(No Model.) 3 Sheets—Sheet 1.

E. REYNOLDS.

BLOWING ENGINE.

No. 245,660. Patented Aug. 16, 1881.

Fig. 1.

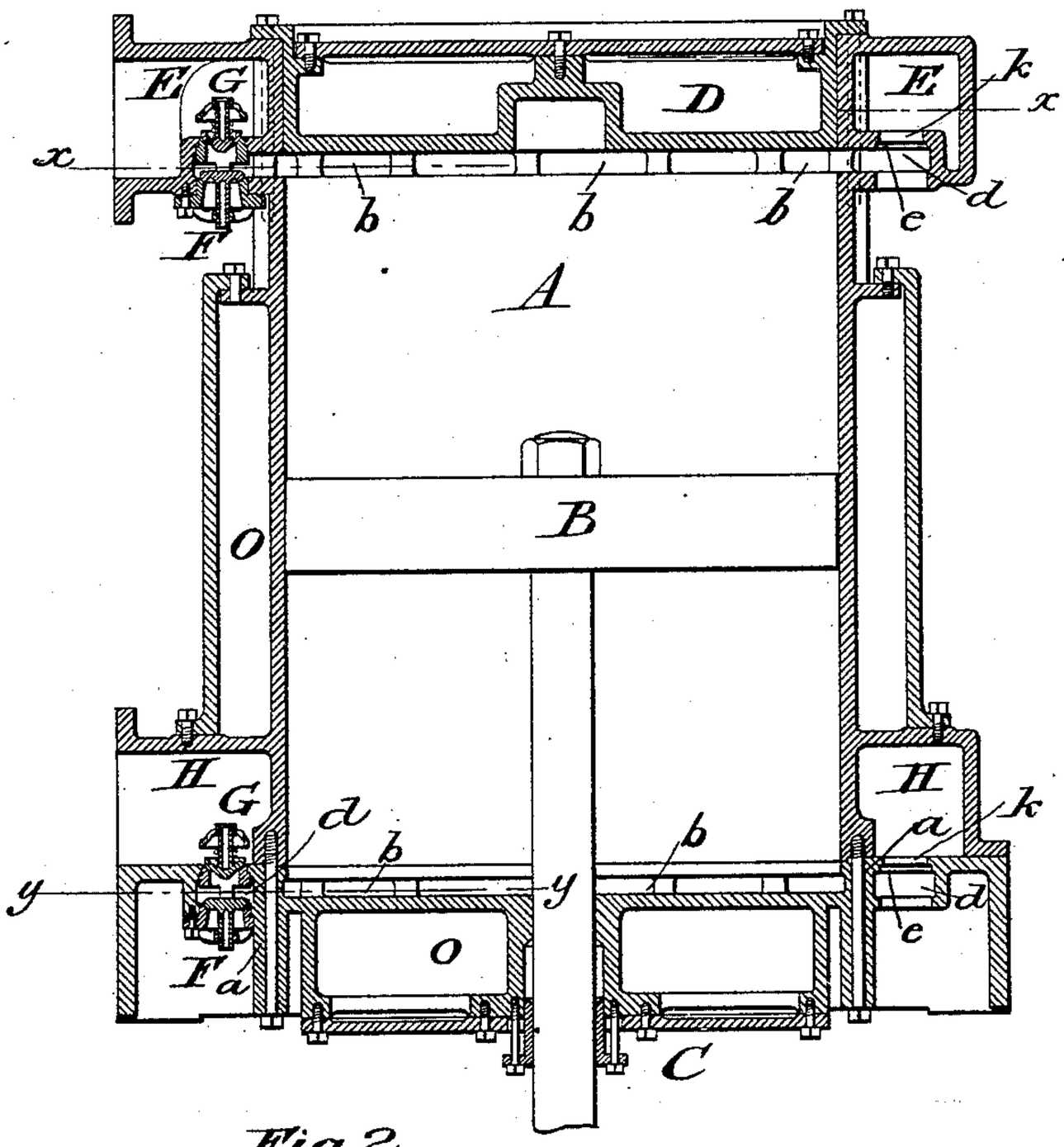
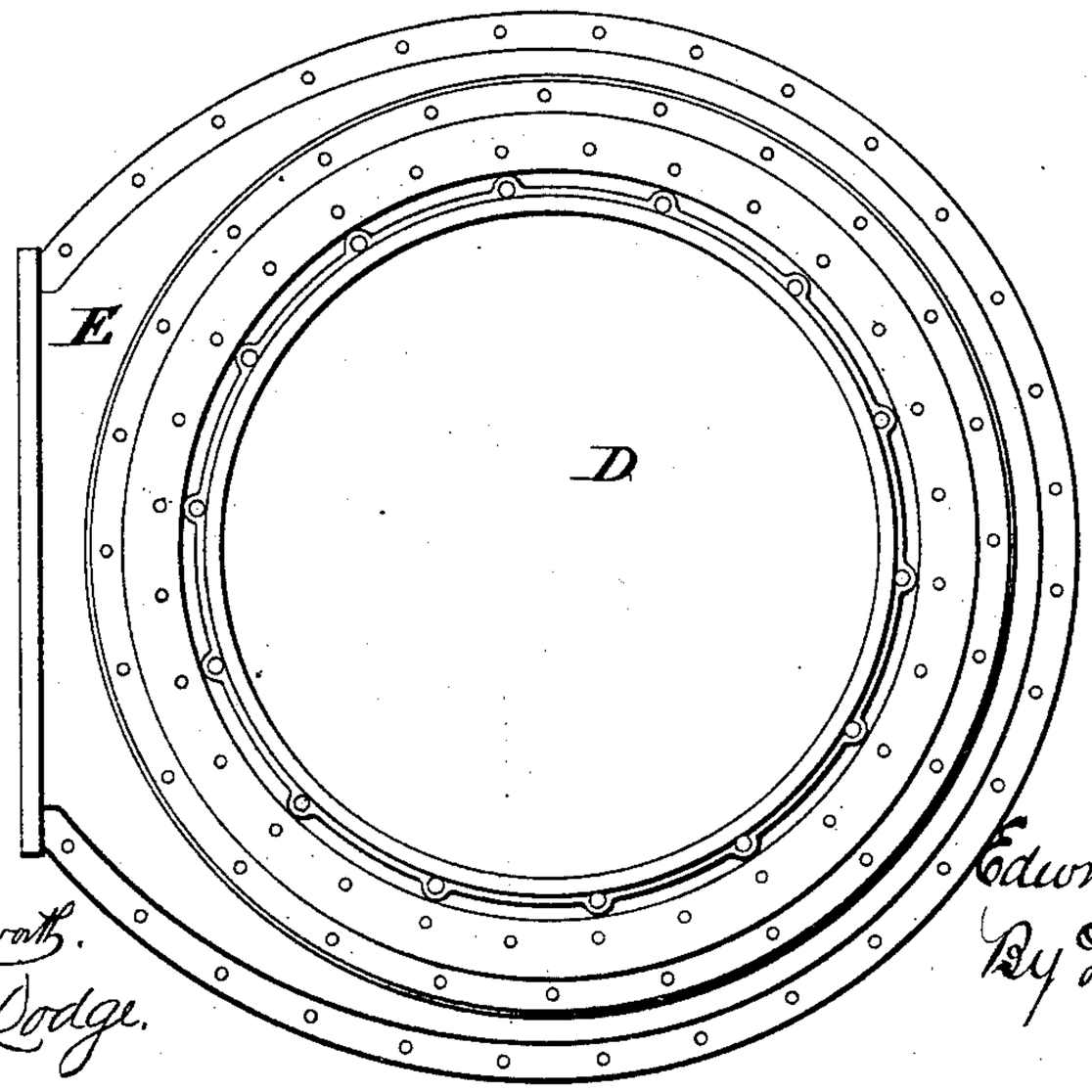


Fig. 2.



