

March 24, 1925.

F. H. C. COPPUS

1,530,982

BLOWER

Filed June 18, 1921

2 Sheets-Sheet 1

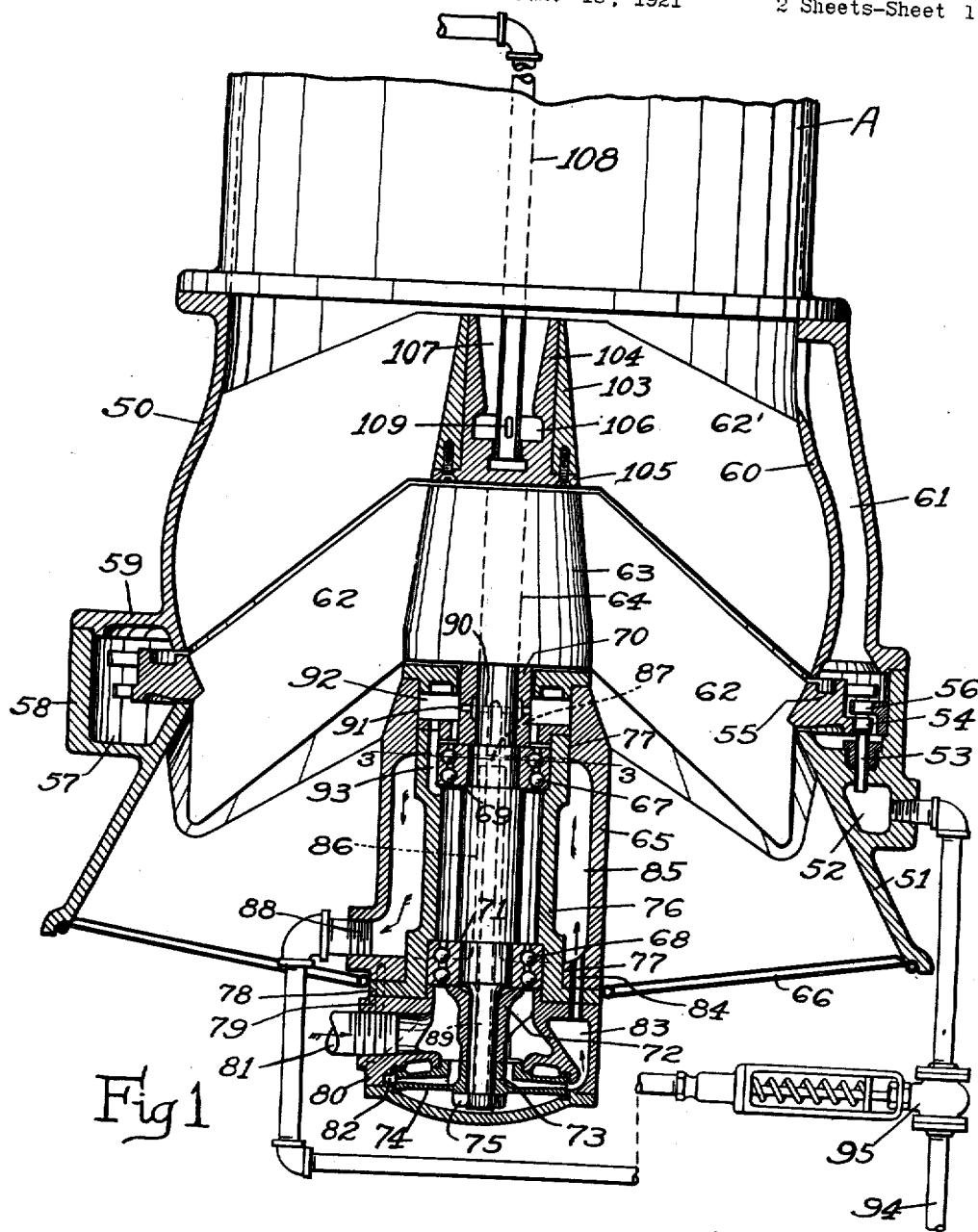


Fig 1

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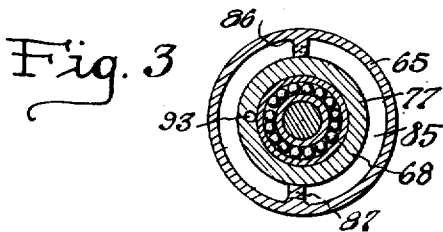
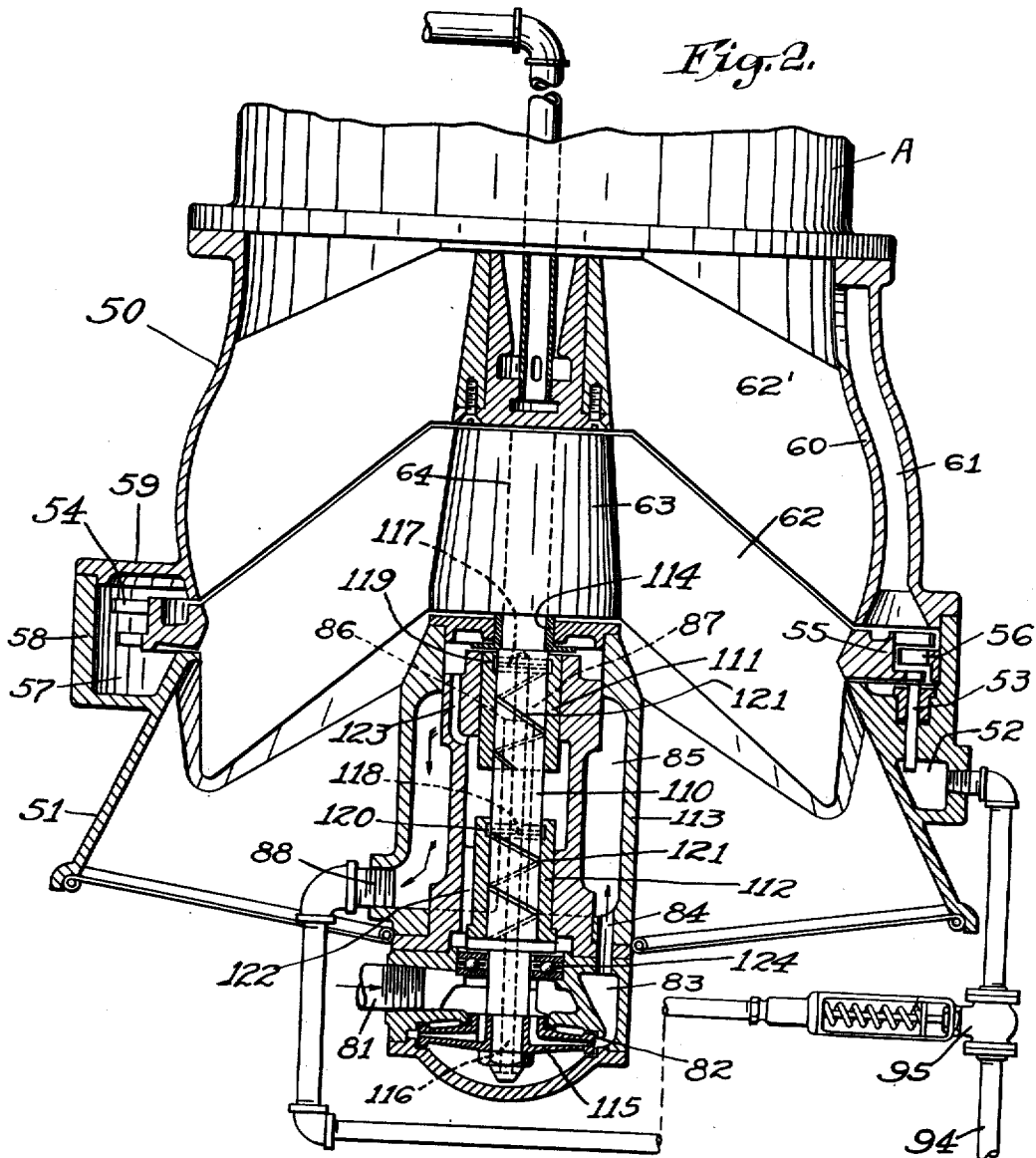
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BLOWER

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

FRANS H. C. COPPUS, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO COPPUS ENGINEERING CORPORATION, OF WORCESTER, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

BLOWER.

