P. H. KANE.

TURBINE BLOWER.

APPLICATION FILED AUG. 22, 1910.

1,017,001.

Patented Feb. 13, 1912.

4 SHEETS—SHEET 1.

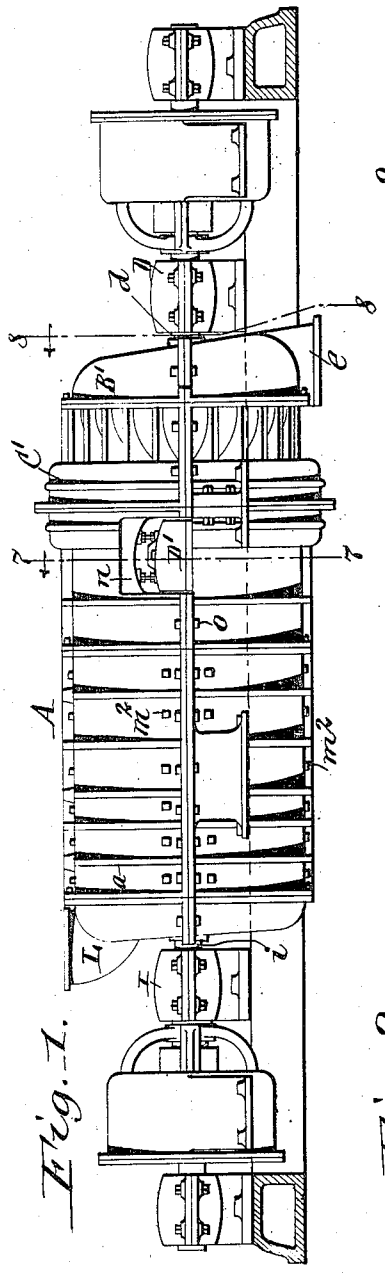

Fig. 1.

