(No Model.)

3 Sheets—Sheet 1.

E. REYNOLDS.

BLOWING ENGINE.

No. 393,856. Patented Dec. 4, 1888.

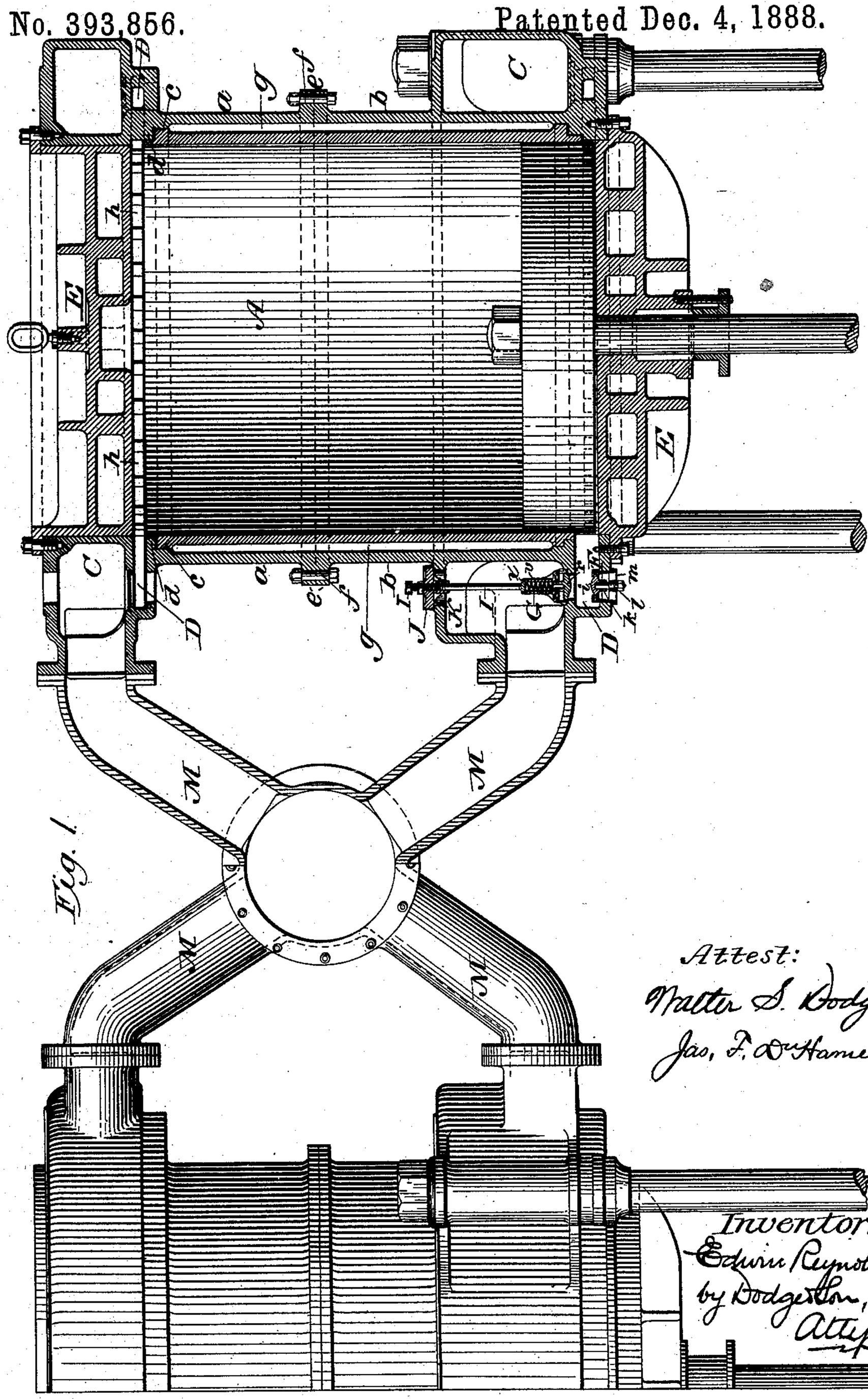

Fig. 1.

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BLOWING ENGINE.

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Fig. 2.

