

(No Model.)

W. McCLAVE.

COMBINED STEAM AND AIR BLOWER FOR BOILER FURNACES.

No. 318,008.

Patented May 19, 1885.

Fig 1.

Fig 2.

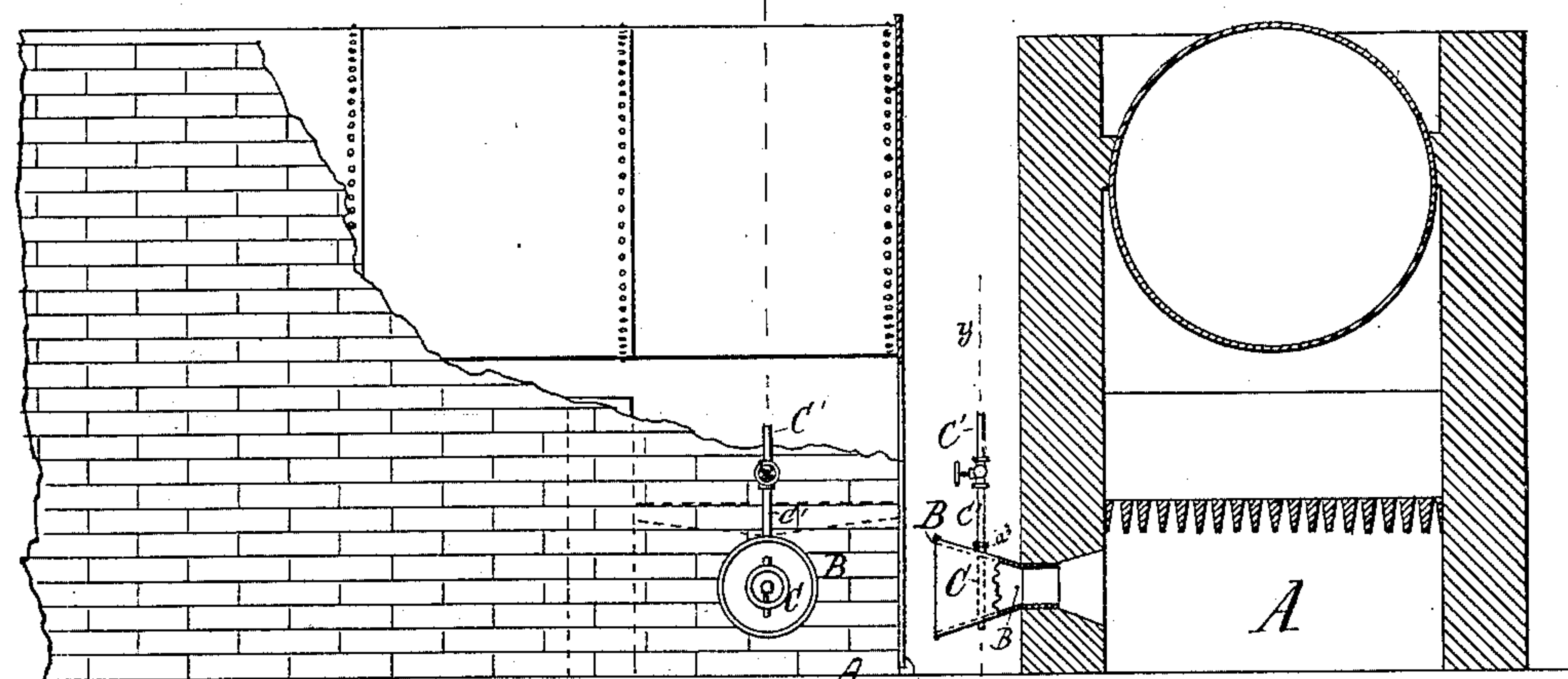


Fig 3.

Fig 4.

