No. 889,713. PATENTED JUNE 2, 1908.

W. McCLAVE.

BLOWER.

APPLICATION FILED SEPT. 5, 1907.

2 SHEETS—SHEET 1.

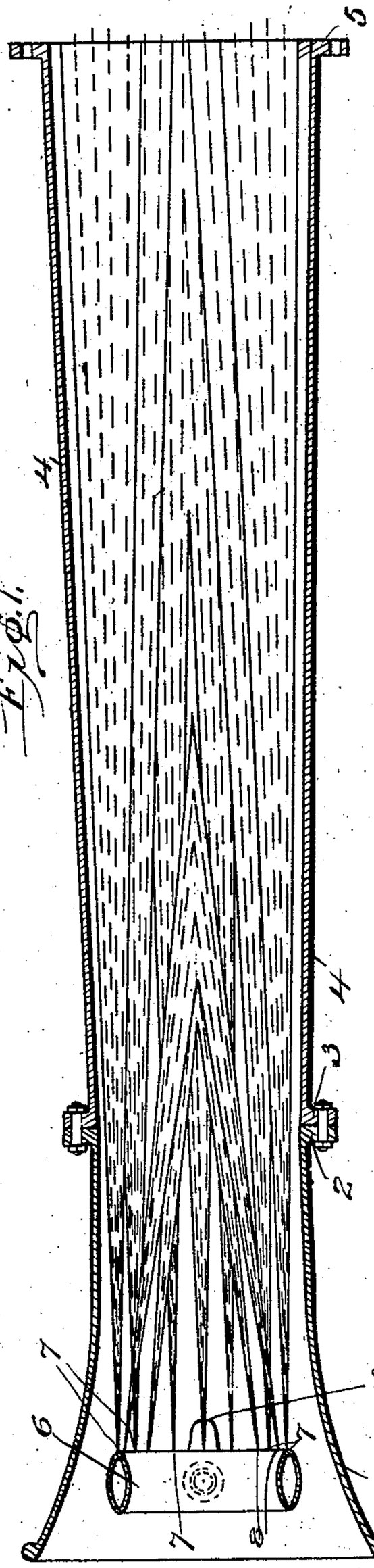

Fig. 1.