Attest.

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Edwin Reynolds.
By Dodge & Son
Attys.

(No Model.) 3 Sheets—Sheet 2.

E. REYNOLDS.

BLOWING ENGINE.

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Fig. 3.

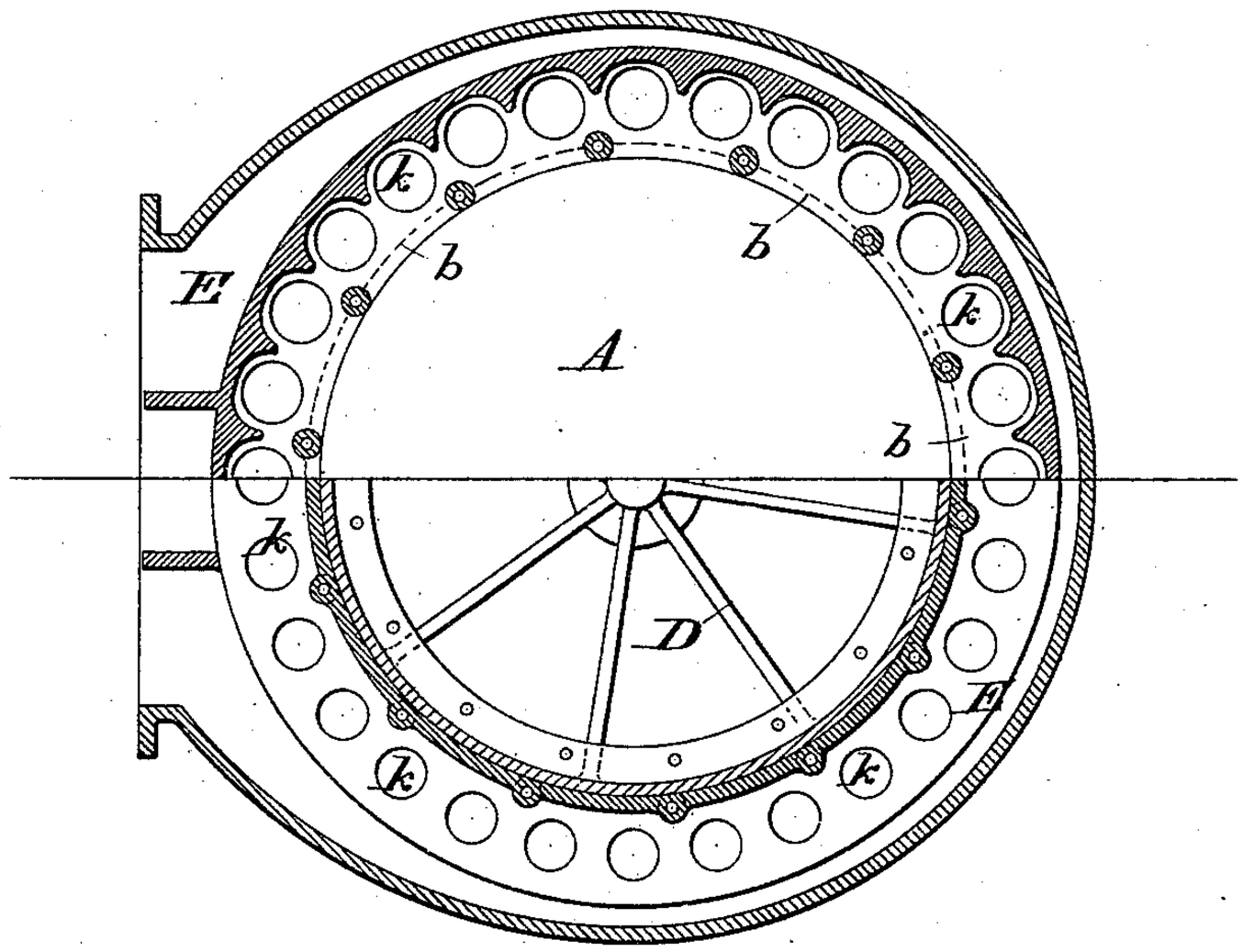
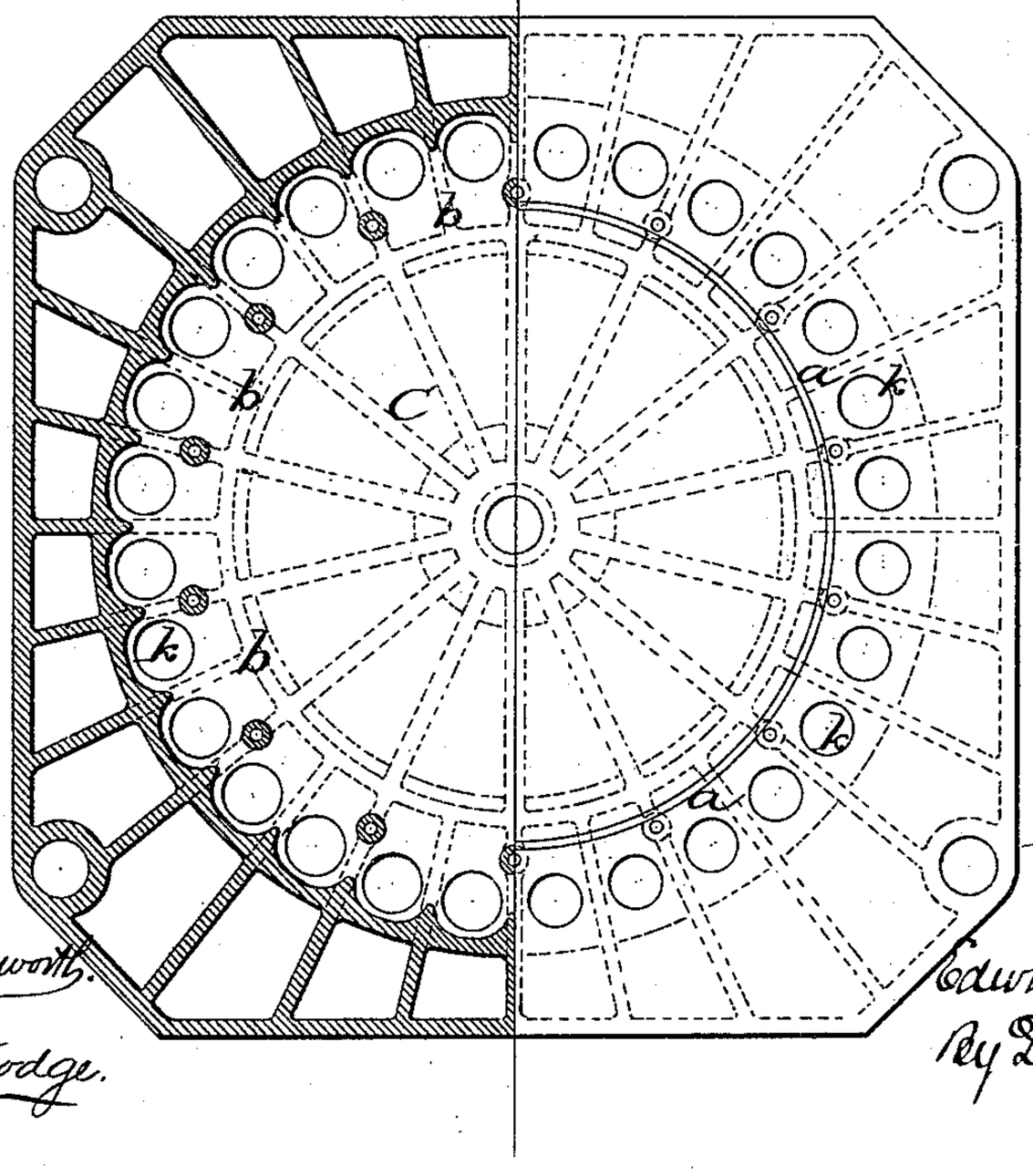


Fig. 4.