Application filed June 18, 1921. Serial No. 478,573.

To all whom it may concern:

Be it known that I, FRANS H. C. COPPUS, a citizen of the United States, residing at Worcester, in the county of Worcester and Commonwealth of Massachusetts, have invented a new and useful Improvement in a Blower, of which the following, together with the accompanying drawings, is a specification.

The present invention relates generally to blowers, such as are used for ventilating and drafting purposes. More specifically, the invention contemplates improvements in a blower or fan whose blades operate in conjunction with a set of stationary guide vanes,—the fan being driven by a steam or other turbine on its periphery. In addition, the invention contemplates radical improvements in the lubrication and cooling of the bearings of the above and other types of blowers, along with the employment of novel means for counteracting end thrust, and preventing the attainment of dangerously excessive speeds. The above and other objects are obtained by the construction of a blower as hereinafter described in detail, reference being had to the accompanying drawings, wherein—

Figure 1 is a sectional view of a blower, embodying the invention.

Figure 2 is a similar view, showing various modifications in structural details.

Figure 3 is a sectional view on the line 3—3 of Fig. 1.

Like reference characters refer to like parts in the different figures.

Referring to Fig. 1, the blower, designated as a whole by the numeral 50, is shown in a vertical position, adapted to blow upwardly, as would preferably be the case where used in the smoke box of a locomotive, or disposed in the stack of a steam boat, or in any other stack or chimney.

The construction as here shown, provides a frustro-conical casing 51, the flaring open end of which constitutes the inlet to the blower. The casing 51 provides on its surface a short segmental steam chamber 52, equipped with a plurality of nozzles 53. These nozzles 53 are so disposed as to direct steam or other motive fluid against the buckets or blades 54 of a turbine wheel 55, here shown as of the two-stage type, with the usual reversing sector 56. The turbine

wheel proper is disposed in an annular chamber 57, which is formed by a flange 58 on casing 51, cooperating with a flange 59 on a superposed cylindrical casing 60, the latter providing an exhaust outlet 61 from the chamber 57.

The turbine wheel 55 is carried directly upon the blades 62, 62, of a propeller fan, the hub 63 of which is mounted upon and keyed to a shaft 64. The air which is handled by said fan is forced upwardly between a specially designed series of stationary guide vanes 62', so arranged as to direct the air, with a minimum of friction, into the conduit A, which for instance may be the stack of a locomotive or steam boat. The shaft 64 is journaled in suitable bearings, as hereinafter described, provided by a bearing housing 65, the latter being stationarily supported by means of a plurality of radial ribs 66, connecting it with the casing 51.

When the blower is disposed vertically, as shown, the bearings must not only sustain the entire weight of the fan, the shaft and the turbine, but in addition must resist the high back pressure created by the rapid rotation of the fan blades. The resulting excessive end thrust on the bearings of the shaft 64 is counteracted by a construction which will now be described.

The bearing housing 65 which receives the shaft 64 provides upper and lower ball bearings 67 and 68. Ball bearing 67 is held against shoulder 69 of shaft 64 by a bushing 70, the latter being engaged by the hub 63 of the fan. The lower ball bearing 68 is held against flange 71 of shaft 64 by a bushing 72, the latter bearing at its lower end against the hub 73 of an impeller 74, secured to shaft 64 by a key, not shown, and by a nut 75. The ball bearings 67 and 68 are contained in a sleeve 76 that is telescoped within the housing 65 in spaced relation thereto, the sleeve 76 making a tapered fit with said housing, as shown at 77, 77; a flange 78 of sleeve 76 is secured to the housing 65 by the same bolts 79 that retain the housing 80 of impeller 74.

The impeller housing 80 provides an inlet 81 for the introduction of a liquid, such as water or oil. The rotation of shaft 64, by means of the steam turbine wheel secured to the blades of the fan procures the operation of the impeller 74 in such a manner as

to circulate the fluid under pressure, delivering the same into channel 82, from whence the flow is through chamber 83 and passage 84 into the space 85 between housing 65 and sleeve 76. This space 85 is divided longitudinally into two parts, by means of ribs or partitions 86. As a consequence, the liquid flows upwardly in one part, here shown as the right hand part, and then, passing through an opening 87 at the top, flows downwardly through the left hand part, discharging at 88 from the housing 65.

