Oct. 4, 1949. J. KARRER 2,483,643

MULTISTAGE CENTRIFUGAL BLOWER WITH SPIRAL CASINGS

Filed Nov. 20, 1945

Fig. 3.

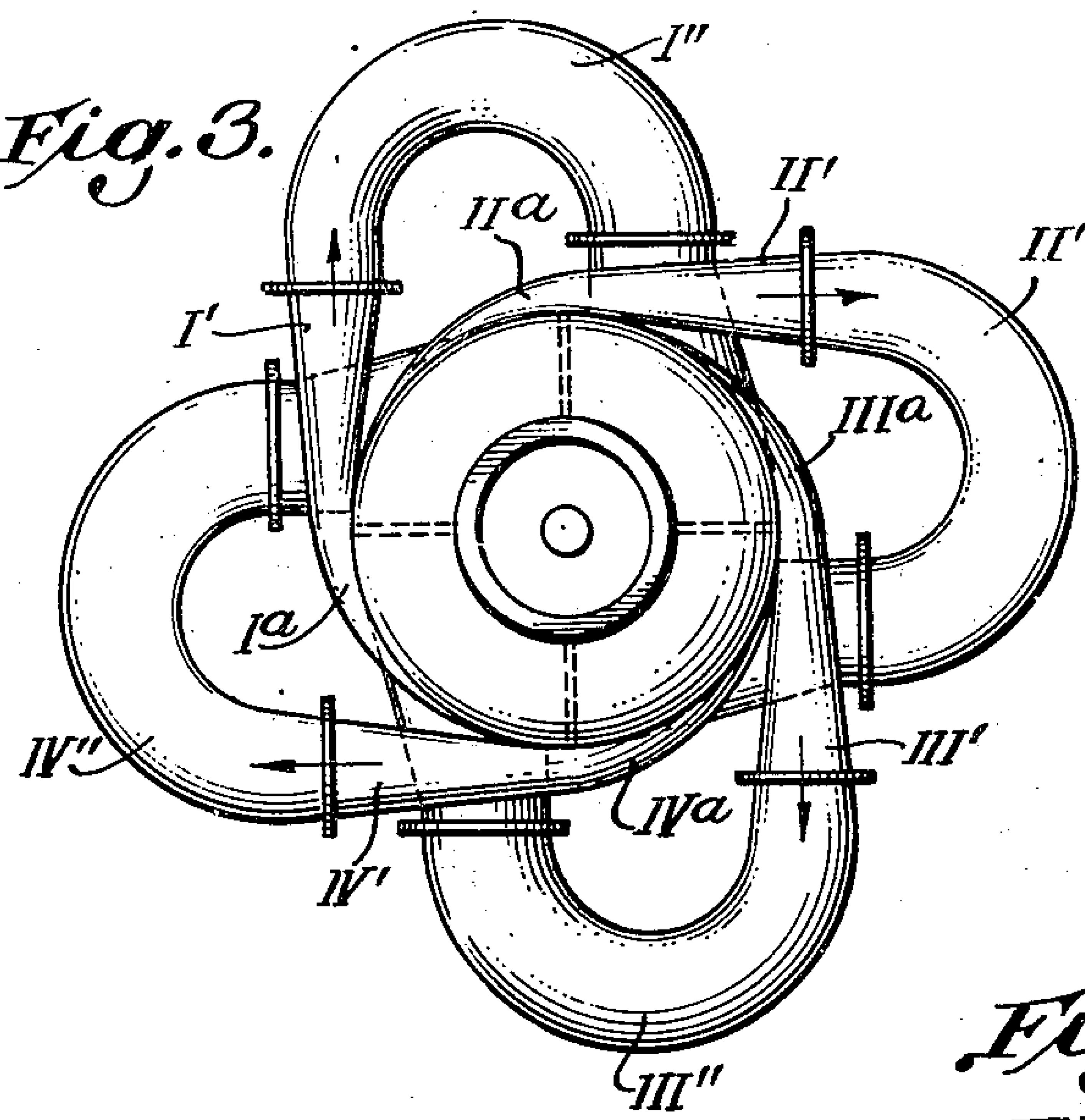


Fig. 1.

