Dec. 2, 1924. 1,517,329

L. WEISS ET AL

CENTRIFUGAL FAN OR BLOWER

Filed Aug. 29, 1921

Fig. 1

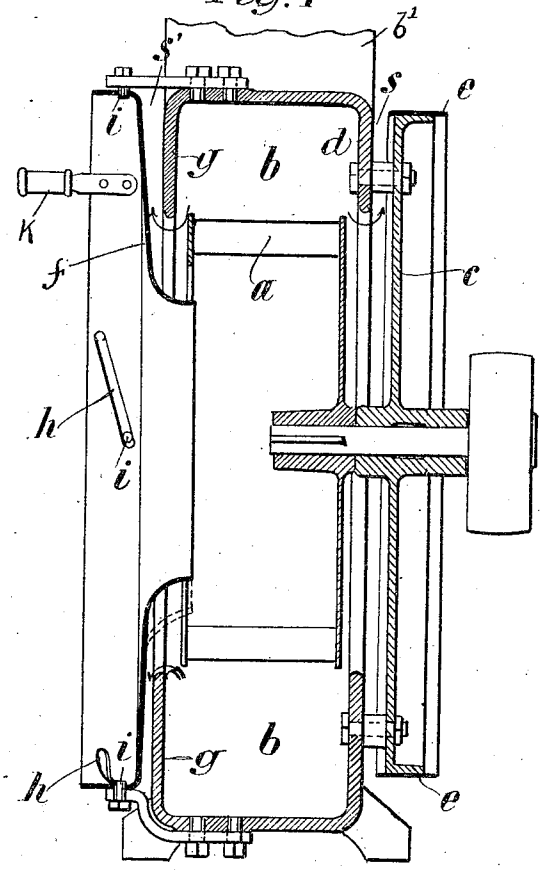
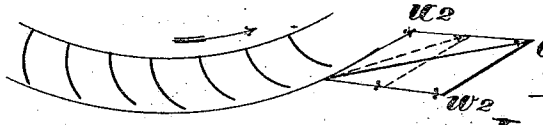


Fig. 2



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Patented Dec. 2, 1924.

1,517,329

UNITED STATES PATENT OFFICE.

LEO WEISS AND EUGEN MANDLER, OF VIENNA, AUSTRIA.

CENTRIFUGAL FAN OR BLOWER.

Application filed August 29, 1921. Serial No. 496,226.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that we, LEO WEISS, a subject of Austria, residing at Vienna, Austria, and EUGEN MANDLER, a subject of Czechoslovakia, residing at Vienna, Austria, have invented certain new and useful Improvements in Centrifugal Fans or Blowers (for which we have filed an application in Austria June 12, 1920, Patent 87,733), of which the following is a specification.

This invention relates to centrifugal fans or blowers and the object of the invention is to increase the pressure thereof without increasing the circumferential speed of the wheel, another object being to vary the pressure by an adjustable contrivance.

The essence of the invention is based on the well-known fact that the delivery pressure of a centrifugal fan running at a uniform speed increases up to a certain point when a portion of the air leaving the wheel is allowed to escape instead of the full quantity of air being allowed to flow into the air channels.

The invention will now be more particularly explained with reference to the accompanying drawings illustrating a ventilator, the blades of which are curved and tilted forward. It is known that with such centrifugal fans the amount of centrifugal power used to obtain pressure is comparatively small and that the pressure is obtained to a large extent from the velocity of the air or gas discharged by the wheel, which velocity increases with the amount of gas that passes through the wheel, as will be seen from the diagram illustrated in Figure 2 in connection with the outlet conditions. In the latter diagram, u^2 is the circumferential speed, w^2 the relative and c^2 the resultant velocity of discharge. If a portion of the air discharged by the wheel is allowed to escape then the amount of air passing through the fan will be greater than previously and w^2 will become greater, thereby causing in its turn an increased velocity of the air as it leaves the fan blades.

The present invention is based on the fact that the increase in pressure will be more, the smaller the resistance which the escaping air has to overcome. In order correspondingly to reduce this resistance, according to the present invention, the air is discharged through a diffuser viz:—through a channel of gradually increased section. Such a diffuser reduces the outlet resistance whereby the greater part of the velocity energy of the escaping air is recovered at the same time as pressure energy so that the total efficiency of the ventilator is only slightly impaired. As is well known the velocity is greater and therefore the pressure lower at the narrow part of the diffuser than at the enlarged outlet section thereof and consequently the ventilator has to work only against this lower pressure.

For the reduction of the outlet resistance it is further of advantage that the air should escape immediately it leaves the ventilator blades so that the total capacity of the ventilator need not be used to overcome both the frictional and pressure resistance of the ventilator casing.

According to the invention the air is allowed to escape by one or more annular orifices arranged concentrically with the shaft of the ventilator on the ventilator casing being opened, these orifices being opened and adjusted by means of a throttling arrangement.