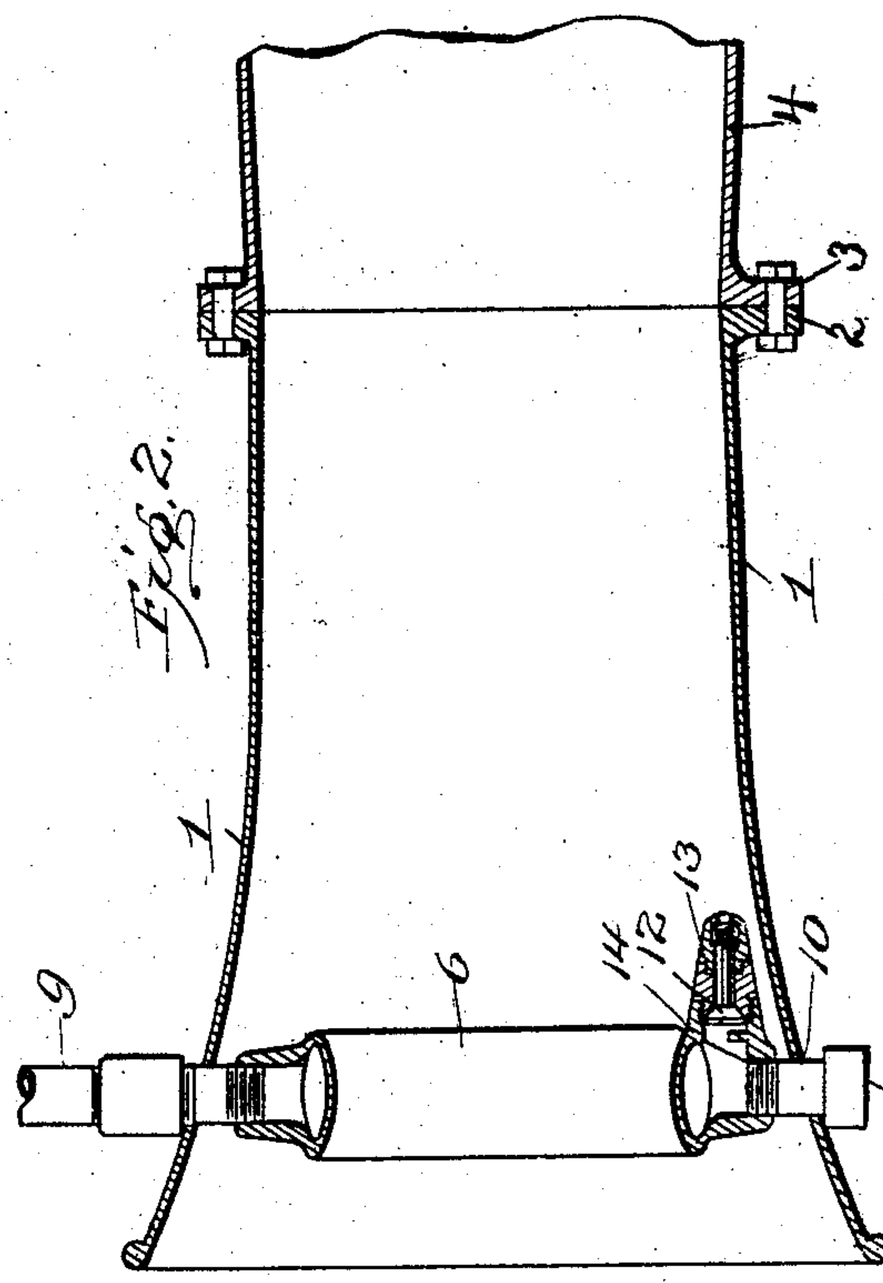

Fig. 2.

