G. W. ALLEN.

MULTISTAGE BLOWER FOR PNEUMATIC CLEANERS.

APPLICATION FILED SEPT. 22, 1915.

1,247,064.

Patented Nov. 20, 1917.

2 SHEETS—SHEET 1.

Fig. 3



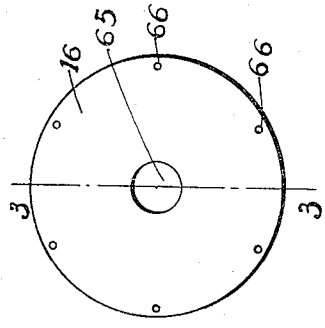


Fig. 2

Fig. 1

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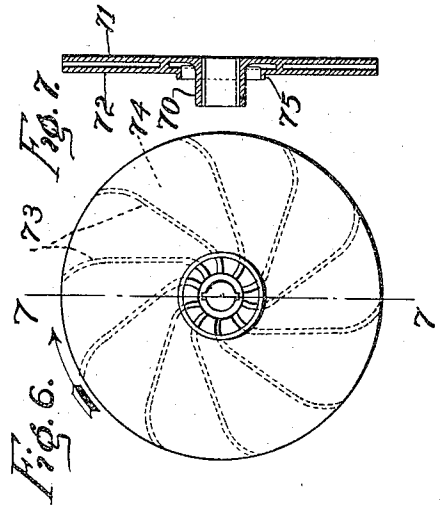


Fig. 7.

Fig. 6.

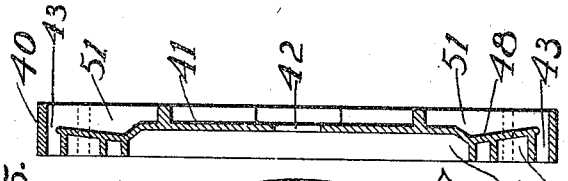


Fig. 5.

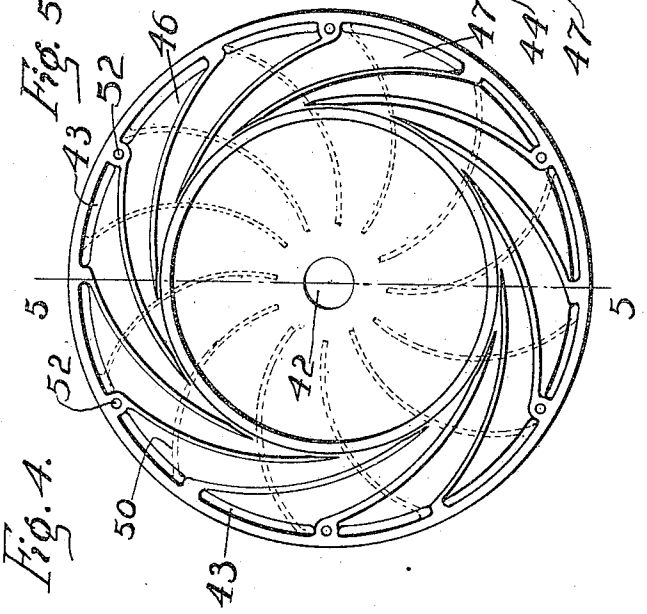


Fig. 4.

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UNITED STATES PATENT OFFICE.

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MULTISTAGE BLOWER FOR PNEUMATIC CLEANERS.

1,247,064. Specification of Letters Patent. Patented Nov. 20, 1917.

Original application filed September 11, 1914, Serial No. 861,223. Divided and this application filed September 22, 1915. Serial No. 52,005.

To all whom it may concern:

Be it known that I, GEORGE W. ALLEN, a citizen of the United States, residing at Hyde Park, Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Multistage Blowers for Pneumatic Cleaners; 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.

The present invention relates to pneumatic cleaners and more particularly to multistage blowers which are designed for use with such cleaners. This application is a division of the application of George W. Allen for pneumatic cleaners, filed September 11, 1914, Serial No. 861,223.

The object of the invention is to improve and reorganize the construction of multistage blowers particularly with reference to economy of manufacture.

With the above object in view, the present invention consists in the blower hereinafter described and particularly pointed out in the claims.

