COMMONWEALTH of AUSTRALIA

PATENTS ACT 1952

APPLICATION FOR A STANDARD PATENT

We

JAMES HOWDEN & COMPANY LTD.,

OF 195 Scotland Street,

Glasgow G5 8PJ

Scotland

GREAT BRITAIN

hereby apply for the grant of a Standard Patent for an invention entitled;

"CENTRIFUGAL FANS AND BLOWERS"

which is described in the accompanying provisional specification.

Details of basic application(s):

<table>
<thead>
<tr>
<th>Number</th>
<th>Convention Country</th>
<th>Date</th>
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<tbody>
<tr>
<td>85306321.2.</td>
<td>EUROPE</td>
<td>5th September 1985</td>
</tr>
</tbody>
</table>

The address for service is care of DAVIES & COLLISON, Patent Attorneys, of 1 Little Collins Street, Melbourne, in the State of Victoria, Commonwealth of Australia.

Dated this 25th day of August 1986

To: THE COMMISSIONER OF PATENTS

(a member of the firm of DAVIES & COLLISON for and on behalf of the Applicant).

Davies & Collisson, Melbourne and Canberra.
COMMONWEALTH OF AUSTRALIA
PATENTS ACT 1952
DECLARATION IN SUPPORT OF CONVENTION OR NON-CONVENTION APPLICATION FOR A PATENT

In support of the Application made for a patent for an invention entitled: "CENTRIFUGAL FANS AND BLOWERS"

Robert Ross Wilson

1. DR. R.R. WILSON - DIRECTOR
   xx of: JAMES HOWDEN & COMPANY LIMITED, a British Company of: 195, Scotland Street, Glasgow G5 8PJ, Scotland. Great Britain.

   do solemnly and sincerely declare as follows:
   1(a) I am the applicant for the patent
   or (b) I am authorized by
   JAMES HOWDEN & COMPANY LIMITED
   the applicant for the patent to make this declaration on its behalf.

   2(a) Robert Alexander Walker, a British Subject
   of: 24, Mexwood Road, Galston, Ayrshire KA4 8JN, Scotland. Great Britain.

   or (b) ROBERT ALEXANDER WALKER, a British Subject
   of: 24, Mexwood Road, Galston, Ayrshire KA4 8JN, Scotland. Great Britain.

   is the actual inventor of the invention and the facts upon which the applicant is entitled to make the application are as follows:

   "The applicant would, if a patent were granted upon an application made by the inventor, be entitled to have the patent assigned to it".

   3. The basic application, as defined by Section 141 of the Act, was made in EUROPE: No. 850306321.2 on the 5th September, 1985 by JAMES HOWDEN & COMPANY LIMITED.

   in
   by
   in
   by

   4. The basic application referred to in paragraph 3 of this Declaration was the first application made in a Convention country in respect of the invention the subject of the application.

   Declared at Glasgow this 12th day of November, 1986

   R. R. Wilson
   Director

   DAVIES & COLLISON, MELBOURNE and CANBERRA.
A centrifugal fan comprising a bearing arrangement, a shaft rotatable about its axis in said bearing arrangement, two single inlet centrifugal impellers mounted on said shaft for rotation therewith at axially spaced locations thereon, two separate casings each surrounding its own impeller, said casings being mounted so as to be axially spaced from one another, said bearing arrangement including a main bearing located between said two separate casings, and thus between said two impellers, whereby at least one of said impellers is mounted in overhung relation to said main bearing, said main bearing taking a major portion of the bearing load of the impellers, and drive means for rotating said shaft.
COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952-1973

COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE:

CLASS

INT. CLASS

APPLICATION NUMBER: 61799/86

LODGED: 

COMPLETE SPECIFICATION LODGED:

ACCEPTED:

PUBLISHED:

PRIORITY:

RELATED ART:

NAME OF APPLICANT: James Howden & Company Ltd

ADDRESS OF APPLICANT: 195 Scotland Street,
Glasgow G5 8PJ, Scotland,
GREAT BRITAIN

ACTUAL INVENTOR(S): Robert Alexander WALKER
24 Mexwood Road, Galston,
Ayrshire KA4 8JN,
Scotland, GREAT BRITAIN

ADDRESS FOR SERVICE: Davies & Collinson
1 Little Collins Street,
Melbourne 3000, Australia

COMPLETE SPECIFICATION FOR THE INVENTION ENTITLED:

CENTRIFUGAL FANS AND BLOWERS

The following statement is a full description of this invention, including the best method of performing it known to us:
"CENTRIFUGAL FANS AND BLOWERS"

The present invention relates to centrifugal fans or blowers.

Conventional heavy duty double suction centrifugal fans and blowers basically consist of a bearing arrangement, a shaft rotatable about its axis in said bearing arrangement, two single inlet centrifugal fan impellers mounted on said shaft and rotatable therewith, a fan casing surrounding the impellers and drive means for rotating the shaft. While such designs are well proven in service, they do have significant disadvantages in very large size fans, due to scale effects on the basic geometry of the rotor.