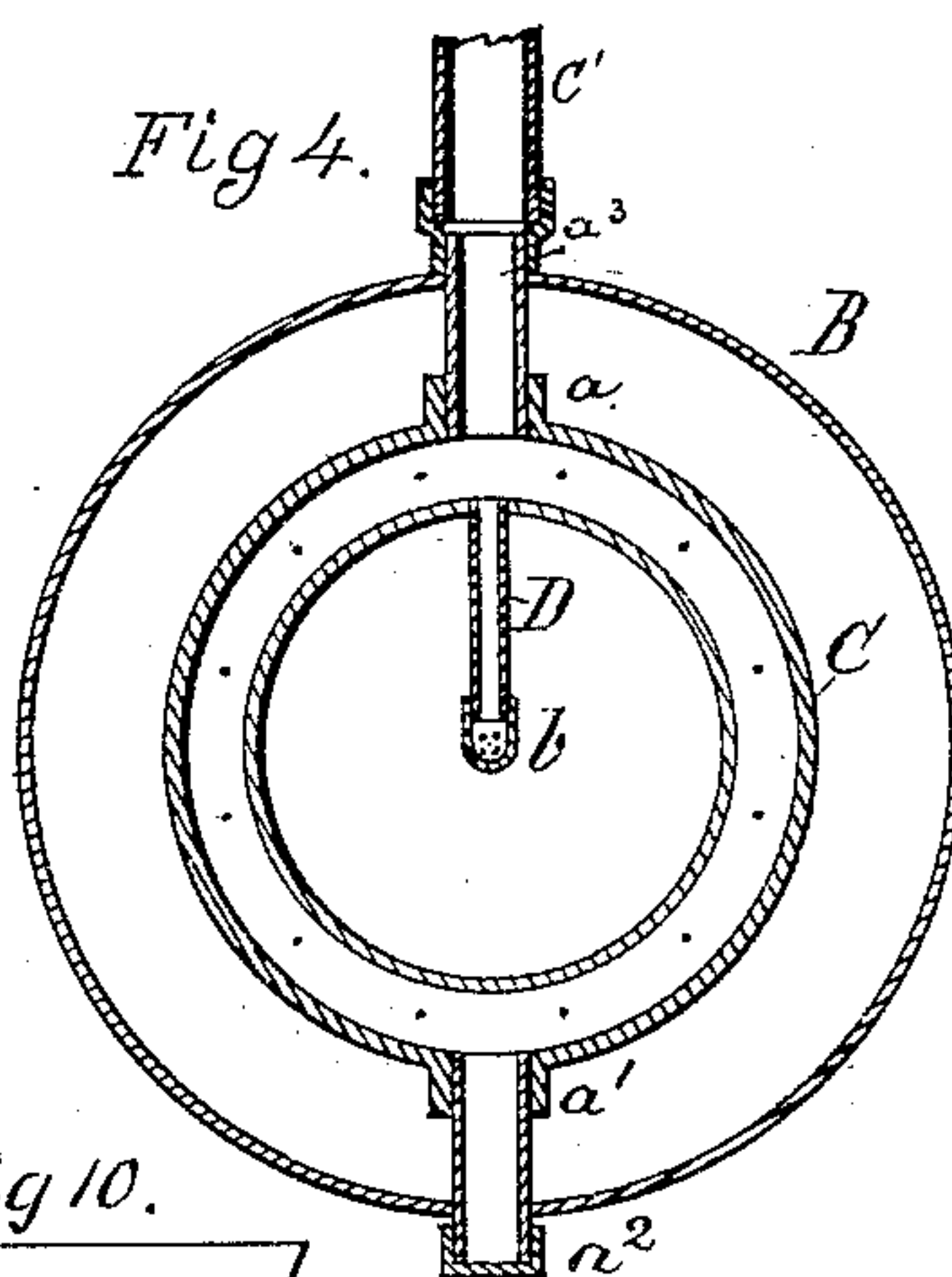
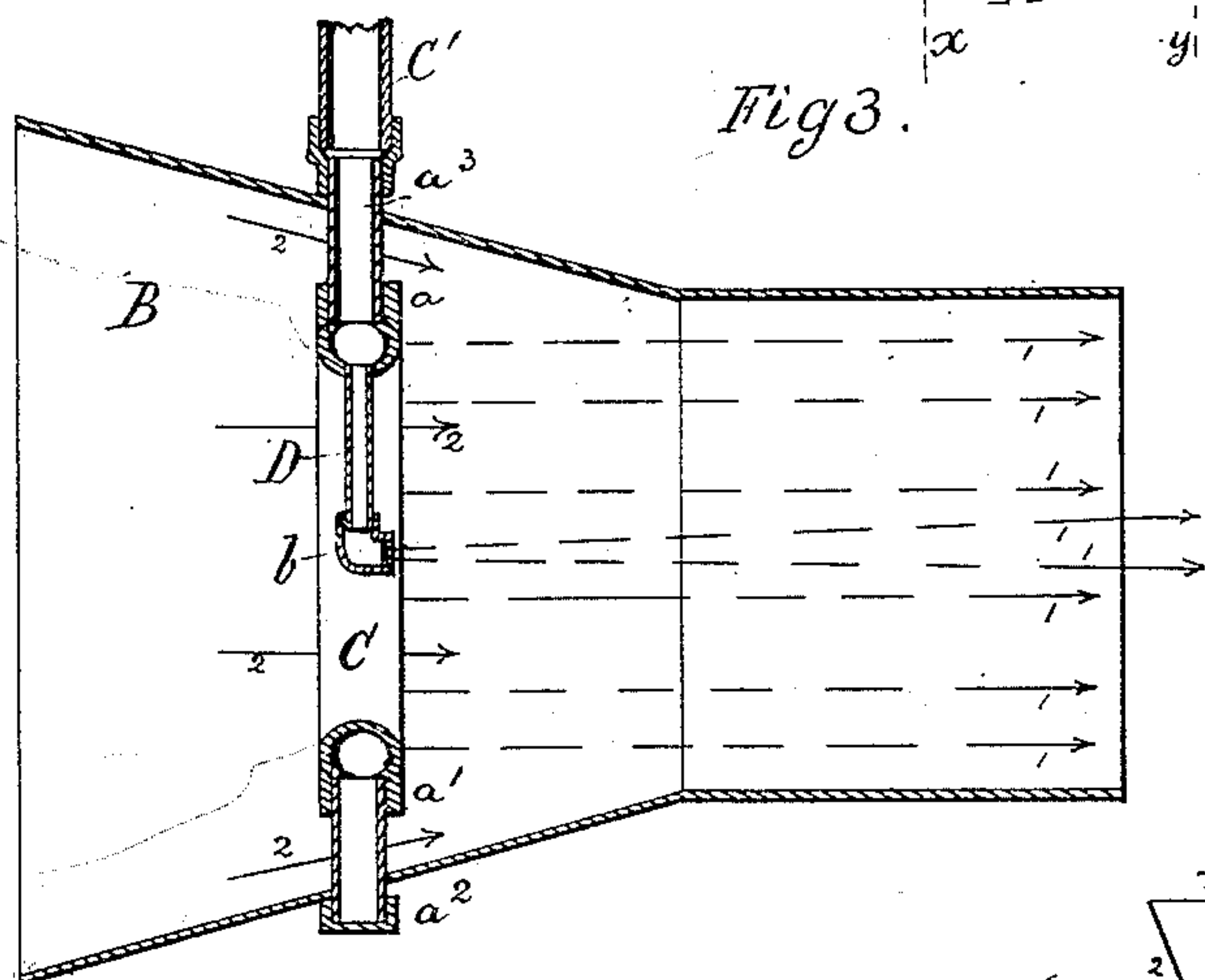