In the drawings which illustrate the preferred embodiment of the present invention, Figure 1 is a side elevation, taken partly in section of the multistage blower; Fig. 2 is a front elevation of one of the sheet metal partition plates; Fig. 3 is a section along the line 3—3 of Fig. 2; Fig. 4 is a front elevation of one of the intermediate blower casings; Fig. 5 is a section along the line 5—5 of Fig. 4; Fig. 6 is a front elevation of one of the fans or runners; and Fig. 7 is a section along the line 7—7 of Fig. 6.

The present invention is illustrated as embodied in the blower of a pneumatic cleaning system of the stationary type in which the blower and a dust-collector are mounted separately. The blower is connected through suitable suction connection to the dust-collector and the dust-collector is connected to a suction piping system in the building. The suction piping system is provided with suitable intakes to which flexible hose may be attached in the rooms to be cleaned, as will readily be understood by those skilled in this art.

A fan casing composed of a number of sections having central webs which coöperate with sheet metal partition plates located between them to form fan chambers and air passages is not broadly claimed herein, the same being shown and claimed in my copending application Ser. No. 803,938, filed Dec. 1, 1913.

The blower 1 is of the multistage horizontal type and is driven by an electric motor 2 mounted on the same base 3. The blower is connected through an intake 4 to the dust-collector which removes the dust from the air so that clean air passes through the blower. The blower discharges the air through the exhaust passage 5 into the room, or, if desired, into a connection to out-of-doors.

The blower comprises ten fans or runners 10, keyed to a common shaft 11 and inclosed in a fan casing 12. The fan casing is built up of a plurality of sections or single castings. These sections or casings are the inlet casing or section 13, nine intermediate casings or sections 14, and the discharge casing or section 15. Between these sections are placed flat sheet metal partition plates 16 which coöperate with the sections to form the fan chambers and the fan intake or discharge passages.

The shaft 11 is supported in bearings 20 and 21 in the inlet and exhaust casings respectively. The stuffing-boxes 22 form substantially air- and dust-tight joints around the shaft.

The intermediate casings 14 each have the outline of a short cylinder, the outer periphery of which is a smooth unbroken cylindrical surface. The inlet and discharge casings also each have substantially the outline of a short cylinder except for the inlet and exhaust connections 4 and 5 and the legs 25. The smooth cylindrical exterior surface thus given to the blower greatly conduces to its attractive appearance and leaves no holes or crevices to catch and hold dust or dirt. The inlet, intermediate and discharge casings are all made of castings, preferably iron. The rear face of the inlet casing 13 is ground flat, the front and rear faces of the intermediate casings 14 are ground flat and parallel, and the front face of the discharge casing 15 is ground flat. When the blower casing is assembled, the flat sheet iron partition plates 16 are placed between the casing

sections fitting against and between the ground flat surfaces. The entire casing is therefore built up of a number of layers of laminæ which are fitted flat against each other, so that the fitting and assembling of the various parts is done easily and cheaply. The sections are held assembled by means of six tie rods or bolts 26 which extend through alined holes through the inlet, intermediate and exhaust casings and through the sheet metal partition plates. The ends of the rods 26 are threaded and bear nuts 27 so that the whole casing is held together rigidly. The fit between the flat end surfaces of the castings forming the casings and the edges of the sheet metal partition plates is substantially air tight when the parts are drawn together by means of the tie rods 26.

The inlet casing 13 consists of an exterior thin annular ring shell 30 and a circular web 31 which forms the front end of the blower casing. Formed on the web 31 are a number of lugs 32 which fit against and serve as a support for the central part of the adjacent partition plate 16. The inlet casing forms a circular chamber into the top of which the air passes from the inlet connection 4 and from the middle of which the air passes to the eye of the first fan.

