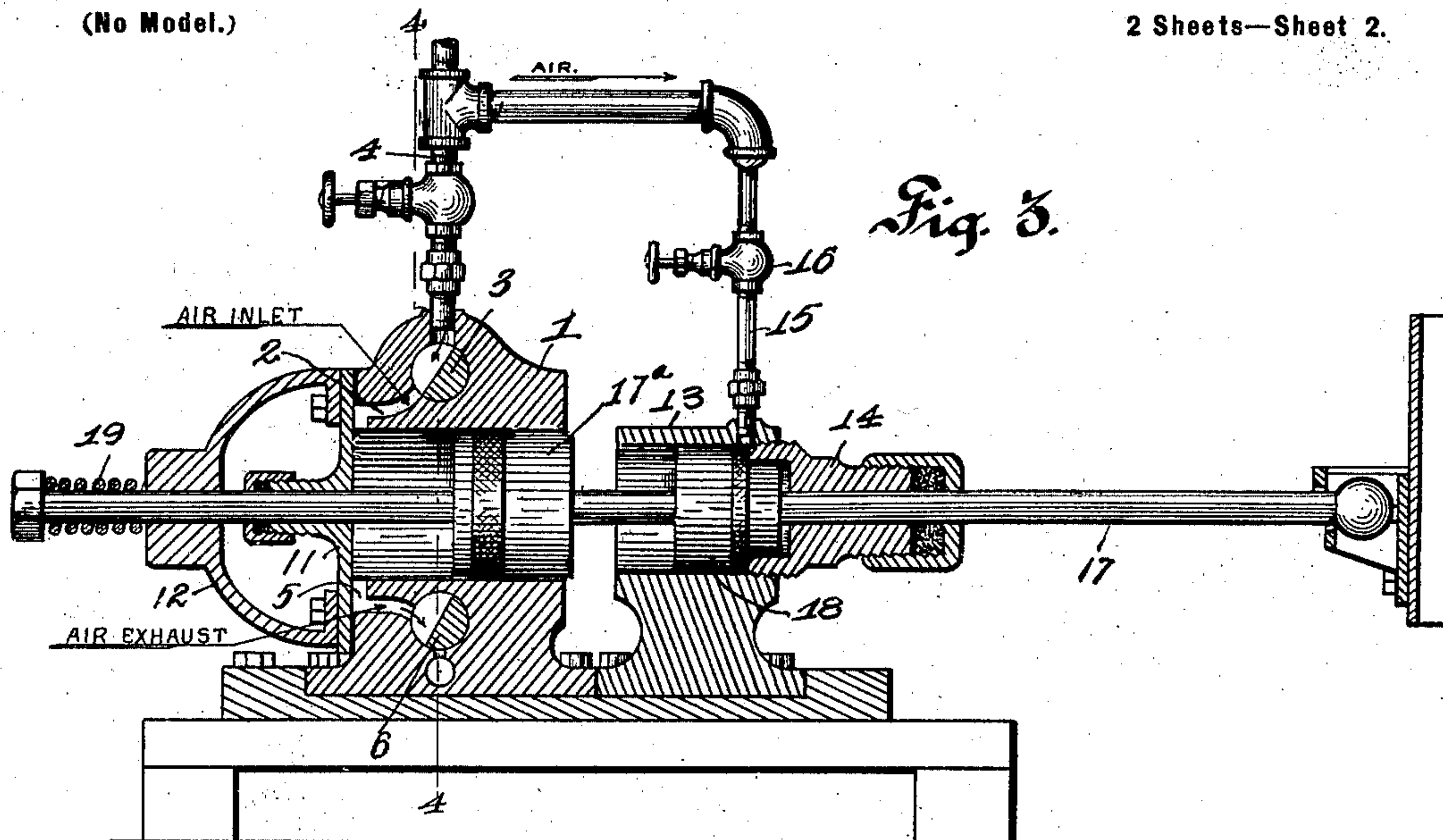


Fig. 3.

