

Dec. 20, 1960

R. COESTER
TURBO-MACHINE

2,965,284

Filed Nov. 23, 1956

2 Sheets-Sheet 1

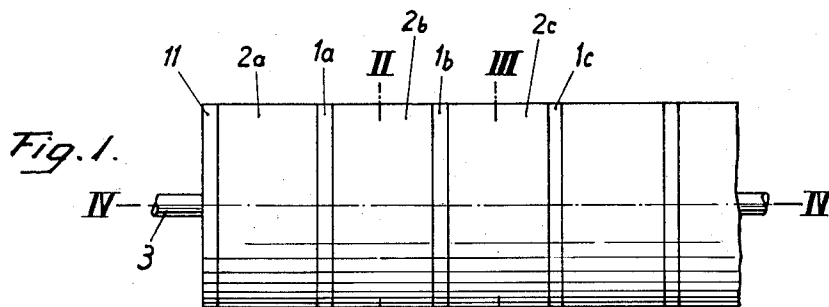
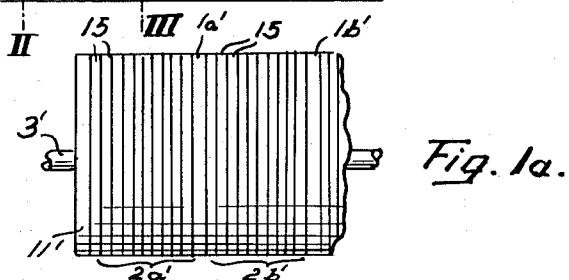
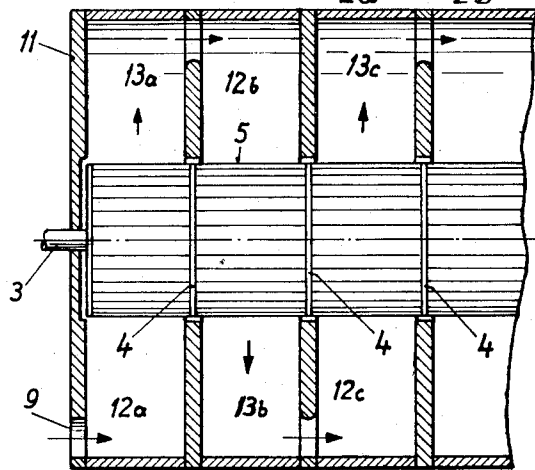


Fig. 4

INVENTOR.
Robert Coester
BY
William J. Gubler

Dec. 20, 1960

R. COESTER
TURBO-MACHINE

2,965,284

Filed Nov. 23, 1956

2 Sheets-Sheet 2

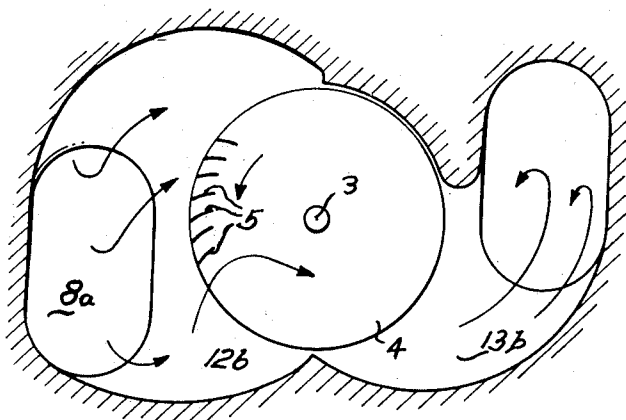


Fig. 2.

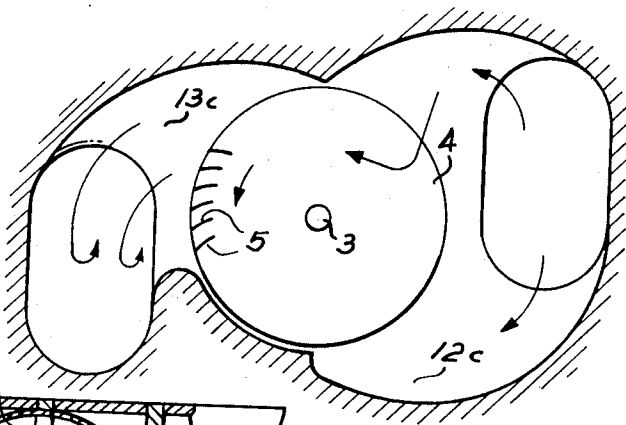


Fig. 3.