Fig 10.

Fig 5.

Fig 6.

Fig7.

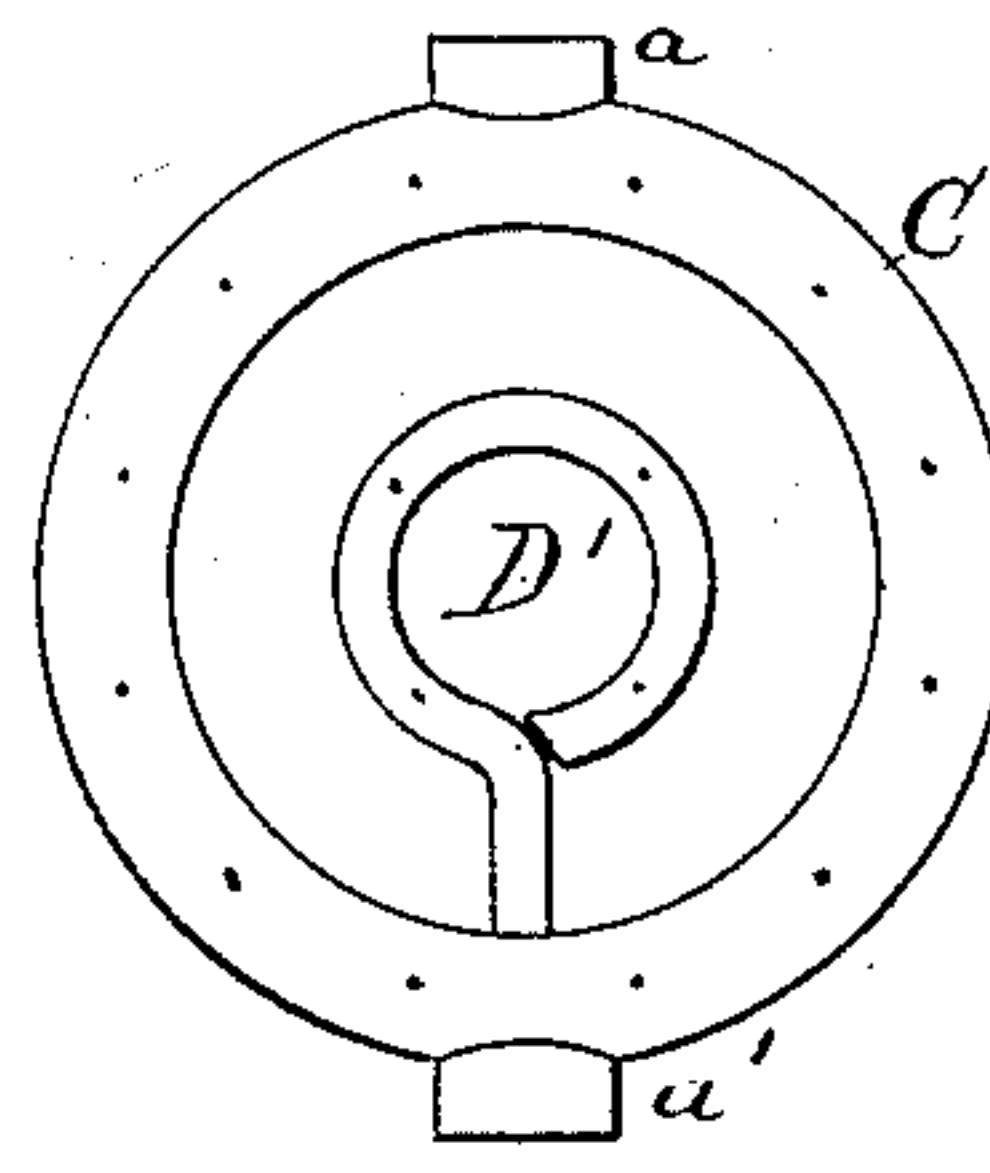
