

(No Model.)

E. M. STRANGE.

VALVE GEAR FOR AIR COMPRESSORS.

No. 373,419.

Patented Nov. 15, 1887.

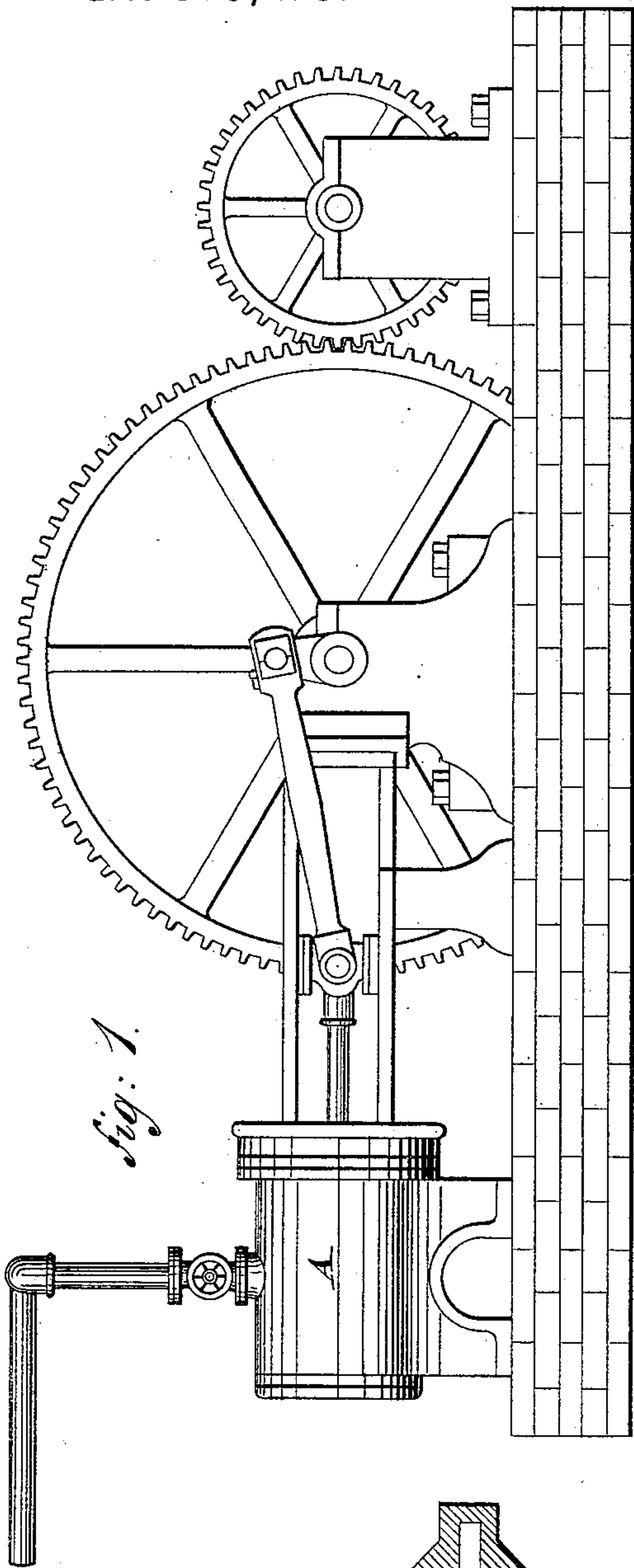


Fig. 1.

