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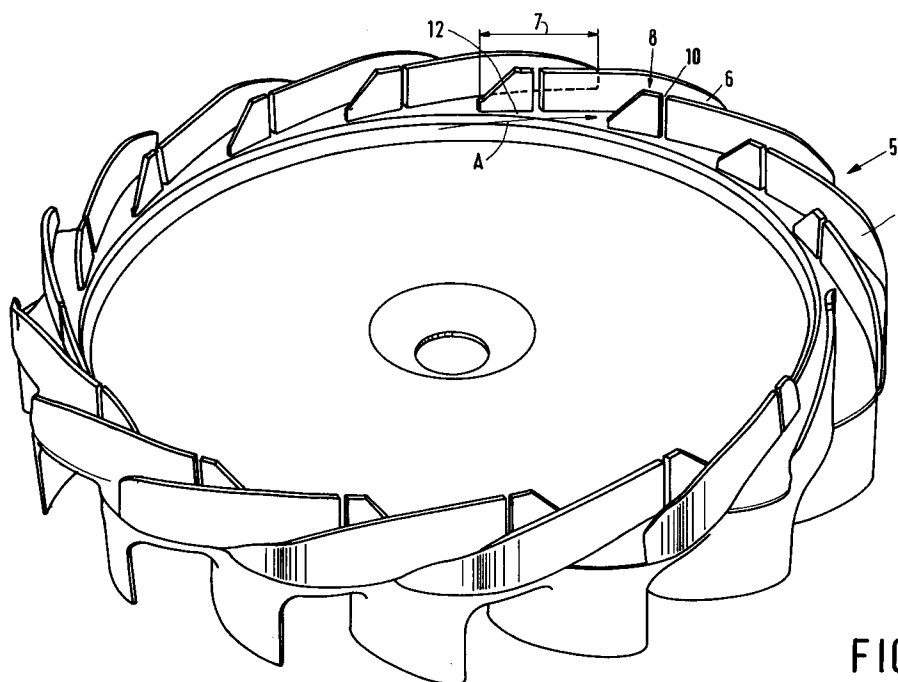
**0 556 895 A1**

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NL-5656 AA Eindhoven (NL)**(54) **Device for displacing a gaseous or liquid medium, and vacuum cleaner comprising such a device.**

(57) A device for displacing a gaseous or liquid medium comprises a rotatably drivable impeller wheel and a diffusor (5) having a plurality of guide vanes (6) adjoining the impeller wheel viewed in the flow direction (A), of which two successive guide vanes have an overlap (7) viewed in the flow direction, between which guide vanes diverging passages (8)

for the medium are formed. In order to reduce the noise level each guide vane has at least one opening (10) which, viewed in the flow direction (A), is situated in the first one of two successive guide vanes outside said overlap (7). Preferably, the opening is a slit.

**FIG.2****EP 0 556 895 A1**

The invention relates to a device for displacing a gaseous or liquid medium, which device comprises a rotatably drivable impeller wheel and a diffusor comprising a plurality of guide vanes adjoining the impeller wheel viewed in the flow direction, of which two successive guide vanes have an overlap viewed in the flow direction, between which guide vanes diverging passages for the medium are formed.

Such a device is known from US-A-4,679,990.

A problem associated with compressors is the high noise level. In fact, any obstacle in a fluctuating gas or liquid stream constitutes a source of noise. In general, the level of the noise produced upon impingement of a stream upon an obstacle is to be minimised. In a device for displacing a gas or a liquid, such as for example a compressor, such an obstacle acting as a source of noise is formed by *inter alia* a wall of a guide vane of a diffusor.

It is an object of the invention to provide a device for displacing a gaseous or liquid medium with a comparatively low noise level.

To this end the device in accordance with the invention is characterised in that each guide vane has at least one opening which, viewed in the flow direction, is situated in the first one of two successive guide vanes outside said overlap.

It is another object of the invention to provide a vacuum cleaner which has a compressor forming part of said device and whose noise level is low.

To this end the vacuum cleaner in accordance with the invention is characterised in that each guide vane adjoining the rotatable vanes of the compressor has an opening which, viewed in the flow direction, is situated in the first one of two successive guide vanes outside said overlap.

Surprisingly, it has been found that said steps lead to a considerable reduction of the noise level in a device and in a vacuum cleaner in accordance with the invention. A possible explanation could be that time-shifted pressure impulses of different magnitude are produced at opposite sides of a guide vane, and that these impulses are levelled out by the openings in the guide vanes.