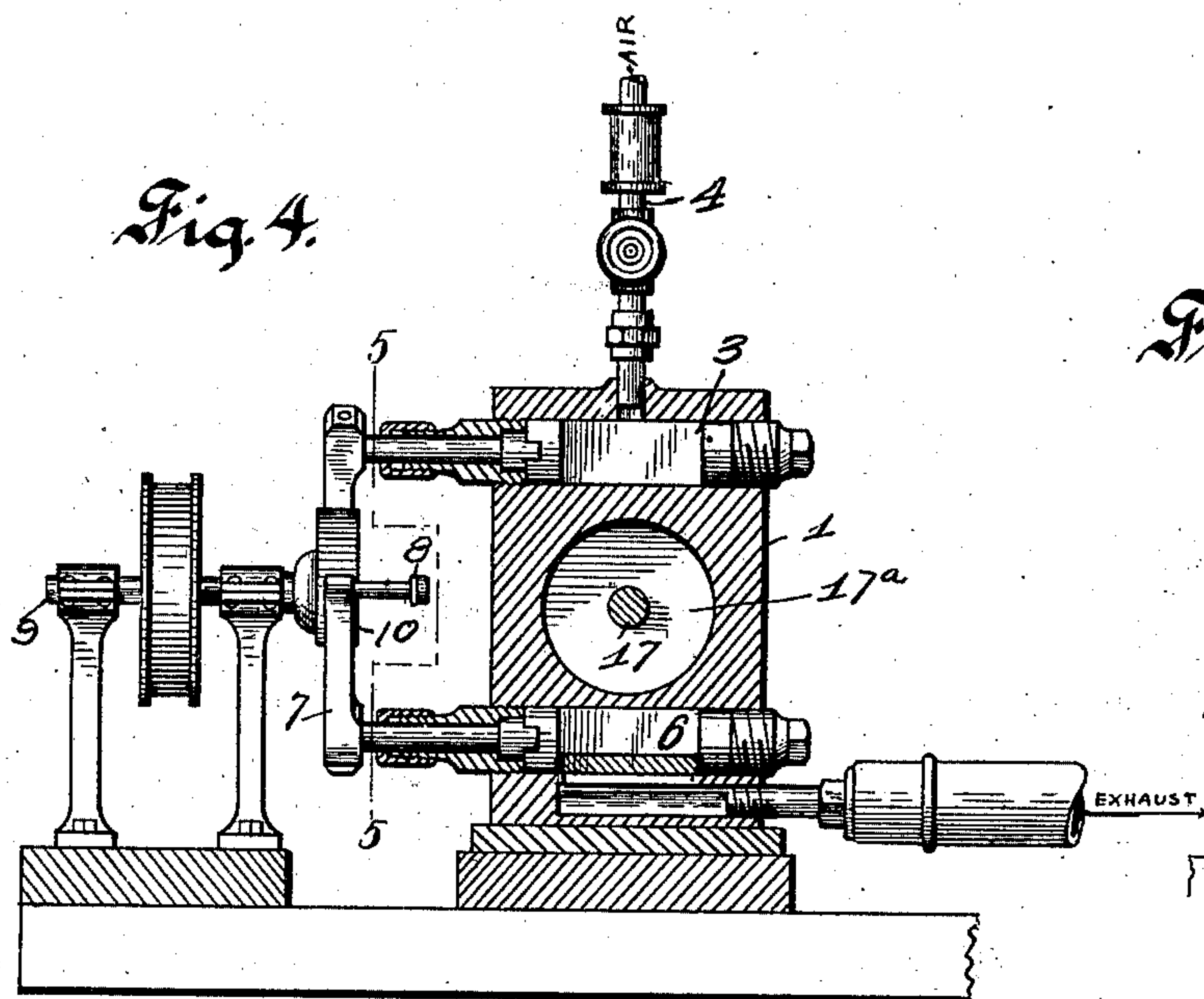


Fig. 4.

Fig. 5.

