(No Model.) 3 Sheets—Sheet 1.

P. L. WEIMER.

BLOWING ENGINE.

No. 354,279. Patented Dec. 14, 1886.

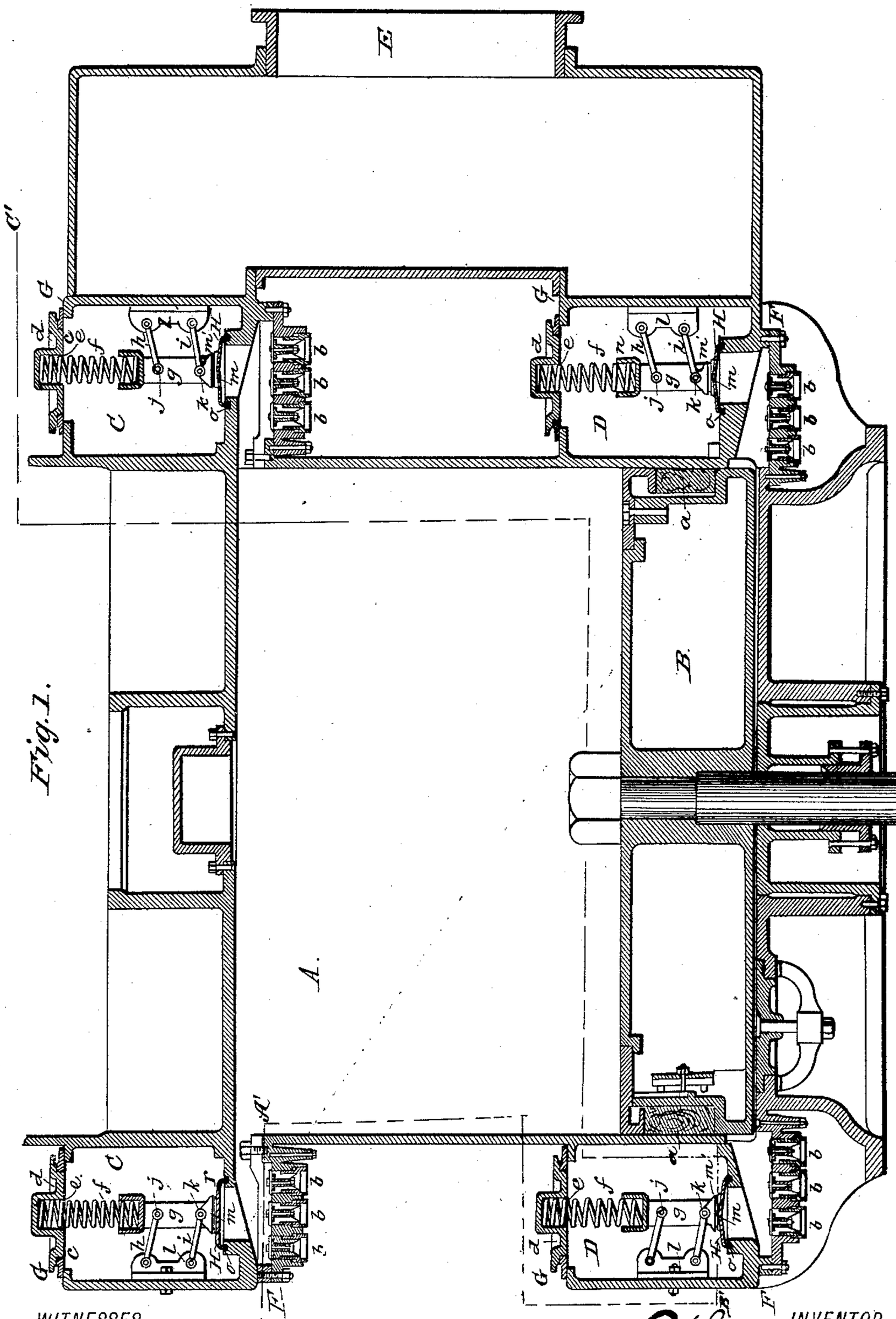

Fig. 1.