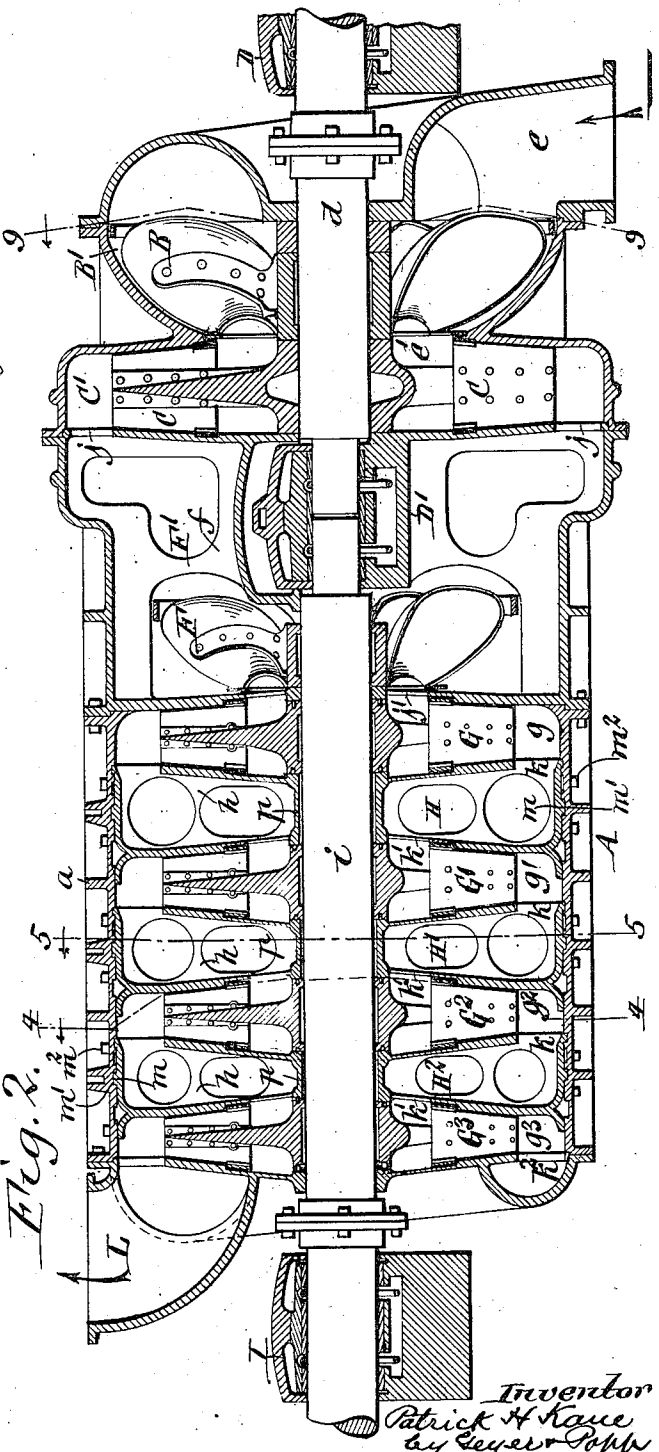

Fig. 2.

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4 SHEETS—SHEET 2.

Fig. 4.

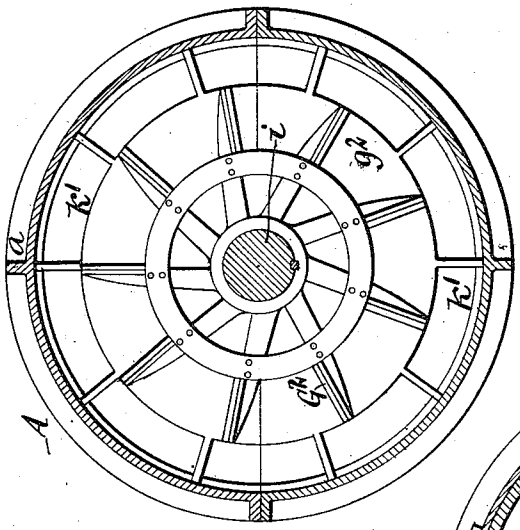


Fig. 5.

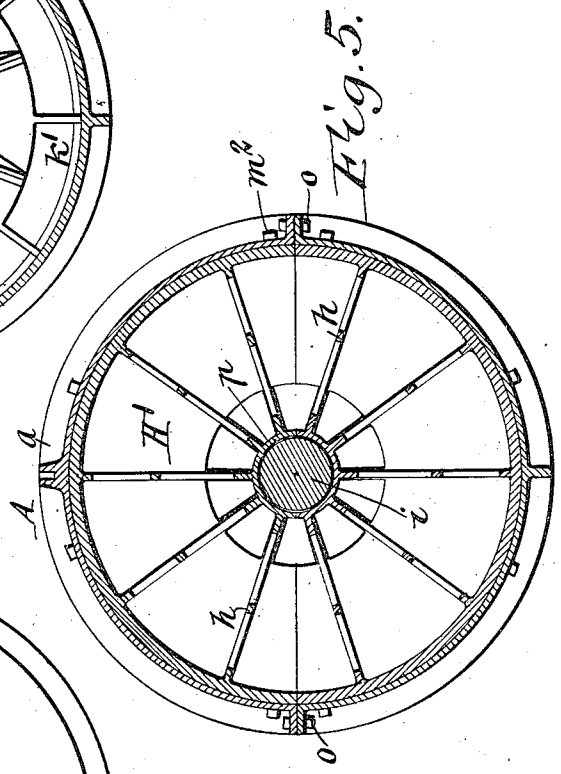


Fig. 3.

