W. McCLAVE.

TURBINE BLOWER.

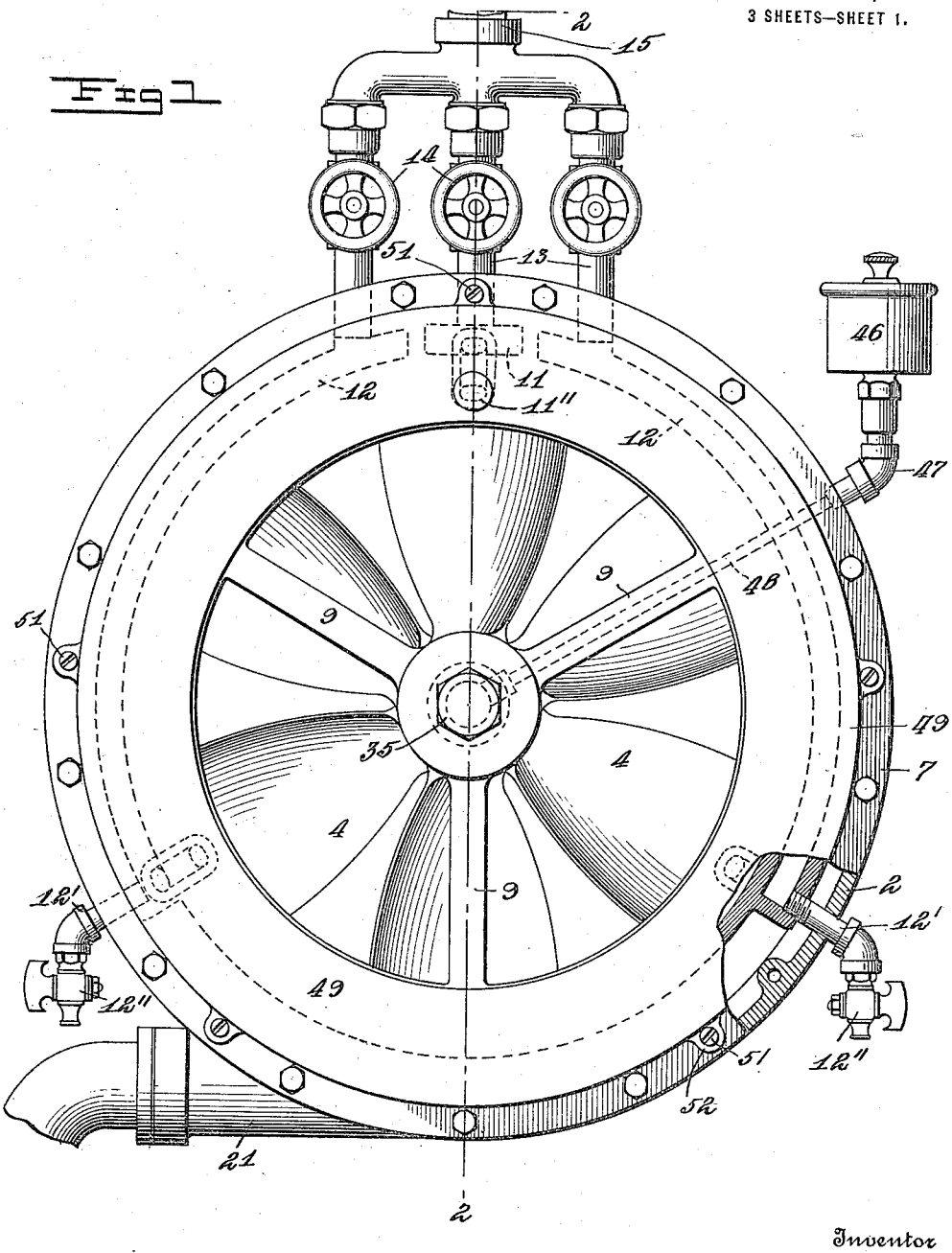
APPLICATION FILED JULY 27, 1914.

1,165,794.

Patented Dec. 28, 1915.

3 SHEETS—SHEET 1.

Fig 1



Witnesses

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3 SHEETS—SHEET 2.