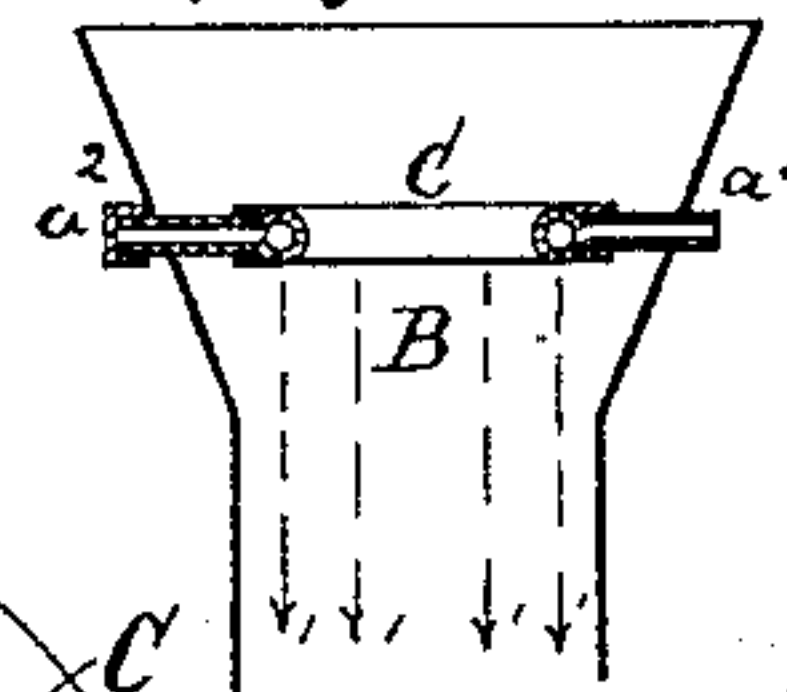
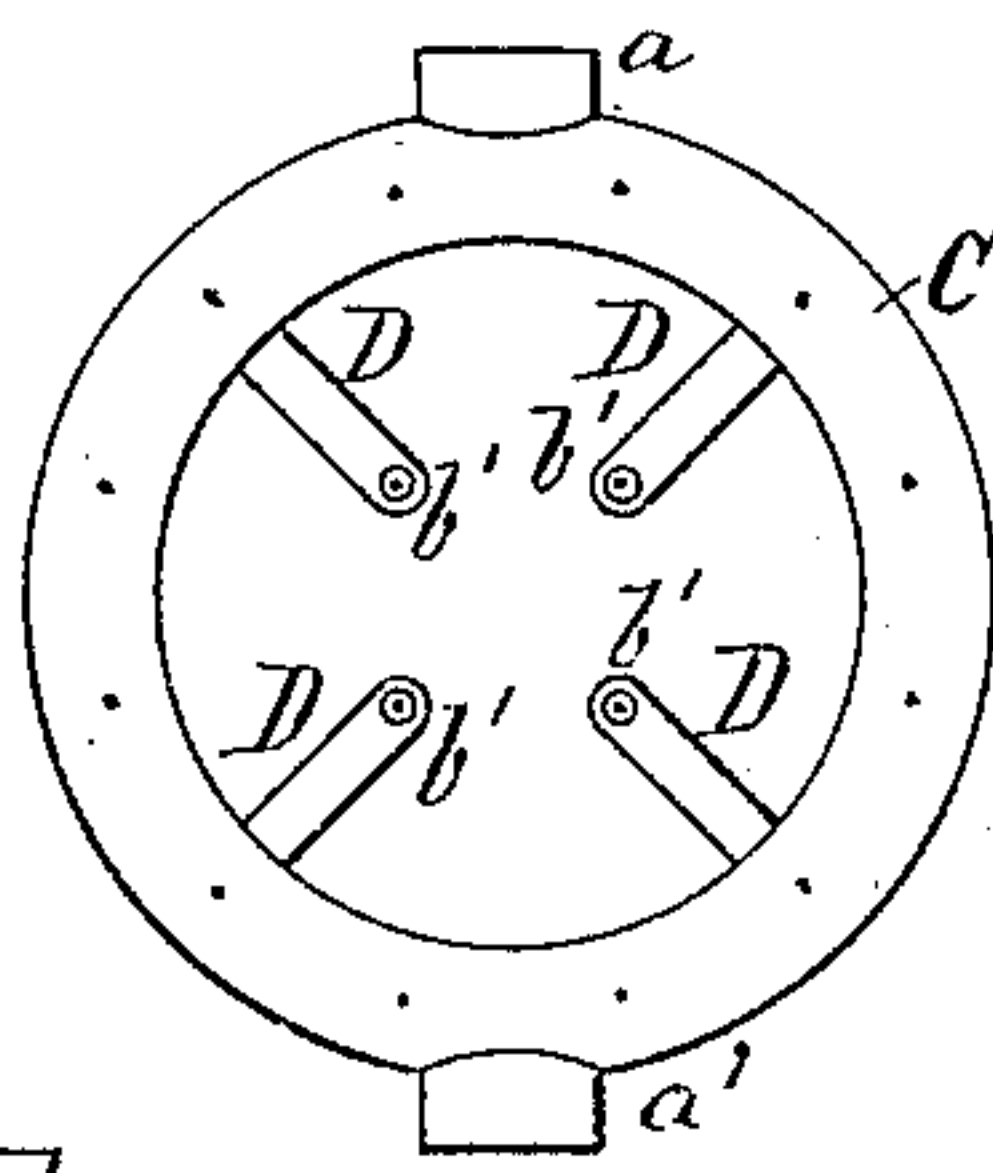