In order to enable a pressure impulse to be levelled out effectively a preferred embodiment of the device is characterised in that the opening is a slit.

A further embodiment is characterised in that the slit extends parallel to the impeller-vane end edges facing the guide vanes. As a result of this, levelling out will take place at the location of the slit over its entire height substantially simultaneously and within a minimal time.

Yet another embodiment of the device in accordance with the invention is characterised in that the slits extend over the entire height of the guide vanes and are open at one end.

The invention will now be described in more detail on the basis of a vacuum-cleaner compressor shown in the drawings. In the drawings

Fig. 1 is a view of a compressor with the impeller wheel and the diffusor shown partly in sectional view,

Fig. 2 is a perspective view of the diffusor with the guide vanes, and

Fig. 3 shows noise amplitude versus frequency curves for guide vanes with and without slits.

The compressor comprises a housing 1 with an inlet 2. The housing accommodates a motor 3, which drives an impeller wheel 4, and a diffusor 5 having a plurality of guide vanes 6. Viewed in the flow direction A two successive guide vanes have an overlap 7 (see Fig. 2). In operation the rotation of the impeller wheel causes air to be drawn into the housing of the compressor through the inlet 2 and to be blown radially towards the diffusor 5. In the diffusor the air stream is guided by the diverging passages 8 (see Fig. 2) and deflected *via* the wall 9 of the compressor housing, after which it is blown past the motor.

The guide vanes 6 of the diffusor have openings in the form of slits 10 extending parallel to the end edges 11 of the impeller vanes 12, which edges face the guide vanes. Near the entry side 12 of the air each guide vane 6 preferably has one slit which extends over the entire height of the guide vane and which is open at the upper end. Measurements on a compressor having a speed of 25,000 revolutions per minute have revealed that a slit width of approximately 1 mm yields a noise level reduction of approximately 10 dB(A) at twice the rate of passage of the vanes (*i.e.* the product of the number of vanes and the number of revolutions) and higher harmonic frequencies. This is illustrated in Fig. 3, in which the rate of passage of the vanes {Hz} has been plotted versus the noise amplitude {dB(A)}. The curve A relates to the situation without slits in the guide vanes and the curve B to the situation with slits in the guide vanes.

The device is particularly suitable for use in compressors, for example in vacuum cleaners, but also in blowers in which diffusor-like vanes are arranged downstream of the impeller wheel.

## Claims

1. A device for displacing a gaseous or liquid medium, which device comprises a rotatably drivable impeller wheel and a diffusor comprising a plurality of guide vanes adjoining the impeller wheel viewed in the flow direction, of which two successive guide vanes have an overlap viewed in the flow direction, between which guide vanes diverging passages for the medium are formed, characterised in that each

guide vane has at least one opening which, viewed in the flow direction, is situated in the first one of two successive guide vanes outside said overlap.

2. A device as claimed in Claim 1, characterised in that the opening is a slit. 5
3. A device as claimed in Claim 2, characterised in that the slit extends parallel to the impeller-vane end edges facing the guide vanes. 10
4. A device as claimed in Claim 2 or 3, characterised in that the slits extend over the entire height of the guide vanes and are open at one end. 15
5. A vacuum cleaner comprising a device as claimed in any one of the preceding Claims. 20