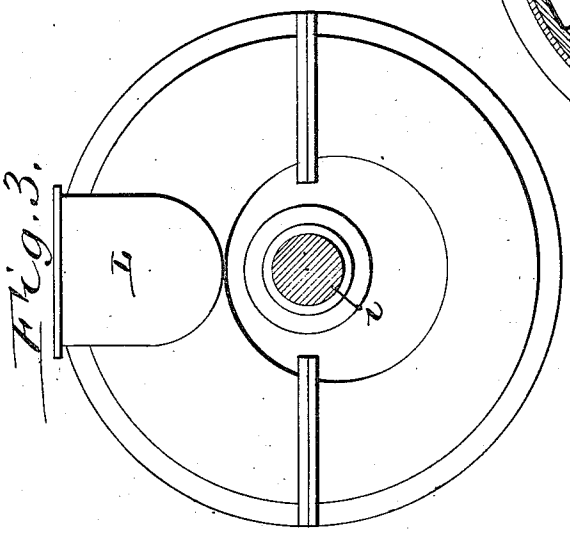
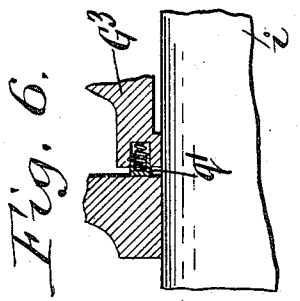


Fig. 6.



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4 SHEETS—SHEET 3.

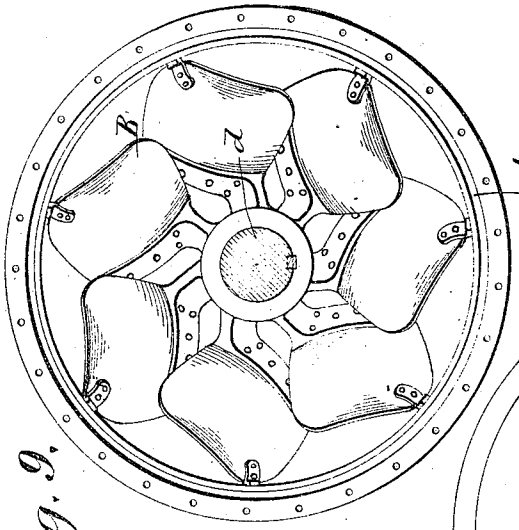

Fig. 9.

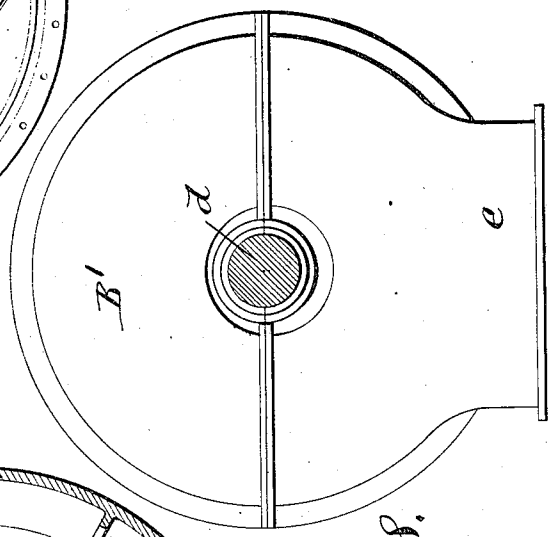

Fig. 8.

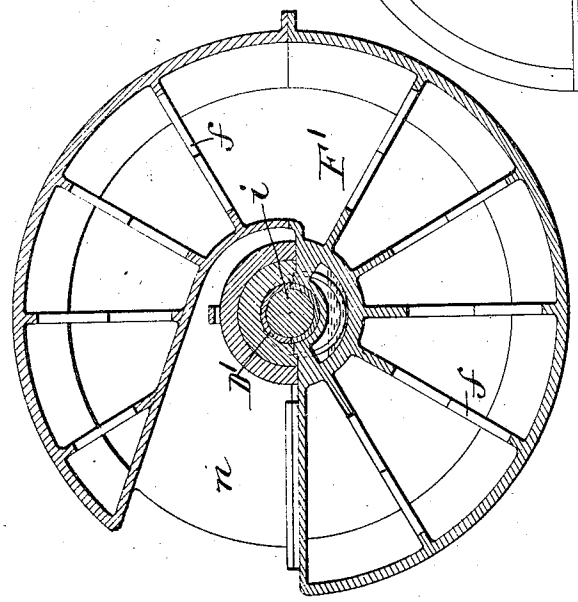

Fig. 7.