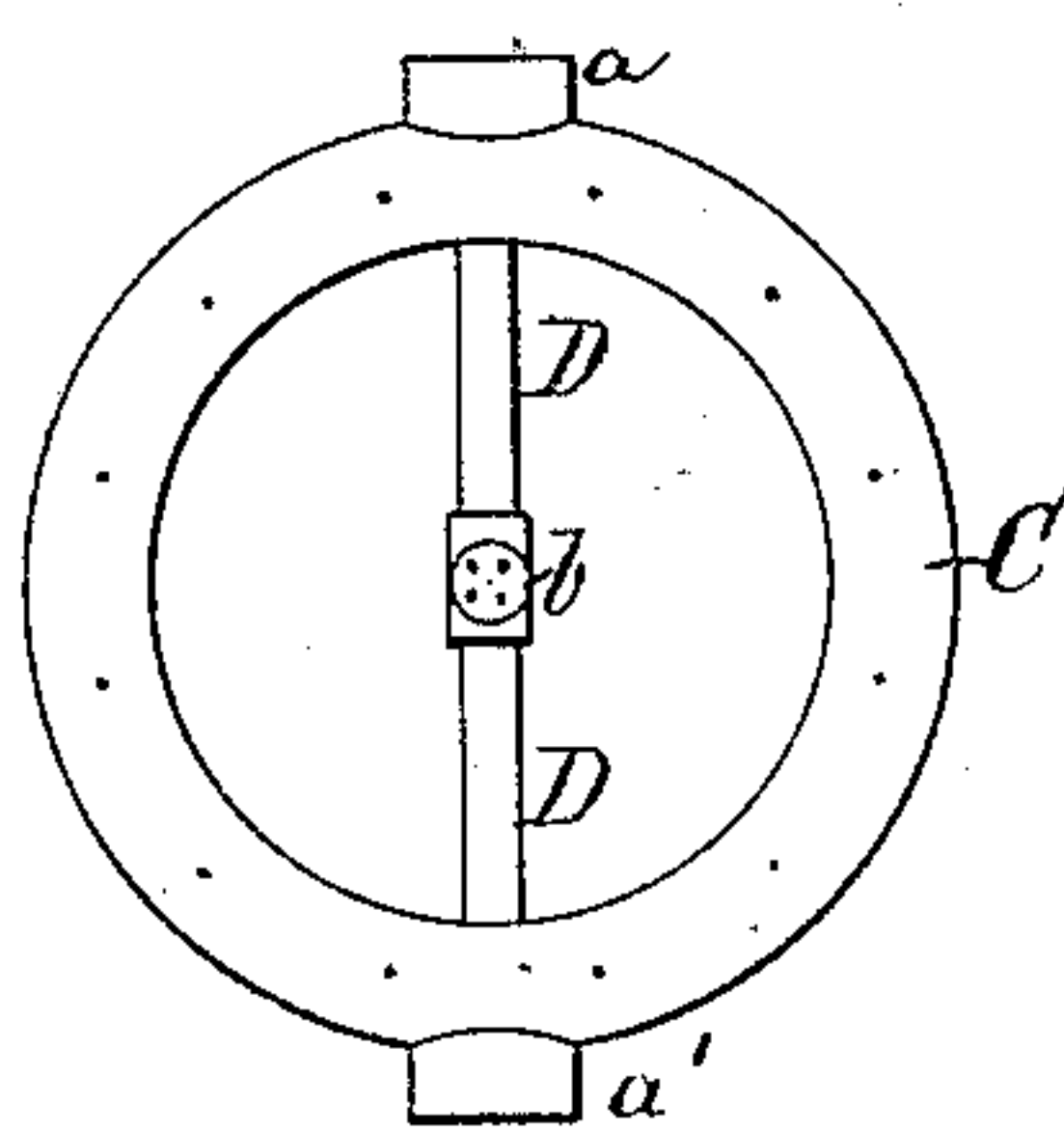
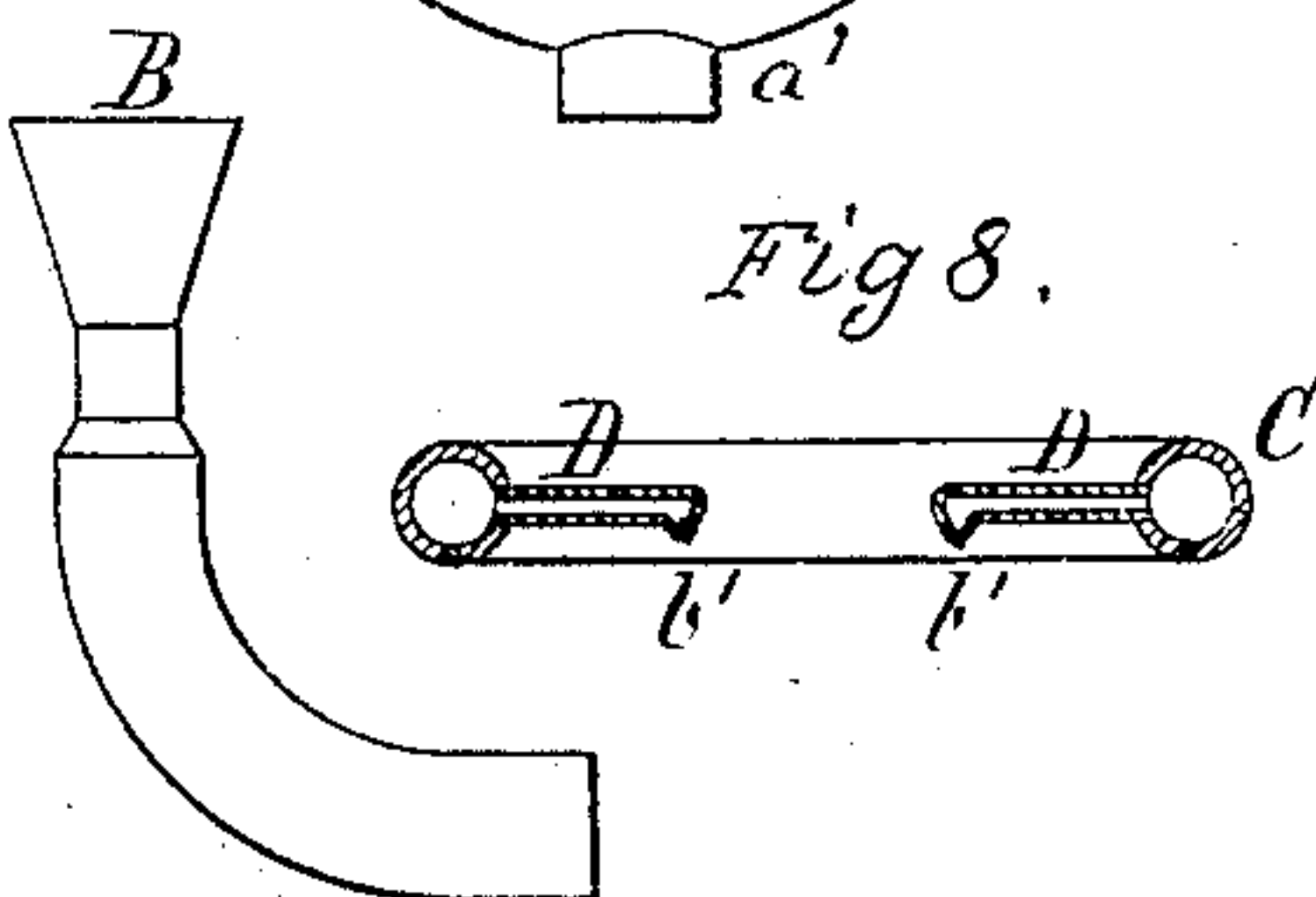