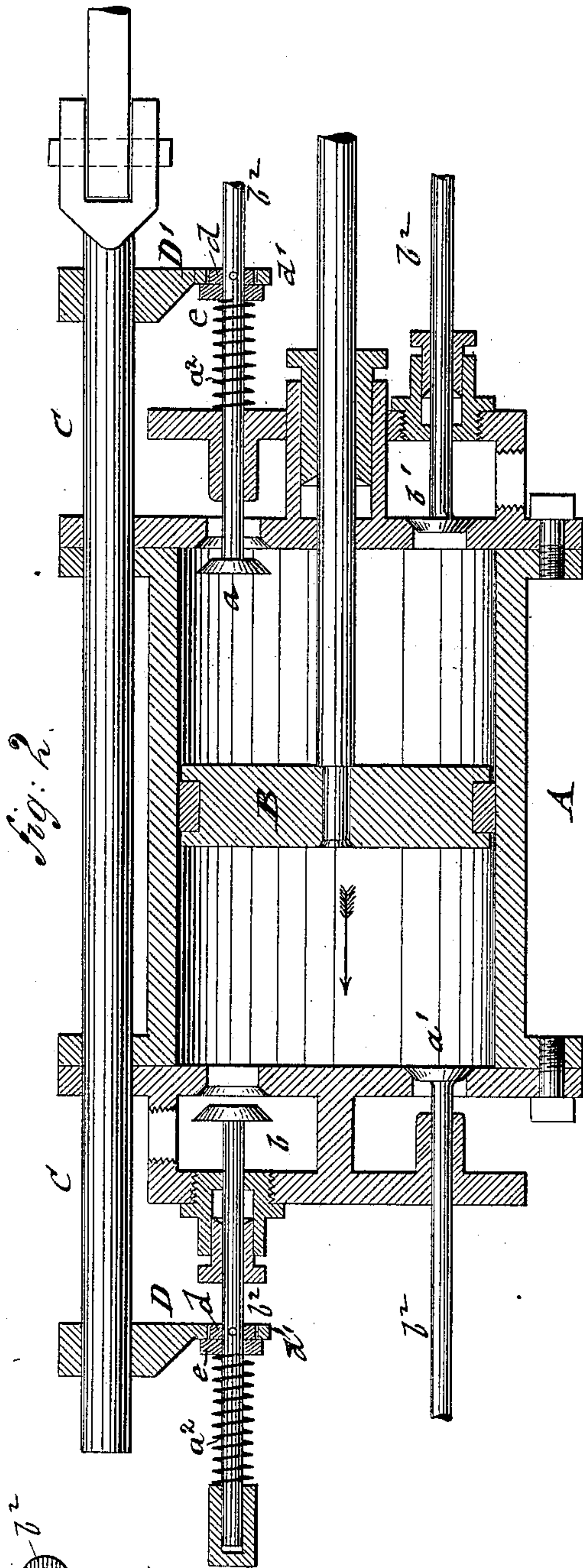


Fig. 2.