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(No Model.) 3 Sheets—Sheet 3

E. REYNOLDS.

BLOWING ENGINE.

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Fig. 5.

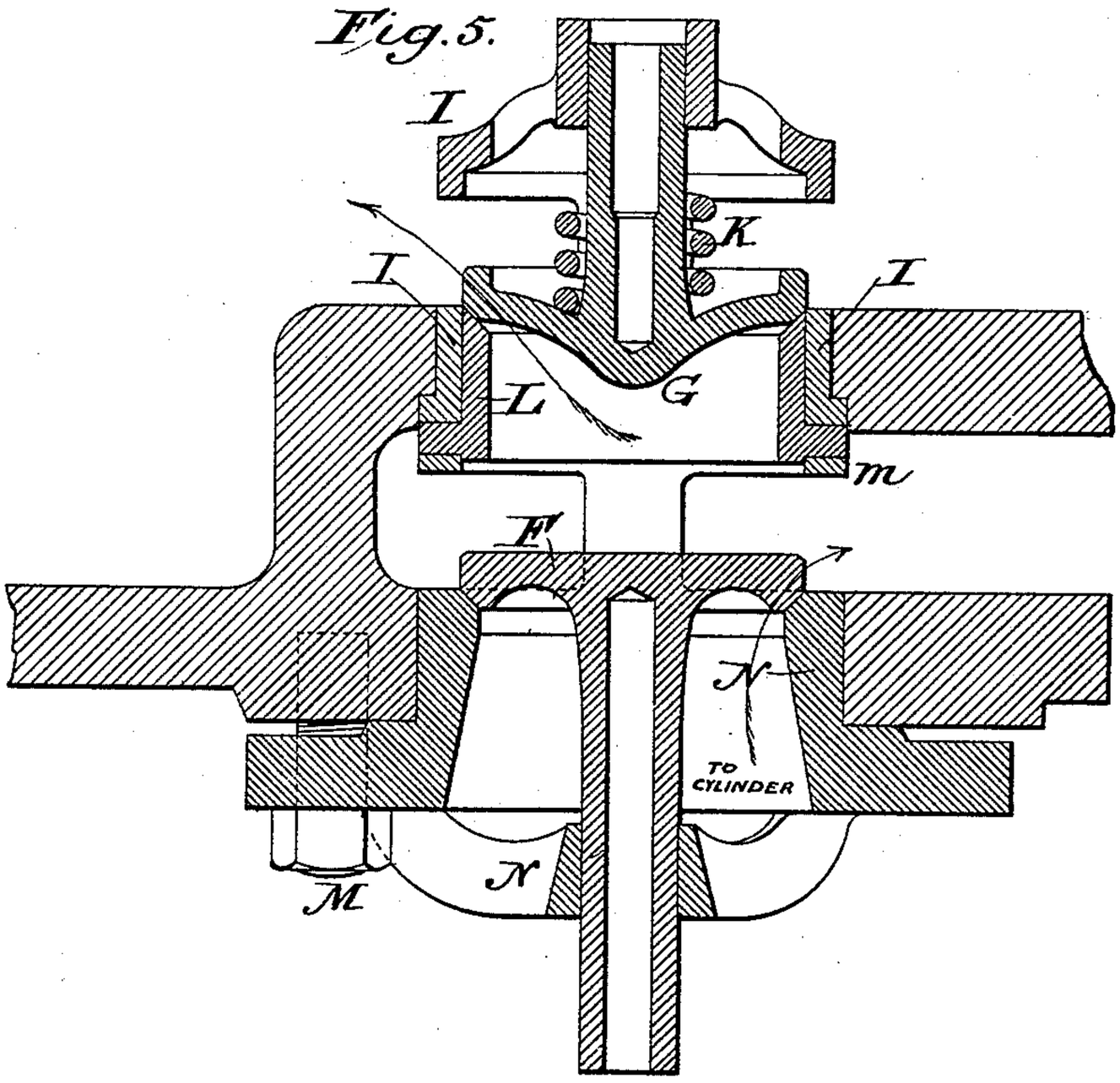


Fig. 6.