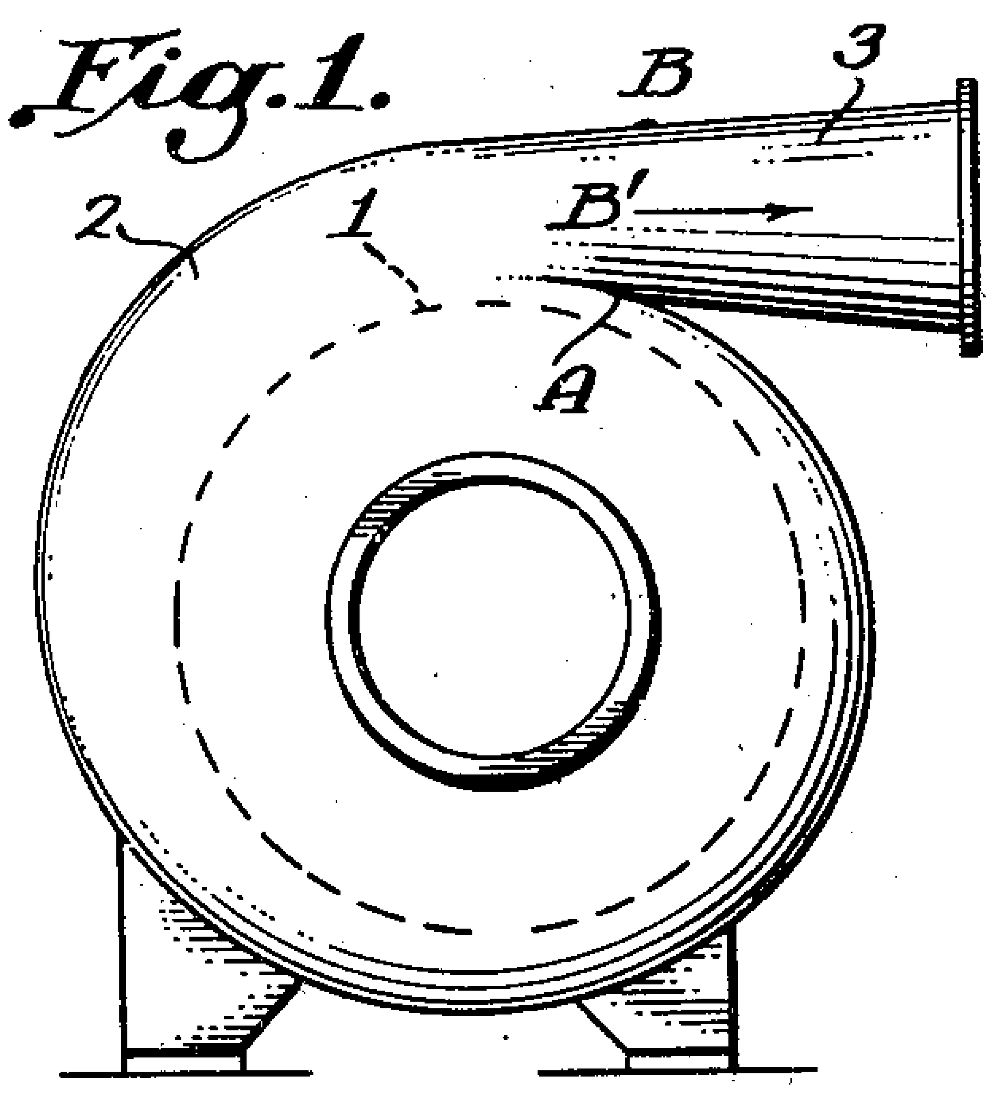


Fig. 2.