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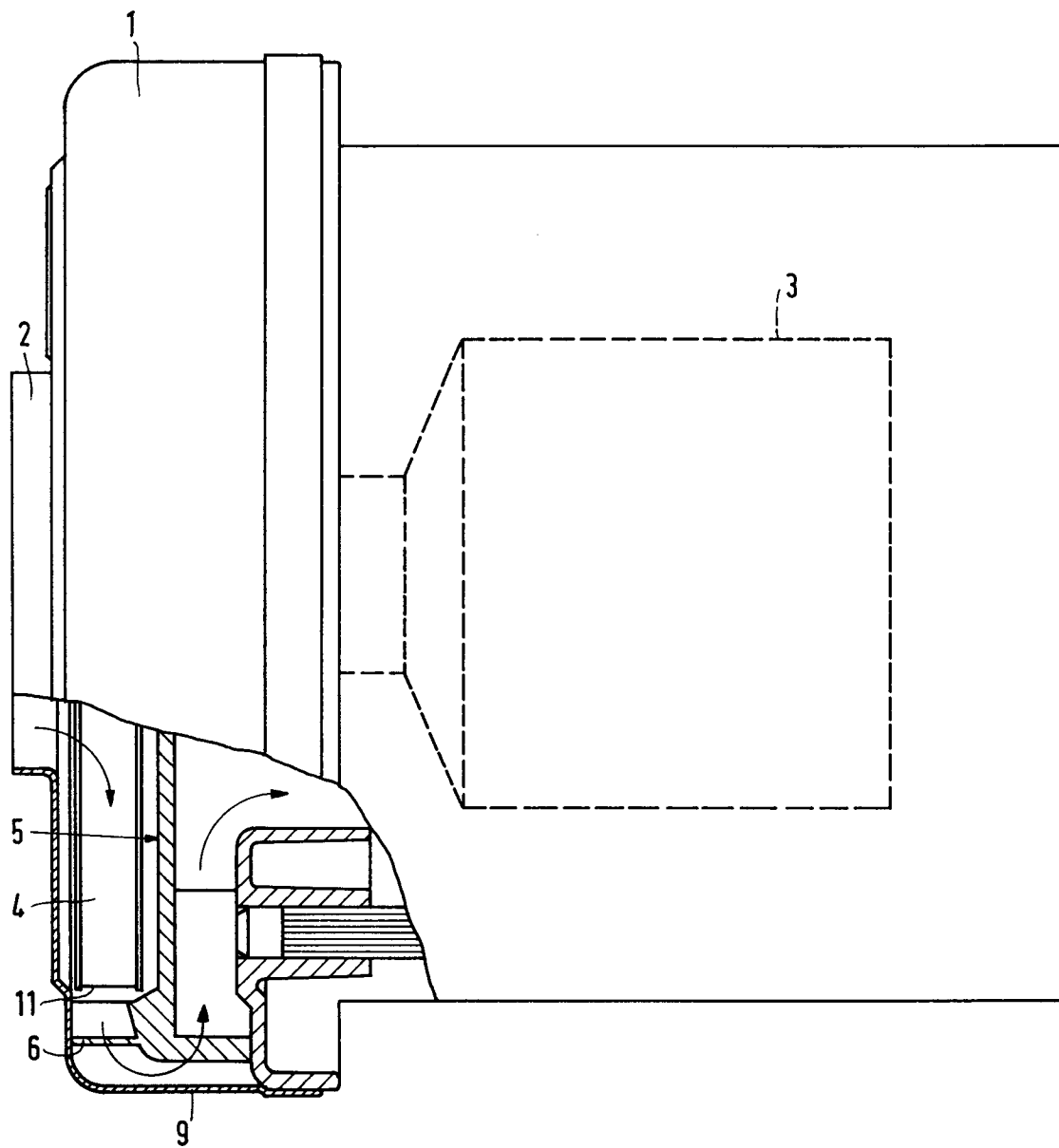