The problems of such heavy duty fans are discussed later in this specification with reference to Figures 1 and 2.

The present invention aims to overcome the major problems resulting from the scale effect, by providing the fan casing as two separate casings, each surrounding its own impeller, the two casings being spaced apart and by providing the bearing arrangement so that it includes a main bearing which is located between the two casing parts, and this between the two impellers, this main bearing taking a major portion of the bearing load of the impellers.

With such an arrangement because the actual load bearing portion of the shaft can be relatively short, the diameter of the shaft can be significantly reduced and it is determined largely by the torque which the remainder of the shaft has to transmit from the drive source, such as an electric motor. It is also possible very significantly to reduce the impeller hub weight and therefore its cost.

The drive means may be connected to the shaft at a location between the impellers, for example either by mounting a drive motor between the impellers or by providing a belt or chain drive or gearbox drive.
Preferably, however, the bearing assembly includes a second bearing at a location spaced along the shaft from the main bearing, a drive means being positioned adjacent the second bearing. There will be a much reduced load on the outer bearing which will allow the size of this bearing to be greatly reduced. Because of the very much reduced total rotor weight, there will be easier handling, less starting torque and reduced foundation loads.

Because the shaft can be made of lesser diameter than hitherto, and when the second portion of smaller diameter is provided, the shaft blockage of the flow of air to the inlet of the impellers will be greatly reduced on one side and will be totally eliminated on the other side from that on which the drive motor will be provided. The other side, of course, will only be an overhung portion cantilevered out from the main bearing.

The main portion of the shaft may be detachably connected to the second portion of the shaft and the casing may include slots and removable cover panels, so that when cover panels are removed and the main shaft-portion are disconnected from the second shaft portion, the impellers can be rolled out of the casing.

The two fan impellers and their volutes may be of a different size and/or design. Furthermore, the impeller or impellers which are mounted in overhung relation to the main bearing may be provided with a simple disc flow control.

In order that the present invention may more readily be understood, the following description is given, merely by way of example, reference being made to the accompanying drawings, in which-

Figure 1 is a schematic, broken away side elevation of one known form of large capacity double centrifugal fan or blower;

Figure 2 is a view similar to Figure 1 of a
second known form of such apparatus;

Figures 3, 4, 5, 6 and 7 are similar views of five different embodiments of large capacity double centrifugal fans or blowers according to the present invention; and

Figure 8 is an end elevation of the arrangement of Figure 7.

Referring first to Figure 1, the assembly illustrated therein includes a horizontal axis large diameter shaft 10 mounted between two bearings 12 and 14. The shaft passes through a casing indicated by the general reference numeral 16 and including first and second inlet ducts 18, 20 located just inwardly of the bearing 12, 14. The inlet ducts 18 have laterally extending inlet frusto-conical portions 22, 24 substantially co-axial with the shaft 10. Mounted centrally on the shaft 10 is a double inlet impeller 26, 27 which is surrounded by volute portion 28, 29, respectively, of the fan casing.

The two bearings 12 and 14 are spaced apart from one another by a substantial distance and the shaft 10 will need to have a fairly large diameter to enable it to support a heavy duty double inlet impeller 26, 27. The shaft is driven by a motor indicated schematically at 30 positioned to the left of the bearing 14.

Problems arise with the construction of Figure 1 mainly from the fact that, in order to maintain an acceptable critical speed for the rotor, the ratio of shaft to impeller weight is size dependent and, in very large fans, the shaft weight can be of the order of 3 times the impeller weight. A most obvious disadvantage of this is the total rotor weight can become excessive resulting in very high loads on the foundations 32, 34 carrying the bearings 12, 14. Similarly it will require very large bearings to support the rotating weight and the shaft forging costs can become disproportionately large and can
approach the order of one third of the total manufacturing cost. Because the shaft 10 is of a relatively large diameter it also provides a substantial blockage on the incoming air through the frusto-conical portions 22, 24, thus reducing the efficiency of the fan or blower.

Figure 2 shows an alternative known arrangement in which like parts have been indicated by like reference numerals. This construction differs from that of Figure 1 in that there is only a single inlet 18 mounted centrally of the assembly and the two impellers 26, 27 are mounted adjacent the bearings 12, 14. Thus there are two single inlet impellers on the common shaft, each located adjacent a separate one of the bearings. This design results in a significant reduction in shaft diameter compared to that shown in Figure 1, with all the advantages that this will bring. It does, however, present considerable practical problems with regard to flow control in the common inlet 18 and in some applications the additional complexity resulting from this is unlikely to be offset by the cost savings resulting from the reduced shaft size.