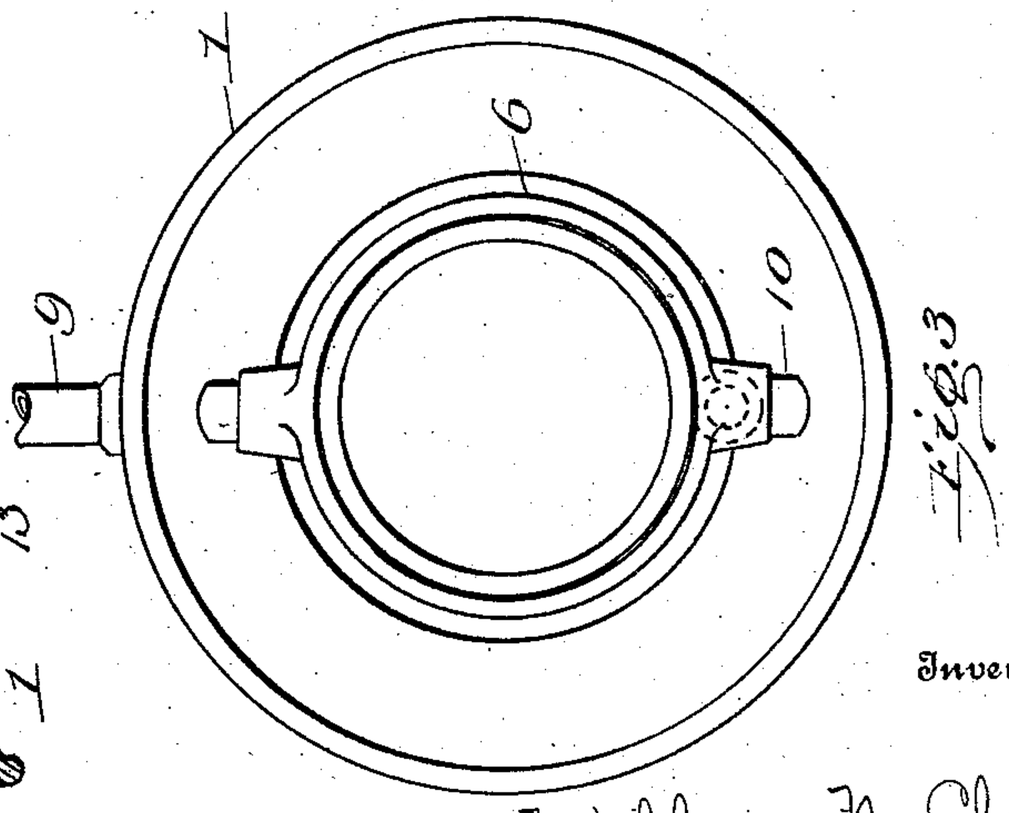

Fig. 3

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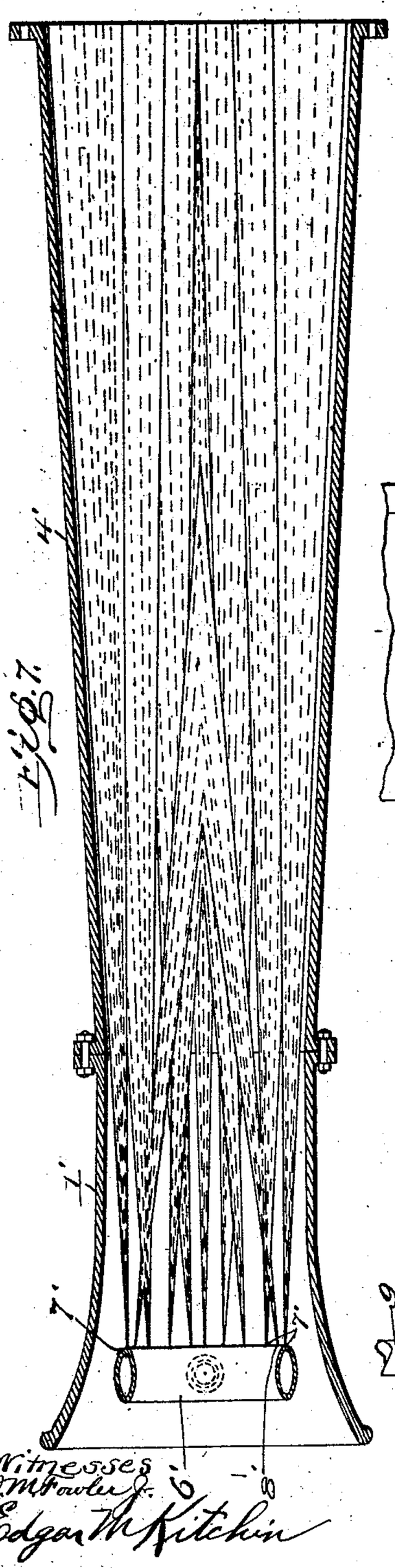