The construction of the intermediate casings 14 is illustrated in detail in Figs. 4 and 5. Each intermediate casing consists of a thin annular shell or ring 40 and an interior substantially flat circular web 41. The web 41 forms a partition substantially closing the inside of the intermediate casing with the exception of the hole 42 for the fan shaft 11 and a plurality of air passages 43 which are left through the web 41 where it joins the inside of the ring 40. The front side of the web has a dished central portion 44 which forms a chamber 45 for one of the fans or runners 10, the front wall of the fan chamber being formed by an adjacent partition plate 16. On the front face of the web 41 around the periphery of the fan are formed a number of vanes 46 which extend radially and tangentially in a general spiral direction from the periphery of the fan to the outer ring-like shell 40 of the intermediate section forming open-sided air passages 47. The adjacent partition plate 16 fits against the tops of these vanes so as to close the open sides of the air passages 47. The portion 48 of the web 41 which forms the rear walls of these air passages is deflected rearwardly so that the passages 47 are divergent, not only because of the divergence of the vanes 46 but also because of the divergence between the partition plate 16 and the deflected portion 48 of the web 41. The air passages 47 form diffusers for the fan which serve to increase its efficiency as will be understood by those skilled in this art. The air passes from the passages or diffusers 47 through the passages 43 to the other side of the web 41. On the opposite side of the web 41 are formed a number of inwardly directed vanes 50 which extend radially and tangentially inward in a general spiral direction to form between them open-sided air passages 51. The adjacent partition plate 16 contacts with the tops of the vanes to close the open sides of the air passages 51. The air passages 51 receive the air from the passages 43 and conduct it to the center of the next fan. The diffuser passages 47 receive the air which is discharged at the periphery of the fan flowing in a substantial tangential direction, check its velocity, changing velocity energy into pressure energy, and delivering the air to the passages 43 from which the air flows into the passages 51 which gradually change the direction of movement of the air from tangential to radial and discharge it flowing substantially radially inward at the center of the next fan. The holes through which the tie rods 26 pass through the intermediate sections are indicated at 52 and are formed through the bases of the vanes 46. This disposition of the holes allows the periphery of the sections to be smooth and unbroken and at the same time places the holes where the metal surrounding them does not form undesirable obstructions in the air passages.

The discharge casing 15, like the inlet casing, has a substantially ring-like peripheral portion 60 and a web portion 61 which forms the end closure for the blower. The casing 15 is also provided with a web 62, the front face of which is dished to form the fan chamber for the last fan of the series and upon which, beyond the periphery of the fan, are formed diffuser vanes like the vanes 46 of the intermediate casings. Air passages 43, like the air passages 43 of the intermediate casings, conduct the air through the web 62 and discharge it into the annular space between the webs 61 and 62 from which the air is discharged to the outlet 5.

One of the partition plates 16 is shown in Figs. 2 and 3, and consists of a disk of flat sheet iron through which are formed the hole for the fan shaft 11 and the holes 66 for the tie rods 26.

One of the fans or runners 10 is shown in Figs. 6 and 7. The fan is formed of a single cored aluminum casting. The fan 10 has an elongated hub 70 which is splined to the shaft 11. At the rear of the hub is an outwardly extending circular plate 71. In front of the plate 71 and spaced a little from it is a flat annular plate 72. A number of fan blades 73 divide the space between the plates 71 and 72 into air passages 74 through which the air is thrown centrifugally by the rotation of the fan, the direction of

which is indicated by the arrow in Fig. 6. At the inner edge of the plate 72 is a short axially-extending annular lip 75 which fits through the hole 65 in the adjacent partition plate 16. The air after it is delivered by the vanes 50 at the center of the fan flows axially through the eye of the fan which is formed about the hub 70 and is thrown centrifugally outward by the fan blades 73 and discharged into the diffusers 47.

The blower herein described is economical to manufacture as all of the joints between the sections are flat and the only machining necessary to insure a tight joint between the sections is an accurate flat grinding or finishing of the section ends. The sheet metal partition plates 16 may be made cheaply and fit between the adjacent finished edges of the castings forming substantially air tight joints. As shown in Fig. 1, the edges of the partition plates extend to the peripheries of the castings and the tops of the vanes 46 and 50 fit against the opposite sides of the partition plates 16 and securely brace them. The bolt holes and the holes for the passage of the drive shaft can be located in the castings and plates by means of templets.

The parts of the blower can all be standardized, and the blower can be easily and quickly assembled by putting the previously machined and standardized parts together layer by layer and clamping them in assembled position by means of the tie-rods 26. Conversely, the blower can be readily disassembled for inspection or repairs.