Fig 2

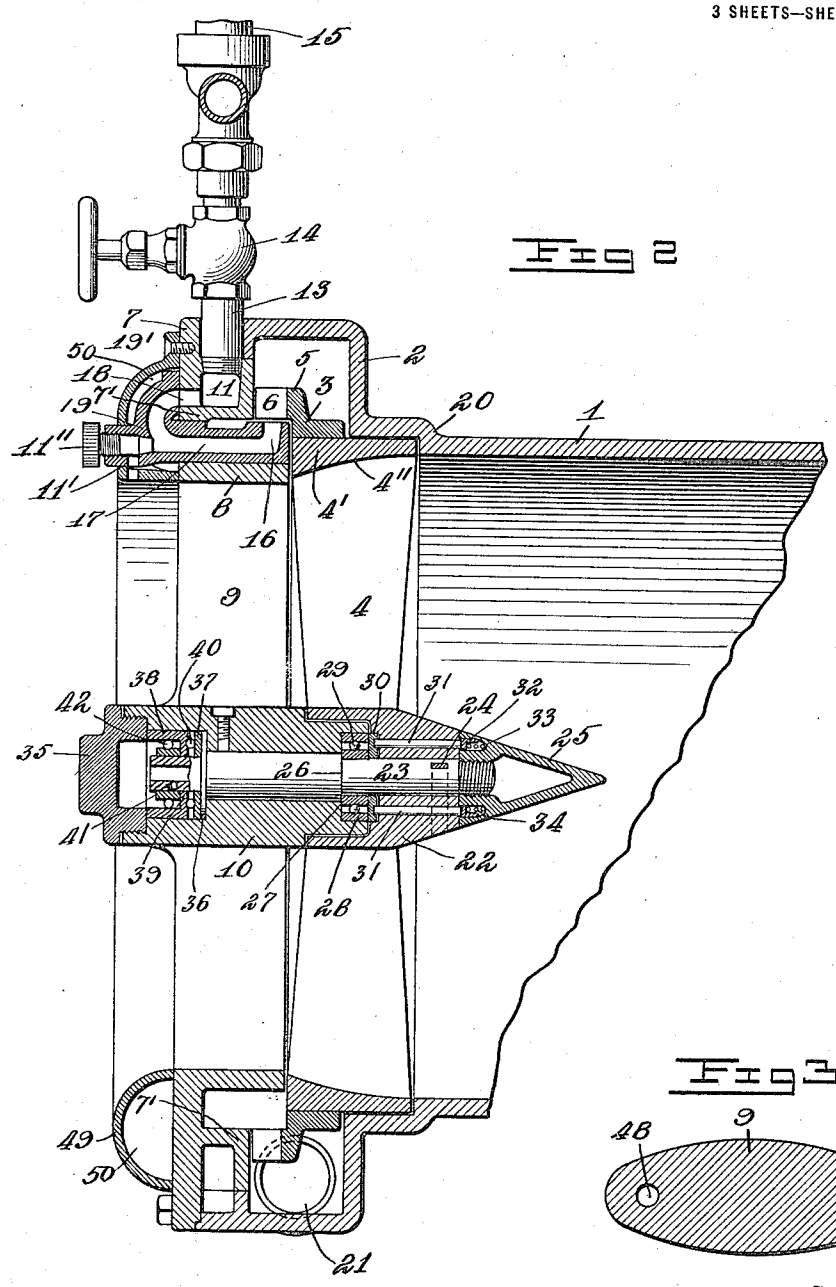


Fig 3

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3 SHEETS—SHEET 3.

