J. J. GIBSON & C. L. W. TRINKS.

POSITIVE DISPLACEMENT ROTARY BLOWER.

APPLICATION FILED SEPT. 24, 1909.

974,481. Patented Nov. 1, 1910.

2 SHEETS—SHEET 1.

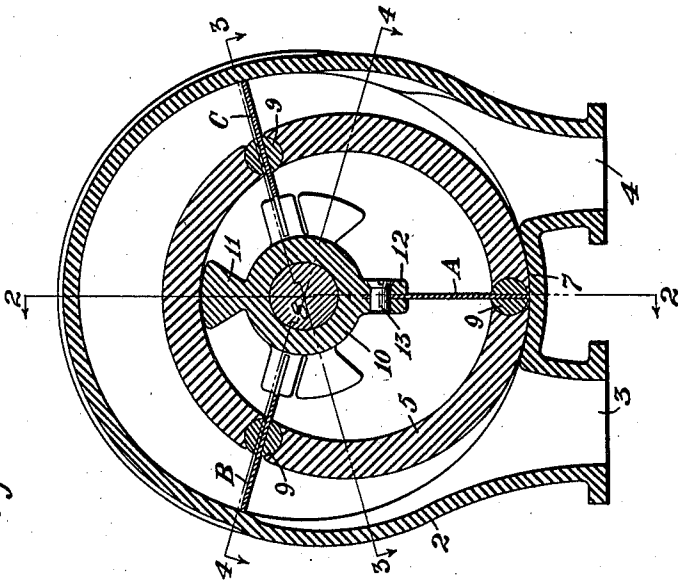

Fig. 1.

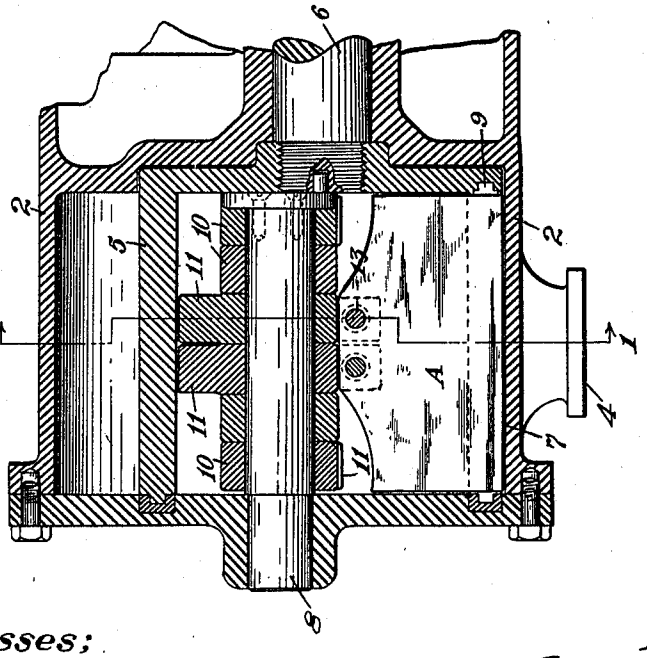

Fig. 2.

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Fig. 4.