Fig 9.

Fig 8.



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COMBINED STEAM AND AIR BLOWER FOR BOILER-FURNACES.

SPECIFICATION forming part of Letters Patent No. 318,008, dated May 19, 1885.

Application filed March 14, 1885. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM McCCLAVE, a citizen of the United States, residing at Scranton, in the county of Lackawanna and State of Pennsylvania, have invented a new and Improved Combined Steam and Air Blower for Boiler-Furnaces, of which the following is a specification.

My invention relates to a combined steam and air blower, which is ordinarily placed within a cone or air-duct leading into the ash-pit of a furnace and beneath the fire bed or grate, or cone or air-duct placed in any other suitable or desirable location for the purpose of supplying steam and air blast to a fire, or for producing a draft, or for effecting ventilation, as may be required.

The invention which I have made in the style of steam and air blower above mentioned consists, first, in the combination of an air-cone, a steam-supply pipe, and a single steam-jet annulus having an aggregated cross-sectional discharging-area less than the cross-sectional area of the steam-supply pipe, as and for the purpose hereinafter set forth.

It consists, second, in the combination, with the single ring or steam annulus having an inlet for supply-steam on its outside periphery, and with an air-cone or air-duct, of a small auxiliary steam-jet pipe or pipes arranged within the said annulus, and in communication with its bore, whereby the movement of the air propelled by the suction or blast of the jets of steam from the annulus through the cone is accelerated at the central part of the cone, while the free movement of the air outside the annulus and between its inside and the auxiliary jet pipe or pipes is effected advantageously.

By my present improvement the heretofore-experienced partially-inefficient suction of the steam-jets of the ordinary single annulus at the central part of the cone, due to the long distance of these jets from the center of the cone, is compensated for, and the sluggishness of the inflow of air with the steam to the ash-pit or other place, especially when there is a back-pressure in the ash-pit, is overcome; and my arrangement always insures a proper portion of steam and air mixed for the pur-

pose desired, whereas with the ordinary single ring or annulus there is often a too great quantity of steam and an inadequate quantity of air supplied, from the fact that the blast becomes banked in the ash-pit by reason of the great resistance offered by the deep bed of coal or culm through which it is required to pass, and by being thus banked the inflow of air through the coal is retarded or caused to become sluggish, while the steam in too great quantity passes freely to the ash-pit and through the fire; but by providing the small auxiliary central steam-jet pipe or pipes this tendency to keep the air back is overcome from the fact that the auxiliary jets accelerate its movement at the point where there is the least direct suction from the jet annulus, and the result is a proper quantity of steam and air mixed being supplied to the fire, and a nearly uniform flow of air through the cone; and it consists, third, in certain other combinations, as will be hereinafter described and specifically claimed.

In the accompanying drawings, Figure 1 is a broken side view of the front portion of a boiler-furnace with my invention. Fig. 2 is a vertical transverse section of the same in the line $x x$ of Fig. 1. Fig. 3 is a vertical central longitudinal section of the cone, annulus, auxiliary steam-jet pipe, and steam-supply pipe. Fig. 4 is a transverse section in the line $y y$ of Fig. 2. Figs. 5, 6, 7, and 8 show modified forms of the annulus and auxiliary jet-pipe or pipes; and Fig. 9 a modified form of the cone or air duct. Fig. 10 is a sectional view, showing the cone with an annulus not provided with the auxiliary steam-jet pipe.