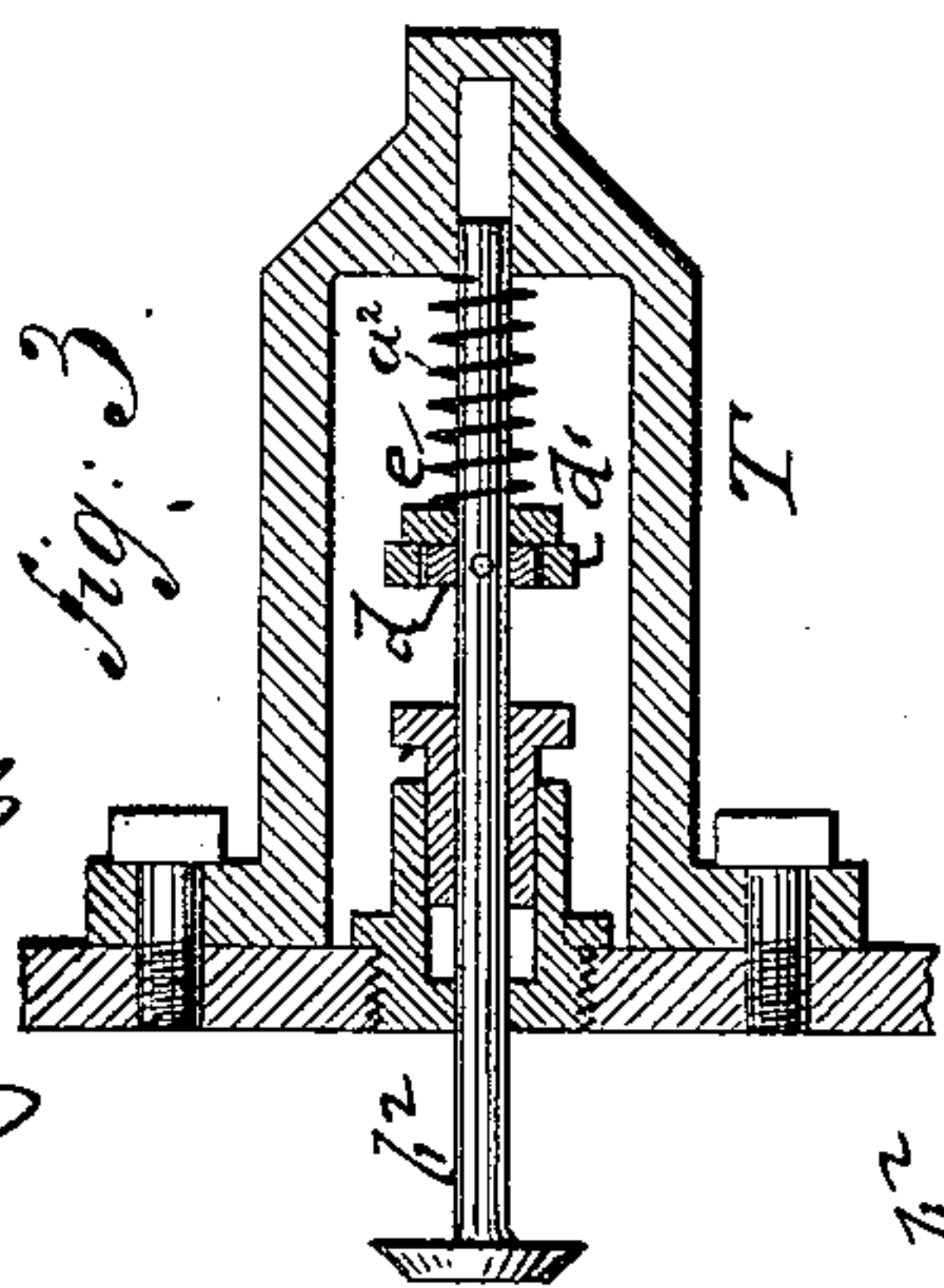


Fig. 3.