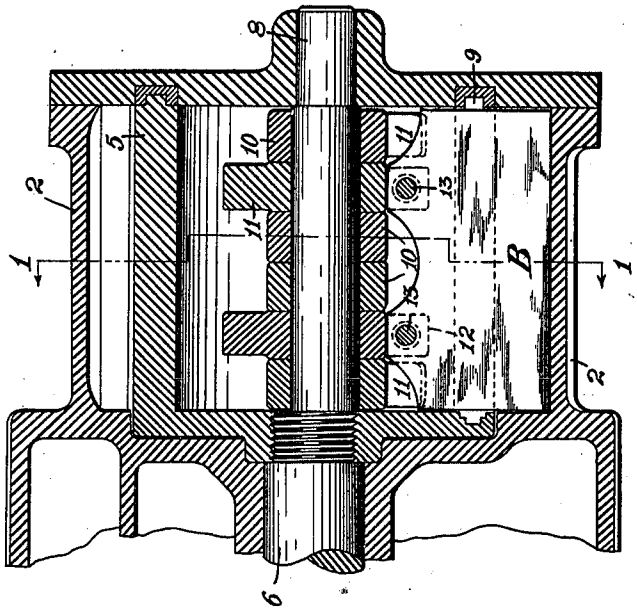
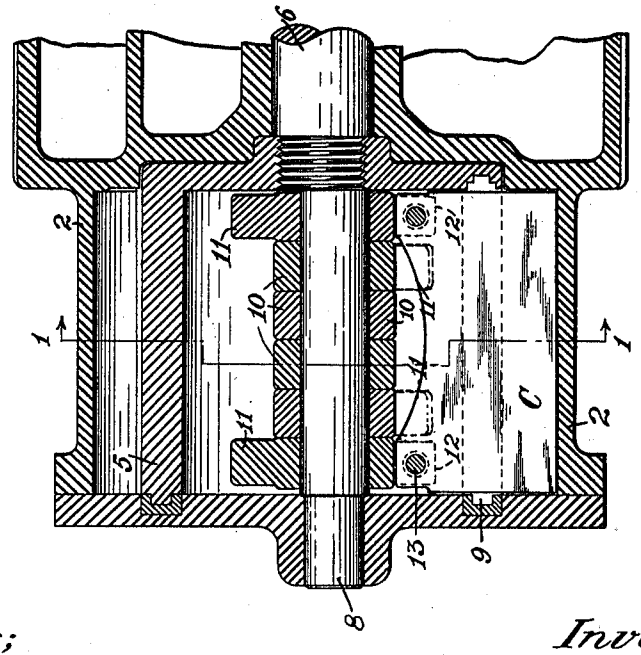


Fig. 3.



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UNITED STATES PATENT OFFICE.

JAMES JOSEPH GIBSON, OF HOMESTEAD, AND CHARLES L. W. TRINKS, OF PITTSBURG, PENNSYLVANIA; SAID TRINKS ASSIGNOR TO SAID GIBSON.

POSITIVE-DISPLACEMENT ROTARY BLOWER.

974,481. Specification of Letters Patent. Patented Nov. 1, 1910.

Application filed September 24, 1909. Serial No. 519,324.

To all whom it may concern:

Be it known that we, JAMES JOSEPH GIBSON, a resident of Homestead, Allegheny county, Pennsylvania, and CHARLES L. W. TRINKS, a resident of Pittsburg, Allegheny county, Pennsylvania, have invented certain new and useful Improvements in Positive-Displacement Rotary Blowers, of which the following is a specification.

This invention relates to that type of rotary blower in which a plurality of blades, turning about a common axis, are driven simultaneously at different speeds.

The blade rotating means usually employed, and that here shown, consists of a cylindrical drum within the blower casing and rotatable on an axis eccentric to the axis of the blades and inclosing the latter, the drum having slots through which the blades work. As heretofore constructed, blowers of this type are of necessity run at relatively low speed.

If the blades of machines of prior design were to maintain the same angular relation to each other at all times, they could be so arranged as to be in centrifugal balance with each other or with parts of the drum; but as their angular relations vary throughout each cycle of their movement, their centrifugal forces vary so that the balance which may exist in one position is not maintained. At high speeds this condition results in wear, vibrations and noise, and as the trouble increases with the speed, the number of revolutions in unit time is limited.

Fully recognizing the limitations of the machine of this type as heretofore constructed, we have sought to reconstruct the same into a high power, high velocity machine without the vital objections of vibrations and noise. This we accomplish by counterbalancing each of the separately movable blades and by providing a balanced rotor or drum so that the centrifugal forces in each of the separately revoluble elements are balanced in all positions and at all speeds. Thus there exists no rocking movement or free force even at the highest speeds. We also aim to provide a counterbalance of such construction that even at the highest speeds which are attainable with direct drive by electric motors or steam turbines no serious distortions or deformations can occur so that perfect alinement and bearing contact is maintained. Counterbalancing of the character referred to necessitates an extension from the blade at the opposite side of its axis of rotation, and this presents a mechanical problem in adapting the invention to machines of relatively small size. The counterweights are of necessity inclosed by the eccentric drum, and must be so arranged as not to interfere with each other or with the drum. These several conditions and requirements are fully met in the machine of our invention.

In the accompanying drawings, Figure 1 is a cross section on line 1—1 of Fig. 2, illustrating a blower constructed in accordance with the invention, and Figs. 2, 3 and 4 are longitudinal sections on lines 2—2, 3—3 and 4—4, respectively, of Fig. 1.