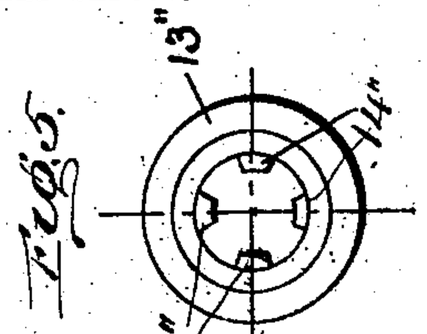

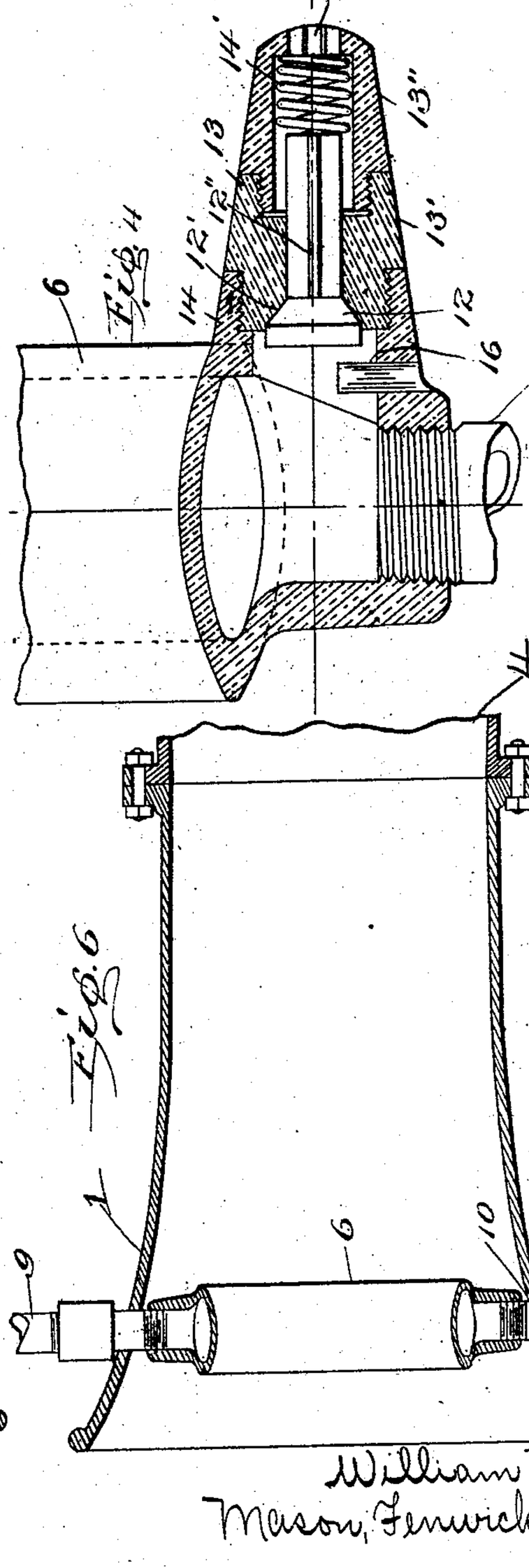

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BLOWER.

No. 889,713. Specification of Letters Patent. Patented June 2, 1908.

Application filed September 5, 1907. Serial No. 391,495.

To all whom it may concern:

Be it known that I, WILLIAM McCLAVE, a citizen of the United States, residing at Scranton, in the county of Lackawanna and State of Pennsylvania, have invented certain new and useful Improvements in Blowers; 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 improvements in blowers, and the object in view is the obtaining of a maximum intake of air with any given amount of steam pressure.

With this and further objects in view, the invention comprises proportioning a directing nozzle relative to intake steam jets directed therethrough such as to practically exactly accommodate the amount of regular expansion of the lines of force of the steam jets without allowing space for back suction, nor yet compress to any considerable extent within the nozzle the moving mass of steam and air.

The invention comprises certain other novel features of construction, combinations and arrangements of parts as will be hereinafter fully described and claimed.

In the accompanying drawings:—Figure 1 is a longitudinal, horizontal section through a blower embodying the features of the present invention. Fig. 2 is a vertical, longitudinal section taken at right angles to the plane of the section of Fig. 1, a portion of the discharge nozzle being broken away. Fig. 3 is an end view thereof. Fig. 4 is an enlarged, detail, fragmentary section disclosing the clean out valve in detail. Fig. 5 is an end view of the clean out valve and casing. Fig. 6 is a section similar to Fig. 2 indicating a slightly modified form of clean out valve apparatus applied thereto. Fig. 7 is a view similar to Fig. 1 of a slightly modified form of construction.

In the blower art it was originally supposed that best results were to be obtained by discharging a jet of steam through an intake bell and discharge nozzle connected with said bell, the nozzle tapering toward a point of connection with the bell to its discharge end whereby the discharge from the end of the nozzle was effected with considerable velocity. The difficulty with this form of blower however was found to reside in the great amount of friction of the lines of force of the steam with the sides of the nozzle as the steam became more and more crowded toward the end of the nozzle. To obviate this difficulty efforts have been made in the direction of flaring the discharge end of the discharge nozzle so as to obviate the crowding of the steam and the resulting friction. The flares heretofore used, however, have been carried to an extreme producing almost as objectionable a result as the crowding of the steam by leaving an annular space within the bell outside the lines of force of the steam, which space produces a back suction. There is a material difference between the lines of force of steam and the lines of the volume of steam, for the entire shell of a blower may be filled with a cloud of steam mixed with air having comparatively no force and of course the resultant discharge will not comprehend a maximum amount of air and will therefore not give the best possible results. Only those portions of the blast which are directly in line with the lines of force of the steam really are effective in the operation of the blower, the surrounding cloud of steam simply producing eddy currents and back suction which tend materially to reduce the amount of air projected through the blower.