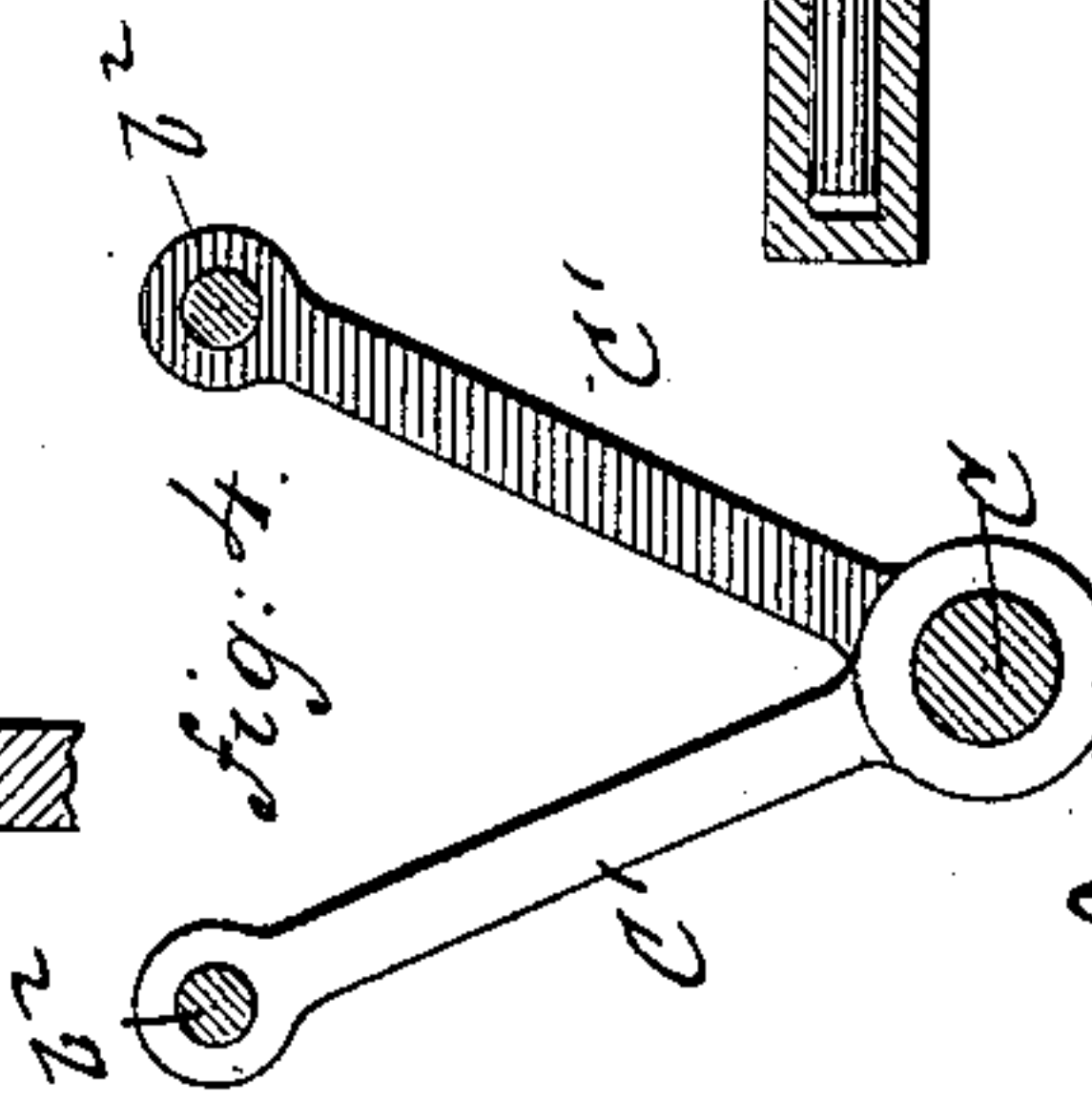


Fig. 4.

WITNESSES:
Ernst Holff
Carl Key

INVENTOR

Edward M. Strange

BY

Copied & Reorganized
ATTORNEYS.

UNITED STATES PATENT OFFICE.

EDWARD M. STRANGE, OF BROOKLYN, NEW YORK.

VALVE-GEAR FOR AIR-COMPRESSORS.

SPECIFICATION forming part of Letters Patent No. 373,419, dated November 15, 1887.

Application filed December 2, 1884. Serial No. 149,305. (No model.)

To all whom it may concern:

Be it known that I, EDWARD M. STRANGE, of Brooklyn, county of Kings, and State of New York, have invented certain new and
5 useful Improvements in Means for Gearing the Valves of Air-Compressors, of which the following is a specification.

My invention relates to the spring-seated valves of an air-compressor cylinder; and it
10 consists in the combination of the springs of such valves with the compressor-piston by mechanism, substantially as hereinafter described, whereby the said springs are disengaged from the valves during that portion of
15 the stroke of the piston when the valves are to be open and are restored to engagement with said valves during that portion of the stroke of said piston when the valves are to be closed, so that the valves will lie free in
20 their seats and bearings when they are to be open and the air-pressure caused by the movement of the piston will open the valves without at the same time having to overcome the tension of the seating-springs, and so that the
25 valves will be closed to their seats and there held by the action of the springs at the termination of that portion of the stroke of the piston when they are to be open as aforesaid, as hereinafter set forth.

