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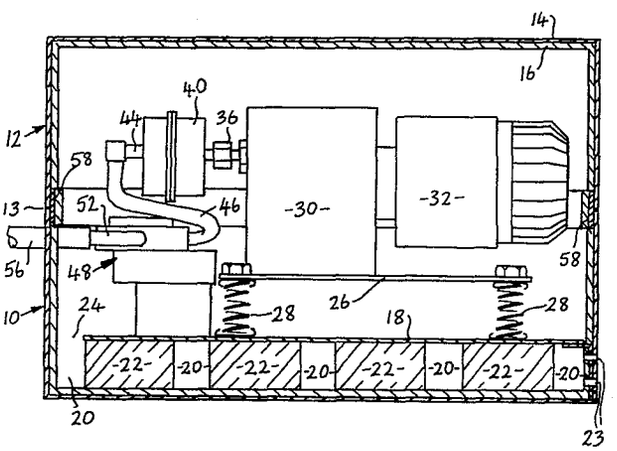
(54) Air compressor equipment.

(57) A housing (10) contains a resiliently mounted electric motor (32) and compressor (30), which draws air into the housing through inlets (23) via a tortuous passage (20) formed by sound absorbent baffles (22), and delivers the air externally of the housing through outlets (54, 56). The housing (10) is made in two halves, each comprising a rigid metal outer layer (14) and a thermally conductive, sound absorbing inner layer (16), e.g. of lead-filled rubber. Silencers (38, 40) are preferably fitted to the compressor, and may comprise air expansion chambers.

In this way the production of noise is reduced and its escape from the housing is kept low, since the housing does not need any openings for the through flow of cooling air by convection.



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AIR COMPRESSOR EQUIPMENT

This invention relates to air compressors, and especially compressors for continuously supplying air under pressure to an air bed or cushion.

An air bed is known in which air is supplied continuously alternately to two inlets of the bed, each inlet leading to a separate inflatable portion of the bed, the air in each portion escaping gradually during the period when it is not being supplied with air, so that the two portions of the bed cyclicly inflate and deflate in sequence. The air preferably escapes by leakage through the top surface of the air bed, thereby providing a flow of air around the body of a person lying on the bed. An air bed could be provided with air leakage from the top surface of a single inflatable portion, so that air is supplied continuously to that portion. In any event, such air beds are generally used in circumstances, such as hospitals, where excessive noise cannot be tolerated. Accordingly, it is important that the compressor should provide the compressed air relatively silently, particularly where each bed is to have its own compressor unit nearby.

The present invention provides an air compressor unit comprising a motor-driven compressor mounted in a housing, the housing having an inlet for air to the compressor and an outlet for air from the compressor, the housing being free of openings for the through passage of cooling air by convection, the housing having walls of a rigid thermally conductive material lined on the inside with a sound-absorbing but thermally conductive material. Preferably the air inlet to the housing leads to the inlet to the compressor via a tortuous passage within the housing, suitably provided by baffles of a sound

absorbing material. The air outlet from the housing is preferably via a conduit which is connected or connectable to external piping for supplying the compressed air. The motor and compressor are suitably supported on resilient mountings, for example springs, within the housing. Silencers are preferably provided on the air inlet to or outlet from the compressor, or both. The rigid material of the housing is preferably sheet metal, and the interior lining may for example be of lead-filled polymeric material, e.g. lead-filled rubber. The housing is preferably constructed in two halves, in one half of which the motor, compressor and associated equipment are mounted, the other half taking the form of a lid.

It will be seen that the housing is essentially entirely of thermally conductive material, while having a sound-absorbent interior lining. It has been found that this housing can provide sufficient dissipation for the heat generated by the motor and compressor to avoid the need for convection cooling openings in the housing, which would allow excessive noise to escape into the environment.

In order that the invention may be more clearly understood, various embodiments will now be described with reference to the accompanying drawings, wherein:

Fig. 1 shows a cross-sectional side view of a compressor unit;

Fig. 2 is a cross-sectional plan view of the housing with the interior equipment shown;

Fig. 3 shows a diagrammatic plan view of the lower part of a modified compressor housing and equipment;

Fig. 4 shows a perspective view of the motor and compressor mounting of Fig. 3; and

Fig. 5 shows an alternative motor and compressor mounting.