Figure 3 illustrates a construction according to the present invention which obviates many of the disadvantages of the arrangements of Figures 1 and 2, and like parts have again been indicated by like reference numerals. The structure is very similar to Figure 1 in that there are two inlets 18, 20, to frusto-conical portions 22, 24 and two outlets volutes 28, 29.

In this construction, however, the two impellers 26, 27 are formed as single inlet impellers mounted on the common shaft 10 and a main bearing 12 is mounted between them and bears most of the weight load of the shaft 10 and of the impellers 26, 27. An overhung portion 11 of the shaft 10 extends to the right of the main bearing 12 as seen in Figure 3, and the first single inlet impeller 26 is mounted thereon. The remaining portion 13
of the shaft 10 carries the second single inlet impeller 27 and extends to the second bearing 14 and from there to a drive motor 30.

Because the main bearing 12 carries most of the weight load, and because the overhung portion 11 and the corresponding part of the portion 13 of the shaft 10 are relatively short, the diameter of the shaft 10 can be made significantly smaller than in the structure of Figure 1. This means that the restriction to flow of air into the impeller 27 is greatly reduced, thus increasing the efficiency of that fan. Furthermore, because all of the parts can be made much lighter, the construction of the foundations 32, 34 can be reduced for a fan of the same size. Alternatively, of course, using conventional size parts, the size of the fan can be increased.

Figure 4 illustrates a similar construction to that in Figure 3 and again like parts have been indicated by like reference numerals. Here it can be seen that the fan constituted by the impeller 26 and the volute 28 is different from that constituted by the impeller 27 and the volute 29.

The construction of Figure 5 is again similar but here the fan constituted by the impeller 26 and the volute 28 is much smaller than that constituted by the impeller 27 and the volute 29.

Figure 6 is a further modification. The two fans are themselves substantially identical, but a disc type flow control is provided by a shaft 36 mounted in a first slide bearing 38 in the housing 16 and the second slide bearing 40 carried on a spider 41. On the end of the shaft 36 is formed a frusto-conical disc flow control. Movement of the shaft in the direction indicated by the arrows will affect the flow of air through the fan.

The structure of Figure 7 differs from that of Figure 3 in that the shaft 10 includes not only the
impeller 27 is to a

The two fans are of the same size, and the impellers 26 and 27 are similar but

The advantage of this construction is that panels

The structure of Figure 7 is shown in each elevation

An end elevational view of the structures of
The claims defining the invention are as follows:

1. A centrifugal fan comprising a bearing arrangement, a shaft rotatable about its axis in said bearing arrangement, two single inlet centrifugal impellers mounted on said shaft for rotation therewith at axially spaced locations thereon, two separate casings each surrounding its own impeller, said casings being mounted so as to be axially spaced from one another, said bearing arrangement including a main bearing located between said two separate casings, and thus between said two impellers, whereby at least one of said impellers is mounted in overhung relation to said main bearing, said main bearing taking a major portion of the bearing load of the impellers and drive means for rotating said shaft.

2. A centrifugal fan according to claim 1, wherein said drive means is connected to said shaft at a location between said impellers.

3. A centrifugal fan according to claim 1, wherein said bearing arrangement further comprises a second bearing at a location spaced along said shaft from said main bearing and wherein said drive means is connected to said shaft adjacent said second bearing.

4. A centrifugal fan according to claim 3, wherein the shaft includes a main shaft portion mounted on said main bearing and carrying said two impellers and a second portion of smaller diameter connected to said main portion and to said drive means, said second portion being mounted in said second bearing.

5. A centrifugal fan according to claim 4, wherein said main portion of the shaft is detachably connected to the second portion of the shaft.

6. A centrifugal fan according to claim 5, wherein each casing includes slots and removable cover panels, so that when said cover panels are removed and said main shaft portion is disconnected from said second shaft
portion, said impellers can be rolled out of the casing.

7. A centrifugal fan according to any preceding claim, wherein the two fan impellers are different size and/or design.

8. A centrifugal fan according to any preceding claim, wherein the impeller or impellers which is/are mounted in overhung relation to the main bearing is/are provided with a simple disc flow control.

9. A centrifugal fan substantially as hereinbefore described with reference to and as illustrated in Figure 3 of the accompanying drawings.

10. A centrifugal fan substantially as hereinbefore described with reference to and as illustrated in Figure 4 of the accompanying drawings.

11. A centrifugal fan substantially as hereinbefore described with reference to and as illustrated in Figure 5 of the accompanying drawings.

12. A centrifugal fan substantially as hereinbefore described with reference to and as illustrated in Figure 6 of the accompanying drawings.

13. A centrifugal fan substantially as hereinbefore described with reference to and as illustrated in Figure 7 and 8 of the accompanying drawings.

14. The steps or features disclosed herein or any combination thereof.

Dated this 25th day of August 1986

JAMES HOWDEN & COMPANY LIMITED
By its Patent Attorneys
Davies & Collison