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Fig. 3.

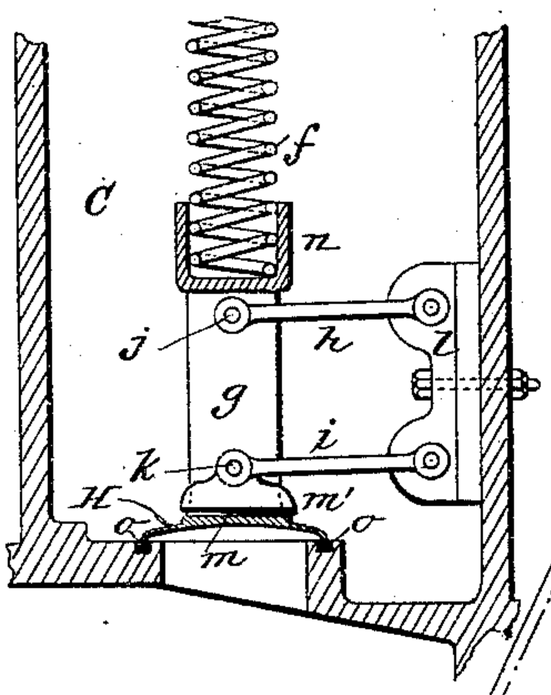

Fig. 4.

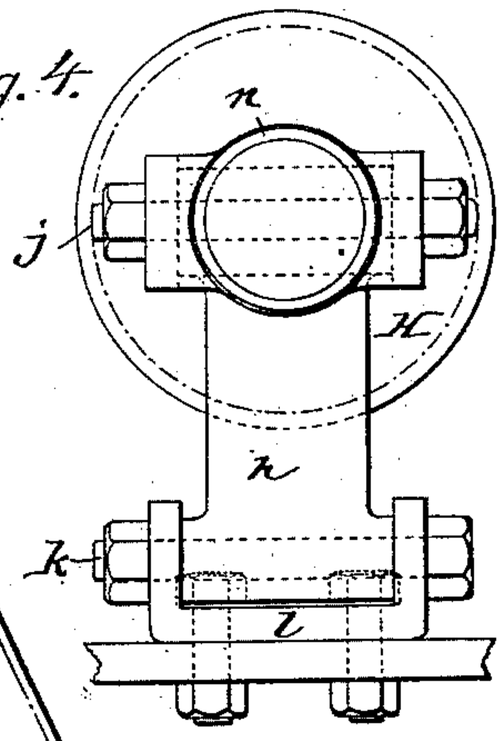

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

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Fig. 5.