A represents a portion of an ordinary ash-pit and grate or fire-bed of a boiler-furnace; B, an ordinary air-cone or air-duct set into the side of the furnace, so as to supply air beneath the grate or fire-bed; C, a hollow jet annulus provided with supporting hollow arms a, a' , and confined within the cone by means of screw-cap a^2 on one side and a reducing-collar, a^3 , on the other side, by which collar it is connected to the steam-supply pipe C' , as represented, or in any other appropriate manner; and D is an auxiliary steam-jet pipe having one or more steam-jet passages in its dis-

charging end. This pipe is placed within the circle of the annulus C, and is connected with the annulus by a screw or other well-known suitable means, so as to be in communication
 5 with the bore of the annulus and with the steam-supply pipe. The auxiliary jet passage or passages may be in a rosette, *b*, on the inner end of the pipe D, or a simple single-jet nozzle of suitable size may be applied on
 10 the end of the pipe, it lying parallel with the longitudinal axis of the cone. The rosette or single-jet nozzle occupies a position central of the annulus C, and if several jet-passages are employed they are placed around a solid cen-
 15 ter of the rosette at a proper distance apart, so that the auxiliary steam-jets shall not interfere with one another when projected through the neck of the cone by the pressure of steam in the boiler. It may be desirable to give a
 20 slight divergence to the auxiliary jets of the rosette, so as to have them pass a little closer to the inner periphery of the neck of the cone on their way to the fire, and thereby more effectively aid the steam-jets of the annulus
 25 C in propelling air through the cone to the fire.

Instead of using either a rosette with one or a series of jet-passages, or a single-jet nozzle, a small annulus, D', Fig. 7, having a steam-
 30 inlet hollow arm, which is in communication with the bore of the annulus C, may be employed as an equivalent of the rosette or single-jet nozzle of the auxiliary steam-jet pipe D.

35 Instead of using one auxiliary jet-pipe, there may be two, three, or more, and on the end of each a jet-nozzle may be fitted, as illustrated in Figs. 6 and 8.

40 My invention is not confined to any precise arrangement or special form of auxiliary steam-jet pipe D, or to any particular number of jet-passages therein.

In practice I have found that with a cone fourteen inches in length from mouth to neck, thirteen inches in diameter at the mouth, and eight and one-half inches diameter at the neck, an annulus of about six inches diameter from center to center of its bore answers well; and that such annulus may have a bore of about
 50 three-quarters of an inch diameter, and there may be twelve jet-passages in the annulus, each having a diameter of about one-twelfth or one-thirteenth of an inch; or there may be an aggregated steam-discharging area in the
 55 annulus equal to a pipe of about one-quarter of an inch diameter. For this size of annulus a supply-pipe, C', of about three-quarters of an inch diameter in its bore leading from the boiler, may be connected by a reducing-socket,
 60 *a*³, and a half-inch nipple to the annulus. The auxiliary jet-pipe D may not exceed in its bore one-quarter of an inch in diameter, and the jet passage or passages in it may be of the same diameter as the jet-passages in the annulus;
 65 but if more than one auxiliary jet is used the diameter of the jets in both the annulus and

the rosette or central annulus, D', of the auxiliary pipe D, may be decreased, so that the aggregated area will be, say, about one-quarter of an inch, more or less. It will be understood
 70 that the aggregated area of all the steam-jet passages of the annulus C and auxiliary steam-jets of pipe D is much less than the cross-sectional area of the steam-supply pipe; and I believe it is my invention to thus employ a
 75 single-jet annulus either separated from or in combination with the auxiliary jet-pipe D when the aggregated jet-area for discharge is less than the cross-sectional area of the supply-pipe, and I desire my patent to cover the same
 80 in either way. The location of the annulus in the size of cone mentioned is preferable to be from five to seven inches from the neck, and the space between the annulus and the inner periphery of the cone may be about two inches
 85 all around, except where the supporting arm or arms of the annulus pass through the cone, and thus allow a large and free space for the air to flow through to the neck of the cone on the outside of the annulus or between the an-
 90 nulus and the cone. The pressure of the steam is preferably "high," for it is desirable that the jets have great velocity, and shall pass the neck of the cone without impinging on its inner periphery to such an extent as to cause a re-
 95 tarding of the outside air-current.

It will be seen that the auxiliary jet-pipe acts as a means for accelerating the movement of the air, which is drawn in mainly by the steam-jets of the annulus C, and thus when
 100 there is any tendency of the central air-current to move sluggishly the auxiliary jets act as assistants, and overcome the cause which produces such sluggish movement, the cause for the sluggish movement being a back-pressure of the blast in the ash-pit when the re-
 105 sistance of the deep fire-bed to its upward passage through the grate is greater than the pressure exerted alone by the jets of the annulus C to propel the air through the cone.