Fig 4

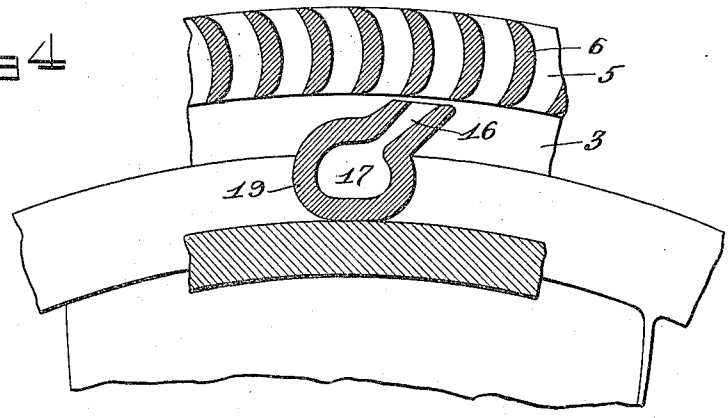


Fig 5

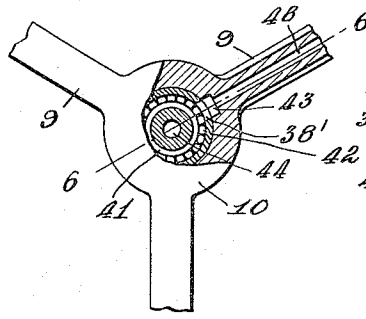


Fig 6

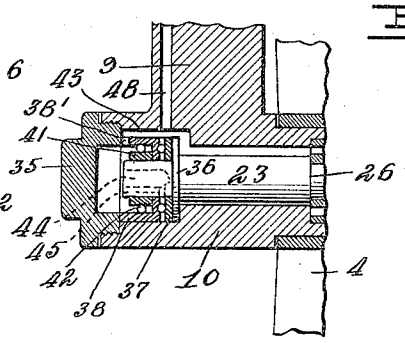


Fig 7

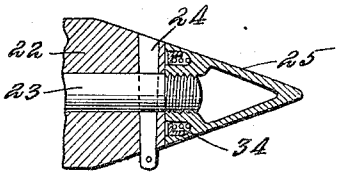
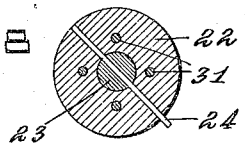


Fig 8



Witnesses

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UNITED STATES PATENT OFFICE.

WILLIAM McCLAVE, OF SCRANTON, PENNSYLVANIA, ASSIGNOR TO McCLAVE-BROOKS COMPANY, OF SCRANTON, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

TURBINE-BLOWER.

1,165,794. Specification of Letters Patent. Patented Dec. 28, 1915.

Application filed July 27, 1914. Serial No. 853,401.

To all whom it may concern:

Be it known that I, WILLIAM McCLAVE, a citizen of the United States, residing at Scranton, in the county of Lackawanna and State of Pennsylvania, have invented certain new and useful Improvements in Turbine-Blowers; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the characters of reference marked thereon.

This invention relates to blowers of the type characterized by the turbine being peripherally located on the fan and adapted to be driven by elastic fluid confined against intermingling with the air being forced.

Among the objects of the invention are simplification of construction and increase in efficiency due to certain improvements in structural formation and relative contour and location of parts.

Another object in view is the decrease of resistance to the forced air with a resulting increase in speed and volume of such air.

A more detail object is the provision of bearings for the rotating parts especially designed to insure true running of the fan.

With these and other objects in view, as will in part become apparent and in part be stated, the invention comprises certain novel constructions, combinations and arrangements of parts as will be hereinafter specified and claimed.

In the accompanying drawings: Figure 1 is a view in front elevation of a turbine blower embodying the invention. Fig. 2 is a vertical, longitudinal, central section therethrough taken on the plane indicated by line 2—2 of Fig. 1, parts being seen in elevation. Fig. 3 is an enlarged, detail, cross section through the spider arm having the lubricant duct. Fig. 4 is an enlarged, detail, transverse-axial fragmentary section disclosing a portion of the turbine and fan. Fig. 5 is a fragmentary, detail view of the hub of the spider, seen partly in transverse-axial section. Fig. 6 is a sectional view taken on the plane indicated by the line 6—6 of Fig. 5. Figs. 7 and 8 are detail, fragmentary sectional views taken respectively longitudinally and transversely of the inner end portion of the hub of the fan.

Referring to the drawing by numerals, 1 indicates a cylindrical casing having its outer end portion formed into an enlarged, annular housing 2 forming a chamber for the turbine. The turbine is constructed of an annulus or cylindrical ring 3 fixed to the periphery of rim 4′ of blower fan 4, and having an outstanding, radial, annular flange 5, which flange is provided with laterally extending, preferably integral, impact buckets 6.

An annular plate 7 closes the housing 2 and is bolted or otherwise fixed to the end of the housing, the plate 7 being formed with an integral, inwardly extending annular flange 8, formed integral with or fixed to the arms 9 of a spider whose converging arms terminate in an axial hub 10.