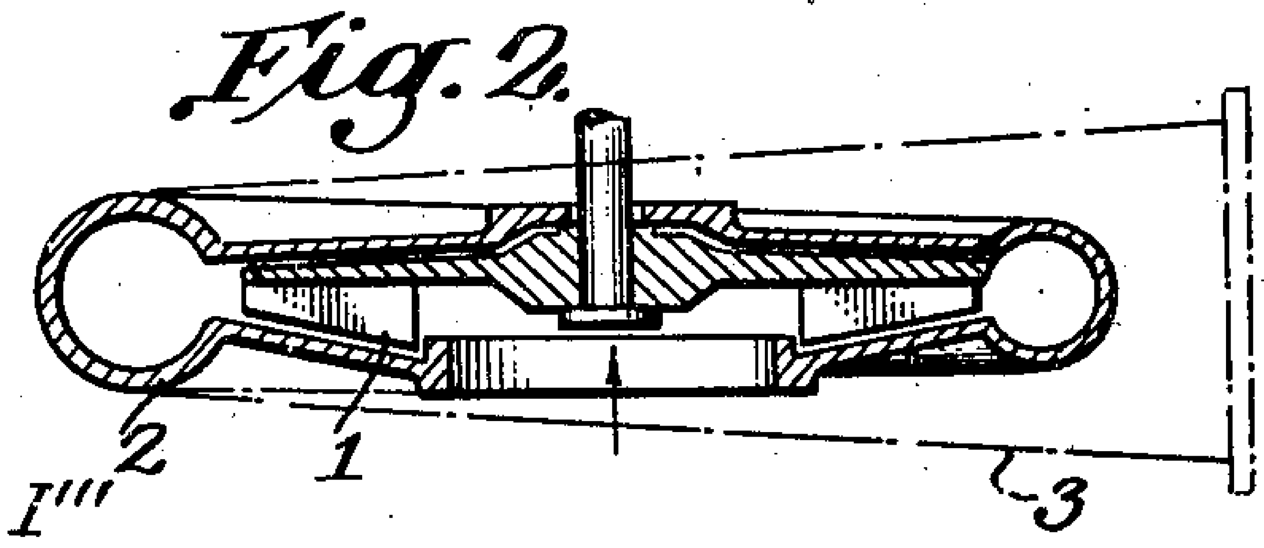


Fig. 4.