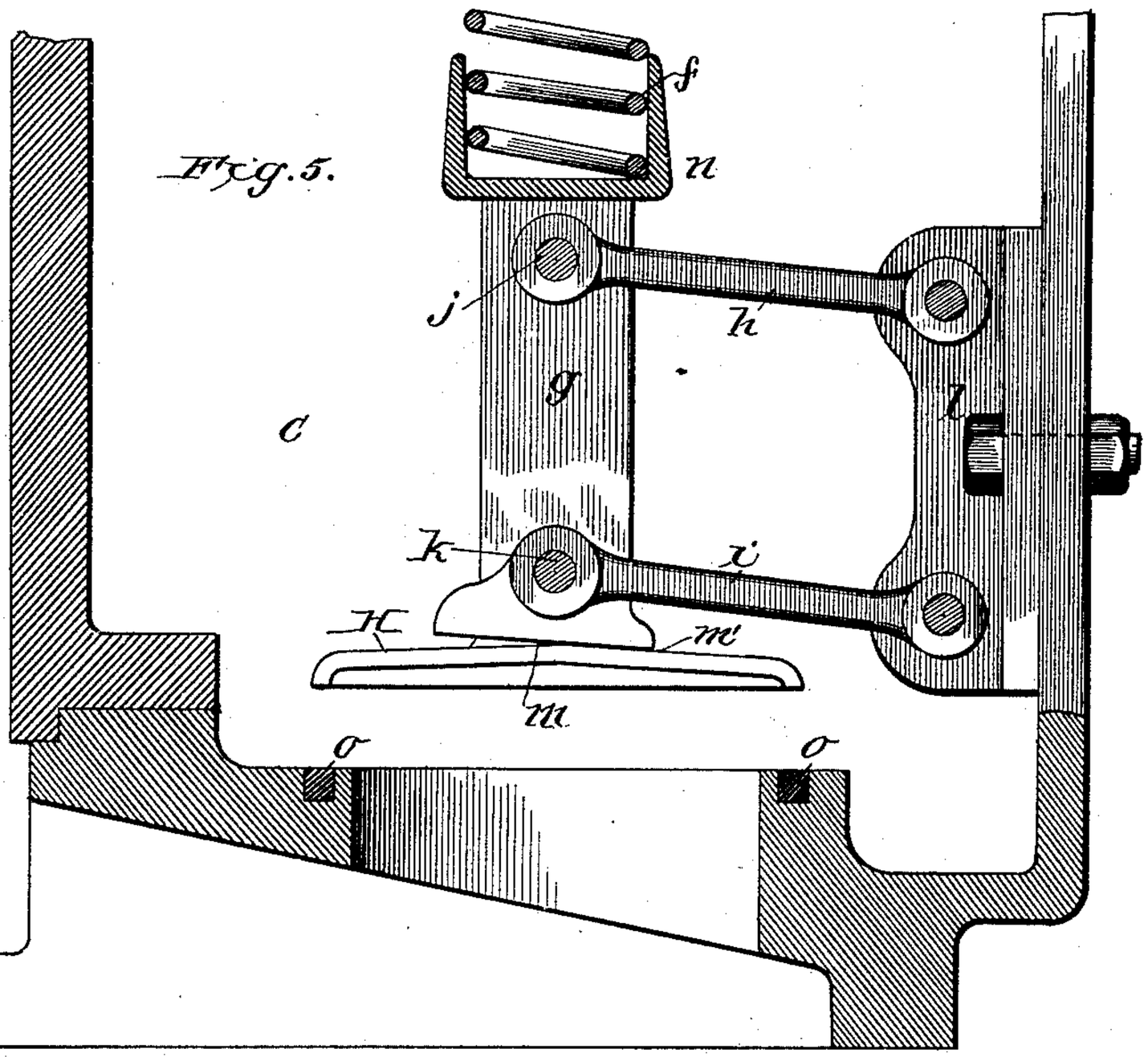


Fig. 6.