While I have given certain preferable proportions for a given sized cone and annulus, and also mentioned high pressure of steam as being desirable, I wish it to be understood
 110 that these proportions will require to be varied according to the size of the boiler-furnace and depth of fuel used on the grate, and also that the pressure in the boiler in some cases might be very slight and yet produce useful results. Therefore I do not confine myself to
 115 any precise proportions or degree of pressure, nor to any precise location of the annulus C, having the auxiliary jet-pipe D, with rosette or central annulus on it, so long as the steam-jets are propelled with sufficient force and ve-
 120 locity to pass through the neck of the cone without obstructing the inflow of air through the cone along with the steam.

In some constructions the central auxiliary jet-pipe might comprise two hollow support-
 125 ing-arms instead of one, and in some constructions the annulus C, with its auxiliary pipe

D', will be applied to a steam-supply pipe passed through the neck of the cone, instead of to a pipe passed through the periphery of the cone, as shown in Figs. 1, 2, and 3 of the drawings, and therefore my invention is not confined to any precise arrangement of the supply-pipe to which the annulus is connected, so long as the annulus is properly located with respect to the cone, and the steam-jets are caused to propel the air freely through the cone, said air passing through spaces both outside and inside the annulus, as illustrated by the arrows 2, while the steam indicated by the arrows 1 passes in the manner illustrated.

In Fig. 9 a modification of the air cone or duct is shown, the same being adapted for boilers having ash-pits below the level of the floor.

As bearing upon the leading novelty and utility of the invention herein described and shown, it should be borne in mind that high-pressure steam up to the point of the outlets is very important in order to obtain jets of steam having great velocity and consequent effectiveness as a motor to pull in air, and while this is so my invention might be of some use with steam at a pressure not very high—*i. e.*, in cases where the inlet is larger than the sum of the outlets—but it would be of comparatively little value at any pressure of steam where the sum of the outlets is larger than the inlet, for in such case the jets have comparatively small induction power for air through the neck of the blower, furnishing in all cases a blast too heavily charged with steam for the amount of air it contains, such blast being a detriment to the fire rather than a benefit, and just in proportion as the sum of the outlets is larger than the inlet will the detrimental effect be increased. And this rule works the other way—*i. e.*, just in proportion as the sum of the outlets is smaller than the inlet will the jets of steam be projected with greater velocity and therefore with better effect for the purpose evolved; but for all practical purposes, (in a steam and air blower,) if the inlet is several times greater than the sum of the outlets, the purpose is served, but in no case can it be obtained by having the sum of the outlets larger than the inlet, nor yet when they are equal.

In making comparisons in the last statement I have used the words "sum of the outlets," &c., and in order to be more correctly understood would say that I mean by that expression the aggregated cross-sectional areas of the jet-perforations or steam-outlets, and have no reference to the number of them.

To indicate the state of the art I refer to Letters Patent No. 182,204, Reissue No. 2,855, No. 2,976 for 1857, English, and No. 48,850, and in view of these patents my invention is confined to steam and air blowers combined which practically have an unobstructed air-space between the periphery of the steam-jet ring and the inner periphery of the cone or air-duct

within which the ring is placed centrally, and in suitable relation to the neck of the cone or air-duct, as fully described, and it is also confined to a steam-jet ring which has the entrance for the supply-steam formed by a hollow arm or branch extending out from the periphery of the ring, and not extending over the central or inner space inclosed by said ring.

As indicating the state of the art prior to my invention, reference is made to the patent of Lawrence, No. 182,204, dated September 12, 1876, and I make no claim to anything shown and embraced by said patent.

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

1. The combination of an air-cone, a steam-supply pipe, and a single annulus with separated jet-perforations forming an aggregated cross-sectional discharging-area much less than the cross-sectional area of the steam-supply pipe, whereby the separated jets of steam can have their entire circumferences exposed to the air, and thereby an increased drawing power secured, and also a practically unobstructed air-space is maintained within and outside the circle of the annulus by the velocity or pressure of the steam, carrying the jets forward with a sufficient force through the neck of the cone to prevent the blocking of the air-ways with a body of steam behind said neck both outside and inside the circle of the annulus, substantially as described.

2. The small auxiliary steam-jet pipe or pipes D, in combination with the single steam-jet annulus C, with separated jet-perforations, and having steam-supply entrance in its periphery, and an air-cone, whereby while the separated jets of steam have their entire circumferences exposed to the air and thereby an increased drawing power secured, and also a practically unobstructed air-space formed and maintained outside the circle of the annulus, the action of the jets of the annulus is assisted by the auxiliary jet pipe or pipes within the circle of the annulus, substantially as described.

3. The combination of the high-pressure steam-supply pipe, the steam-jet annulus C, having an aggregated cross-sectional steam-discharging area less than the cross-sectional area of the supply-pipe, the small steam-jet pipe D, having appropriate jet-nozzle, rosette, or annulus on it at the center of the cone, and an air-cone or air-duct, substantially as described.

4. The combination of the high-pressure steam-supply pipe, the steam-jet annulus having an aggregated cross-sectional steam-discharging area less than the cross-sectional area of the steam-supply pipe, the small auxiliary steam-jet pipe D, having a steam-jetting device on its inner end, and an air cone or duct, substantially as and for the purpose described.

5. The combination, with the cone B, of a single-jet ring, C, arranged centrally within the cone and having an arm for supply-steam at its periphery, an unobstructed air-space practically between itself and the cone, and an auxiliary jet-pipe, D, extending to near its center from its inner periphery, said pipe D terminating in suitable form, as shown and described, for discharging steam in jet form within the circle of the ring, all substantially as and for the purpose described.

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