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4 SHEETS—SHEET 4.

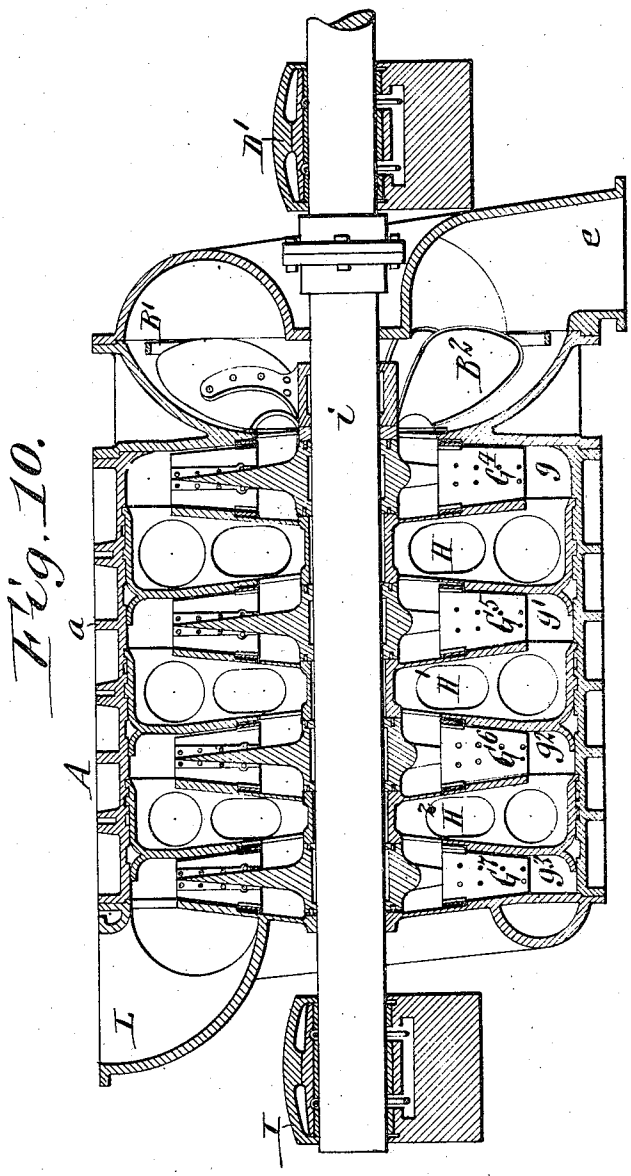

Fig. 10.

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UNITED STATES PATENT OFFICE.

PATRICK H. KANE, OF BUFFALO, NEW YORK.

TURBINE-BLOWER.

1,017,001. Specification of Letters Patent. Patented Feb. 13, 1912.

Application filed August 22, 1910. Serial No. 578,351.

To all whom it may concern:

Be it known that I, PATRICK H. KANE, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Turbine-Blowers, of which the following is a specification.

The object of my invention is the provision of a compact, efficient and comparatively inexpensive blower of the turbine type capable of producing an air pressure high enough to blow steel converters, blast furnaces and the like, where a large volume of air of considerable pressure is required.

One feature of the invention consists in constructing the blower of low and high pressure sections, in such manner that the free air is received by the low pressure section and compressed to a certain degree and thence delivered to the high pressure section where it is further compressed to the desired degree for use, thus producing practically a compound turbine blower.