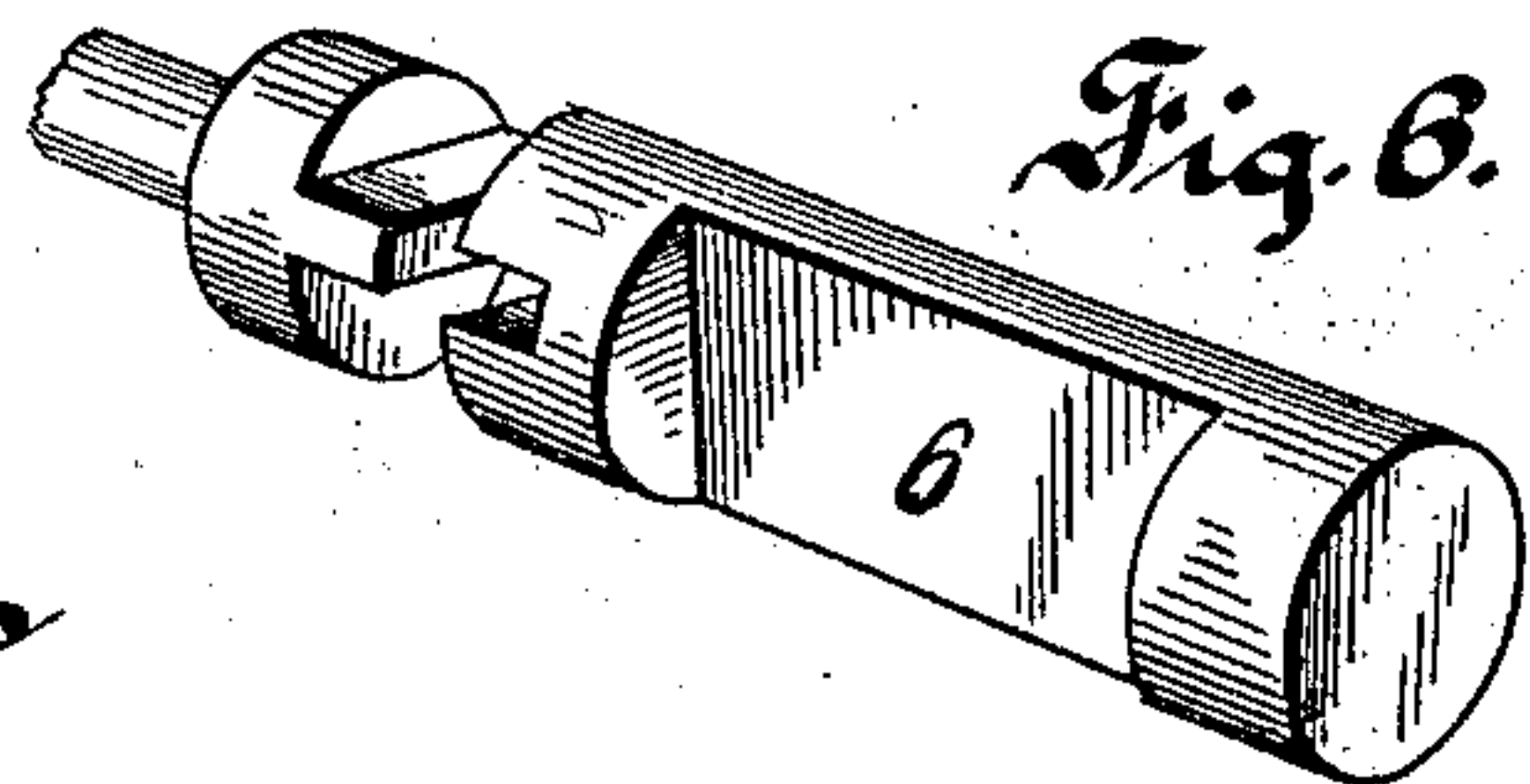
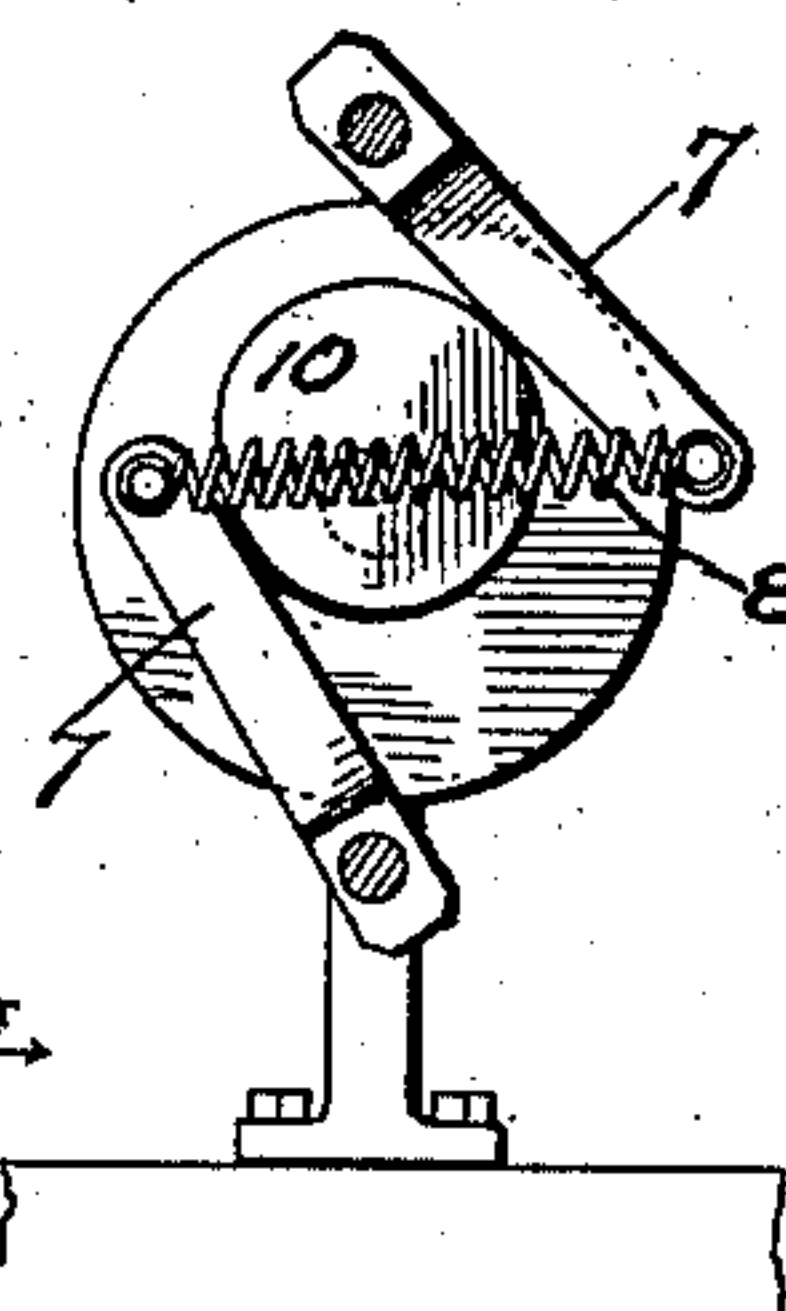