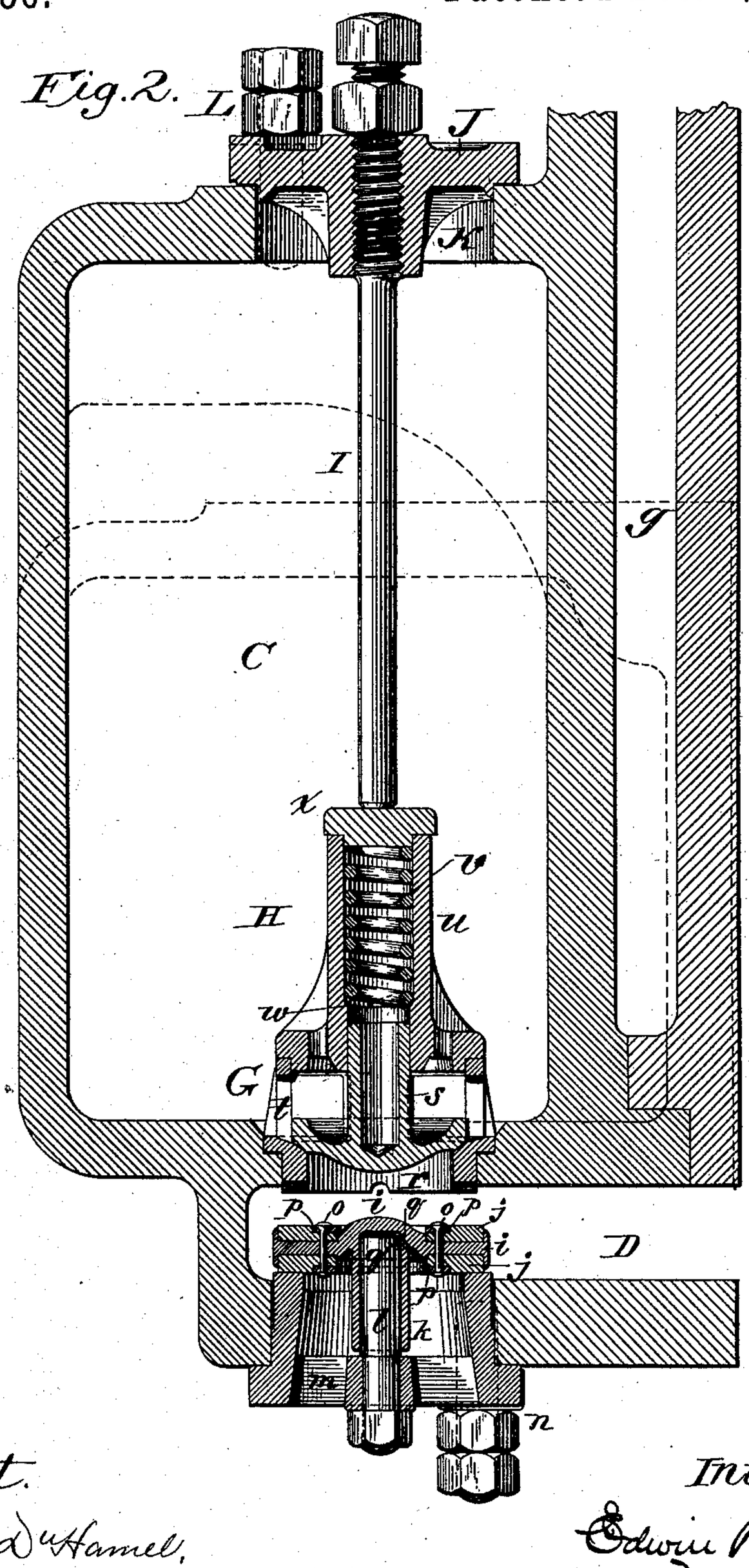

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Fig. 4.

