(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 096 666**
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **83850131.0**

(22) Date of filing: **17.05.83**

(51) Int. Cl.³: **F 04 B 35/00**
F 04 C 29/00

(30) Priority: **07.06.82 SE 8203503**
07.06.82 SE 8203504

(43) Date of publication of application:
21.12.83 Bulletin 83/51

(84) Designated Contracting States:
BE DE FR GB IT

(71) Applicant: **Atlas Copco Aktiebolag**
Nacka(SE)

(72) Inventor: **Van Hee, Michel Arthur**
Hoogbunderlaan 42
B-2550 Kontich(BE)

(72) Inventor: **Berle, Axel Gunnar**
Kievermont 173
B-2440 Geel(BE)

(74) Representative: **Grundfelt, Gunnar et al,**
c/o Atlas Copco Aktiebolag Patent Department
S-105 23 Stockholm(SE)

(54) **A compressor drive arrangement and a method of adjusting driving characteristics of such an arrangement.**

(57) One or more compressor stages (4) are mounted in fixed positions on a gear box (3). A driving gear wheel (15) connected to a drive motor (1) and cooperating with a driven gear wheel (17) on the compressor stage is journalled in bearings (12, 13) mounted in mounting plates (9, 10). The mounting plates (9, 10) are mounted on the gear box (3). The mounting positions of the bearings (12, 13) are adapted to the chosen gear ratio.

By exchanging the driving gear wheel (15) and/or the driven gear wheel (17) and journalling the driving gear wheel (15) in new mounting plates (9, 10) the speed of each compressor can be changed. Possible misalignmeant between the gear wheels (15, 17) can be decreased by moving one of the mounting plates (9, 10) relative to the gear box (3).

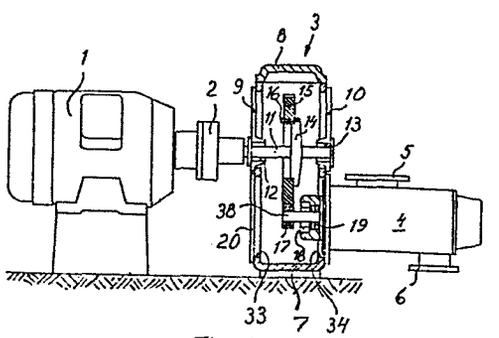

Fig. 1

EP 0 096 666 A1

A compressor drive arrangement and a method of adjusting driving characteristics of such an arrangement.

The present invention relates to a compressor drive arrangement and method of adjusting driving characteristics of such an arrangement. The invention is particularly applicable to gas compressors. The term gas compressor as used in the present application and elsewhere refers to a compressor for the compressing of gases other than air within the process industry.

There are two major problems involved in the design and operation of gas compressors. First, the delivery time for a complete gas compressor installation, including silencers, coolers etc., is very long because each installation is more or less unique. Second, the time required for inspection of bearings, seals etc. is quite long because there are many conduits that must be disconnected and later reconnected. Because the gas involved often is both aggressive and dangerous one must check the tightness very carefully before starting operation again. The time required for inspection and possible replacement of parts may be of the order of a couple of weeks. During this time the process served by the compressor must be stopped. In many process industries such stops cause very substantial losses. Another problem is that the capacity of the compressor must be adjusted after the installation has been made. The reason is that the leakage in the system depends on the molecular weight of the gas. Since extensive tests cannot be performed with compressors intended for unique applications, which furthermore may change from one year to the other, the capacity mostly must be adjusted after delivery. There is no good prior art solution to that problem. Furthermore, after some years there may be a desire to change the capacity of the whole process. This has hitherto meant a complete redesign of the compressor installation.

The present invention, which is defined by the subsequent claims, presents a concept in which the delivery time of a complete operational installation is substantially reduced, the stop time for overhaul and maintenance can be substantially reduced and the capacity of the compressor can be adjusted within a wide range to take care of changing demands for compressed gas.