Fig. 6.

Witnesses

Alfred A. Eicher

J. D. Rippey

Inventors

John N. Shannon

Frank Foshee

John Klein

By: Higdon & Longan Attys



# UNITED STATES PATENT OFFICE.

JOHN KLEIN, JOHN N. SHANNON, AND FRANK FOSHEE, OF DESLOGE, MISSOURI, ASSIGNORS, BY DIRECT AND MESNE ASSIGNMENTS, TO SAID KLEIN, PAUL A. FUSZ, OF GRANITE, MONTANA, AND CHARLES D. McLURE, OF ST. LOUIS, MISSOURI.

## AIR-MOTOR.

SPECIFICATION forming part of Letters Patent No. 686,087, dated November 5, 1901.

Application filed February 25, 1901. Serial No. 48,667. (No model.)

*To all whom it may concern:*

Be it known that we, JOHN KLEIN, JOHN N. SHANNON, and FRANK FOSHEE, of the city of Desloge, St. Francois county, State of Missouri, have invented certain new and useful Improvements in Air-Motors, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

10 This invention relates to air-motors; and it consists of the novel construction, combination, and arrangement of parts hereinafter shown, described, and claimed.

The object of this invention is to provide 15 an improved air-motor having an impulsive action in which the piston is moved by the pressure of the air within a main or primary cylinder and is stopped suddenly and started on the return stroke by a secondary or cushion cylinder having less capacity than the 20 main cylinder and in which the air is compressed to act as a cushion to both stop and return the piston the moment it has traveled the full stroke and the air is permitted to 25 pass out of the main cylinder through an exhaust.

Another object is to provide a motor of the class mentioned having a main and a secondary cylinder and a single piston-rod projecting through both of them, with a separate 30 piston-head for each cylinder and an adjustable end for one of the cylinders, whereby it may be lengthened or shortened, thereby increasing or diminishing the length of the piston-stroke. The construction of this motor 35 involves two adjacent cylinders having a single piston-rod extending through both. These cylinders are of different sizes, and into the largest the air is admitted to move the piston 40 in one direction, and when the piston reaches the end of its stroke an exhaust-outlet is opened to permit the air to pass out and allow the piston to be returned. The air is compressed into the smaller of the two cylinders 45 and there acts as a cushion to suddenly stop and return the piston the moment the exhaust-outlet is opened to permit the air to be expelled from the larger cylinder. There is 50 no exhaust-outlet from the smaller cylinder; but the inlet-pipe is smaller than the inlet

to the larger cylinder, thereby forming a cushion which at once stops and returns the piston when the pressure is removed from the opposite end thereof.