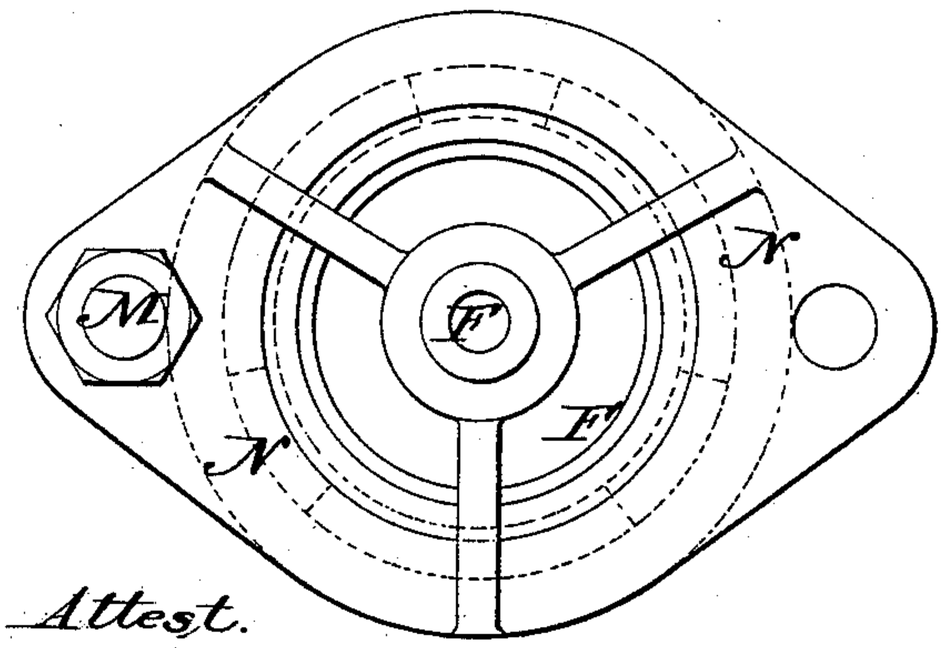
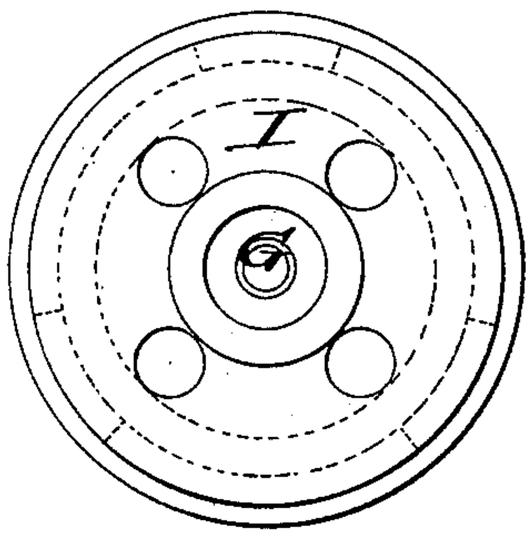


Fig. 7.



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Attys.

UNITED STATES PATENT OFFICE.

EDWIN REYNOLDS, OF MILWAUKEE, WISCONSIN.

BLOWING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 245,660, dated August 16, 1881.

Application filed March 17, 1881. (No model.)

To all whom it may concern:

Be it known that I, EDWIN REYNOLDS, of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain Improvements in Blowing-Engines, of which the following is a specification.

My invention relates to that class of blowing-engines or air-pressers in which a reciprocating piston operates within a cylinder; and it consists in improvements in the construction of the cylinder, the valves, and the valve-seats, the objects of the invention being to so construct the cylinder and valves that all valves are accessible while the engine is in motion, to permit the repair or replacement of any valve which may be out of order with a slight delay in the operation of the engine, and to permit access to the interior of the cylinder without disturbing the valves.