Plate 7 is formed with a central upper port 11 and two lateral ports 12, 12, the three ports, at the upper portion of casing 1, communicating with steam or other elastic fluid supply pipes 13, valved as at 14, and emanating preferably from a common source of supply 15. Port 11 is relatively short, while ports 12 each extend for approximately one-third of the circumference of plate 7, and each port 11, 12 is provided with a discharge nozzle 16 arranged within the ring of buckets 6, and discharging substantially radially outwardly into the concaved faces of the buckets. Nozzles 16 are spaced equidistant about the turbine and each is provided with a passage or port 17 extending inside of the wall of plate 7 forming ports 11, 12, and thence radially outwardly and laterally into communication, through a horizontal aperture or port 18, with the respective port 11, 12. Each passageway 17 is preferably provided by forming a casting or other integral tube 19 of a shape to provide the respective nozzle 16 and proportioned to extend from the outer face of plate 7 radially inwardly and with a return bend about the inner wall of the respective port 11, 12, and then radially outwardly toward buckets 6. Each tube 19 is preferably secured in place by bolts extending through lateral ears 19′ on the tube and into plate 7. A segmental L-shaped flange 7′ is formed integral with plate 7, and extends in continuity of the inner walls of ports 12. The inner wall of ports 11, 12 is spaced radially outwardly from flange 8 a distance sufficient for accommodating tubes 19 therebetween.

At the lower extremity of each port 12 a

drain pipe 12′ communicates with the port and is provided with a pet cock 12″ for enabling drainage of water of condensation, particularly in cold weather, whenever operation is discontinued. A drainage port 11′ leads from port 11 and is normally closed by valve 11″. Valves 12″ are disposed laterally of the blower and are therefore not exposed beyond the front surface, and said valves may therefore assume any appropriate form, but valve 11″ is exposed where obstructions are objectionable and hard usage of the blower is liable to result in damage to any but the simplest form of valve at this point; wherefore only a plug valve 11″ is preferably employed at this point.

The space surrounded by flange 8 is clear and unobstructed except for arms 9 and hub 10, and it is to be noted that said space is of less diameter than the diameter of the main portion of casing 1 so that air being forced into the casing is given an opportunity for slightly expanding, whereby friction is largely eliminated. To facilitate this action the casing is abruptly shouldered at 20 and the rim 4′ is proportioned to fit between annular shoulder 20 and the inner edge of flange 8, the inner surface of the rim being concaved or curved as at 4″ so that the circle described by the outer edge of the surface 4″ is substantially of the same diameter as that of the inner surface of flange 8 and approximately registers therewith, while the circle described by the inner edge of surface 4″ is of substantially the diameter as the inner surface of casing 1 and registers therewith. The inward flare of the inner surface of rim 4′ providing the gradual change in cross-sectional capacity of the air duct may be provided for in various ways of shaping rim 4′, but preferably, as clearly seen in Fig. 2, said rim is thickened at its outer edge and tapers inwardly proportionally to the flare of its inner surface, so that the peripheral surface of rim 4′ is cylindrical and disposed to prevent leakage of the power fluid from annular chamber 2 into the air passage. An exhaust port 21 communicates with housing 2 for directing exhaust fluid therefrom.

The blades of fan 4 are of course given the pitch and character especially adapted for their speed of rotation relative to the volume of air to be forced at the particular speed. Said blades are preferably formed integral with or fixed to a hub 22 keyed to bearing shaft 23 by a radial key 24. Shaft 23 extends throughout hubs 10 and 22, and at its inner end is threaded into a nut 25 which nut is preferably conical, tapering inwardly and having its base axially threaded onto shaft 23 to abut against the inner end of hub 22, the hub continuing the conical form of the nut for offering a minimum of resistance to the closing in of air passing the fan.

The inner end portion of shaft 23 as it enters hub 10 is formed with a shoulder 26 against which abuts an annular race way 27 surrounding and fixed to the shaft, and cooperating with a similar race way 28 fixed to hub 10 and surrounding and spaced from race way 27 for accommodating ball bearings 29, 29 therebetween for affording a radial bearing for shaft 23. To prevent leakage of lubricant from said bearings, an annulus 30 surrounds shaft 23 and is disposed in face contact with the edges of race ways 27 and 28. Annulus 30 is retained in position by plungers or rods 31, 31 extending longitudinally of hub 22 and having their inner ends fixed to a ring 32 axially shiftable in an annular space 33 in nut 25. Ring 32 is preferably L-shaped in cross-section and the radial flange thereof is pressed by a helical spring 34 arranged in recess 33 and tensioned to press annulus 30 toward race ways 27 and 28.