Referring to the drawings, and firstly to Figs. 1 and 2; the housing for the unit is of rectangular shape, and is in two halves 10,12, the half 10 providing a base in which the equipment is mounted, and the half 12 providing a lid thereto which meets the base at 13. The housing has a sheet metal outer skin 14, suitably of steel to provide rigidity and high density; thereby reducing the panel resonance in the walls of the housing. The housing also has an interior lining 16, about 3 mm thick, of a lead-filled rubber material, for example Revertex (Trade Mark). The lead filler assists in sound deadening, but also provides the material with good thermal conductivity.

In the base 10 is a false floor 18 which defines an air inlet passage 20 between it and the bottom wall of the base. The passage 20 is further defined by a series of blocks 22 of acoustic foam polymeric material, which extend alternately from one or other side wall of the base, and give the passage 20 a tortuous (serpentine) configuration. The air inlet to the passage 20 is provided by a set of small openings 23 in one end wall of the base. The air outlet from the passage is provided by a gap 24 between the false floor 18 and the opposite end wall of the base. A platform 26 is resiliently mounted to the base 18 by means of springs 28 at each corner of the platform. To the platform is mounted the air compressor 30, which is conveniently of the rotary sliding vane type. An electric drive motor 32 for the compressor is mounted to the compressor housing. The compressor has an inlet port 34 and an outlet port 36, each of which is fitted with a silencer 38,40 respectively. These silencers reduce the amount of compressor noise escaping through the air inlet and outlet of the compressor. The air inlet 42 to the silencer 38 is open to the interior of the housing, and

thus receives air which enters the main body of the housing from the inlet passage 20 via the opening 24. The air outlet 44 from the silecner 40 is connected by a pipe 46 to the inlet of a rotary valve 48, which is mounted to the false floor 18. The electrically driven rotary valve can be of a known type whose function is to switch the compressed air alternately to one or other of two outlets 50,52 respectively, at predetermined intervals. Flexible conduits 54,56 respectively are connected to these outlets and extend through closely fitting apertures in the end wall of the housing for connection to the two inlets of an alternating pressure air bed, as described above.

The principal characteristic of this compressor unit is its quietness in operation. Various features contribute to this. To begin with, there is the long tortuous air inlet passage to the housing. This passage, being defined largely by sound absorbent baffles 22, acts in effect as an inlet silencer, greatly reducing the amount of noise which can escape from the housing back through the air inlet and into the environment. The resilient mounting of the motor and compressor ensures that minimal mechanical vibration is transmitted to the housing. The silencers on the air inlet and outlet ports of the compressor ensure that very little compressor noise is transmitted through these air passages. Most importantly of all, however, is the fact that the housing has no other openings connecting the interior with the surrounding environment, and in particular has no ventilation openings to allow air convection through the housing to cool the motor and compressor. Such openings are normally provided where an electric motor is operating within an enclosure, but in the present case it has surprisingly been found that the need for such

ventilation can be avoided by providing a metal housing lined with thermally conducting sound insulating material. The fact that the compressor draws its ambient air from within the housing ensures that a certain amount of the heat of the motor and compressor are carried away by the compressed air. The shape and construction of the housing, in two halves, also contributes to the silencing effect, in that the side and end walls, against which the greater amount of the generated noise is directed, are in two parts, thereby reducing panel resonance. The two parts of each wall fit tightly together, by virtue of an upstanding inner flange 58 around the base part, and thus the wall parts are firmly supported on all four sides, again reducing the amount of panel vibration.