With these ends in view the invention consists in locating the valves outside of and around the ends of the cylinder; in the peculiar construction and arrangement of the valve-seats and valves, whereby they are rendered exceedingly cheap and simple and their removal facilitated, and in various minor details hereinafter described.

Referring to the accompanying drawings, Figure 1 represents a longitudinal central cross-section cylinder, piston, and valves of my engine. Fig. 2 represents a top-plan view of the same with the cylinder-head and valve-chamber removed; Fig. 3, a horizontal section on the line *x x*, Fig. 1; Fig. 4, a top-plan view of the lower cylinder-head and valve-seats, one side being shown in section on the line *y y*, Fig. 1. Fig. 5 is a vertical central section through one pair of induction and eduction valves and their attendant parts in operative position; Fig. 6, a bottom-plan view of one of the lower valve-seats; Fig. 7, a top-plan view of the cage or holder of one of the eduction-valves.

A represents the cylinder; B, the reciprocating piston therein; C, the lower cylinder-head, in which the lower valve-seats are also formed; D, the upper cylinder-head, and E an annular casting in which the upper valves are mounted.

The lower cylinder-head, C, is constructed, as shown, with an annular flange or rim, *a*, fitted against and bolted securely to the end of the cylinder, as shown in Fig. 1. Through the flange *a* of the head C there are numerous lateral ports or openings, *b*, through which the air enters and leaves the lower end of the cylinder. The ports *b* open into an annular space or chamber, *d*, entirely surrounding the cylinder, this space *d* communicating at the lower side, through inlet-valves F, with the atmosphere, and communicating at the upper side, through outlet-valves G, with an annular chamber, H, from which the air is delivered to a pipe or other conductor. There are, as shown, a large number of the inlet and outlet valves arranged at short distances apart around the outside of the cylinder. The valves are of the form ordinarily known as "puppet-valves," and are arranged in pairs, each outlet-valve G being directly above the corresponding inlet-valve F.

The manner in which the valves are inserted and secured is clearly represented in Figs. 1, 3, 4, and 5. Circular openings to receive them are formed vertically through the top and bottom of the annular chamber *d*, with a shoulder, *e*, near the upper end of each opening. A skeleton frame or cage, I, to guide the outlet-valve is passed upward through each opening *k*, and a flange on its lower end seated firmly against the flange in the opening, as shown in Fig. 5, the cage extending through and above the opening into the air-receiving chamber H. The outlet-valve G, having a central guiding-stem on its upper side, with a spiral spring, K, surrounding the same, is then inserted and its stem seated in the cage I.

An annular seat, L, for the valve G is inserted within the cage I, and held by a flange at its lower end, resting firmly against the lower end of the cage. The cage and seat are both held to their places by means of the seat N of the inlet-valve F. This seat N is provided with a central eye to receive and guide the downwardly-extending stem of the valve F, and is also provided with an upwardly-extending neck, in which the valve-seat is formed, and which has a skeletonized upper end, *m*, which fits against the lower end of the upper valve-seat, as shown. The lower seat, N, fits closely in place, and is provided at the under side with two ears, through which bolts M are

inserted to hold it firmly in place. It will be seen that the seat N serves not only to receive and guide the inlet-valve F, but also to secure in place the seat L and guiding-cage I of the outlet-valve G, so that by simply removing the bolts M both the inlet and outlet valves and their attendant parts may be instantly released. As the piston rises, the inflowing air raises valve F and passes thence through chambers *d* and ports *b* into the cylinder. As the piston descends, the air-pressure closes the valve F and opens the valve G, the air passing the latter into the chamber H, and thence from the engine. At the upper end of the cylinder the parts are of substantially the same construction as at the lower end, the only essential difference being that the cylinder-head D is cast in a separate independent piece from the annular chamber, so that it may be removed to give access to the interior of the cylinder without disturbing the valves. This construction may be used at the lower end of the cylinder, if desirable. The ports *b*, annular chamber *d*, and the inlet and outlet valves, with their attendant parts, are of the same construction as at the lower end of the cylinder.