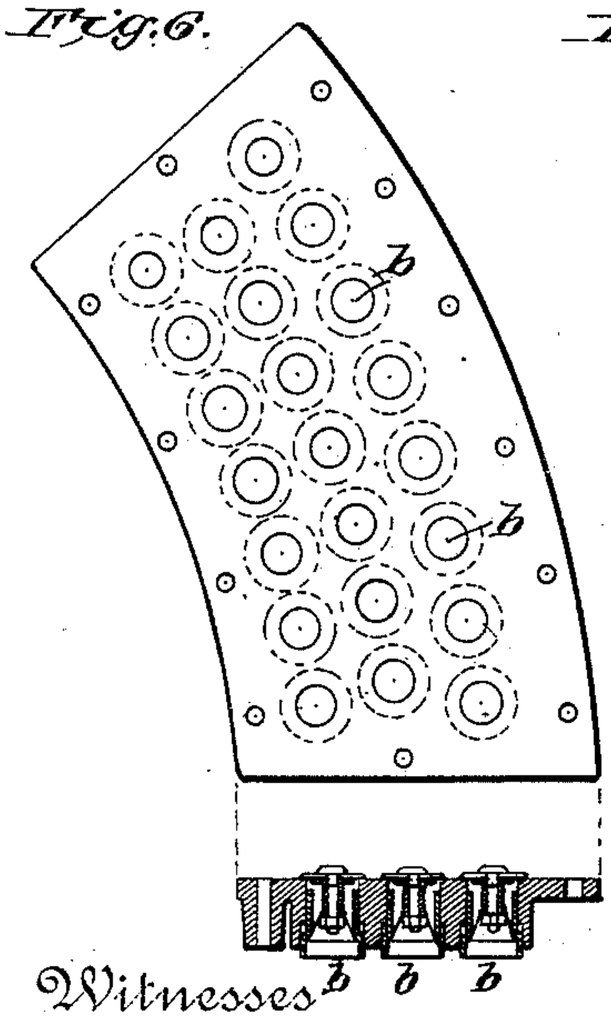


Fig. 7.

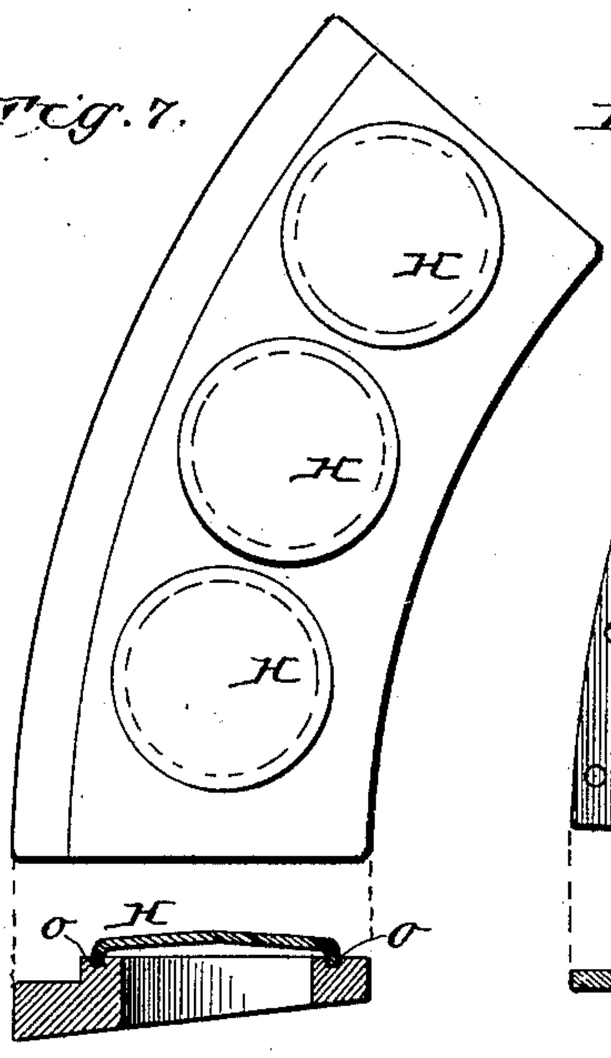
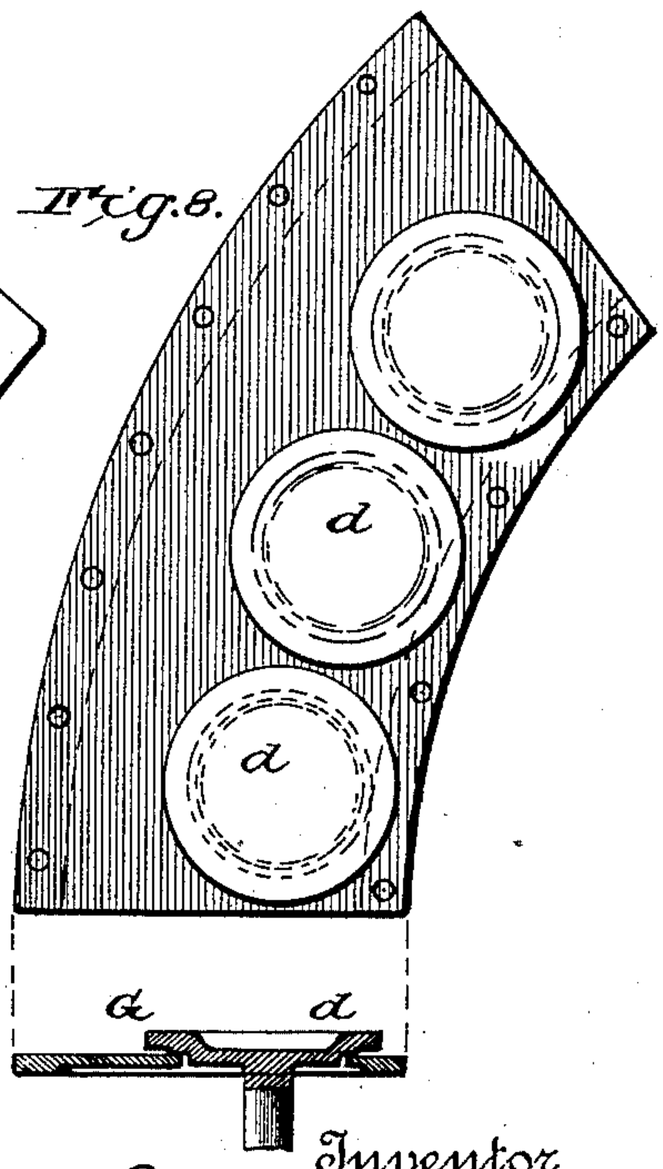