Referring to the drawings, 2 designates the cylindrical casing of the blower having inlet 3 and outlet 4 arranged preferably adjacent to each other. Rotatably mounted within casing 2, eccentric to the axial center of the latter, is the balanced drum or rotor 5. The drum may be driven in any suitable manner, that here shown consisting of a shaft or spindle 6 extending from or geared to a motor, not shown. The eccentric position of the drum is such as to cause it to close with a small clearance (technically known as running fit) against that portion 7 of the inner periphery of casing 2 lying between inlet 3 and outlet 4.

8 is a stub shaft or axle at the center of casing 3 and inclosed by drum 5, and separately rotatable thereon are three blades A, B and C which extend through roller elements 9 confined in the three equally spaced slot-like passages through drum 5.

The construction thus far described is well known, and the advantages resulting from the varying speeds at which each blade is driven by the drum in making a complete revolution are well known to those skilled in the art. The present invention, therefore, is confined to the blade mounting and counterbalancing in connection with a balanced drum or rotor. The perfect counterbalance of the blades to which reference has already been made, is preferably attained by a series of ring-like members 10 loosely mounted on axle 8, each having a counterbalancing enlargement or extension 11 and a diametri-

cally opposite blade holding portion here shown as a slotted lug 12, in which an extension of the blade is inserted and secured by screw or rivet 13. It is very important that the mechanical construction be such as to permit the parts to maintain their shape without distortion even at the highest commercially practicable speeds. For this reason the ring-like members 10 are made heavy and the centrifugal forces of the blades and of the counterweights, as viewed in Figs. 2, 3 and 4 pass through the center of that dimension of the ring which is parallel with its axis. Thus it will be seen that the forces passing through the rings 10 have no tendency whatever to tilt the ring sidewise or to cause binding on the bearing axle 8. An economical and generally convenient and desirable arrangement is to have several ring members 10 interchangeable, with two of them designed to carry and counterbalance each blade. Thus, as shown in Figs. 2 and 3, blade A may be carried by the two centrally located ring-members positioned side by side, while the ring-members for blade B are at the outer sides of those for blade A and between the latter and the ring members for blade C. The ring members are thus fully interchangeable and adapted for any of the several blades. The arrangement of the bearing rings and counterweights is such that the centers of gravity of each pair of counterbalances 11 and its blade are in a line intersecting the center of axle 8 and at right angles thereto. Since, in addition to the foregoing, the products of rotating mass times radius to mass center are the same on both sides of the axis, the blades are perfectly counterbalanced in all positions and at all times regardless of the speed at which they are driven. The result is a total absence of free radial force or rocking moment, and under this condition there can be no vibrations, binding or wear.

The counterweights 11 are preferably fan-shape as this form permits them to move quite close to lugs 12 of the other blades without interfering therewith or with drum 5, as seen in Fig. 1, and without decreasing their necessary weight and size. A further characteristic of the invention, as embodied in what we believe to be the most advantageous and economical manner, is the use of an uneven number of blades so that the several blade elements, each consisting of a blade and its counterweight at diametrically opposite sides of the axis of rotation, may be arranged and may operate in close relation without interference. The number of blades in a rotary pump of this type must be more than one in order to insure positive continuous flow through the pump.

Referring to Fig. 1, it will be seen that there would be no partition between suction 3 and pressure 4 if the blades B and C were removed, and such partition must exist at all times in order to prevent any of the pumped air, gas, etc., from flowing back, or at least from so diminishing the pressure as to create an objectionable pulsation in the flow. With an even number of blades, each would of necessity come into alinement with another blade one or more times during a complete revolution which obviously would preclude the present mode of counterbalancing owing to the resulting interference, and would necessitate such rearrangement as would involve the provision of a larger drum 5 and a generally heavier and more bulky machine.

The balancing of centrifugal forces herein mentioned, and the expression "centrifugally balanced" used in the claims involves two necessary conditions: 1. The mass center of the whole rotating element must lie in the axis of rotation. 2. If any plane section through the rotating body is made in a plane containing the axis of rotation, the mass centers of the two resulting pieces must lie in a plane at right angles to the axis of rotation.