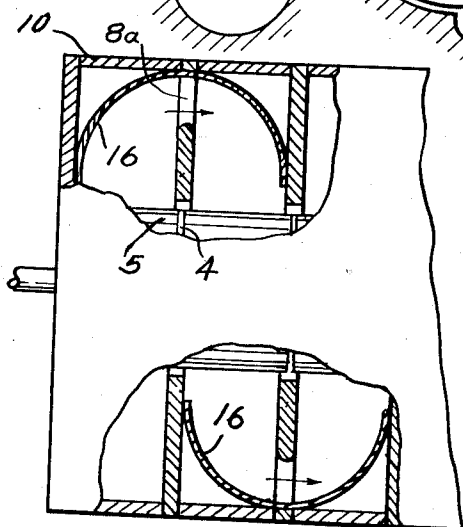


Fig. 4a

INVENTOR.
Robert Coester
BY
Arthur G. Fisher

1

2,965,284

TURBO-MACHINE

Robert Coester, Zumikon, Zurich, Switzerland, assignor to Maschinenfabrik Benninger A.-G., Uzwil, St. Gallen, Switzerland, a Swiss company

Filed Nov. 23, 1956, Ser. No. 623,916

Claims priority, application Switzerland Nov. 24, 1955

6 Claims. (Cl. 230—45)

The present invention relates to a transverse flow turbo-machine, i.e. a blower acting transversely to the stream, for conveying gaseous and liquid media, which is of a simple and withal very compact design.

The use of turbo-machine type designs for blowers, compressors and pumps has not hitherto prevailed over other forms of conveyor wherever high lifts or great discharge pressures are required relative to the quantity delivered. In the turbo-machines already known such conditions as these call for extremely high revolutions, which are mechanically very difficult to control and require expensive gearing for the drive. The dimensions also become unfavourable in regard to flow conditions and extremely high numbers of stages are often involved. Other types of machine require much larger dimensions in comparison with an undesirable effect on price and weight.

The present invention eliminates these disadvantages. It relates to turbo-machines consisting of stage units in which a space is divided into an high pressure and low pressure chamber by a conveyor rotor, the flow through the rotor being perpendicular to its axis. It is characterized by the fact that at least two similar stage units, through which the rotor passes, are arranged consecutively in the sense of flow, the rotor being divided in the plane of separation of the two units by a partition wall which rotates with it.

In the enclosed drawings, embodiments of the turbo-machine according to the present invention are given by way of example.

Fig. 1 is a side elevation of an assembled turbo-machine;

Fig. 1a diagrammatically represents in side elevation a slight modification over the turbo-machine of Fig. 1;

Fig. 2 is a section through a structural element along the line II—II in Fig. 1;

Fig. 3 is a section through a structural element adjacent to the structural element in Fig. 2, along the line III—III of Fig. 1;

Fig. 4 is a horizontal section along the line IV—IV of Fig. 1;

Fig. 4a is a slight modification over the arrangement of Fig. 4.

Figs. 2 and 3 represent a cross-section, by way of example, through the stage unit of a turbo-machine which is known under the name "Mortier blower"; it should, however, be pointed out that the invention can also be applied to other turbo-machines.

The whole turbo-machine is assembled from any number of stage units 2a, 2b, 2c etc. forming a casing 10 as shown in Fig. 1. The blower rotor 5 which is provided with discs 4 having the blower blades mounted thereon passes through the machine and is driven by the shaft 3. The first stage unit 2a is arranged next to the end shield 11 of casing 10, next to it is a wall means 1a, then another stage unit 2b, a wall means 1b etc. All the stage units 2a, 2b, 2c and the wall means 1 can be

2

completely identical and interchangeable, they are, however, so arranged that at least a portion of the low pressure chamber of one stage unit is located in longitudinal direction opposite the low pressure chamber of the next stage unit in such a way that the connecting channels 8a from one stage unit to the next are as short as possible and at the same time the flow paths exhibit a minimum curvature. How this is to be achieved in the individual case will be dictated more or less automatically by the shape chosen in the particular instance for the high pressure and low pressure chambers. This assembly will be clear on comparison of Figs. 2 and 3.

Fig. 4 shows an assembled turbo-machine in section. If the shaft 3 and thus the blower rotors are made to revolve, a low pressure is created in chamber 12a with the result that, for example, air streams through the aperture 9 into this chamber. This air is fed into the chamber 13a and flows through the channel 8a into the first chamber 12b of the adjacent structural unit 2b. Here the flow is again fed to the rotor in the same manner as in the preceding stage unit but in the other direction. In this way the conveyORIZED material flows through the chambers 12b, 13b, 12c, 13c, etc. On each passage through a blower rotor the general pressure is increased. Thus an extremely compact arrangement is obtained which permits four times more pressure to be produced in the same space than with any other known turbo-machine. Moreover a machine assembled from such stage units contains by comparison a small number of simple structural elements. By suitable combinations the most varied operating conditions can be obtained without any significant additional expenditure on structural elements. The separating discs built into the rotor run in the partition walls of the housing with little play. The gap created there can be given the form of a labyrinth so as to ensure a better seal.

The whole arrangement enables a very considerable simplification of design to be realized. The machine has moreover a very low specific rotational speed and this enables it to be employed wherever the high speed of existing turbo-machines was a bar to their use.