In the drawings, Figure 1 is a side elevation showing our improved motor. Fig. 2 is 55 a plan view of the same. Fig. 3 is a central longitudinal section. Fig. 4 is a sectional view taken on the line 4 4 of Fig. 3 and looking to the right. Fig. 5 is a sectional view 60 showing the valve-operating devices and is taken on the line 5 5 of Fig. 4. Fig. 6 is a perspective view showing one of the valves.

In the construction of this motor the two cylinders are mounted upon a suitable support and axially aligned. 1 indicates the larger 65 cylinder, which is provided with an air-inlet 2, located at a suitable point along which is a rock-valve 3, whereby the passage of the air into the cylinder may be stopped. An air- 70 supply pipe 4 leads from a source of air-supply and communicates with the passage 2 and is provided with an ordinary valve, whereby the flow of air may be regulated. An exhaust- 75 outlet 5 leads from the opposite side of the cylinder, and at a suitable point along the said outlet is located a valve 6, similar to the valve 3 in construction, and which closes the passage 5 whenever the passage 2 is open. These 80 valves are preferably rock-valves, and rods are connected thereto which project beyond the side of the cylinder, and connected to each of the said rods is an arm 7. A spring or other suitable connection 8 connects the ends of the 85 arms 7, so that when one is moved to turn the valve to which it is attached the other valve will also be operated. By this arrangement the valves are simultaneously operated, so that when the valve 3 is opened to permit 90 the passage of the air into the cylinder the valve 6 is closed to retain the air within the cylinder, and the moment the piston has reached the limit of its stroke the air-exhaust passage 5 is opened by the rotation of the 95 valve 6, which permits the outward passage of the air, and at the same time the valve 3 is turned to close the passage 2.

A shaft 9 is located at the side of the cylinder 1 and carries a cam 10 on its inner end, which operates between the arms 7. The 100



shaft 9 is designed to be rotated in any desired manner, and when so rotated the arms 7 will be moved by the cam 10. The cam 10 is held in contact with the arms 7 by said spring 8, and when the arm 7 which is connected to the valve 3 is pressed upward to open the passage 2 the connection 8 moves the arm 7 which is connected to the valve 6, thereby closing the exhaust-valve 5. The reverse operation takes place when the cam is moved around to operate the valve 6 to open the exhaust-valve 5.

One end of the cylinder 1 is closed by means of an end plate 11, in which is formed a bearing for the support of the piston-rod. An exterior bearing 12 is attached to the said cylinder-plate 11, and the piston-rod passes therethrough.

13 indicates the smaller or secondary cylinder, mounted upon a support adjacent to the cylinder 1. The said cylinder 13 is provided with an adjustable end 14, whereby the length of the cylinder may be increased or diminished to change the degree of compression, thereby regulating the length of the stroke of the piston. This end 14 is preferably threaded into the cylinder, so that a perfectly air-tight connection is formed to prevent the passage of any of the air which is compressed within the cylinder. An air-pipe 15 leads from the air-supply pipe 4 into the cylinder 13, adjacent to the adjustable end 14. The said pipe 15 is smaller than the air-pipe which leads into the cylinder 1, for the reason that the air is kept continually compressed within the cylinder 13, and a constant flow of air is not required. A regulating-valve 16 is located at a convenient point along the pipe 15.

17 indicates the piston-rod, which projects through both cylinders and carries two piston-heads, one for each cylinder. The larger piston-head 17<sup>a</sup> operates within the cylinder 1 and receives the impact of the air to operate the piston-rod to the right. The smaller piston-head 18 operates within the cylinder 13 and is designed to move the piston-rod in the direction opposite from that in which it is moved by the piston 17<sup>a</sup>. The area of the piston 17<sup>a</sup> is larger than that of the piston 18, for which reason the air which is admitted into the cylinder 1 will compress the air in the cylinder 13 and force the piston to the right the full length of its stroke, at which time the valves 3 and 6 are operated to permit the air to pass from the cylinder 1 through the exhaust and prevent further passage of the air therein. When this occurs, the compressed air within the cylinder 13 expands and drives the piston back in the opposite direction, and when it reaches its full stroke the valves 3 and 6 are again opened to admit the air into the cylinder 1 and operate the piston, as above described.