The basic idea making the above mentioned advantages possible is that the present invention uses a gear box in the drive system with the compressor stage mounted in a fixed position on the gear box. A driving gear wheel connected to the drive motor is journalled in bearings which are mounted in mounting plates provided on the gear box. The fixed compressor stage position makes it possible to have fixed positions for all conduit connections to the compressor. In this way it is possible to start the designing of the conduit system, including silencers, coolers etc., long before the compressor stage has been defined. This reduces the delivery time of a complete operational compressor installation substantially. The use of separate mounting plates in which the driving gear wheel is journalled makes it possible to change the gear ratio by exchanging one of the gear wheels and mounting the driving gear wheel in new, inexpensive, mounting plates where bearing positions adapted to the new gear ratio have been provided. A further advantage with separate mounting plates is that a possible misalignment between the axes of the driving gear wheel and the driven gear wheel on the compressor stage can be reduced by moving one of the mounting plates relative to the gear box so that the cooperation between the gear wheels is improved. A further advantage with the present invention is that the gear box may be provided with access openings through which bearings and seals may be inspected and/or replaced without removing the conduits from the compressor. According to an advantageous embodiment of the invention the size of the

mounting means, e.g. flanges, on the gear box for the compressor stage is the same for several sizes of compressor stages. It is also possible to provide said access openings with mounting flanges for compressor stages so that the same gear box can be used for an extensive range of compressor stage sizes. It is of course possible to use virtually any type of compressor stage with the present invention.

The invention is exemplified below with reference to the accompanying drawings in which fig 1 shows a compressor plant. Fig 2 shows a section through a gear box in fig 1. Fig 3 shows a second embodiment of the gear box. Fig 4 shows a section through the gear box of fig. 3. Figs 5-7 show the gear box with compressor stages mounted in different configurations.

The compressor plant shown in fig 1 comprises a drive motor 1, which by means of a coupling 2 is connected to a gear box 3. A compressor stage 4 having an inlet 5 and an outlet 6 is attached to the gear box. Gear box 3 comprises a lower part 7 and an upper part 8. The gear box is provided with mounting plates 9, 10 in which a shaft 11 is journalled by means of bearings 12, 13. A driving gear wheel comprising a hub 14 and a gear ring 15 is mounted on shaft 11 and is thus connected to drive motor 1. Gear ring 15 is secured to hub 14 by means of screws 16. Compressor stage 4 is provided with a driven gear wheel 17 which is mounted on a shaft 38 through which the compressor stage is driven. Shaft 38 is journalled in bearings 18 and provided with seals 19. Compressor stage 4 is mounted on mounting means 34 which comprises the rim of a hole having the same reference numeral. The rim may be provided with a number of threaded holes for receiving screws by means of which the compressor stage is secured to the gear box. Opposite mounting means 34 the gear box is provided with a mounting means or access opening 33. Mounting means 33 is during operation of the compressor plant covered by a cover plate 20.

The gear box shown in figs 3 and 4 comprises a lower part 27 and an upper part 28 which are joined at a dividing plane 29. Mounting plate 9, and mounting plate 10, is secured both to part 27 and to part 28 by means of screws 30. As seen in fig 4 the driving gear wheel 15 cooperates with two driven gear wheels 24, 25. The corresponding compressor stages are mounted on mounting means 32, 33 which have fixed positions on the gear box. The gear ratios determining the speed of each compressor stage is selected by selecting gear wheels 24, 25 and/or gear wheel 15. In order to make up for the chosen gear ratios the position of shaft 11 is chosen by positioning bearings 12 and 13 in such positions in mounting plates 9, 10 that acceptable cooperation between the gear wheels is obtained. Because the driving gear wheel is journalled in simple and inexpensive mounting plates the speed of the compressor stages can easily be changed by changing one or more gear wheels and replacing the mounting plates with new mounting plates having the new bearing positions. It is also easy to decrease possible misalignment between the driving gear wheel and a driven gear wheel by moving one of the mounting plates relative to the gear box, e.g. by rotating the mounting plate. The latter method works only when shaft 11 is in an off-center position in the mounting plates.