We claim:

1. In a blower, the combination of a casing, a plurality of counterbalanced blades rotatable on a common axis therein, and centrifugally balanced blade rotating means.

2. In a blower, the combination of a casing, separately rotatable blades therein revoluble on a common axis, a counterbalance for each blade on the opposite side of the blade axis from the blade, and centrifugally balanced blade rotating means.

3. In a blower, the combination of a casing, an unequal number of blades rotatable therein on a common axis, a counterbalance for each blade on the diametrically opposite side of the blade axis from the blade, and centrifugally balanced blade rotating means.

4. In a blower, the combination of a casing, a plurality of separately rotatable blades therein revoluble on a common axis, a counterbalance for each blade at the opposite side of the blade axis from the blade, the centers of gravity of each blade and its counterweight being in a common plane at right angles to the axis of rotation, and centrifugally balanced blade rotating means.

5. In a blower, the combination of a casing, an axle arranged centrally therein, a plurality of hub members loose on said axle, said members having like counterweight extensions, blades each secured to certain of the hub members, and centrifugally balanced blade rotating means.

6. In a blower, the combination of a casing, an axle, a plurality of interchangeable counterweighted hub members rotatable on the axle with blade attaching portions on said members diametrically opposite their counterweights, blades each secured to cer-

tain of the members at said portions, and balanced blade rotating means.

7. In a blower, the combination of a cylindrical casing, a centrifugally balanced drum rotatable in the casing on an axis eccentric to the casing axis, the drum formed with blade slots, and a plurality of separately rotatable counterweighted blades mounted concentrically within the casing, the mass center of each blade and its counterweight coinciding with their axis of rotation.

8. In a blower, the combination of a cylindrical casing, a centrifugally balanced drum rotatable in the casing on an axis eccentric to the casing axis, the drum formed with blade slots, separately rotatable blades mounted concentrically in the casing and within the drum and extending through the drum slots, and counterweight means for each blade at the opposite side of the blade axis from the blade and wholly within the drum.

9. A valveless rotary blower consisting of a casing, an eccentrically mounted balanced drum, an axle within the drum and concentric with the casing, and a plurality of individually balanced individually rotating blades mounted on the axle and rotated by said balanced drum.

10. In a rotary blower, a casing, an axle arranged concentrically therein, bearing members mounted to turn individually on the axle, blades secured to the bearing members, counterweights carried by the bearing members in position to direct the centrifugal force of each counterweight centrally through that dimension of its bearing member which is parallel with its axis of rotation, and centrifugally balanced blade rotating means.

11. A valveless rotary blower consisting of a circular casing, a cylindrical slotted centrifugally balanced drum mounted eccentrically within the casing, an axle concentric with the casing and around which the drum rotates, a plurality of individually rotatable blades mounted on said axle wholly within the drum and extending through the slots of the latter, and counterbalancing means for each blade movable therewith and located wholly within the drum.

12. A valveless rotary blower consisting of a circular casing, a cylindrical slotted centrifugally balanced drum mounted eccentrically in the casing, an axle concentric with the casing and around which the drum rotates, a plurality of blades within the drum and extending through the slots thereof and mounted on said axle wholly within the drum, and counterweights rigid with the blades, each counterweight being fan-shaped to permit it to move into close proximity to the other blades without interfering therewith.

13. A valveless rotary blower consisting of a circular casing, a cylindrical slotted balanced drum mounted eccentrically in the casing, an axle concentric with the casing and around which the drum rotates, bearing members within the drum and individually rotatable on the axle, blade securing means and a counterweight carried by each bearing member at diametrically opposite sides thereof, and blades held by the securing means of the bearing members and extending through the slots of the drum.

14. A valveless rotary blower consisting of a circular casing, a cylindrical slotted balanced drum mounted eccentrically in the casing, an axle concentric with the casing and around which the drum rotates, blades extending into the drum through the slots thereof, bearing members within the drum and individually rotatable on the axle, said members arranged in pairs—one pair for each blade, and blade securing means and a counterweight projecting from diametrically opposite faces of each bearing member with the blades fastened to the securing means of the respective pairs of members.

In testimony whereof we affix our signatures in presence of two witnesses.

JAMES JOSEPH GIBSON.
CHARLES L. W. TRINKS.

Witnesses:
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J. M. NESBIT.