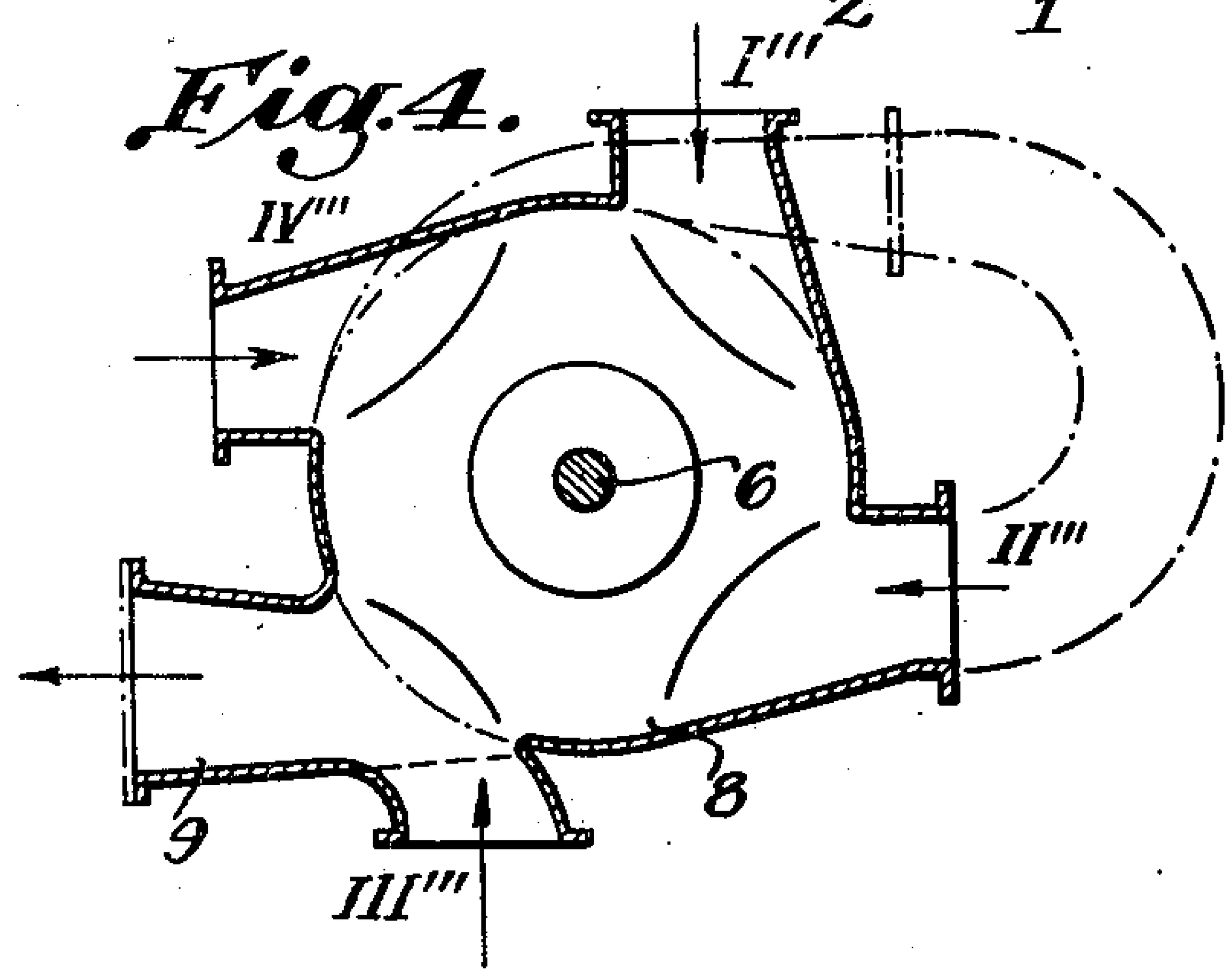
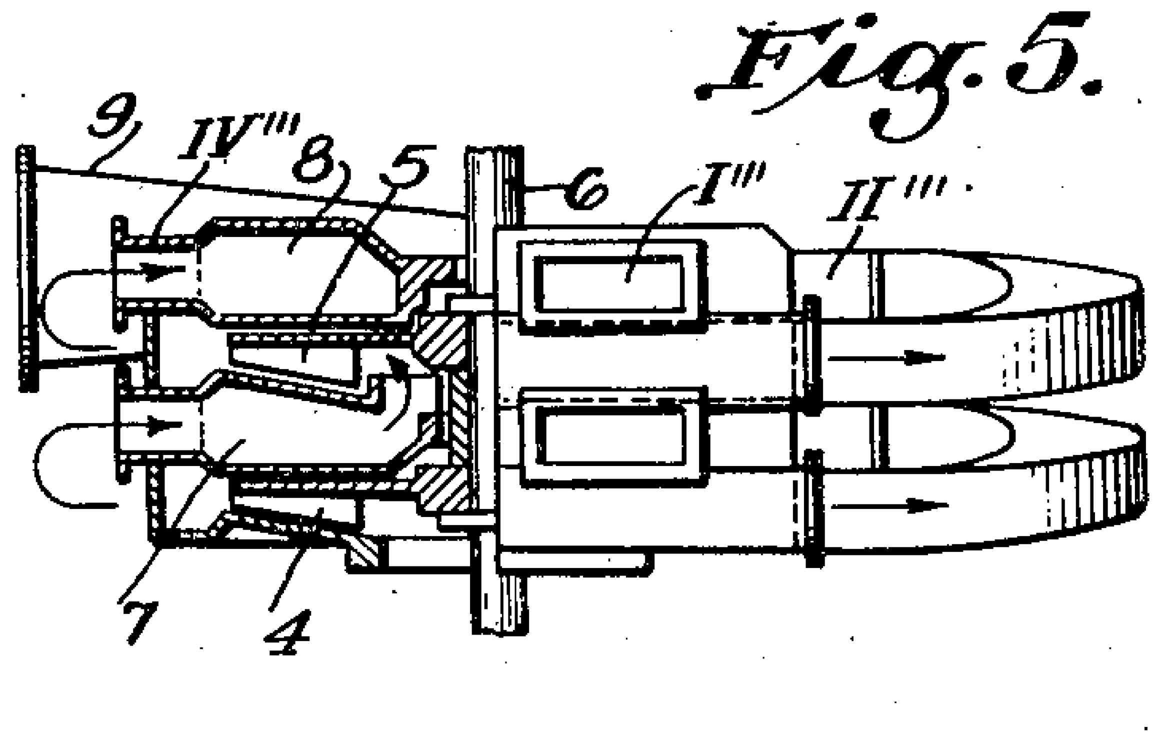