The present invention contemplates the obviating of the waste of power and the induction through the blower of a maximum amount of air with a given head of steam by the elimination of the objections arising both from the restricted and from the too greatly flared nozzle, and this object is obtained largely by the provision of a nozzle which flares gradually in a ratio proportionate to the natural flare of the lines of force of the steam so that the present improved nozzle is adapted to accommodate at all points the said lines of force without offering any space for back suction or dead areas of steam, and at the same time the improved nozzle offers no resistance to the passage of the active steam.

The present invention is susceptible of various embodiments, and in order that the invention may be fully set forth two embodiments have been illustrated in the accompanying drawings, of which, for the purpose of the present application I shall refer to that disclosed in Fig. 1 and the detail figures

thereof as the preferred embodiment. Referring therefore to the preferred embodiment as illustrated, 1 indicates the intake bell of the blower, which bell is transversely circular and longitudinally tapering from its intake to its end. The inner end of the bell 1 is provided with an annular flange 2 to which is bolted or otherwise suitably secured the annular flange 3 of the contiguous or outer end of a discharge nozzle 4. I employ the terms inner and outer ends with reference to the structure assuming the blower to be positioned horizontally, but obviously if the blower is positioned vertically with the bell uppermost, the said ends may be referred to respectively as lower and upper ends or if the occasion should arise for using the blower in an inverted condition, reference might then be made to the said ends respectively as upper and lower ends. For the purpose of this description however, it is assumed that the blower is disposed horizontally with the understanding of course that the blower may be positioned in any relationship to the furnace to be supplied with air as may be found most desirable. The nozzle 4 flares gradually to its inner end in a ratio proportionate to the natural spread or flare of the lines of force of steam being projected through the bell and nozzle, and at the inner end of the nozzle the same is provided with an annular flange 5 adapted for connection with a conduit of any preferred type.

Within the outer end of the bell 1 is arranged a hollow annulus 6 supplied with steam under pressure through a pipe 9, the annulus being formed elliptical in transverse section as seen in the drawing. The inner end of the annulus is provided with a series of apertures as indicated at 7, 7 which are bored parallel to the longitudinal axis of the annulus, and as the longitudinal axis of the annulus is coincident with and in the line of the longitudinal axes of the bell 1 and nozzle 4, the said bores 7 are parallel to the longitudinal axis of the nozzle 4, and therefore the longitudinal axes of the several jets of steam project through the aperture 7 and are parallel to the longitudinal axis of the nozzle 4. The bores or apertures 7 are spaced apart about the entire annulus. The annulus 6 is also formed with a set of bores or apertures 8, 8, one bore 8 being disposed between each of the two bores 7, and the bores 8 being inclined so as to project converging jets of steam which meet within the nozzle 4. The circle of the apertures or bores 7 is concentric to the outer end of the nozzle 4 and of less diameter than said end, the difference in diameter being such as to accommodate the natural spread or flare of the lines of force of steam from the said several jets, the outer end of the said nozzle having its diameter even slightly larger than the diameter of the column of lines of force of steam entering the nozzle so that a thin annular film of air may exist between said column of steam and the wall of the nozzle for preventing skin friction. The nozzle 4 gradually flares toward its inner end in a ratio proportionate to the natural spread or flare of the lines of force of the steam jets from the apertures 7, and the space for the thin film of air is maintained throughout the length of the nozzle, but is not permitted to increase in thickness, and therefore no back suction or objectionable eddy current results. The converging jets produce lines of force of steam within the circular column of the lines of force produced by the jets from the apertures 7, and therefore the entire nozzle 4 is filled with a solid column or piston of active lines of force of steam taking with them a maximum volume of air.