FIG.1

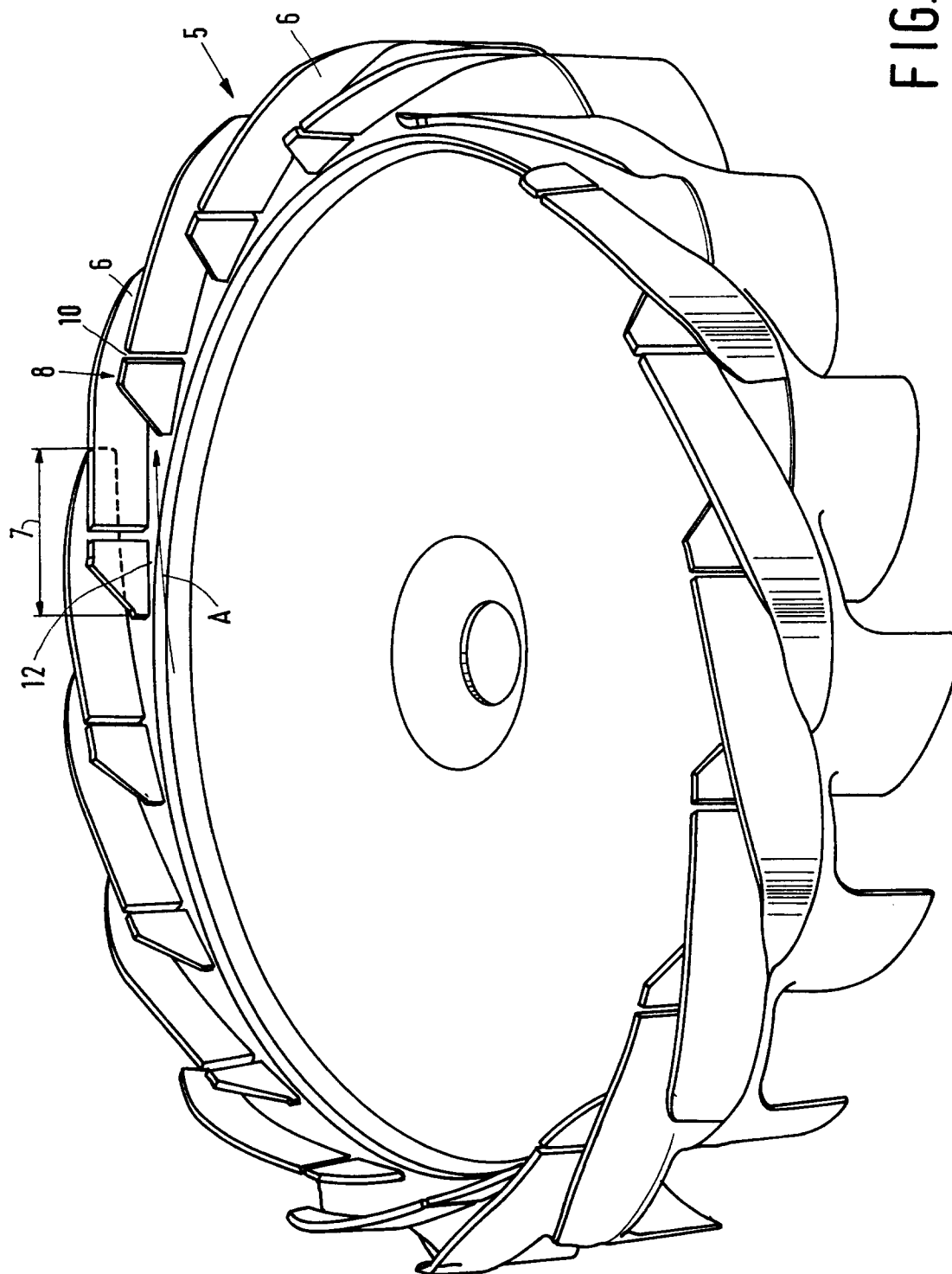


FIG. 2

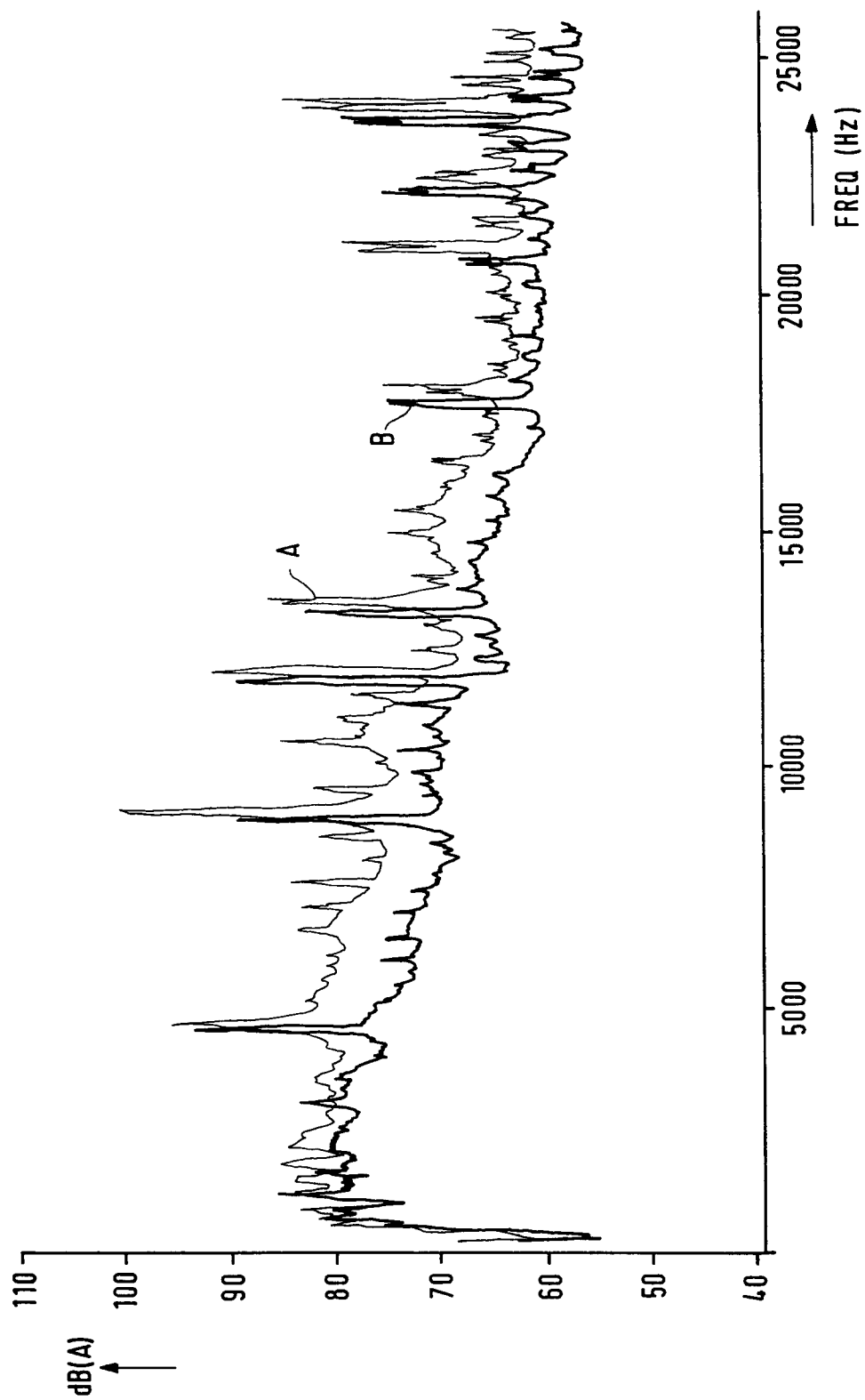


FIG.3



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# EUROPEAN SEARCH REPORT

Application Number

EP 93 20 0352

| 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.5) |
| X                                                                                                                                                                                                                                                      | PATENT ABSTRACTS OF JAPAN<br>vol. 5, no. 18 (M-53)(690) 3 February 1981<br>& JP-A-55 146 299 ( MATSUSHITA ) 14<br>November 1980<br>* abstract *        | 1-5                                                                                                                                                                                                                                                                                   | F04D29/44<br>F04D29/66                        |
| X                                                                                                                                                                                                                                                      | ---<br>PATENT ABSTRACTS OF JAPAN<br>vol. 5, no. 18 (M-53)(690) 3 February 1981<br>& JP-A-55 146 298 ( MATSUSHITA ) 14<br>November 1980<br>* abstract * | 1-3,5                                                                                                                                                                                                                                                                                 |                                               |
| X                                                                                                                                                                                                                                                      | ---<br>FR-A-2 185 222 (SOCIÉTÉ<br>NEYRPIC-CREUSOT-LOIRE)<br>* page 2, line 10 - line 30; figures 1-4 *                                                 | 1-4                                                                                                                                                                                                                                                                                   |                                               |
| Y                                                                                                                                                                                                                                                      |                                                                                                                                                        | 5                                                                                                                                                                                                                                                                                     |                                               |
| Y,D                                                                                                                                                                                                                                                    | ---<br>US-A-4 679 990 (YAMAURA)<br>* column 1, line 5 - line 6 *                                                                                       | 5                                                                                                                                                                                                                                                                                     |                                               |
| X                                                                                                                                                                                                                                                      | ---<br>US-A-2 399 072 (THOMPSON)<br>* the whole document *                                                                                             | 1-3                                                                                                                                                                                                                                                                                   | TECHNICAL FIELDS<br>SEARCHED (Int. Cl.5)      |