Fig. 8.



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UNITED STATES PATENT OFFICE.

PETER L. WEIMER, OF LEBANON, PENNSYLVANIA.

BLOWING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 354,279, dated December 14, 1886.

Application filed April 12, 1886. Serial No. 198,657. (No model.)

To all whom it may concern:

Be it known that I, PETER L. WEIMER, a citizen of the United States, residing at Lebanon, in the county of Lebanon and State of Pennsylvania, have invented certain new and useful Improvements in Blowing-Engines; 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.

This invention relates to that class of machines known to the art as "blowing-engines," which are distinguished from air-compressors in that they are designed with special reference to supplying large quantities of air at a comparatively low degree of pressure, varying from about three to fourteen pounds pressure. Under the old constructions of blowing-engines they were limited in their speed to from twelve to fifteen revolutions per minute. This limited speed was entirely due to the construction of the air-valves of the blowing-cylinder, they being too large to admit of rapid action and their "lift" or travel too great to suggest an attempt to secure the entire area of admission or discharge.

In order to overcome the disadvantages attending the old form of blowing-engine, I designed the engine patented by me August 22, 1876, No. 181,295, and reissued January 21, 1879, No. 8,545, in which the first practical and successful effort was put forth to increase the valve-area of a blowing-engine and keep the stroke or lift of the valve within such limits as to render high speed of the piston possible. The engine referred to was improved and secured by Letters Patent granted to me December 30, 1884, No. 309,904, in which the cumbersome flexible valves were displaced by small metal valves.

In the several constructions of engines referred to it was ascertained by their practical operation that a large percentage of the power applied was lost or absorbed by the blowing-cylinder. After a number of experiments, in which much time was consumed and large expense incurred, it was discovered that the defect lay in the want of sufficient area of the discharge-valves and in their manner of construction. A resistance of from one to two and one-half pounds pressure was encountered in forcing the air through the contracted area of the discharge-valves. When discharge-valves of small area were used, it was also found that considerable power was absorbed in raising the valves from their seats, the difference of area between the top and under side of the valve increasing as the diameter of the valves was reduced. Thus with a valve of five (5) inches area under the valve and six and one-half ($6\frac{1}{2}$) inches on top, with the engine blowing ten (10) pounds, the pressure on top of the valve would be sixty-two (62) pounds. To overcome this back-pressure and allow the valve to open, the pressure in the blowing-cylinder must be increased to twelve and one-half ($12\frac{1}{2}$) pounds. As the diameter of the valve increases, this difference between its top and bottom area decreases; hence the advantage in using large discharge-valves.