30 Figure 1 is a side elevation of an air-compressor. Fig. 2 is a horizontal section, on an enlarged scale, of an air-compressor cylinder containing my invention. Fig. 3 is a sectional view in detail of a modified form of valve-gear containing my invention, and Fig. 4 is an
35 elevation of a modification of a portion of the valve-gear containing my invention.

In air-compressors as at present constructed the air inlet and outlet valves of the com-
40 pressing-cylinder are opened by the air-pressure on the valves, the springs, which constantly press upon the valves, having their tension overcome by this air-pressure. When the valves are closed, the closing is accom-
45 plished by the unimpeded action of the springs. The inlet-valves are opened by the suction of the piston in the compressor-cylinder, the valves opening as soon as the suction overcomes the tension of the valve-springs.
50 In leaving its seat the valve acquires a momentum which varies with the speed of the

piston and the weight of the valve; hence when the valve is arrested by the spring the latter has a tension greater than the difference
55 between the suction in the cylinder and the pressure of the atmosphere. The spring exerts, therefore, a jerking action on the valve, bringing it back to its seat, after which it is again opened by the suction. This intermittent opening and closing or vibrating of the valve
60 continues until the piston arrives at the end of its stroke. The outlet-valves are opened by the pressure of the air in the cylinder established by the piston in its forward stroke, and occurs when such pressure exceeds the
65 pressure of the air in the air-receiver and the tension of the valve-springs. The pressure in the cylinder is therefore sometimes considerably greater per square inch than that in the receiver. This causes a loss of power in the
70 machine. It is also attended with an intermittent and vibratory motion of the valve on its seat until the piston reaches the end of its stroke, the vibrations being of greater violence than in the case of the inlet-valves. These
75 vibrations of the valves cause wear on the valves and their seats, besides producing a loud clattering noise and resulting in a loss of power.

The object of my invention is to obviate
80 these objectionable results.

A is an air-compressor cylinder.

B is the piston. The outlet-valves are at a and a' , and b and b' are the inlet-valves, said
85 valves being pressed to their seats by springs a^2 , said springs being arranged upon the stems b^2 of the valves, as is usual in the construction of air-compressors.

The following devices may be employed to effect the combination of the valve-springs
90 with the compressor-piston for the purposes of my invention:

C is a rod extending longitudinally of and alongside the cylinder and having bearings, as shown, and it is given a reciprocating motion
95 by being connected by means of a crank-rod, eccentric-rod, or other well-known device to the crank-shaft or other operating device, such as is usually employed to actuate the compressor-piston.

D D' are arms fixed upon said rod and reach-
100 ing to and encircling the stems of the outlet

and inlet valves, respectively, and beyond one end of the seating-springs, as shown, on that side of the cylinder. The valve-springs have a fixed bearing at one end, against which their tension is exerted to close the valves, and at their opposite ends adjacent to the rod-encircling or ring-shaped ends d' of the arms they impinge against movable collars e , arranged to slide on the stems, as shown, which collars are limited in their traverse of the stems in the direction of the recoil of the springs by the collars d , which are fixed on said stems and are of less diameter than the collars e , as shown. The ends d' are of such a diameter that they will clear the collars d and will engage the collars e . The collars d are fixed on the stems relatively to the springs, as shown, so that when the collars e are stopped by said collars d the tension of the springs will be exerted on the valves to close the same to their seats.

The arms D and D' are placed on the rod C , as shown, and the rod C is connected to the crank-shaft of the compressor-piston, so that the reciprocation of the said rod relatively to the reciprocation of the piston will be such that the arms D D' in their movement in one direction will engage the movable collars e , and thus collapse the springs when the piston has reached that part of its concurrent stroke when the valves are to be open, and in their reverse movement will release the collars e , which will then engage and be stopped by the fixed collars d when the piston has concluded that portion of its stroke when the valves are to be open and are to be closed to their seats.