A spring 19 encircles the end of the piston-rod 17 and abuts against the member 12 to assist in the backward movement of the pis-

ton or to return the piston independent of any aid from the air in the piston 13 in case no air is admitted thereto.

This motor is especially designed for operating machines in which a quick and impulsive action is required. The movement of the piston-rod is rapid, and it is stopped as by impact against a cushion, for the reason that the air within the cylinder 13 has no outlet and being compressed therein immediately expands upon the removal of the pressure from the opposite end of the piston. The spring 19, surrounding the rear end of the piston-rod and being compressed by its forward movement, will expand and assist in the return movement of the piston. The length of the piston-stroke may be regulated by adjusting the end 14 of the cylinder 13 to increase or diminish the length of the cylinder, thereby regulating the extent of the movement before the piston 18 abuts against the said end 14. The regulating-valves 3 and 6 are connected to each other, so that when one is moved the other will likewise be operated, thereby maintaining a perfect unitary movement between the two. The motor is especially adapted for use to operate any class of machines in which a reciprocating movement is required—such, for example, as concentrating tables—for which purpose the motor has been found of great practical use. It gives a sudden and impulsive action, such as no other motor will give and which is very essential in that class of machines. The spring 19 is of sufficient strength to return the piston independent of the air in the cylinder 13 and may be used for that purpose whenever it is not desired to admit air into the said cylinder.

We claim—

1. A motor, consisting of a primary cylinder, a secondary cylinder, means for varying the length of the secondary cylinder, pistons for said cylinders, means whereby air is compressed in the secondary cylinder by movement of the pistons in a given direction, a single piston-rod operating through both of said cylinders, and means for operating the piston-rod in different directions by the admission of air into the cylinders, substantially as specified.

2. A motor, consisting of a primary cylinder, a piston, means for operating the piston in one direction by the admission of air into the primary cylinder, a separate cushion-cylinder having one end open, and means for operating the piston in the opposite direction by the air within the cushion-cylinder, substantially as specified.

3. An air-motor, consisting of a primary cylinder provided with an open end and having an air inlet and exhaust, a separate aligned cushion-cylinder having an inlet-pipe communicating therewith, means for operating the piston in one direction by the pressure of the air within the primary cylinder, and means for releasing the pressure in the primary cylinder to permit the piston to be



moved in the opposite direction by the expansion of the air within the cushion-cylinder, substantially as specified.

4. An air-motor, consisting of a primary cylinder provided with inlet and outlet passages, a cushion-cylinder in alinement therewith and provided only with an inlet-passage, a piston-rod extending through both of said cylinders, means for operating the rod in one direction by admitting air into the primary cylinder, means for moving the rod in the opposite direction by the expansion of the air within the secondary or cushion cylinder and means for varying the extent of movement of the rod, substantially as specified.

5. An air-motor, consisting of a primary cylinder having an inlet-passage to admit air therein and an outlet-passage to permit the exhaust of the air, a valve located in each of said passages, means whereby one of said valves will be opened when the other is closed, a cushion-cylinder, means for admitting air therein, a single piston-rod operating through both of said cylinders and adapted to be moved in one direction by the admission of air into the primary cylinder and in the opposite direction by the expansion of the compressed air in the cushion-cylinder when the

exhaust-passage from the primary cylinder is open and means for varying the length of the piston-stroke, substantially as specified.

6. An air-motor, consisting of a primary cylinder having an inlet-passage to admit air therein and an outlet-passage to permit the exhaust of the air, a rotary valve located in each of said passages for opening and closing the same, a cushion-cylinder having an inlet-passage but no outlet, a single piston-rod operating through both of said cylinders and adapted to be moved in one direction by the admission of air into the primary cylinder and in the opposite direction by the expansion of the air in the cushion-cylinder, and a strong spring adapted to assist in the backward movement of the piston and to move it independently when the cushion-cylinder is not used.

In testimony whereof we affix our signatures in presence of two witnesses.

JOHN KLEIN.  
JOHN N. SHANNON.  
FRANK FOSHEE.

Witnesses:

W. T. HAMMOCK,  
S. E. JACKSON.