Another feature of the invention consists in constructing the fans or propellers and their cases of progressively decreasing area or dimensions in order to reduce its volume and increase its pressure as it passes through the several stages from the inlet to the delivery end of the blower.

The invention consists further in certain structural features designed to reduce the weight of the machine and facilitate the assemblage of its parts.

In the accompanying drawings consisting of 4 sheets: Figure 1 is a side elevation of the improved blower, with the bed plate shown in section. Fig. 2 is a longitudinal central section thereof, on an enlarged scale. Fig. 3 is a rear view of the blower with the shaft shown in section. Figs. 4 and 5 are transverse sections, on the correspondingly-numbered lines in Fig. 2. Fig. 6 is a fragmentary longitudinal section of one of the air propellers, showing its packing ring. Figs. 7 and 8 are transverse sections on lines 7—7 and 8—8, Fig. 1. Fig. 9 is a similar section on line 9—9, Fig. 2. Fig. 10 is a longitudinal central section of a modified construction of the blower.

Similar letters of reference indicate corresponding parts throughout the several views.

Referring to the embodiment of the invention shown in Figs. 1–9, A indicates the casing of the machine, preferably of cylindrical form and stiffened by ribs *a*. The low pressure section of the blower comprises an inlet fan or propeller B, and one or more low pressure fans or propellers C arranged respectively in chambers B^1 C^1 of the casing and both secured to a shaft *d* supported in suitable bearings D, D^1. The shaft may be driven by a motor of any suitable or desired type, but I prefer to use a steam turbine. An air inlet connection *e* leads to the first inlet chamber B^1 and the latter communicates with the propeller chamber C^1 by a passage e^1. Both the inlet propeller B and the low-pressure propeller C may have ordinary fan-blades, if desired, but the inlet propeller is preferably constructed to grasp and draw a comparatively large volume of free air into the inlet chamber B^1, and for this purpose it is provided with scoop-like blades, as shown in Figs. 2 and 9.

In the drawings, a single low pressure propeller C is shown, but a plurality of such propellers may be employed, if desired.

The high pressure section of the blower comprises a scoop or supply-propeller F similar to the inlet propeller B, a series of high pressure fans or propellers G, G^1, G^2, G^3 similar to the low pressure fan C, but preferably of somewhat smaller diameter, a chamber F^1 containing the supply-propeller, and air chambers or receivers H, H^1, H^2, alternating with said high-pressure propellers and located on the inlet sides thereof, respectively. The supply propeller F and said high-pressure propellers are mounted on a common shaft *i* supported in the intermediate bearing D^1 and a rear bearing I. This shaft is independent of the shaft *d* and adapted to be driven at a higher speed by a motor of any suitable construction, although I prefer a steam turbine. The several propellers G, G^1, G^2, G^3 are arranged respectively in propeller chambers *g*, g^1, g^2, g^3.

As shown in Fig. 2, the supply chamber

or reservoir F^1 communicates with the fan chamber C^1 by an annular passage j arranged near the periphery of said chambers, and with the chamber g of the first high pressure propeller by an annular passage j^1 arranged near the center of said chambers. Each of the receivers H—H^2, communicates near its periphery with the propeller chamber in rear thereof by a passage k, and near its center with the propeller chamber in front thereof by a passage k^1, while the peripheral passage k^2 of the last propeller chamber leads into the outlet or delivery connection L of the blower.

In order to stiffen the casing of the machine and permit a lighter construction thereof, the supply chamber F^1 is provided with perforated radial webs f extending from the front to the rear wall of said chamber and from its cylindrical wall to the bearing D^1. For the same purpose, the front and rear walls of the receivers H—H^2 are connected by similar perforated webs h. To facilitate the construction and assemblage of the parts, said receivers are preferably divided horizontally into upper and lower sections cast separate from the casing A and interlocked therewith by coöperating tongues m and grooves m^1 formed on these parts and secured thereto by bolts m^2, as shown in Fig. 2. The receivers may however be secured in place by any other suitable means. To admit the receivers and other internal parts, the casing A is divided horizontally into upper and lower halves or sections which are secured together by bolts o, as shown in Fig. 2. The sides of these receivers form the side walls of the high-pressure propeller chambers or compartments. By this construction, the receivers also serve to stiffen the casing, permitting a lighter construction thereof.