In the use of large discharge-valves the air on top and under the valve acts as a cushion to prevent a too rapid opening or closing of the valve. Thus, when the piston has moved sufficiently far to raise the discharge-valve, the pressure of air on its back or top prevents a sudden rising of the valve, and it rises only far enough from its seat to allow the air to pass. This distance of rise or lift is in proportion to the amount of air discharging from the blowing-cylinder, due to the speed of the engine; hence the discharge-valves should have sufficient area provided for the maximum speed of the engine.

After a series of costly experiments I succeeded in fixing the combined discharge-valve area at one-fifth ($\frac{1}{5}$) of the area of the blowing-cylinder in cross-section, or the area of the piston-head, (the piston moving at a speed of four hundred feet per minute,) by dividing the combined area of the discharge-opening into a number of valves, so that the maximum lift of each valve shall not exceed one and one-half inch. With this proportion of discharge-valve area to the cross-sectional area of the blowing-cylinder the difference of pressure on the top and bottom of each valve is reduced as far as practical with a lift or rise that shall not be so great as to induce slamming or pounding. When the piston speed is full, the valve will rise its full height, but will do so gradually. As the piston approaches the end of its stroke the quantity of air passing through the valve diminishes and

the valve approaches its seat gradually. When the piston speed is not full, the discharge-valves open only in proportion to the amount of air flowing through them without "jar" or "slam," as before mentioned. The receiving-valves when opening have no air-pressure on the top of them, and the under side, being free to atmospheric pressure, opens very rapidly and with great force; hence it was found necessary to reduce their area and consequent lift to a minimum. A lift of nine-sixteenths of an inch and an area of five inches has, by practice, been demonstrated as the most suitable both for opening and closing quickly and without injury to their moving parts. The combined area of the receiving-valves can be reduced to one-sixth ($\frac{1}{6}$) or one-seventh ($\frac{1}{7}$) of the area of the blowing-cylinder when the piston is moving at four hundred (400) feet per minute.

To secure the greatest efficiency attainable in the high-speed blowing-engine, I have retained the small quick-acting inlet-valves shown in my patent of December 30, 1884, and introduced large discharge-valves, as will hereinafter be fully explained.

It has heretofore been proposed in single-acting air-pumps to use small inlet-valves in the piston and a single discharge-valve covering one end of the cylinder, the object being to get the full area of the cylinder in the discharge of its contents. This effort has, however, been a failure, for the reason that the valve was not provided with sufficient lift to secure said area in the discharge of the cylinder. Furthermore, devices which may be used with a comparative degree of success in air-compressors are wholly inoperative and inapplicable to blowing-engines, on account of the difference in the speed at which they are operated and the quantities of air they are required to supply.

In my construction I arrange the inlet and outlet valves in annular series in a chamber outside of the blowing-cylinder, which is a common form of blowing-engine in use in Europe as early as 1867 and 1868, and fully illustrated in printed publications. While I avail myself of this old feature (which is public property) in the construction of my engine, I make a radical departure from the valve arrangement used in any former blowing-engine of which I have any knowledge.

With the foregoing objects in view, my present invention consists in the constructions hereinafter described, and particularly pointed out in the claims.

In the accompanying drawings, which form a part of this specification, Figure 1 represents a vertical section of a blowing-cylinder; Fig. 2, a plan view of the same on the lines A′ B′ C′ of Fig. 1, showing the inlet-valves, the discharge-valves, and the removable covers for the discharge-valve chambers; Fig. 3, a vertical section of the discharge-valve and its connection, and Fig. 4 a plan of the same. Fig. 5 is an enlarged sectional view showing one of the discharge-valves open to its full extent and the relation of the foot on the lower link to the back of the valve for limiting its throw. Figs. 6, 7, and 8 are diagrammatic views, respectively, of the section shown on lines A′, B′, and C′ of Fig. 1.