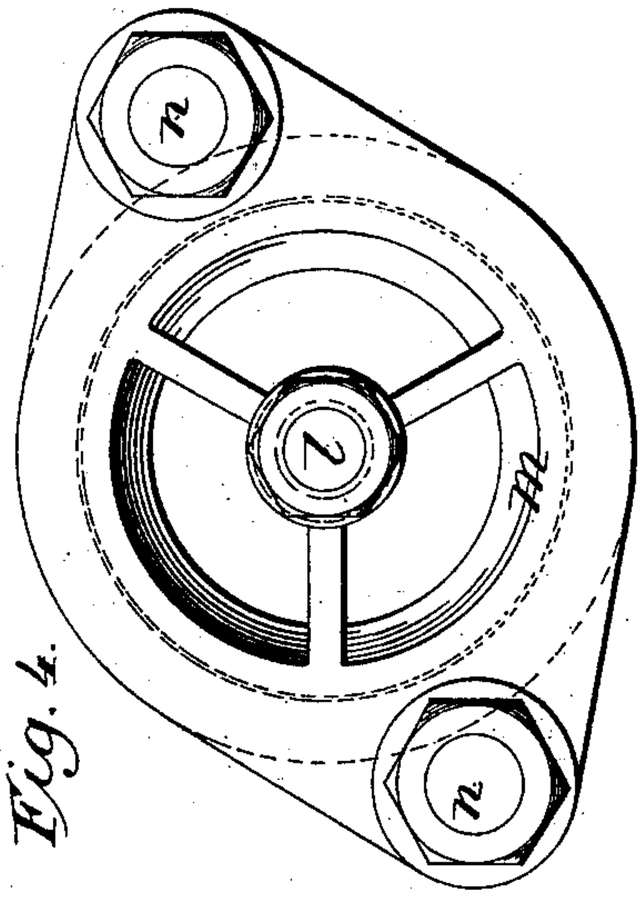


Fig. 6.

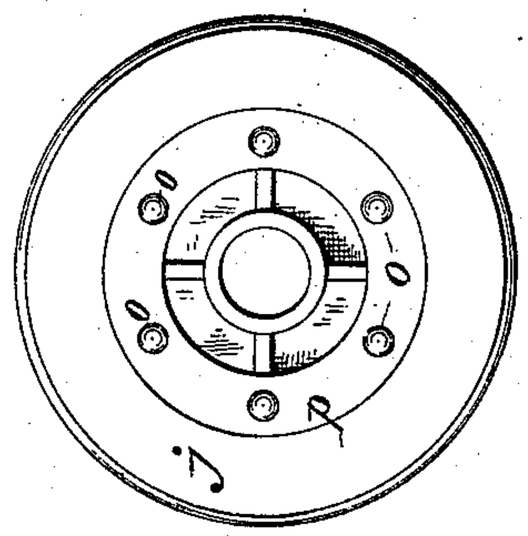


Fig. 3

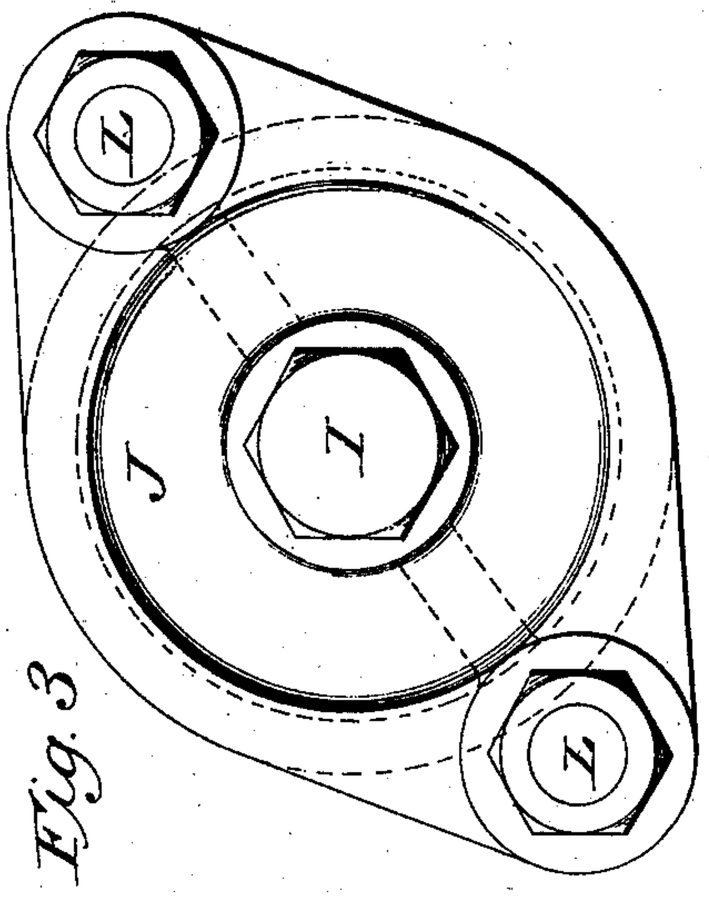
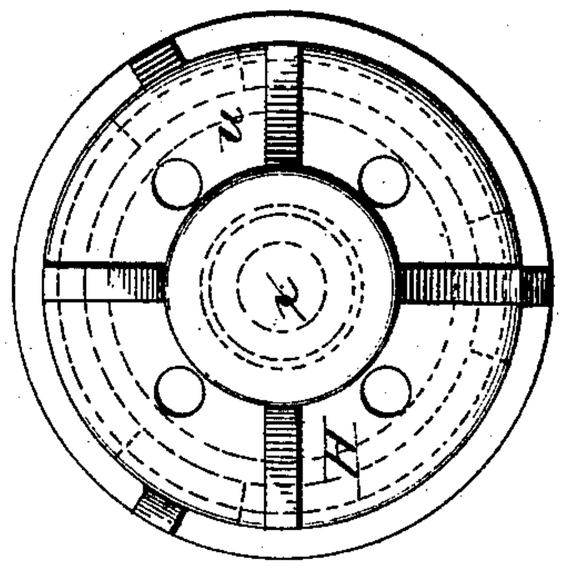