In order to gradually reduce the volume and increase the pressure of the air forced through the blower, the high-pressure propellers are made progressively narrower or of smaller blade-area toward the delivery end of the machine, as shown in Fig. 2, the dimensions of the receivers H—H^2 being correspondingly graduated.

As shown in Figs. 1 and 7, the casing is provided in one side with a recess or housing n leading to the intermediate shaft-bearing D^1, and isolated from the interior of the casing. The lower part of this bearing is located within the casing, while its removable cap or upper part is located within said recess or housing, as shown. By this construction, said bearing cap can be removed without permitting air to escape from the casing, enabling the bearing to be inspected without stopping the blower and without the necessity of removing the top-section of the casing.

The receivers H, H^1, H^2 are provided centrally with hubs or thimbles p which loosely surround the shaft i and abut at their ends against the hubs of the adjacent propellers. The bore of the hub of each of the receivers H—H^2 is made larger in diameter than the periphery of the shaft i and out of contact therewith so as to prevent the shaft from engaging with the bore of the receivers when this shaft i or the bearings D^1, I become worn and the shaft drops slightly. Suitable packings are interposed between these hubs and thimbles and between the last propeller G^3 and the rear wall of its chamber to form practically air tight joints. The preferred packing (best shown in Fig. 6) consists of a spring-pressed ring q^1 seated in an annular groove in the end of the propeller hub and bearing against the adjacent hub or wall.

The operation of the blower is as follows: The shaft d of the inlet propeller B and the low pressure propeller C is driven at a comparatively low speed, while the shaft i of the high pressure propellers G—G^3 is driven at a relatively high speed. The purpose of employing comparatively large inlet propellers driven at a low speed is to draw a very large volume of free air into the blower-casing at some pressure and at a speed to supply the quantity of air required by the high-pressure propellers. The air thus grasped by the inlet propeller B is somewhat compressed in the inlet chamber B^1 and delivered into the chamber C^1 of the low-pressure propeller C which after further compressing it, expels it into the supply chamber F^1 of the high-pressure propellers. From this chamber the partly-compressed air is taken by the scoop-propeller F and forced into the chamber g of the first high-pressure propeller G, which latter in turn forces the air through the exit-passage k into the receiver H, whence the air is successively forced by the propellers G^1, G^2 and G^3 through the remaining chambers g^1, g^2, g^3 or stages of the machine until it is finally discharged through the outlet connection in a highly compressed state and delivered to the blast furnace or other apparatus. As the air is forced through the several stages, its pressure is increased or compounded, this effect being increased by the progressive diminution of the dimensions of the high-pressure propellers and the intervening receivers hereinbefore described.

It will be understood from the foregoing that the efficiency of this compound turbine blower is due to grasping a maximum volume of free air and conveying it through the low-pressure stage or stages into a receiver which thus furnishes a large volume of partly compressed air to the high-pressure propellers which latter owing to their greater speed further compress the air to the desired pressure.

If desired, the feature of grading the width of the pressure fans or propellers may be combined with an air supply fan or scoop-fan, without the use of a low-pressure propeller. Such a modified construction is shown in Fig. 10, in which G^4—G^7 indicate the pressure-fans, and B^2 the scoop-fan.