Fig. 5.



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Patented Oct. 4, 1949

2,483,643

UNITED STATES PATENT OFFICE

2,483,643

MULTISTAGE CENTRIFUGAL BLOWER WITH SPIRAL CASINGS

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Application November 20, 1945, Serial No. 629,878
In Switzerland July 29, 1939

Section 1, Public Law 690, August 8, 1946
Patent expires July 29, 1959

1 Claim. (Cl. 230—130)

The centrifugal blowers (fans and compressors) with spiral casing hitherto designed operate in such a manner that the rotor wheel conveys the medium drawn in to the spiral. In these cases the spiral casing can be designed only as a collecting chamber, that is to say, the medium continues to flow on with approximately the same velocity at the outlet of the rotor wheel in the spiral, and the velocity is converted into pressure in a diffusor outside the spiral. The spiral casing may also be designed with an increased cross-section for the purpose of converting the velocities into pressure already in the spiral.

Both constructions are connected with great disadvantages; in both cases the media entering the casing at the beginning of the spiral are deflected 360° up to their discharge from the spiral. As the media entering the casing at the end of the spiral from the rotor wheel continue to flow on in a straight line, the media suffer a mean reflection of 180°. If the great velocities are taken into consideration, especially in blowers and compressors, it will be readily seen that great losses must occur in the spirals as made today. If the spiral casing is also designed as a diffusor the mean velocities, it is true, become smaller and consequently also the losses of flow. However, designing the spiral casing as a diffusor produces other drawbacks. The great velocities obtaining at the inlet of the spiral are gradually converted into pressure at least partially. The velocity decreases toward the outlet, and the static pressure increases. This takes place especially at the outer circumference. At the inner circumference new media always enter the spiral from the rotor wheel, and as here the velocities have not yet been converted into pressure, the static pressure is smaller at the inner circumference causing transverse currents and vortices to appear.

In order to eliminate these disadvantages, the invention proposes subdividing, in a centrifugal blower with spiral casing, said spiral casing into at least two partial spirals, with diffusors joining the spirals. In that way the mean deflection can drop at least to 90°, in the case of three spirals to 60°, with four to 45°, etc. The losses of deflection can thereby be reduced to very small values; for example, for the various angles of deflection the following coefficients of resistance are found

30°	60°	90°	180°
0.03	0.90	0.2	0.42

By transferring the principal conversion of pressure to the outside of the spiral, different pressures are moreover avoided as much as possible, thus obtaining the smallest losses and the highest degree of efficiency.