In this way, by the constant circulation of fluid, the bearings of the blower are maintained fully and efficiently cool; it will readily be seen that, if necessary, the circulating fluid before being returned to the inlet of the impeller can be passed through cooling coils, not shown, to remove the absorbed heat therefrom; or, if desired, the outlet 88 can be connected directly with the inlet 81.

In addition, and of the utmost importance, the circulation of this fluid by the impeller creates a positive resistance for counteracting in a large measure the end thrust heretofore mentioned. The restricted passage 84 may be varied in any suitable manner to make this resistance greater or less, as the case may be, and the resulting pressure of the liquid all around the pump or impeller 74 is exerted preponderantly upon the under surface thereof, thus counteracting the normal thrust in the opposite direction upon the bearings 67 and 68.

If the circulating fluid be a lubricant, such as oil, this expedient for cooling the bearings and counteracting the normal end thrust thereon, may also serve for their lubrication. To this end the shaft 64 may be provided with a central longitudinal passage 89, which at the top branches radially into two passages 90, 90, for communicating, through openings 91, 91, of bushing 70, with an annular space 92 above ball bearing 67.

The oil, under pressure, rises through the shaft and overflows into space 92, thence passing through the bearings 67 and 68 back to the inlet side of impeller 74. An overflow or by-pass for the excess oil is provided by a passage 93 in the sleeve 76. In this way, coincident with the cooling and partial balancing of the journal bearings of the blower, their lubrication is efficiently and thoroughly effected.

Still another function may be performed by this circulation of a secondary fluid by impeller 74. If the turbine driven blower attains an excessive speed, beyond a predetermined limit of safety, then obviously the pressure of this circulating secondary fluid will be very greatly increased; and this increase of pressure may be utilized in any well known manner, to operate a safety valve in the steam line 94 that supplies the

turbine of blower 47. In this way, an emergency governor for the turbine is provided, the valve being shown diagrammatically at 95 as subject to the pressure of the secondary fluid when the latter exceeds a predetermined limit.

When the blower is used for creating induced draft in the smoke box of a locomotive, as proposed in my copending companion application, Serial No. 478,572, filed June 18, 1921, provision must be made for auxiliary drafting means to be used in the event of any accident to the blower. As shown, the guide vanes 62' provide a central hollow hub portion 103, which is adapted to receive a sleeve 104 having an end flange 105 which is secured to hub 103. The sleeve 104 provides an interior recess 106, the latter opening upwardly and outwardly, in a flaring manner, through the bore 107 of said sleeve. A steam supply pipe 108 is carried downwardly through said bore and is threaded to the bottom of the sleeve, said pipe having a plurality of openings 109 in the plane of recess 106. If for any reason, the blower 50 is put out of commission, it is still possible to produce a draft in stack A by admitting steam to the pipe 108; such steam is discharged into the recess 106, and passes upwardly and outwardly through the bore 107 in the form of a jet so as to induce a draft sufficient to carry the products of combustion out of the smoke box of the locomotive or steam boat boiler, as the case may be, or out of any other stack or chimney.

In the form of device shown in Fig. 2, the general construction of the blower casing, turbine and fan is the same as above described, the essential difference being in the manner of mounting and lubricating the shaft 110 of said fan. Said shaft is journaled for rotative movement in suitable bushings 111 and 112 which are provided by a bearing housing 113, the latter being supported in the same way as the housing 65 of Fig. 1.

The shaft 110 is surrounded at its upper end by a ring 114, the latter preventing the escape of the fluid, for cooling and lubrication, which is circulated as before by an impeller or pump 115 on the lower end of said shaft. The circulation of such fluid, for the purpose of creating a force to counteract the end thrust on the shaft, takes place in substantially the same manner as in the form first described; the bearing housing 113, in respect of its several passages and the ducts for the circulation of said fluid, being constructed like the bearing housing 65, and such passages and ducts, for convenience, being similarly numbered. The lubrication of the shaft 110 is accomplished by the provision of a passage 116 extending upwardly from the

lower end of said shaft and having transverse branches 117 and 118 that communicate with grooves 119 and 120, respectively, in the upper ends of bushings 111 and 112.