A further improvement can be realized where necessary by arranging for the separate structural elements 2a, 2b, 2c . . . not to consist of a single piece as shown in Fig. 1 but of several lamina-type metal sheets as shown in Fig. 1a. The various elements in Fig. 1a which correspond to those of Fig. 1 have been designated with the same reference numerals as in Fig. 1 but have additionally been primed. A larger or smaller number of laminae are arranged side by side according to the width desired in the structural unit. Where there is a large number of consecutively arranged structural units it may be of advantage to make the width of the housing decrease in the direction of flow. In such a case it is of advantage to build up the separate units from laminae. Further, provision can be made for guide elements in the form of suitably mounted plates 16 in order better to control the flow of material, as, for example, indicated in Fig. 4a; the flow can, of course, also be circuited by means of loop ducts mounted outside the actual structural elements.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

1. In a transverse flow turbo-machine: a housing, a plurality of substantially parallel partitions sub-dividing said housing into a plurality of chambers, each of said partitions having a first substantially circular passage therethrough, said first passages being in alignment with each other, a rotor rotatably extending through said first passages and sub-dividing each chamber into a low pressure and a high pressure stage, said rotor being provided with blades extending parallel to the axis of said rotor,

one component of said blades extending in radial direction with regard to said rotor, and disc members supported by said rotor and respectively located in said passages and rotatable therein together with said rotor, said partitions respectively having second passages therethrough, the second passages of each two successive partitions respectively being arranged on diametrically opposite sides of said rotor and alternately connecting a high pressure stage with a low pressure stage and a low pressure stage with a high pressure stage.

2. A transverse flow turbo-machine comprising a casing, wall means arranged in said casing and having substantially circular first passage means, said wall means also having second passage means therethrough and subdividing said turbo-machine into a plurality of stage units, a rotor extending through said first passage means and being provided with blades extending parallel to the axis thereof, one component of said blades extending in radial direction with regard to said rotor, and disc means rotatably supported by said rotor and located in said first passage means and supporting said blades, said rotor dividing each stage unit into a low pressure chamber and a high pressure chamber, at least a portion of the low pressure chamber of one of said stage units being located in longitudinal direction opposite the high pressure chamber of a directly adjacent stage unit and communicating therewith through the respective second passage means in said wall means, the low pressure chamber of the first stage unit having an inlet opening and the high pressure chamber of the last stage unit having an outlet opening, said rotor being exposed to said low pressure chambers over a surface area larger than the surface area exposed to said high pressure chambers to thereby initiate in each stage unit a flow of fluid from the respective low pressure chamber to the respective high pressure chamber whereby a continuous flow of said fluid through all of said stage units is created.

3. A turbo-machine according to claim 2, in which the last two consecutively arranged stage units are of identical form.

4. A turbo-machine according to claim 2, which includes loop ducts arranged outside said stage units.

5. A transverse flow turbo-machine comprising a casing, wall means arranged in said casing and having substantially circular first passage means, said wall means also having a second passage means therethrough and subdividing said turbo-machine into a plurality of stage units, said separate stage units being detachably connected to each other, a rotor extending through said first passage means and being provided with blades extending in radial direction with regard to said rotor, and disc means rotatably supported by said rotor and located in said first passage means and supporting said blades, said rotor dividing each stage unit into a low pressure cham-

ber and into a high pressure chamber, at least a portion of the low pressure chamber of one of said stage units being located in longitudinal direction opposite the high pressure chamber of a directly adjacent stage unit and communicating therewith through the respective second passage means provided in said wall means, the low pressure chamber of the first stage unit having an inlet opening and the high pressure chamber of the last stage unit having an outlet opening, said rotor being exposed to said low pressure chambers over a surface area larger than the surface area exposed to said high pressure chambers to thereby initiate in each stage unit a flow of fluid from the respective low pressure chamber to the respective high pressure chamber whereby a continuous flow of said fluid through all of said stage units is created.

6. A transverse flow turbo-machine comprising a casing, wall means arranged in said casing and having substantially circular first passage means, said wall means respectively also having second passage means therethrough and subdividing said turbo-machine into a plurality of stage units, at least one of said stage units being formed of superimposed laminae, a rotor extending through said first passage means and being provided with blades extending parallel to the axis thereof, one component of said blades extending in radial direction with regard to said rotor, and disc means rotatably supported by said rotor and located in said first passage means and supporting said blades, said rotor dividing each stage unit into a low pressure chamber and into a high pressure chamber, at least a portion of the low pressure chamber of one of said stage units being located in longitudinal direction opposite the high pressure chamber of a directly adjacent stage unit and communicating therewith through the respective second passage means provided in said wall means, the low pressure chamber of the first stage unit having an inlet opening and the high pressure chamber of the last stage unit having an outlet opening, said rotor being exposed to said low pressure chambers over a surface area larger than the surface area exposed to said high pressure chambers to thereby initiate in each unit a flow of fluid from the respective low pressure chamber to the respective high pressure chamber whereby a continuous flow of said fluid through all of said stage units is created.

References Cited in the file of this patent

UNITED STATES PATENTS

912,882	Oraker	Feb. 16, 1909
1,017,001	Kane	Feb. 13, 1912
1,920,952	Anderson	Aug. 8, 1933
2,033,273	Buck	Mar. 10, 1936
2,422,763	Wislicenus	June 24, 1947
2,774,307	Zepp	Dec. 18, 1956