Fig. 5.



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UNITED STATES PATENT OFFICE.

EDWIN REYNOLDS, OF MILWAUKEE, WISCONSIN.

BLOWING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 393,856, dated December 4, 1888.

Application filed October 12, 1883. Serial No. 108,839. (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.

This invention relates to blowing or air-compressing engines, and is designed as an improvement upon the one for which Letters Patent of the United States were issued to me bearing date the 16th day of August, 1881, and numbered 245,660, to which reference is hereby made for such features or details as may not be found herein.

In the accompanying drawings, Figure 1 represents a vertical central section through one of the blowing-cylinders, which are usually employed in pairs, showing also a part of the second cylinder in elevation. Fig. 2 is a sectional view, on a larger scale, through the annular air-chamber of the cylinder and through the induction and eduction valves; Figs. 3, 4, and 5, detail views of the valves or their fastenings.

The purpose of the present invention is to simplify and improve the construction of the engine described in my former patent, and particularly to cheapen and facilitate the construction of the cylinder and to permit the eduction-valves to be removed without disturbing the induction-valves.

Referring now to Fig. 1, it will be seen that the cylinder consists of an inner cylindrical body or lining, A, an exterior shell or casing, B, formed of two parts, *a* and *b*, each having formed in it one of the annular air-chambers C and valve-chambers D, and heads E, secured to the parts *a b* by tap-bolts or other ordinary fastenings.

The inner cylinder or lining, A, is formed with a circumferential flange or shoulder, *c*, near each end, against which fits a like flange, *d*, with which both the parts *a* and *b* are provided. The abutting ends of the parts *a b* are also formed with outwardly-projecting flanges *e*, which are firmly drawn together by bolts *f*, to unite said parts and to draw their flanges or shoulders *d* firmly against the corresponding shoulders, *e*, of the internal cylinder or lining, A, thereby also holding the said inner cylinder securely in place. The outer shell sets away from the inner cylinder or lining, as shown in Fig. 1, and forms an annular space, *g*, for the circulation of water, if required, to prevent the cylinder from heating. For the same purpose the heads E are preferably cast hollow.

The above-described construction of the cylinder greatly facilitates casting, lessens the expense, permits the lining or inner cylinder to be made of a different kind or quality of metal from the shell, if desired, and enables the manufacturer to renew said inner cylinder quickly and easily and without renewing any other part.

D indicates an annular valve-chamber, one at the upper and another at the lower end of the cylinder and communicating with the interior thereof by lateral passages *h*, close to the ends of the inner cylinder or lining, A, said chamber D being provided with induction-valves F and eduction-valves G, the former admitting air from the external atmosphere to chamber D, whence it is drawn into the cylinder A through the lateral passages *h* by the movement of the piston from said passages, and the latter permitting the air to escape from chamber D into air-chamber C at the approach of the piston in the same manner as described in my aforesaid patent.

The induction-valves each consist of a metal disk, *i*, having rubber, leather, or other elastic or compressible facings, *j*, applied to its upper and lower faces to insure a perfect fit and close joint and to prevent the noise and wear that would be produced if the two metal surfaces were allowed to come into immediate contact, said disk being formed with a central tubular neck or sleeve, *k*, which fits upon and is guided by a vertical stem, *l*, which projects upward within the center of the valve-opening from a skeleton plate, *m*, which is formed with an upwardly-projecting tubular neck turned to fit accurately within the valve-opening, and with perforated ears to receive tap-bolts *n*, by which the plate *m* is secured in place, as shown. The annular neck or body projects slightly into the chamber D, and forms a seat or bearing-face for the valve-disk which is limited in its movement by the height of said chamber, and thereby prevented from leaving its guiding-stem when in position.