5 From these grooves in the bushings lead spiral grooves 121, 121, by which the oil is led down and around the shaft so as to thoroughly lubricate the portions thereof that are inclosed by said bushings. Said
10 oil finally returns to the inlet of the pump or impeller by way of passage 122; the excess of oil is led off through passage 123, corresponding to the passage 93 of Fig. 1.

When the shaft 110 is stationary, or when
15 it is rotating slowly, its downward thrust is taken on an end thrust bearing 124 of the usual type. As soon however, as the shaft attains any speed, the pump 115 builds up a pressure in the circulating fluid
20 which is sufficient, as previously described, to compensate for the end thrust of the shaft, so that the weight of the shaft and fan, together with the thrust occasioned by the rapid rotation of said fan, is relieved.
25 In this way the thrust bearing 124 is relieved of pressure, and thus is allowed to idle, when the shaft is rotating at normal speeds.

I claim,

30 1. In a blower, a rotatable peripherally driven fan, bearings for said fan, and means operative by the rotation of said fan for circulating a cooling fluid around said bearings under pressure, said fluid serving to
35 lubricate said bearings by gravity.

2. In a blower, a rotatable fan, a turbine for driving same, means operable by the rotation of said fan for circulating a cooling and lubricating fluid under pressure,
40 and means responsive to excessive pressure of said fluid for throttling the supply of steam to said turbine.

3. In a blower, a rotatable fan, a shaft on which said fan is mounted, bearings
45 for said shaft and a hub supporting said bearings, in combination with a centrifugal pump carried by said hub and driven by said shaft for circulating a lubricating fluid under pressure and a peripheral drive for
50 said fan.

4. In a blower, a rotatable fan, a shaft on which said fan is mounted, bearings for said shaft and a hub supporting said bearings, in combination with a centrifugal
55 pump carried by said hub and driven by said shaft for circulating a fluid under

pressure, the pressure of said fluid being exerted in opposition to the end thrust of said shaft and fan on said bearings, and peripheral driving means for said fan. 60

5. In a blower, a rotatable fan, a shaft on which said fan is mounted, bearings for said shaft and a hub supporting said bearings, in combination with a centrifugal pump carried by said hub and driven by
65 said shaft for circulating a fluid under pressure, the pressure of said fluid being exerted in opposition to the end thrust of said shaft and fan on said bearings, means to regulate said pressure of said circulating fluid and peripheral driving means for
70 said fan.

6. In a blower, a rotatable fan, a shaft on which said fan is mounted, bearings for said shaft and a hub supporting said bearings, in combination with a centrifugal
75 pump carried by said hub driven by said shaft for circulating a cooling fluid around said bearings under pressure.

7. In a blower, a rotatable fan, a turbine for driving same, a centrifugal pump operable by the rotation of said fan for circulating a cooling and lubricating fluid under pressure, and means responsive to
80 excessive pressure of said fluid for throttling the supply of steam to said turbine. 85

8. In a blower, a rotatable fan, a shaft on which said fan is mounted, bearings for said shaft and a hub supporting said bearings, in combination with means carried by
90 said shaft for circulating a fluid under pressure, the pressure of said fluid being exerted in opposition to the end thrust of said shaft and fan on said bearings, and means to regulate said pressure of said circulating fluid. 95

9. The combination with a rotating shaft having bearings, of magnet operative by the rotation of said shaft for imparting pressure to a circulating fluid in opposition to the end thrust of said shaft, means
100 for regulating the pressure of said circulating fluid, and means for procuring the lubrication of said bearings by gravity flow of said circulating fluid. 105

10. The combination with a blower having stationary guide vanes, of an auxiliary steam jet disposed centrally of said guide vanes, and peripheral driving means for said blower.