Communicating with the lowermost point of the annulus 6 is a tube 10 which extends through the lower wall of the bell 1 and is provided with a removable cap 11, the cap being adapted to be removed for the insertion of a cleaning out tool for the annulus. However, necessity for cleaning out may be largely obviated by the provision of a bleeding valve 12 arranged within a casing 13. The casing 13 may be threaded directly into the connection of the pipe 10 as at 14 within the bell 1, or the said valve casing 13 may be threaded into an L[15] or other suitable connection threaded onto the other end of the pipe 10. Whether the valve 12 is arranged within the bell 1 as seen in Fig. 2 or outside of the same, as seen in Fig. 6, the construction of valve and valve casing is the same, and therefore detail description of the structure with reference particularly to Figs. 4 and 5 is applicable to both arrangements, the outside valve of course requiring some form of conduit pipe while the inside valve has its discharge taken care of through the intake bell and discharge nozzle. The valve and casing are preferably constructed as seen in detail in Figs. 4 and 5 in which the casing is indicated as being formed of a nipple 13′ into which is threaded a second nipple 13″, the nipple 13′ being provided with a valve seat 12′ for the valve 12. The valve 12 is formed with the usual head and with a stem 12″ extending through the nipple 13′ and into the nipple 13″ and is engaged at its outer end by a spring 14′ which presses the valve away from its seat, the spring resting upon radially inwardly extending lugs 14″, 14″ formed at the outer end of the nipple 13″, said nipple being provided with an internal bore for accommodating the spring 14″. A lug 16 projects into the path of movement of the valve 12 for limiting the inward movement thereof.

In operation, when the steam is first admitted to the annulus 6 the pressure thereof is comparatively low, and therefore the steam will escape past the valve 12, which is normally held off of its seat by the spring 14.

The steam continues to escape past the valve 12 until the pressure thereof is sufficient to counteract the pressure of the spring 14′ whereupon the steam pressure will seat the valve 12 against the pressure of the spring 14 and causes the said valve to retain its seat. In the meantime, it is obvious that the escaping steam has cleaned out the scale from the annulus which gathers there from the steam supply pipe, thereby stopping up the smaller jet holes. If it is desired to further clean out the annulus without removing the cap 11 and inserting a cleaning tool, it is only necessary to pass a rod into the inner end of the nipple 13″ until it strikes the end of the valve stem 12″ and presses the valve 12′ off of its seat against the steam pressure. A suitable hook or bent rod might be employed for this purpose with facility, and, as soon as the valve 12 is forced off its seat, the steam under high pressure, say for instance 80 or 90 pounds to the square inch will escape and thoroughly clean out the annulus. As soon as the rod is removed, the valve 12 will again take its seat, and the further escape of steam will be prevented.

Although, as expressed above, it is preferable to have the apertures 7 disposed in such manner that the longitudinal axes of the resultant jets of steam will all be parallel to the longitudinal axis of the nozzle 4, particularly when a high pressure blast is desired, I have been able to obtain efficient results where a lower pressure blast is desired by arranging the jets in such manner as to diverge as indicated for instance in Fig. 7, the salient point being the flaring of the discharge nozzle in a ratio proportionate to the natural spread or flare of the lines of force of the steam whereby frictional resistance of the flow of the steam is obviated and at the same time no back suction is produced.

In Fig. 7 I have illustrated the intake bell 1′ and discharge nozzle 4′ differing only from the bell 1 and nozzle 4 in that the inner end of the bell is slightly enlarged or increased in diameter, and the outer end of the nozzle is correspondingly increased in diameter, and the said nozzle flares to a greater extent. The annulus 6′ is provided with apertures 7′, 7′ which are inclined outwardly for producing diverging jets of steam, but the divergence is only sufficient for causing the lines of force of the steam to pass along contiguous to the walls of the nozzle 4, sufficiently free therefrom not to be subjected to frictional resistance, the natural lateral spread or expansion of the lines of force being accommodated by the flare of the nozzle and such flare being proportioned substantially in the ratio of the natural spread or flare of the lines of force of the steam. The annulus 6′ is also provided with the bores or apertures 8′ arranged for directing converging jets for filling the central portion of the nozzle with lines of force of steam so as to introduce a complete compact solid column or piston containing a maximum amount of air.