Fig 5-7 show some possibilities of mounting compressor stages on gear box 27. The gear box is provided with a number of mounting means 31, 32, 33 and 34. Of these, mounting means 32 and 34 have the same size. Mounting means 31 and 33 are shown with sizes which each differs from the size of mounting means 32, 34. Mounting means 31 and 34 are provided on a first side 36 of the gear box and mounting means 32 and 33 on a second opposite side 37 of the gear box. Compressor stage 4 of fig 5 is provided with a driven gear wheel 17. Holes 31, 32 are covered by cover plates 20. In fig 6 the gear box is provided with compressor stages 21,

are mounted on the second side 37 of the gear box. Compressor stages 22, 23 of fig 7 having driven gear wheels 25, 26 are mounted on the first side 36 of the gear box. During operation all mounting means or access openings are covered either by a compressor stage or a covering plate 20. Since the size of the mounting flange and the positions of the inlet and outlet are the same for several sizes of compressor stages, i.e. stages with different capacities, it is possible to use the gear box for an extensive range of compressor capacities. It is also possible to design the conduit system before the actual compressor capacity is determined and to reach bearings and seals on the gear box side of the compressor stage without removing any conduit.

In order to reach bearing 18 and seal 19, fig 1, for maintenance and possible replacement upper part 8 of the gear box and cover plate 20 are removed. Screws 16 are removed so that gear ring 15 can be lifted somewhat. After removal of driven gear wheel 17 bearing 18 and seal 19 can be reached through access opening 33. If the gear box is of the type shown in figs 3 and 4 screws 30 securing the mounting plates to the lower part 27 of the gear box are removed so that upper part 28 of the gear box can be lifted together with the driving gear wheel journalled in the mounting plates 9, 10. Bearing 18 and seal 19 are then reached in the same way as in the fig 1 embodiment. In fig 4 the driving gear wheel is shown as having a hub 14 and a gear ring 15. In this case a gear wheel mounted directly on the shaft 11 can be used instead.

Claims:

1. A compressor drive arrangement comprising a drive motor (1), a gear box (3) incorporating a driving gear wheel (15) connected to the drive motor and a compressor stage (4) mounted on first mounting means (34) on the gear box, said compressor stage having a driven gear wheel (17) for cooperation with said driving gear wheel, characterized in that said first mounting means (34) has a position on the gear box (3) being independent of the gear ratio between said driving (15) and driven gear wheels (17), that the gear box is provided with mounting plates (9,10) having bearings (12,13) in which the driving gear wheel is journalled, said bearings being positioned such in said mounting plates that said gear ratio between the driving and the driven gear wheels is obtained.

2. A compressor drive arrangement according to claim 1, characterized in that the gear box (3) is provided with second mounting means (31) for a further compressor stage (23), the position of said second mounting means being independent of the gear ratio between said driving gear wheel (15) and a driven gear wheel (26) on said further compressor stage.

3. A compressor drive arrangement according to claim 1 or 2 characterized in that the size of said mounting means (34) on the gear box (3) is the same for several sizes of compressor stages.

4. A compressor drive arrangement according to claim 1, 2 or 3, characterized in that the gear box (3) comprises a first part (28) and a second part (27), that said mounting means (34) is provided on said second part and that said first part together with said with said driving gear wheel (15) can be separated from said

second part to give access to details on the compressor stage (4), mounted on said mounting means, for maintenance of said details.

5. A compressor drive arrangement according to claim 1, 2 or 3, characterized in that the driving gear wheel comprises a hub (14) and a gear ring (15) mounted on said hub and that said gear ring can be separated from the hub and displaced relative to the hub to give access to details on the compressor stage (4), mounted on said mounting means (34) , for maintenance of said details.

6. A method of adjusting driving characteristics of a compressor drive arrangement, characterized in that at least one compressor stage (4) is maintained in fixed position on a gear box (3), that a driven gear wheel (17) on the compressor stage and/or a driving gear wheel (15) journalled in bearings (12,13) in mounting plates (9,10) on the gear box is exchanged and that new mounting plates having bearing positions adapted to the new gear wheel combination are mounted on the gear box.