FRANS H. C. COPPUS.

lower end of said shaft and having transverse branches 117 and 118 that communicate with grooves 119 and 120, respectively, in the upper ends of bushings 111 and 112. From these grooves in the bushings lead spiral grooves 121, 121, by which the oil is led down and around the shaft so as to thoroughly lubricate the portions thereof that are inclosed by said bushings. Said oil finally returns to the inlet of the pump or impeller by way of passage 122; the excess of oil is led off through passage 123, corresponding to the passage 93 of Fig. 1.

When the shaft 110 is stationary, or when it is rotating slowly, its downward thrust is taken on an end thrust bearing 124 of the usual type. As soon however, as the shaft attains any speed, the pump 115 builds up a pressure in the circulating fluid which is sufficient, as previously described, to compensate for the end thrust of the shaft, so that the weight of the shaft and fan, together with the thrust occasioned by the rapid rotation of said fan, is relieved. In this way the thrust bearing 124 is relieved of pressure, and thus is allowed to idle, when the shaft is rotating at normal speeds.

I claim,

1. In a blower, a rotatable peripherally driven fan, bearings for said fan, and means operative by the rotation of said fan for circulating a cooling fluid around said bearings under pressure, said fluid serving to lubricate said bearings by gravity.

2. In a blower, a rotatable fan, a turbine for driving same, means operable by the rotation of said fan for circulating a cooling and lubricating fluid under pressure, and means responsive to excessive pressure of said fluid for throttling the supply of steam to said turbine.

3. In a blower, a rotatable fan, a shaft on which said fan is mounted, bearings for said shaft and a hub supporting said bearings, in combination with a centrifugal pump carried by said hub and driven by said shaft for circulating a lubricating fluid under pressure and a peripheral drive for said fan.

4. In a blower, a rotatable fan, a shaft on which said fan is mounted, bearings for said shaft and a hub supporting said bearings, in combination with a centrifugal pump carried by said hub and driven by said shaft for circulating a fluid under

pressure, the pressure of said fluid being exerted in opposition to the end thrust of said shaft and fan on said bearings, and peripheral driving means for said fan.

5. In a blower, a rotatable fan, a shaft on which said fan is mounted, bearings for said shaft and a hub supporting said bearings, in combination with a centrifugal pump carried by said hub and driven by said shaft for circulating a fluid under pressure, the pressure of said fluid being exerted in opposition to the end thrust of said shaft and fan on said bearings, means to regulate said pressure of said circulating fluid and peripheral driving means for said fan.

6. In a blower, a rotatable fan, a shaft on which said fan is mounted, bearings for said shaft and a hub supporting said bearings, in combination with a centrifugal pump carried by said hub driven by said shaft for circulating a cooling fluid around said bearings under pressure.

7. In a blower, a rotatable fan, a turbine for driving same, a centrifugal pump operable by the rotation of said fan for circulating a cooling and lubricating fluid under pressure, and means responsive to excessive pressure of said fluid for throttling the supply of steam to said turbine.

8. In a blower, a rotatable fan, a shaft on which said fan is mounted, bearings for said shaft and a hub supporting said bearings, in combination with means carried by said shaft for circulating a fluid under pressure, the pressure of said fluid being exerted in opposition to the end thrust of said shaft and fan on said bearings, and means to regulate said pressure of said circulating fluid.

9. The combination with a rotating shaft having bearings, of magnet operative by the rotation of said shaft for imparting pressure to a circulating fluid in opposition to the end thrust of said shaft, means for regulating the pressure of said circulating fluid, and means for procuring the lubrication of said bearings by gravity flow of said circulating fluid.

10. The combination with a blower having stationary guide vanes, of an auxiliary steam jet disposed centrally of said guide vanes, and peripheral driving means for said blower.

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Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,530,982, granted March 24, 1925, upon the application of Frans H. C. Coppus, of Worcester, Massachusetts, for an improvement in "Blowers," errors appear in the printed specification requiring correction as follows: Page 3, line 77, claim 6, after the word "hub" insert the word *and*; same page, line 98, claim 9, for the word "magnet" read *means*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

/ Signed and sealed this 21st day of April, A. D. 1925.

[SEAL.]

KARL FENNING,
Acting Commissioner of Patents.

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[SEAL.]

KARL FENNING,
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