It will be noted as a marked feature of my engine that all the valves are exposed in such manner that they may be removed from the outside of the cylinder without interfering with each other. The valves and valve-seats are all constructed in duplicate, so that in the event of the breakage or disarrangement of any valve it may be instantly removed and another inserted in its place with but a momentary stoppage of the engine.

In the drawings I have represented the usual water-jacket, O, around the exterior of the cylinder and of the cylinder-heads; but this jacket may be used or not, as preferred.

The drawings represent the annular air-chamber H and the adjacent valve-chambers *d* as being cast together in one piece. While this is the preferred construction, they may be made in separate pieces, if desired.

The spiral springs K are applied to the stems of the outlet-valves G for the purpose of checking the upward movement of the valves and preventing the violent concussion which might otherwise occur when running the engine at high speeds.

In order to render the valves as light as possible, their guiding-stems are bored out or made tubular. By thus lightening they are caused to operate more easily and with less noise than would otherwise be the case. While it is preferred to adhere to the details shown in the drawings, it is manifest that the form and arrangement of the parts may be modified in many respects, which will suggest themselves to the skilled mechanic, without departing from the limits of my invention or materially changing their mode of action; and for this reason I do not confine myself to the exact details represented.

A distinctive feature of my engine consists in the arrangement of valves in annular series around the cylinder in the nearest possible proximity to the interior of the same, whereby the air-space between the cylinder and the valves is reduced to a minimum and the efficiency of the engine for high-pressure work greatly increased as compared with engines in which the valves are arranged in straight series at a distance from the interior of the cylinder.

It is also to be noted, in connection with my construction, that the same ports serve both for the admission and the escape of the air, thus reducing the air-space between the cylinder and valves very greatly below that which necessarily exists in engines having separate ports for the inlet and outlet of the air.

I am aware that independently-removable valves have been applied from the exterior of the cylinder, the valves being, however, covered by caps or casings, and the parts so constructed that it was necessary to remove said caps before access could be gained to the valves. My construction differs therefrom in that my valves are constantly exposed, and that they are at all times accessible for the purpose of removal or for other purposes without the previous removal of other parts.

Having thus described my invention, what I claim is—

1. In a blowing-engine, eduction and induction valves located outside of and in close proximity to the cylinder in annular series.

2. In a piston blowing-engine, the combination of a cylinder and an annular chamber surrounding the same and communicating therewith, with lateral ports and eduction and induction valves located in opposite sides of said chamber.

3. The combination of the cylinder, the lateral ports, the annular chamber into which said ports open, induction-valves on one side of said chamber, eduction-valves on the opposite sides of said chamber, and an air-delivery chamber into which the eduction-valves open.

4. In a piston blowing-engine, an annular air-chamber communicating with the interior of the cylinder, and eduction and induction valves arranged in pairs in line with each other at opposite sides of said chamber.

5. In combination with the cylinder, the annular metal body or end piece having ports *b*, chambers *d*, and openings to receive the inlet and outlet valves.

6. In combination with the valve G, its cage and seat, an annular support, N, constructed and applied, substantially as shown, to maintain the cage and seat in position.

7. The combination of the cage I, valve G, seat L, seat N, and valve F, as shown.

8. In a blowing-engine, an induction and eduction valve, one secured in place by means of the other, substantially as described and shown.

9. In a piston blowing-engine, the combination of an outwardly-opening valve and a spring,

substantially as shown, which commences its action after the valve has opened and ceases its action before the valve is closed.

10. In a piston blowing-engine, the combination of a cylinder and a series of valves communicating therewith, said valves being exposed when in an operative position directly on the exterior of the cylinder, and being constructed substantially as described, whereby their independent and instantaneous removal is permitted.

EDWIN REYNOLDS.

Witnesses:
EDW. P. ALLIS, Jr.,
HARRIE M. FUMADE.