Now it is evident when the piston B is at either end of its stroke all the valves will be closed, while the arms D D' will be just beginning engagement with the sliding collars e , and when the piston begins a forward stroke the arm D' will engage the sliding collar e , and thus compress the spring a^2 , thereby relieving the inlet-valve a of the action of such spring and allowing the valve to lie free in its seat, so that as soon as the suction of the partial vacuum caused by the receding piston is sufficient to overcome the inertia of the valve and the friction of its stem in its seat the valve will open and admit air into the cylinder, and will remain open, without vibrating, until the piston arrives at the end of its said stroke. When the piston is about midway of its said stroke, as in Fig. 2, the arm D' should reach the limit of its travel toward the cylinder end, as in Fig. 2, and begin to return on its course, so that the said arm will gradually release its pressure upon the valve-spring and restore such pressure to the valve by the engagement of the sliding collar with the fixed collar on the valve-stem, thereby operating to close the said valve at the end of said piston-stroke. The arm D' then leaves the sliding collar e and the spring holds the valve firmly seated until the end of the return-stroke of the piston.

It is furthermore evident that substantially

the same result is attained in connection with the outlet-valves b b' . When the piston begins its forward stroke, as in Fig. 2, the arm D , by its engagement with the sliding collar e on stem of valve b , relieves the said valve of the action of its spring. As soon as the pressure in the cylinder caused by the forward movement of the piston exceeds the pressure in the air-receiver, into which the compressed air in these machines is forced, and the inertia and friction of the valve and its stem are overcome, the outlet-valve opens and remains open, without vibrating, until the piston reaches the end of said stroke. When the piston reaches half-stroke, the arm D should reach the limit of its motion in the same direction, and should begin its return course, so that the spring will be gradually released by said arm and the action thereof be restored to the valve to close the valve at the end of said piston-stroke.

The described devices are shown in the drawings as connected to and operating the valves upon one side of the cylinder. It is obvious that such devices may be employed, as described, in connection with the valves on the opposite side of the cylinder.

Any other known and equivalent mechanism may be employed in place of that which I have described to effect the combination of the valve-springs with the piston, whereby the springs will be disengaged from the valves during a portion of the piston-stroke, as and for the purpose set forth.

In place of the two reciprocating rods C , a single rod may be used, as shown in Fig. 4, carrying two sets of arms, C' C' , reaching from said rod to the valve-stems, one set of arms being for the outlet-valves and the other for the inlet-valves.

It is preferable to have the outer end of the stem of the outlet-valve move in an approximately air-tight cylinder or chamber, T . (Shown in Fig. 3.) When the valve is thrown open, the air-cushion in this chamber will prevent the striking together of any of the metallic surfaces in proximity to the valve or stem. By having the area of the cross-section of the stem of the outlet-valve equivalent to the difference of area between the inner and outer faces of the outlet-valve itself the power necessary to open the outlet-valve after equilibrium is established between the air-pressure in the cylinder and in the receiver need only be what is sufficient to overcome the friction on the valve-stem and the inertia of the valve.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, with the spring of the spring-seated valve of an air-compressor cylinder, which valve, when released from the tension of the spring, is free to move by the pulsation of the compressor-piston, of a positively-operated spring-releasing mechanism or device, substantially as described, connected to the power that drives the compressor-piston, and constructed to engage the valve-spring and to release the valve from the tension there-

of at a given point in and during a given portion of the piston stroke, as and for the purpose set forth.

2. In an air-compressor having a cylinder,
5 piston, and spring-seated inlet and outlet valves, the combination of the valve-springs with the piston by means of a reciprocatory rod geared to and having concurrent motion with the piston, as described, and arms carried by said rod, adapted to engage sliding
10 collars on the valve-stems, between which and fixed bearings the springs have play, and to

clear fixed collars on the valve-stems which limit the movement of the sliding collars in the direction of the recoil of the springs, as 15 specified, and for the purpose set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

EDWARD M. STRANGE.

Witnesses:

PAUL GOEPEL,
SIDNEY MANN.