7. A method according to claim 6, characterized in that one of the mounting plates (9,10) is moved relative to the gear box (3) in order to decrease possible misalignment between the axes of the driving gear wheel (15) and the driven gear wheel (17).

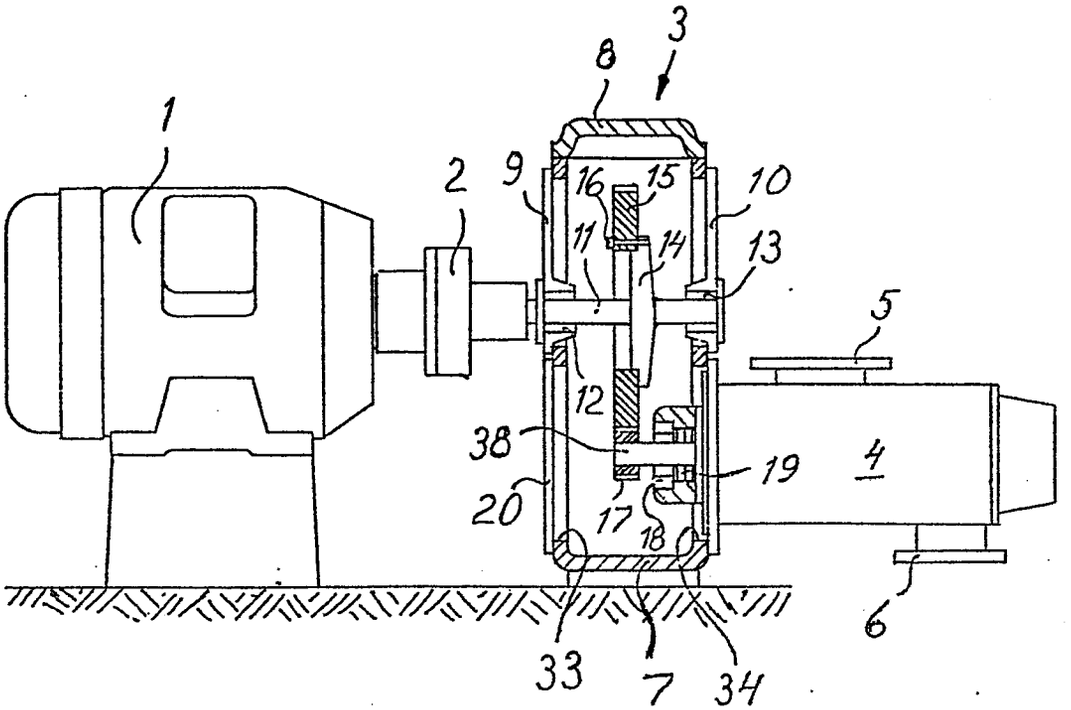
1
2
3
8
9
10
11
12
13
14
15
16
17
18
19
20
38
4
5
6
7
33
34

