July 14, 1925. 1,546,323

A. E. SPOWAGE

PRESSURE FAN APPARATUS

Filed March 24, 1925

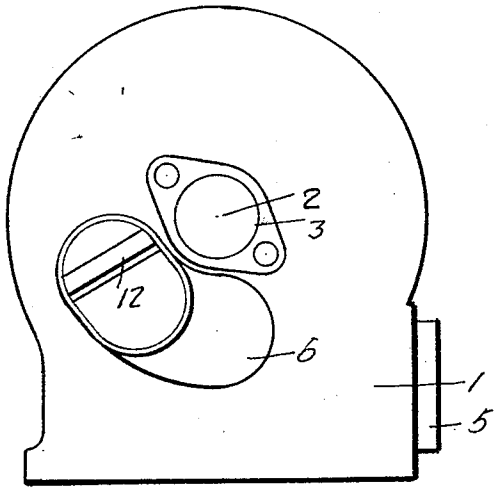



FIG.3.

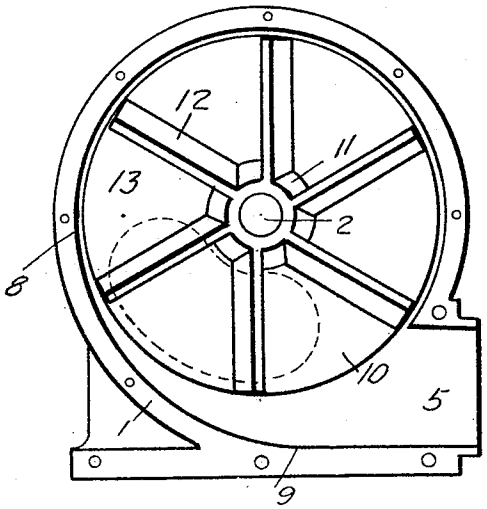



FIG.4.

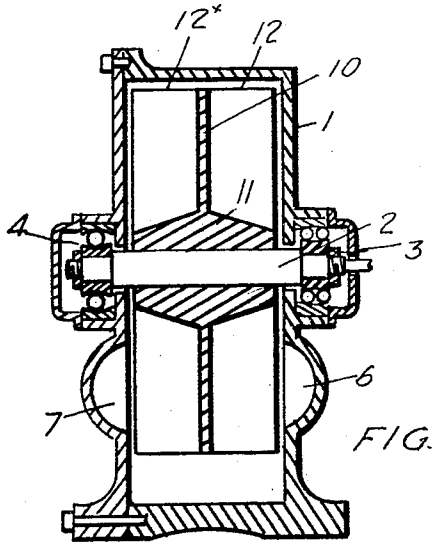



FIG.5.

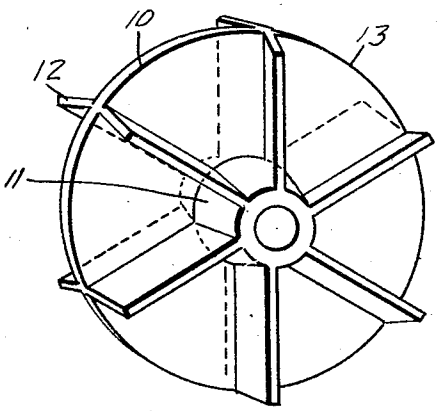



FIG.6.

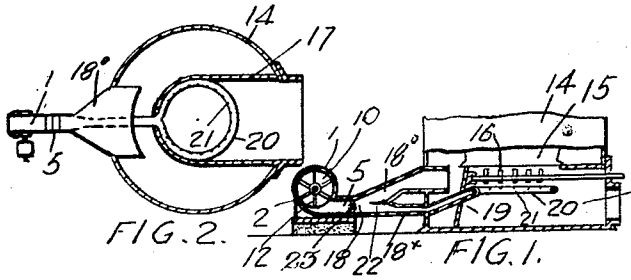



FIG.2. FIG.1.