The outer end portion of hub 10 is formed with an enlarged annular space which is closed by a nut 35, and within this annular space, shaft 23 extends and is formed with an integral or fixed flange 36, having its inner face abutting against the shoulder at the inner terminus of said annular space. A race way 37 surrounds shaft 23 and engages the outer face of flange 36. An elongated race way 38 surrounds and is spaced from shaft 23 and has its outer edge abutting against nut 35, the inner edge of race way 38 being formed with an integral, annular, inwardly-turned flange forming a race way 39 spaced from and coöperating with race way 37, the ball bearings 40 therebetween taking up the thrust of shaft 23 and hub 22. A race way 41 surrounds and is fixed to shaft 23 within and spaced from race way 38, and ball bearings 42 engage said race ways to form radial bearings for the outer portion of shaft 23. It is noted that for a given length hub, radial bearings 29 and 42 are spaced longitudinally of shaft 23 a maximum distance apart, whereby true running of the fan is insured.

As best seen in Figs. 5 and 6, hub 10 is formed with a longitudinal oil duct 43 extending from the outer edge of race ways 27 and 28 to the outer edge of race way 38, so that lubricant will be distributed to all bearings, finding its way directly to bearings 29, and through notch 38′ in race way 38 to bearings 42, and through a bore 44 in shaft 23 and a lateral port 45 therein to bearings 40. A lubricant supply cup 46 is arranged for gravity feed, and communicates through pipe 47 to a port 48 formed in the material of one of the arms 9 of the spider, said port 48 leading directly into oil duct 43.

The relatively great velocity of the air passing fan 4 exposes the contacted parts to the heat absorbing capacity of the air, which, particularly in cold weather, becomes a matter of great importance since in cooling the steam in and entering chamber 2 the effective force of the steam is appreciably affected. To as far as possible eliminate this loss, a baffle is provided, and consists of a ring 49 formed transversely semicircular so as to provide a dead air space 50 when applied against plate 7. Shield or baffle ring 49 is fixed in place by bolts 51 extending through tabs 52, formed on ring 49, and threaded into plate 7.

The operation of the structure will, it is thought, be perfectly clear from the foregoing, but may be briefly stated as follows: Valves 14 are opened, and the nozzles deliver their blasts to the turbine buckets. The impact and reaction of the elastic fluid result in rapid rotation of fan 4 which intakes air through the slightly reduced intake and discharges it along the relatively larger casing. As the incoming air is given practically no opportunity to chill the power fluid, maximum efficiency is obtained from the turbine. To stop the fan, valves 14 are turned off, and valves 12″ and 11″ are preferably moved to their open position to allow drainage.

What I claim is:—

1. In a turbine blower, the combination, with a casing, of a rotary fan discharging therein, an annular support surrounding the fan in the plane of the fan, turbine buckets carried by said support and projecting axially beyond the plane of one face of the fan, and means for delivering power fluid substantially radially to the buckets.

2. In a turbine blower, the combination with a rotary fan, of an annular support surrounding the fan, said support and fan lying in the same plane, a turbine carried by said support and offset axially therefrom, means for delivering power fluid substantially radially to the turbine, and a casing disposed to prevent intermingling of the power fluid with air forced by the fan.

3. In a turbine blower, the combination, with a casing, of a rotary fan discharging therein, an annular support surrounding the fan in the plane of the fan, a turbine carried by said annular support and offset to one side thereof and means overhung by the turbine for delivering power fluid thereto.

4. In a turbine blower, the combination, with a casing, of a rotary fan discharging therein, an annular support surrounding the fan in the plane thereof, a turbine carried by and offset to one side of said support, and means for delivering power fluid to the turbine substantially radially thereof.

5. In a turbine blower, the combination, with a casing, of a rotary fan discharging therein, an annular support surrounding the fan and lying in the plane thereof, a turbine carried by and offset to one side of the support, and means for delivering power fluid from within outwardly substantially radially to the turbine.

6. In a turbine blower, the combination, with a casing having an annular housing, of a rotary fan disposed to discharge into the casing and surrounded by an annular support, said fan and support lying in the same plane, a turbine carried by the support and having its buckets extended into a plane axially from the fan within the annular housing, and means for delivering power fluid outwardly substantially radially to the turbine and into the housing.

7. In a turbine blower, the combination, with a casing having an annular housing, of a rotary fan disposed to discharge into the casing, the fan having a rim radially closing the housing, a turbine fixed to the periphery of the fan and offset axially from the fan within the annular housing, and means for delivering power fluid outwardly substantially radially to the turbine and into the housing.