By varying the quantity of escaping air the pressure of the fan is regulated without its speed being varied, such a regulation being much more economical than the usual one by which the whole quantity of discharged air is throttled since in the latter system of regulation the ventilator has to revolve at a speed corresponding to the highest pressure so that the reduction of pressure can only be obtained by loss of energy. In contra-distinction thereto, in the present invention the ventilator can rotate at a speed which gives just sufficient pressure for the average continuous output and

the pressure can be increased gradually in the manner described. In order to render this clearer, we will give a particular example:—

A cupola fan of usual construction running at a constant speed has to overcome under the average working conditions a pressure of 500 m/m W. G. Now in order to allow for any forced working such a fan must have a speed corresponding to say a pressure of 600 m/m W. G. so that in order to obtain the required delivery head of 500 m/m W. G. for average working, the air channel has to be throttled by means of a damper. This constant throttling however, means a constant loss of energy. In contradistinction thereto according to this invention the fan will receive only a speed necessary for 500 m/m W. G. and the effect for temporarily obtaining a higher pressure of say 600 m/m W. G. is obtained in a very simple way viz:—by allowing a portion of the air to escape in the manner above referred to.

In the accompanying drawing Figure 1 is a vertical sectional view of an apparatus constructed in accordance with the invention.

Fig. 2 is a diagram illustrating a principle of the invention.

Figure 1 in the accompanying drawing illustrates this arrangement, by way of example, as applied to a ventilator. For the escaping of the air an annular opening or gap s is provided on the driven side of the wheel a revolving in a spiral casing b which opening is formed by a bearing shield c being fixed at a suitable distance from the wall of the casing d. If desired the amount of escaping air may be regulated, for instance, by means of a damper e which permits the annular opening referred to, to be more or less closed according to requirements by its axial displacement.

An annular opening s^1 is also provided on the suction side of the fan between the wall of the casing g and the suction plate f. In spite of the vacuum existing in the interior of the fan wheel in this arrangement only a very small quantity of air will flow back thereto from the casing b, since the air having once passed the blades, it rotates and in consequence of its centrifugal force it can be forced radially inwards only with difficulty. However communication between the suction and the outlet side can be completely shut off for instance, by suitably forming the suction plate as is indicated by the dotted line on the lower end of Figure 1. By sufficiently extending the suction plate f and the wall of the casing g radially, the space s^1 between them is caused to act as an expanding diffuser in which the escaping air partly converts its velocity into pressure, which means that as the fan wheel as already hereinbefore referred to has to deliver a smaller pressure, can do this by a correspondingly reduced amount of work in order to accelerate the flow of the escaping air.

It is to be understood that this kind of diffuser may be replaced by any other kind as for instance guide vanes, spiral casings etc.

On the suction side of the blower, the quantity of air escaping from the casing b may be regulated and consequently also the pressure produced by the blower, by adjusting the distance between the suction plate f and the wall of the casing g. In order to facilitate accurate adjustment, the suction plate f is provided with four helical slits h engaging with studs i secured to the casing.

By turning the suction plate by means of a handle k the plate is displaced in its axial direction and the greater the distance between the suction plate and the wall of the casing, the more air can escape and the higher will then be to a certain extent the pressure produced by the blower.

It is also to be pointed out that after the air has escaped through the diffuser s^1 it can be conducted back to the suction side of the ventilator or be taken to a vacuum space. This however, does not form part of the present invention.

What we claim is:—

1. The combination with a centrifugal fan having means for permitting the escape of a portion of the fluid discharged by the fan blades, and a diffuser through which said portion of air is allowed to escape.

2. A combination as claimed in claim 1 in which the diffuser includes expanding exhaust passages through which said portion of air is allowed to escape.

3. A combination as claimed in claim 1 in which the diffuser includes an annular orifice arranged concentrically with the axis of the fan, and a valve mechanism for varying the area of said orifice.

4. A combination as claimed in claim 1 in which the diffuser is formed by one wall of the fan casing and by a suction plate arranged adjacent said wall, said plate being provided with slanting slots, and fixed pins engaging said slots, whereby rotation of said plate will cause axial movement of the latter toward or away from the fan.

5. In combination, a centrifugal fan including a casing, a bladed rotor arranged in said casing, means for admitting air to the interior of said rotor, and a diffuser through which a portion of the air forced by said rotor is adapted to escape after passing through the rotor, said casing being provided with an ordinary outlet through which the major portion of the air driven by the rotor is adapted to be discharged from said casing.

6. The combination with a centrifugal fan casing having a main air outlet and exhaust apertures, a plate fixed to one side of said casing and extending outwardly beyond one of said apertures, a valve ring for regulating the discharge of air passing between said plate and one side of the casing, a bladed rotor arranged in the casing, pins fixed to said casing, and a diffuser plate adjustably connected to said pins and having an outlet arranged within said rotor.

In testimony whereof we have signed our names to this specification.

ING. LEO WEISS.
ING. EUGEN MANDLER.

Witnesses:
JOSEF SCHMIDT,
MORITZ SCHMOLKA.