| A                                                                                                                                                                                                                                                      | ---<br>CH-A-317 623 (SULZER)<br>* the whole document *                                                                                                 | 1-4                                                                                                                                                                                                                                                                                   | F04D                                          |
| A                                                                                                                                                                                                                                                      | ---<br>DE-A-3 835 622 (SUNDSTRAND)<br>* the whole document *                                                                                           | 1-4                                                                                                                                                                                                                                                                                   |                                               |
| A                                                                                                                                                                                                                                                      | ---<br>US-A-3 917 434 (BANDUKWALLA)<br>* the whole document *                                                                                          | 1-4                                                                                                                                                                                                                                                                                   |                                               |
| -----                                                                                                                                                                                                                                                  |                                                                                                                                                        |                                                                                                                                                                                                                                                                                       |                                               |
| The present search report has been drawn up for all claims                                                                                                                                                                                             |                                                                                                                                                        |                                                                                                                                                                                                                                                                                       |                                               |
| Place of search<br>THE HAGUE                                                                                                                                                                                                                           |                                                                                                                                                        | Date of completion of the search<br>26 MARCH 1993                                                                                                                                                                                                                                     | Examiner<br>TEERLING J.H.                     |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                                                                                                        | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>-----<br>& : member of the same patent family, corresponding document |                                               |