By mounting the high and low pressure propellers side by side on independently-driven shafts which are arranged end to end, I combine the advantage of gradually compressing the air by stages with the advantage of a strong and compact construction of the rotary elements or propellers which permits propeller-units to be added or multiplied horizontally for increasing the capacity of the machine. The propellers can by this construction and arrangement be made of comparatively small diameter to afford the necessary strength to withstand the great centrifugal strain to which they are subjected, without requiring an unduly heavy and expensive construction thereof. When such fans or propellers are arranged concentrically as has hitherto been proposed, the outer or large ones must be made of considerable diameter in order to obtain a machine of comparatively large capacity. In a blower of large capacity, such as required for blast furnaces and converters, this concentric form would not only render the machine objectionably tall and expensive, but the increased diameter of the outer propeller or propellers which obviously travel at the highest peripheral speed and under the greatest strain, would have the least strength, owing to the length of their arms or the diameter of their webs, requiring them to be made so heavy as to render this concentric type of blower impracticable for large machines.

I claim as my invention:

1. A compound turbine blower comprising a low pressure air propeller, a high pressure air propeller which receives the air from said low pressure propeller, the low and high pressure propellers being mounted side by side on independent shafts arranged end to end, and means for independently driving said shafts.

2. A compound turbine blower comprising a low pressure air propeller, a high pressure air propeller which receives the air from said low pressure propeller, the low and high pressure propellers being mounted side by side on independent shafts arranged end to end, and independent motors for driving said propellers at different speeds.

3. A compound turbine blower comprising a low pressure air propeller, a high pressure air propeller which receives the air from said low pressure propeller, the low and high pressure propellers being mounted side by side on independent shafts arranged end to end, means for independently driving said shafts, and an air chamber located between said low and high pressure propellers, said chamber receiving the air from the low pressure propeller and delivering it to the high pressure propeller.

4. A compound turbine blower comprising a case containing a series of propeller-chambers arranged side by side, a plurality of pressure-propellers arranged in said chambers and each delivering air to the succeeding chamber, said chambers and propellers being constructed of progressively-decreasing dimensions toward the outlet of the blower, and an air-gathering and supply fan having scoop-shaped blades and arranged to deliver air into the first of said propeller-chambers.

5. A compound turbine blower, comprising a low-pressure air propeller, an inlet propeller arranged to deliver the incoming air to the low-pressure propeller, a plurality of high-pressure air-propellers, and a supply propeller interposed between said low-pressure propeller and the first of the series of high-pressure propellers.

6. A compound turbine blower, comprising a low-pressure air propeller, an inlet propeller arranged to deliver the incoming air to the low-pressure propeller, a plurality of high-pressure air-propellers, receivers alternating with the last-named propellers, and a supply-propeller arranged between said low-pressure propeller and the first of the series of high-pressure propellers.

7. A turbine blower, comprising a case, a shaft bearing arranged therein, independent shafts having their inner ends supported in said bearing, a low-pressure propeller mounted on one of said shafts, a high-pressure propeller mounted on the other shaft, the low-pressure propeller delivering air to the high-pressure propeller, and means for driving said shafts at different speeds.

8. A turbine blower, comprising a case having an air inlet and an outlet, front and rear bearings located at opposite ends of the case, an intermediate bearing arranged within the case, a front shaft mounted in said front and intermediate bearings, a rear shaft independent of said front shaft mounted in said rear and intermediate bearings, independent motors for said shafts, a low-pressure air-propeller mounted on said front shaft and a high-pressure air-propeller mounted on said rear shaft, said low-pressure propeller delivering air to the high-pressure propeller.

9. A turbine blower, comprising a case, a shaft arranged therein and carrying an air-propeller, said case having an external recess isolated from the interior thereof, and a bearing for said shaft having a lower part arranged in the case and a removable cap arranged in said recess.

10. A turbine blower, comprising a case

divided horizontally into upper and lower sections, means for securing said sections together, a shaft arranged centrally in the case, air propellers mounted on said shaft, air receivers alternating with said propellers and divided into sections corresponding with those of the case, said receivers being separate from the case and extending from said shaft to the peripheral wall of the case, and means for securing said receivers to the case.

Witness my hand this 18th day of August, 1910.

PATRICK H. KANE.

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ANNA HEIGIS.