Fig. 1

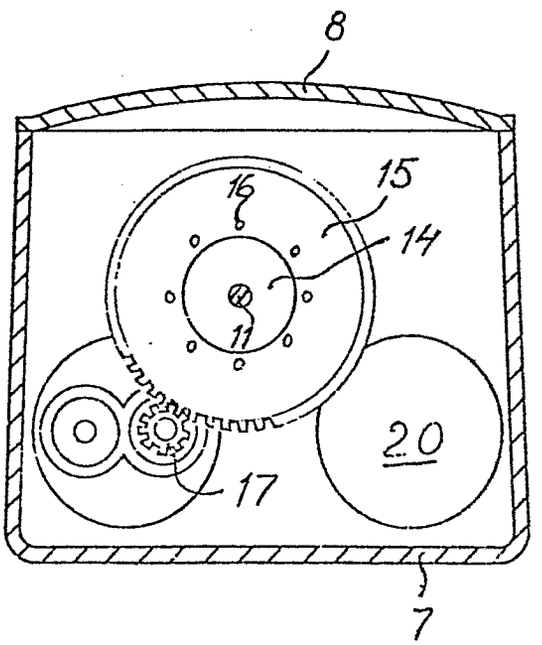
8
15
16
14
11
20
17
7

Fig. 2

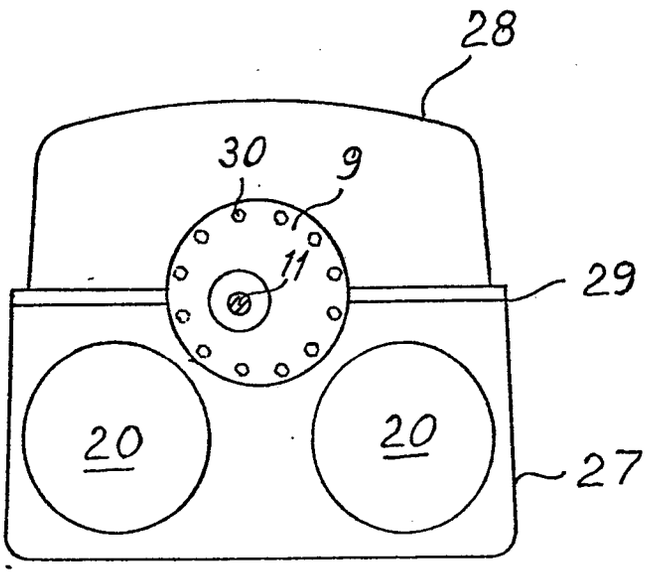

Fig. 3

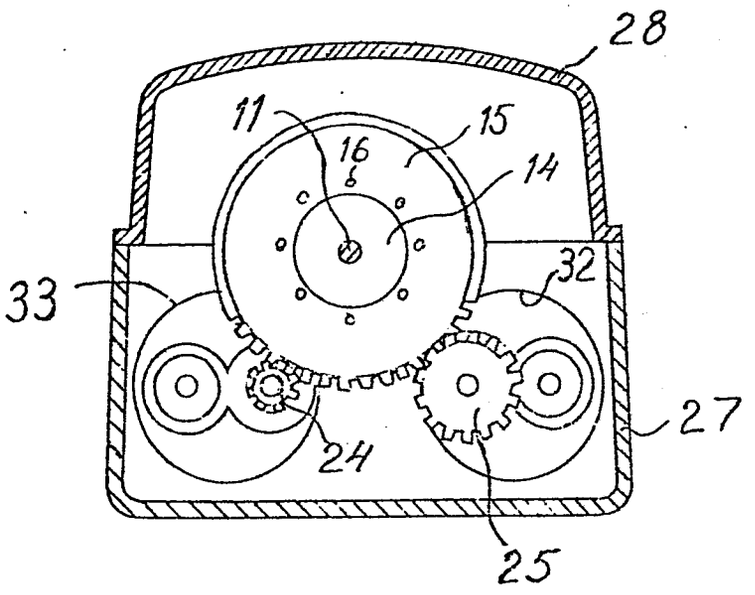

Fig. 4

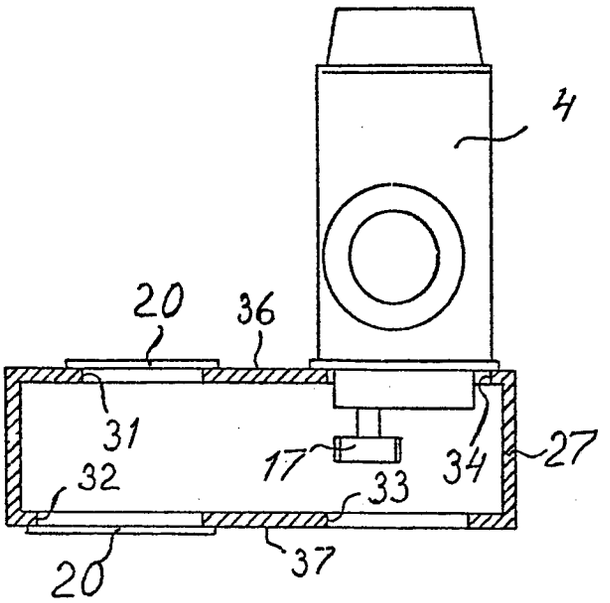

Fig. 5

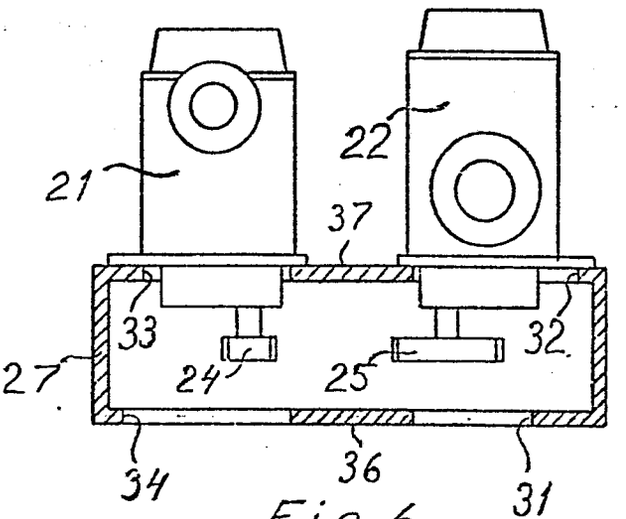

Fig. 6

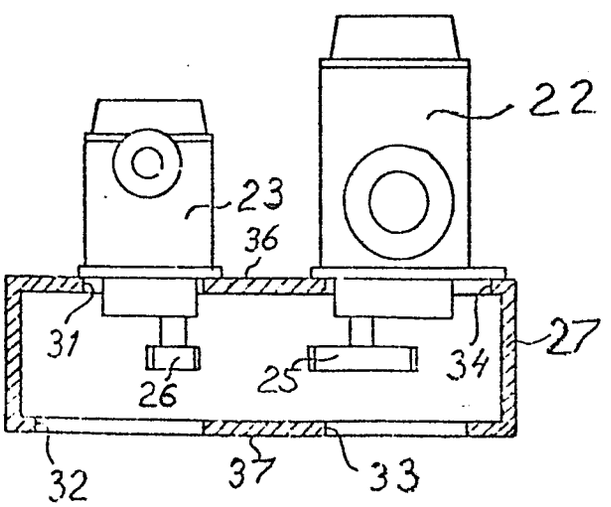

Fig. 7

European Patent Office

EUROPEAN SEARCH REPORT

0096666
Application number

EP 83 85 0131

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Y	GB-A-2 022 191 (KLÖCKNER-HUMBOLDT-DEUTZ AG) * Complete document *	1	F 04 B 35/00 F 04 C 29/00
A		4-7	
Y	DE-U-6 805 377 (ZAHNRADFABRIK FRIEDRICHSHAFEN AG) * Claims 1, 2; figures 1, 2 *	1,6,7	
A		2	
Y	US-A-3 888 134 (L.T. MIRANDA) * Claims 1, 3, 5-9; figures 1, 2, 6 *	1,6,7	
A	DE-A-2 355 911 (TWIN DISC) * Complete document *	1,2,6, 7	TECHNICAL FIELDS SEARCHED (Int. Cl. ³) F 04 B 35/00 F 04 C 29/00 F 16 H 57/00 F 16 H 1/00
A	GB-A-1 436 273 (KLÖCKNER-HUMBOLDT-DEUTZ AG) * Complete document *	1,5,6	
A	GB-A- 850 140 (I.C. JENNINGS) * Claims 1-3; page 3, lines 92-119; figures 1, 5, 6 *	1,2	
A	GB-A-2 082 681 (STAL REFRIGERATION AB)		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	05-08-1983	LEMBLE Y.A.F.M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO Form 1503. 03.82