Having thus described the invention what is claimed is:

1. The combination of a plurality of centrifugal fans mounted on a common driving shaft, and a fan casing comprising a plurality of sections all having flat adjacent faces and each section having a central web to form one wall of a fan chamber, and sheet metal partition plates clamped between the flat adjacent surfaces of the sections and each forming the second wall of the fan chamber.

2. The combination of a plurality of centrifugal fans mounted on a common driving shaft, and a fan casing including an inlet section, an outlet section and one or more intermediate sections, said intermediate sections each having a central web to form one wall of a fan chamber, and a plurality of flat sheet metal partition plates located between the adjacent faces of the sections and extending to the peripheries of the sections to form the second wall of the fan chamber.

3. The combination of a plurality of centrifugal fans mounted on a common driving shaft, and a fan casing including a section consisting of a ring-like outer shell and a central web, said web having a central opening for the fan shaft and having near its periphery air passages for the air to pass through the shell and having on its opposite faces guide vanes for leading the air from the periphery of one fan to the said passages and guide vanes for leading the air from said passages to the intake of the next fan respectively.

4. The combination of a plurality of centrifugal fans mounted on a common driving shaft, and a fan casing including a section consisting of a ring-like outer shell and a central web, said web having a central opening for the driving shaft and having air passages near its periphery for the passage of air through the web, said web having on one side a dished portion to form a fan chamber and beyond the periphery of the fan having a plurality of vanes to form diffuser passages for the fan for leading the air from the periphery of the fan to the said air passages and having on its opposite side a plurality of vanes for leading the air from said air passages to the intake of the next fan.

5. The combination of a plurality of centrifugal fans mounted on a common driving shaft, and a fan casing including a plurality of intermediate sections each consisting of an outer ring-like shell and a central web, having on its opposite faces a plurality of vanes, the ends of the shell and the tops of the vanes at the ends of the section being finished flat and in the same plane, and a plurality of flat sheet metal partition plates located between the sections and fitting against the finished ends of the shells and the finished tops of the vanes.

6. The combination of a plurality of centrifugal fans mounted on a common driving shaft, and a fan casing including a plurality of intermediate sections each consisting of an outer shell and a central web, said central web having an opening for the driving shaft and having air passages at its periphery, and a plurality of sheet metal partition plates placed between the sections, said partition plates having central openings larger than the driving shaft to furnish an air passage around the driving shaft for the air to pass through each partition plate to the intake of the next fan.

7. The combination of a plurality of centrifugal fans mounted on a common driving shaft, and a fan casing including a plurality of intermediate sections each consisting of an outer shell and a central web, said central web having an opening for the passage of the driving shaft and having air passages at its periphery, and a plurality of sheet metal partition plates placed between the sections, said partition plates having central openings larger than the driving shaft to furnish an air passage around the driving shaft for the air to pass through each partition plate to the intake of the next fan, said fans having at their central portion axially

extending annular lips extending through the central openings in the partition plates and forming the eyes of the fans.

8. The combination of a plurality of centrifugal fans mounted on a common driving shaft, and a fan casing including a plurality of intermediate sections each consisting of an outer ring-like shell and a central web having on its opposite faces a plurality of vanes forming open-sided air passages, and a plurality of partition plates, each plate being located between adjacent sections with opposite faces contacting with the vanes of the adjacent sections to close the sides of the air passages.

9. The combination of a plurality of centrifugal fans mounted on a common driving shaft, a fan casing including a plurality of intermediate sections each having a central web which has on its opposite faces a plurality of vanes forming open-sided air passages, and a plurality of partition plates, each plate being located between adjacent sections with opposite faces contacting with the vanes of the adjacent sections to close the sides of the air passages.

10. The combination of a plurality of centrifugal fans mounted on a common driving shaft, and a fan casing including a plurality of intermediate sections each having a central web which has on its opposite faces a plurality of vanes forming open-sided air passages, a plurality of partition plates, each plate being located between adjacent sections with opposite faces contacting with the vanes of the adjacent sections to close the sides of the air passages, and tie rods passing through the intermediate sections and partition plates for clamping them together.

GEORGE W. ALLEN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."