The intake bell is, of course, preferably bell shaped, but obviously may be made in the form of a cone or otherwise as found preferable, and I wish the term bell employed throughout the appended claims to be so construed as to comprehend any of such obvious modifications. Furthermore, while I have described the intake bell and discharge nozzle as being formed separately and secured together, it is apparent that the two parts may be formed integral and the claims should be construed accordingly, it being immaterial so far as the operation is concerned whether the bell and nozzle are formed integral or merely connected together so long as the bell merges into the nozzle and thus produces a continuous passage-way constituting, when considered as an entirety, a blower duct to which may be connected any desired form of conduit for delivering the blast to any point preferred.

What I claim is:—

1. In a steam blower duct, the combination of an intake portion and a relatively long discharge nozzle, the intake portion converging inwardly for some distance and then merging into the discharge nozzle which discharge nozzle flares longitudinally away from the merging point its entire length, a hollow annulus disposed within the intake portion, and means for supplying the annulus with steam, said annulus being provided with two series of discharge openings for steam jets, one series discharging in lines which keep the longitudinal axes of the several jets parallel with the longitudinal axis of the discharge nozzle, the flare of the discharge nozzle being in a ratio proportionate to the expansion of the lines of force of the said steam jets, the other series of jets being directed in converging lines toward the longitudinal axis of the nozzle.

2. In a steam blower duct, the combination of an intake portion and a relatively long discharge nozzle merging into the inner end thereof, and flaring longitudinally from the point of merger throughout its entire length, a hollow annulus disposed within the intake portion, means for supplying steam to the annulus, said annulus being provided with two series of discharge openings of steam, one series discharging in lines converging to the longitudinal axis of the discharge nozzle, and the other series of jets discharging in lines adapting the outer sides of their expanding lines of force to conform substantially to the longitudinally flaring lines of the discharge nozzle for the entire length thereof.

3. In a blower, the combination with an intake bell, of an annulus formed for discharging steam into the bell, means for supplying

steam to said annulus, a valve casing open to the atmosphere and communicating with said annulus, said casing being formed with an internal bore, a spring disposed within the bore, the free end of the valve casing being formed with lugs retaining the spring in position, the valve casing being formed with a valve seat, a valve within the valve casing adapted at times to rest upon said seat under steam pressure, and a spring for said valve disposed for normally maintaining the valve off of its seat, the spring being disposed for moving the valve in a direction opposing the pressure of the steam within the annulus.

4. The combination with an intake steam blower duct, of an annulus adapted to discharge into the bell, means for supplying steam to said annulus, a valve casing communicating with the annulus and opening to the atmosphere, a valve within said casing, a spring normally maintaining said valve open, and means adapted to apply the pressure of the steam to close the valve when the pressure of steam exceeds the spring pressure.

5. The combination with an intake steam blower duct of an annulus formed for discharging steam into the bell, means for supplying steam to said annulus, a valve casing communicating with said annulus and open to the atmosphere and formed with a valve seat, and a valve within said casing adapted to prevent escape of steam when held upon its seat by steam pressure, a spring for moving the valve inwardly when the steam pressure falls below the tension of the spring, and means to limit the inward movement of the valve.

6. In a steam blower duct, the combination of an intake portion, and a relatively long discharging nozzle merging with the inner end thereof, and flaring longitudinally from the point of merging throughout its entire length, a hollow annulus disposed in the intake portion, means for supplying steam to the annulus, said annulus being provided with two series of discharge openings for steam, one series discharging in lines converging to the longitudinal axis of the discharge nozzle, and the other series of jets discharging in lines adapting the outer side of their expanding lines of force to conform substantially to the longitudinal flaring lines of the discharge nozzle for the entire length thereof.

7. In a steam blower, a discharge nozzle adapted to discharge a series of jets of steam within and conforming to the periphery and flare of an outwardly flaring duct-extension, circular in cross section, maintaining substantially an air-way of uniform thickness between the extending lines of the steam jets and the inner periphery of the duct extension.

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

WILLIAM McCLAVE.

Witnesses:
W. W. Baylor,
D. J. Davis.