INVENTOR
A. E. SPOWAGE
BY
attys.

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# UNITED STATES PATENT OFFICE.

ARTHUR EDWARD SPOWAGE, OF TORONTO, ONTARIO, CANADA.

## PRESSURE-FAN APPARATUS.

Application filed March 24, 1925. Serial No. 18,004.

*To all whom it may concern:*

Be it known that I, ARTHUR EDWARD SPOWAGE, a subject of the King of Great Britain, and a resident of the city of Toronto, in the county of York, in the Province of Ontario, Canada, have invented certain new and useful Improvements in Pressure-Fan Apparatus, of which the following is the specification.

My invention relates to improvements in a pressure fan apparatus, and the object of the invention is to devise a fan apparatus particularly adapted for providing a force draft to a furnace, cupola, or the like, in which a low speed fan is provided which will produce a high velocity air current by eliminating the slippage of the air past the revolving fan blades, by providing a fan so formed as to have a maximum forward impelling action upon the air, and by providing a maximum free air supply to the fan blades, and it consists essentially of the arrangement and construction of parts as hereinafter more particularly explained.

Fig. 1 is a sectional view through the ash pit grate and bottom portion of the fire pot of a furnace showing my device applied thereto.

Fig. 2 is a plan sectional view through Figure 1.

Fig. 3 is an enlarged elevation of the fan employed in connection with my device.

Fig. 4 is a similar view to Figure 3 showing the face plate removed.

Fig. 5 is a transverse section through Figure 4.

Fig. 6 is a perspective detail of the fan member.

In the drawings like characters of reference indicate corresponding parts in each figure. Referring particularly to Figures 3 to 6,

1 indicates the fan casing in which is mounted the shaft 2 in bearings 3 and 4 located on each side of the casing.

5 is the air outlet.

6 and 7 are the air inlets located in each side wall of the fan casing adjacent to the outlet 5.

It will be noted on particularly referring to Figure 4 that the major portion of the casing 1 is concentric to the centre of the shaft 2 to the point 8, adjacent to the inlets 6 and 7, from which it diverges by gradually increasing radius so as to merge into the lower wall of the outlet 5 as indicated at 9.

10 is my fan which comprises a hub 11 in the form of a double cone through which the shaft 2 extends, the hub being suitably secured to such shaft.

Blades 12 which are broad V shaped in cross section radiate from the hub and extend in close proximity to the inner periphery of the concentric portion of the fan casing 1, the outer edges of such blades being parallel transversely to the inner periphery of the casing as indicated at $12^{\times}$ Figure 5. The fan may if desired be provided with a central reinforcing disk 13 connecting the blades together.

It will be seen by this construction particularly from Figure 4 that the air space extends from the point 8 in gradually increasing dimension past the lower peripheral portion of the fan and the air inlets 6 and 7 to the outlet 5.

By this construction it will be readily seen that there is no possibility of air crowding back in the casing away from the inlet and outwardly from the fan blades so as to slip past such blades and prevent them having their full effective pressure force upon the air to carry and force it through the outlet. The blades radiate directly from the centre of the fan and being broad V shaped hold the air in contact with the blades so that the blades have a grip thereon, and yet permit such air as it is carried to the outlet to slip freely off the blades as it is carried to the outlet to be impelled therethrough, and prevent it being forced inward of the blade towards the centre of the fan and carried around therewith, thus losing pressure force.

Referring particularly to Figures 1 and 2,

14 is the outer casing of the furnace containing the fire pot 15, grate 16 and ash pit 17.

The outlet 5 of the fan casing is provided with a bifurcated extension 18 connected thereto by any suitable means, the lower arm $18^{\times}$ of such extension passing through the wall of the furnace casing 14 and upwardly in an inclined direction through the back of the wall of the ash pit 17 as indicated at 19.