Reference being had to the drawings and the letters marked thereon, A is the cylinder; B, the piston, provided with the usual packing, *a*.

C and D are annular chambers formed around the upper and lower ends of the cylinder A, into which air from the cylinder is delivered by the piston, and from which it is discharged through the opening E. The top and bottom covers of said annular chambers are made in separate sections, each being a segment of a circle, and they vary in number according to the diameter of the blowing-cylinder. In the cylinder shown the covers are formed in eight (8) sections. The lower sections, F, are provided with a number of openings, which are closed by the receiving-valves *b*. (Shown in my Patent No. 309,904.) The upper surfaces of these sections are planed off smooth, and form a seat for the valves *b*, thus enabling me to prepare the seats for all of the valves in each section at one operation, which reduces the labor and expense to the minimum. The upper sections, G, are provided with a series of large openings, *c*, which are provided with removable hoods *d*, in each of which is formed a recess or pocket, *e*, to receive one end of a spring, *f*.

H are discharge-valves, which are located directly over the inlet-valves *b*, and are each of about five (5) to seven (7) times the area of each of said inlet-valves. From the back of each discharge-valve H project parallel guide-bars *g g*, between which are secured links *h i* by bolts *j k*, and the opposite ends of said links are secured to a bracket, *l*, attached to the wall of the annular chambers C D by suitable bolts. On the lower link, *i*, is formed a foot-piece, *m*, which crosses a portion of the valve, and when the valve is thrown open by the discharging air the foot-piece strikes the back of the valve H and limits its rise or lift, as shown in Fig. 5. On the upper ends of the parallel bars *g g* is formed a cup, *n*, in which the lower end of the spring *f* is supported. The tension of the spring closes the valve after each stroke of the piston has been completed.

By attaching the valves H to the links *h i* they may be used in any desirable position, as they will operate with the same efficiency whether they be applied in a vertical, horizontal, or angular position, and in practice their lift is found to be about one and one-half inch. The valves H are seated upon a substance softer than metal—such as rubber, leather, wood, or other analogous material—which is embedded in an annular recess, *o*, formed in the casting.

Upon reference to my former patent, No. 309,904, it will be observed that in my present construction I have greatly increased the di-

mensions or area of the annular chambers C D, which receive the air from the ends of the cylinder A. This feature of change was necessary to accommodate the increased supply of air discharged through the large valves H and prevent choking or back-pressure.

In practice it has been found that inlet-valves severally of from five (5) to seven (7) inches area and discharge-valves severally of from twenty-five (25) to thirty-five (35) inches area, or of about five (5) to seven (7) times the area of the inlet-valves, (as hereinbefore stated,) will admit of from fifty (50) to seventy-five (75) revolutions per minute with safety, and accomplish excellent results. The sum total of the areas of the discharge-valves in each head is slightly in excess of the sum total of the areas of the inlet-valves. Practice has also demonstrated that very good results can be obtained by the application of discharge-valves of slightly more than double the area of the inlet-valves.

Having thus fully described my invention, what I claim is—

1. In a blowing-engine, a valve having movement at a right angle to the plane of its seat, in combination with a swinging link attached thereto and provided with a foot or projection the face of which is in a plane corresponding with the back of the valve, whereby the rise of the valve is controlled, substantially as described.

2. In a blowing-engine, a valve having parallel guide-bars projecting from its back, in combination with swinging links attached thereto, one of which is provided with a foot or projection crossing a portion of the valve, and adapted to be struck thereby to limit the lift of the valve, substantially as shown and described.

3. In a blowing-engine, a valve having swinging links pivotally connected thereto and to a fixed portion of the structure, in combination with a spring interposed between the valve and one of the walls of the valve-chamber, substantially as described.

4. In a blowing-engine, a valve-chamber having a series of removable covers provided with recesses or sockets, in combination with a valve having swinging links pivotally connected thereto and a spring interposed between the valve and the cover and seated in sockets, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

PETER L. WEIMER.

Witnesses:
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W. B. BOGER.