8. In a turbine blower, the combination, with a casing having an annular housing open radially inwardly, of a rotary fan disposed to force air into the casing, the fan having a rim disposed between a portion of the casing and one wall of the housing and closing the radial opening of the housing, the inner surface of the rim forming substantially a continuation of the inner surface of the housing and casing, a turbine within the housing, and means for delivering power fluid to the turbine.

9. In a turbine blower, the combination of an annular housing having an annular, inward-radial opening, a rotary fan having a rim fitted between portions of the walls of the housing and closing said opening, the inner surface of the rim forming substantially a continuation of the inner surface of the housing, a turbine carried by and offset axially of said rim and extending into the housing, and means for supplying power fluid to the turbine.

10. In a turbine blower, the combination of a casing, an annular housing having an annular inward-radial opening extending laterally of the housing for a portion of its width, an annular shoulder in the casing formed by an outwardly projecting annular offset in the casing adjacent the housing, a rotary fan having its periphery located in the annular opening and offset intermediate the shoulder and inner wall of the housing, a ring fixed to the periphery of the fan and disposed in the radial opening for closing the same, and turbine buckets carried by the

ring and offset to one side therefrom radially beyond the inner wall of the housing and within the housing, and means for supplying power fluid to said buckets.

11. In a turbine blower, the combination of an annular housing having an annular inward-radial opening extending laterally of the housing for part of its width, a rotary fan, a turbine supported on the rim of the fan and disposed to occupy the radial opening, the inner surface of the fan rim forming substantially a continuation of the inner surface of the inner wall of the housing, said turbine having buckets extended axially within the housing in position for overhanging the inner wall of the housing, and means for directing power fluid substantially radially against said buckets.

12. In a turbine blower, the combination with an annular housing having a port at one side, of a rotary fan, a turbine connected with the fan and extending into the housing, power fluid supply means extending into the housing communicating with said port, and a tube mounted in the housing communicating with the port and leading laterally therefrom and being extended radially inwardly and thence axially into and communicating with said housing, said tube being removable from the housing independently of the power supply means.

13. In a turbine blower, the combination, with an annular housing having a port at one side, of a rotary fan, a turbine connected with the fan and extending into the housing, means for supplying power fluid extending into the housing to the port, and a tube mounted in the housing communicating laterally with the port and extending thence radially inwardly and thence axially to the housing and opening into the housing in position for discharging radially toward the turbine, said tube being removable from the housing independently of the power supply means.

14. In a turbine blower, the combination, with an annular housing having a port, of a rotary fan, a turbine connected thereto and extending into the housing, a tube mounted in the housing communicating laterally with the port and having a return bend communicating with the housing for supplying power fluid to the turbine, and means extending into the housing for supplying power fluid to the port, said tube being removable from the housing independently of the power fluid supply means.

15. In a turbine blower, the combination, of an annular housing, a turbine operating therein, a rotary fan actuated by the turbine for forcing air axially through the space surrounded by the housing, and a shield disposed in front of the housing.

16. In a turbine blower, the combination of an annular housing, a turbine operating therein, a rotary fan connected to be actuated by the turbine for forcing air axially through the space surrounded by the housing, and an annular shield engaging the outer radial wall of the housing.

17. In a turbine blower, the combination of an annular housing, a turbine operating therein, a rotary fan surrounded by the housing and connected to be actuated by the turbine, and a transversely semi-circular shield disposed in front of the housing.

18. In a turbine blower, the combination of an annular housing, a turbine operating therein, a rotary fan surrounded by the housing and connected to be actuated by the turbine, and a transversely curved hollow shield disposed in front of the housing.

19. In a turbine blower, the combination, with a turbine and a rotary fan actuated thereby, of a fixed hub, the fan having a hub engaging the fixed hub, a shaft fixed to the hub of the fan and journaled in the fixed hub, means for supplying lubricant to the bearings of the shaft, an annulus engaging the fixed hub for retaining lubricant therein, rods engaging the annulus and extending substantially parallel to the shaft through the hub of the fan, a nut engaging the shaft and abutting against the hub of the fan, said nut being formed with an annular recess, an annulus in said recess engaging said rods, and a spring engaging the last named annulus and pressing the same in a direction for maintaining the first mentioned annulus seated.

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