20 is a circular pipe into which the pipe $18^{\times}$ leads, such pipe being provided with perforations 21 so as to direct the air forced

through the arm 18× into the pipe 20 upward and inward through the grates of the furnace and thereby producing a force draft increasing the combustion. The upper arm 18° of the bifurcated member 18 leads through the wall of the furnace casing 14 into the air space between the casing and the fire pot so as to increase the circulation of the heated air and force it upward into the hot air pipes.

22 is a deflecting damper for controlling the air discharged through the fan outlet 5, so that it is fed in the required proportion either to the pipe 20 beneath the grates or into the hot air space of the furnace.

The air which is deflected to the pipe 20 is passed through a small pipe so that the air at high velocity is forced therethrough so as to provide a high pressure in the pipe 20 passing through the perforations 21 to the grates of the furnace and through the fire increasing the rate of combustion. The air which is deflected through the arm 18° passes through a pipe of much larger dimension than the pipe 18× and is delivered to the wide mouth of such pipe into the air space between the casing and the heat radiating surfaces of the furnace, such air being delivered at low velocity, adapted for aiding the circulation of the heated air through the heating system of the building.

I also provide a supplemental damper 23 which controlls the total amount of air delivered from the fan to the pipe 18× and arm 18° leading to the furnace thereby controlling the amount of air and the amount of combustion and heat circulation in accordance with the atmospheric temperatures.

It may also be pointed out that by the employment of my device, a very much cheaper grade of coal can be used, such as slack, as by supplying the fire with air under pressure forced through would produce perfect combustion in the fire bed formed by this grade of coal.

From this description it will be seen that I have devised an apparatus which will deliver air at a high velocity to the point required and yet provide such high velocity by means of a low speed fan, this effect being produced by eliminating air slippage, providing a maximum air intake at the point of air supply and by providing a fan from which the air is freely impelled without any tendency of such air clinging thereto, and revolving therewith.

What I claim as my invention is:

1. In a pressure fan apparatus, a revoluble shaft, a fan casing in which the shaft is journalled having a peripheral outlet and lateral inlets in the side walls of the casing adjacent the outlets, and having the major portion of the casing extending between the outlet and that side of the inlet remote from the outlet concentric to the main shaft and having the remaining portion eccentric in gradually increasing diameter to the outlet, a fan secured to the shaft and having directly radiating blades having their outer end edges parallel with the inner peripheral wall of the casing, and a hood extending over each air inlet to direct the inward air flow in the direction of revolution of the fan.

2. In a pressure fan apparatus, a revoluble shaft, a fan casing in which the shaft is journalled having a peripheral outlet and lateral inlets in the side walls of the casing adjacent the outlet, and having the major portion of the casing extending between the outlet and that side of the inlet remote from the outlet concentric to the main shaft and having the remaining portion eccentric in gradually increasing diameter to the outlet, a fan secured to the shaft and having directly radiating blades having their outer end edges parallel with the inner peripheral wall of the casing, a perforated pipe adapted to extend around and beneath a furnace grate and a pipe connection between such perforated pipe and fan outlet, and a supplemental air pipe extending from the fan outlet into the air space of a furnace.

3. In a pressure fan apparatus, a revoluble shaft, a fan casing in which the shaft is journalled having a peripheral outlet and lateral inlets in the side walls of the casing adjacent the outlets, and having the major portion of the casing extending between the outlet and that side of the inlet remote from the outlet concentric to the main shaft and having the remaining portion eccentric in gradually increasing radius to the outlet, a fan secured to the shaft and having directly radiating blades having their outer end edges parallel with the inner peripheral wall of the casing, a perforated pipe adapted to extend around and beneath a furnace grate, a pipe connection between such perforated pipe and fan outlet, a supplemental air pipe extending from the fan outlet into the air space of the furnace, and means for directing the air in the required proportion either to the perforated pipe beneath the furnace grate or through the pipe leading into the air chamber of the furnace.

ARTHUR EDWARD SPOWAGE.