The facings *j* are held in place by rivets or bolts *o*, passing through the disk and facings

and through annular clamping-plates *p*, as shown in Fig. 2.

The sleeve *k* of disk *i* is preferably made to fit accurately upon stem *l*, both being made of cylindrical form for convenience of manufacture; and to prevent the formation of a vacuum or of an impeding air-cushion within the neck *k* an opening, *q*, is formed to permit the entrance and exit of air to and from its interior. This opening may, however, be small enough to very slightly retard the motion of the valve to prevent undue jar in closing.

The eduction-valves each consist of a disk, *r*, provided with a stem, *s*, preferably made hollow to reduce its weight, a cage, H, consisting of a lower section, *t*, flanged to rest upon a ledge or shoulder around the opening made to receive the valve, through which opening the lower annular portion of the cage projects, as shown in Fig. 2, and an upper section, *u*, resting upon the lower section, *t*, and containing a spring, *v*, to insure the descent of the disk *r*.

The upper section, *t*, is necked or shouldered, as shown, to permit it to both enter and rest upon the upper end of part *u*, thereby preventing it from shifting about thereon, and the tubular central portion which contains the spring *v* is formed with a ledge or shoulder, *w*, a short distance above the point to which the neck or stem *s* of disk *r* descends, said shoulder serving to limit the descent of the spring, and thereby to relieve the valve of its pressure just before the disk reaches its seat, and also permitting the disk to be started from its seat free of the spring-pressure.

To permit the insertion of the spring, its shell or case is made open at the top, a cap or cover, *x*, being provided to cover said open end and to form a bearing-plate both for the spring and for a screw rod or stem, I, by which the valve as a whole is held in place. The rod I passes through a correspondingly-threaded cap-plate, J, which closes an opening, K, through which the valves are inserted and removed, said plate being held in place by tap-bolts or other suitable fastenings, L, advisably furnished, like the rod I and the tap-bolts *n*, of plates *m* with jam-nuts, as shown.

The cap or cover *x* may be held in place upon the valve-cage by fastening screws, pins, or other devices to prevent its being raised by the spring, if necessary, though ordinarily the spring will be made of such length that when freed from pressure it will reach only from the shoulder *w* to the lower face of the cap.

The sides of the lower section, *t*, of the cage are formed with large openings in the air-chamber C to permit the escape of air through the valve, and openings are made through the base of part *u* to lighten the same and permit air to enter and escape freely at the back of the disk.

From the foregoing it will be seen that the eduction-valves G may each be removed and replaced independently of each other and of the induction-valves, and that in the same manner the induction-valves may be applied and removed independently of each other and of the eduction-valves.

The object of forming the cage H in two parts is to permit the convenient insertion and removal of the valve-disk and to permit the valve-seat to be ground or turned perfectly true.

The air delivered into chamber C is conveyed to a delivery main or receiver by pipes M, which unite at a common point, as shown in Fig. 1, two such branches coming from the opposite ends of both compressing-cylinders, which, as before stated, are generally arranged in pairs.

The four branches thus form a brace or trussing in the form of the letter **X** between the two cylinders, thus firmly uniting them and causing them to mutually support and steady each other and rendering other or special trussing or bracing at that point unnecessary.

Having thus described my invention, what I claim is—

1. In combination with the annular air-chamber C and valve-chamber D, the former provided with openings K, valves G, each comprising a valve cage and cap, valve disk and stem, and a spring, removable caps J, applied to the openings K, and rods or stems I, extending from the caps J to the caps of the valve-cages and serving to hold said cage caps and cages in place.

2. The eduction-valve G, consisting of cage H, provided with spring *v* and with a shoulder or stop, *w*, to limit the movement of said spring, and disk *r*, having neck or stem *s*, substantially as described and shown.

3. In combination with the annular air-chamber C and valve-chamber D, the former provided with openings K, valves applied to openings in the wall separating said chambers, caps J, applied to the openings K above said valves, and rigid stems I, extending from the caps J to the cages of the valves and serving to hold said cages in position.

EDWIN REYNOLDS.

Witnesses:

GEO. G. PHILLIPS,

BRUNO NORDBERG.