Another drawback of known designs consists in the casings being designed considerably wider than the rotor wheel, with the result that the media, after discharge from the rotor are deflected laterally, which again leads to losses. This disadvantage also is eliminated with the subdivided spiral casing. For, by subdividing the spiral and transferring the principal conversion of velocity into pressure to the outside of said spiral, the cross sections of the partial spirals may be reduced to such a degree that the width of the spiral may be diminished approximately to that of the rotor wheel, or that at least the widening toward the outside does not exceed an angle of 20° and the height of the spiral does not exceed double the width of the rotor wheel, whereby favorable flowing conditions are obtained.

If, for instance, the spiral casing has three partial spirals I, II, III, the mean deflection is only 60°, and the loss drops to about 70° of that of a blower of the usual design. With more partial spirals the loss becomes still smaller; however, too great a subdivision, more than six, produces hardly any gain.

To the partial spirals are joined the diffusors, in which the pressure conversion takes place principally. The diffusers may be in the plane of the spiral or be deflected according to the condition of the design.

In the case of a single stage blower and if the partial diffusers cannot lead directly to the place of use, all the partial diffusers may be led to a single outlet, for example by lengthening two diffusers and leading them to the third. Such lengthening and deflection causes only small losses, as the cross section may be made small in this case, and the velocities thus kept low.

In the case of multiple stage designs, the partial diffusers are led by transfer conduits into the suction chamber of the following stage.

Of course, the invention may be applied to all centrifugal machines with spiral casings for air or gaseous media.

In the accompanying drawings,

Figs. 1 and 2 are elevational and transverse cross-sectional views respectively of a blower of usual design.

Figs. 3, 4, and 5 are elevational, diagrammatic, and bottom plan views, respectively, the last view being partially in cross-section, of a multi-stage centrifugal blower constituting the invention.

The annexed drawings explain the subject matter of the invention. Figs. 1 and 2 show a view and section respectively of a blower of the usual design, with a blower wheel 1 and a spiral casing 2. 3 is a diffuser built on to it. The filament of flow entering at A the spiral casing 2 will move on at the other circumference and up to the outlet undergoes a deflection of 360° at point B. The last filament of flow enters at B' (A) the casing from the rotor wheel and does not undergo any deflection. Therefore, the mean of the deflection of the medium is 180°.

Figs. 3, 4, 5 show a multiple stage centrifugal blower. The two rotor wheels 4 and 5 (Fig. 5) are carried by the shaft 6 and convey into the spiral casings I^a; II^a; III^a; IV^a. In the diffusers I'; II'; III'; IV' the velocity is converted into pressure. By means of the transfer tubes I''; II''; III''; IV'' the air is conveyed to the suction chamber 7 of the second stage. The rotor wheel 5 draws it from the chamber 7 into which the transfer tubes I''; II''; III''; IV'' discharge. The second stage also has four partial spirals and four diffusers. The four transfer tubes discharge into the outlet chamber 8 through the connections I'''; II'''; III'''; IV''', Fig. 4. 9 is a common discharge, for the medium.

Having thus described my invention, I claim:

A multi-stage centrifugal blower having the combination of a leading and a succeeding ro-

tatable fluid impeller, the peripheral region surrounding said leading impeller having therein a plurality of exposed sectoral spiral casings constituting the housing of the blower, each of said casings receiving fluid from its impeller for therethrough evolving a high velocity of the fluid, said pluralities of casings jointly producing a total increase of efficiency with reduction of losses of the centrifugal blower, an exposed diffuser for each of said casings joined to the outlet thereof for converting the velocity of its fluid into pressure, and a branching conduit for and joined to each of said diffusers and to the inlet of the suction chamber of said succeeding impeller transferring the fluid coursing from its said leading impeller, its said casing, and its said diffuser into the suction chamber of said succeeding impeller.

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