Referring now to Fig. 3; the air compressor equipment is in many respects similar to that of Figs. 1 and 2, and like parts will be given like reference numerals, and will only be described briefly, and are only shown in simplified diagrammatic form in Fig. 3. The lower half 10 of the rectangular housing for the unit is shown in plan view, and has a false floor 18 below which is a tortuous air inlet passage emerging at a gap 24 into the main part of the housing. An electric motor 32 is connected to an air compressor 30, which is in turn mounted to a platform 60, which is in turn resiliently mounted to the false floor 18 by means of spring steel strips 62. The platform and resilient mounting is shown in more detail in Fig. 4. The platform has a flat rectangular central region 64 with upwardly inclined triangular wings 66 at opposite sides thereof. The wings 66 have apertures 68 by means of which the motor and compressor are secured to the platform. The central region 64 has apertures 70 through which the platform is mounted to the central regions 72 of the spring steel strips 62, which are of arch shape, the ends of the arch

being out-turned at 74 to provide feet having apertutes 76 through which the feet are secured to the false floor 18.

The compressor has an inlet port 34 and an outlet port 36. These are connected axially to cylindrical inlet and outlet expansion chambers 78,80 respectively, suitably made of rigid plastics material. The inlet expansion chamber has a small inlet opening 82 in the end wall alongside the inlet port 34. The outlet expansion chamber 80 has an outlet conduit 44 connected to a pipe 46 to the inlet of a rotary valve 48 which is mounted to the false floor 18 and is electrically driven so as to direct compressed air alternately to supply conduits 54,56 which extend from the housing. In the conduits 54,56 are connected air filters 38,40, which can be the same as the similarly numbered items in the above-identified earlier Application, these filters, which should also act as silencers, being in that earlier Application, connected to the inlet and outlet ports 34,36 in place of the expansion chambers in the present embodiment. The advantage of the expansion chambers is that they absorb a good deal of the pulsation noise, typically about 200 Hz from the vanes of the compressor. The inlet opening 82 to the inlet expansion chamber is kept small, typically 4.8 mm diameter with chamfered edges, to create impedance necessary for the expansion chamber to have the desired effect. By placing the filters 38,40 in the supply lines 54,56, additional noise suppression is obtained, particularly the noise of the valve 48, and also they are more easily replaceable, and further they are subjected to equal use and can therefore be expected to require replacement simultaneously.

Fig. 5 shows an alternative form of motor and compressor mounting, which is in many respects similar to that of Fig. 4. However, the wings 66 are of rectangular

rather than triangular configuration, and instead of arched spring steel mounting strips of the form shown in Fig. 4, generally C-shaped spring steel strips 78 are secured to the wings 66 at the four corners of the platform. Other forms of spring mounting strips could alternatively be used.

CLAIMS:

1. An air compressor unit comprising a motor-driven compressor (30) mounted in a housing (10,12), the housing having an inlet (23) for air to the compressor and an outlet (50,52) for air from the compressor, characterised in that the housing is free of openings for the through passage of cooling air by convection, the housing having walls of a rigid thermally conductive material (14) lined on the inside with a sound-absorbing but thermally conductive material (16).

2. An air compressor unit according to claim 1 wherein the air inlet (23) to the housing leads to the inlet (42) to the compressor via a tortuous passage (20) within the housing.

3. An air compressor unit according to claim 2 wherein the tortuous passage (20) is formed by baffles (22) of a sound absorbing material.

4. An air compressor unit according to any one of claims 1, 2 and 3, wherein the motor (32) and compressor (30) are supported on resilient mountings (28;62;78) within the housing.

5. An air compressor unit according to any one of the preceding claims wherein silencers (38,40;78,80) are provided on the air inlet (34) to or air outlet (36) from the compressor (30), or both.

6. An air compressor unit according to claim 5 wherein the silencers comprise air expansion chambers (78,80).

7. An air compressor unit according to any one of

the preceding claims wherein the rigid material (14) of the housing is sheet metal and the interior lining (16) is a metal-filled polymer.

8. An air compressor unit according to claim 7 wherein the metal-filled polymer is a lead-filled rubber.

9. An air compressor unit according to any one of the preceding claims, wherein the housing is constructed in two halves, in one half (10) of which the motor (32), compressor (30) and associated equipment (38,40, etc.) are mounted, the other half (12) taking the form of a lid.

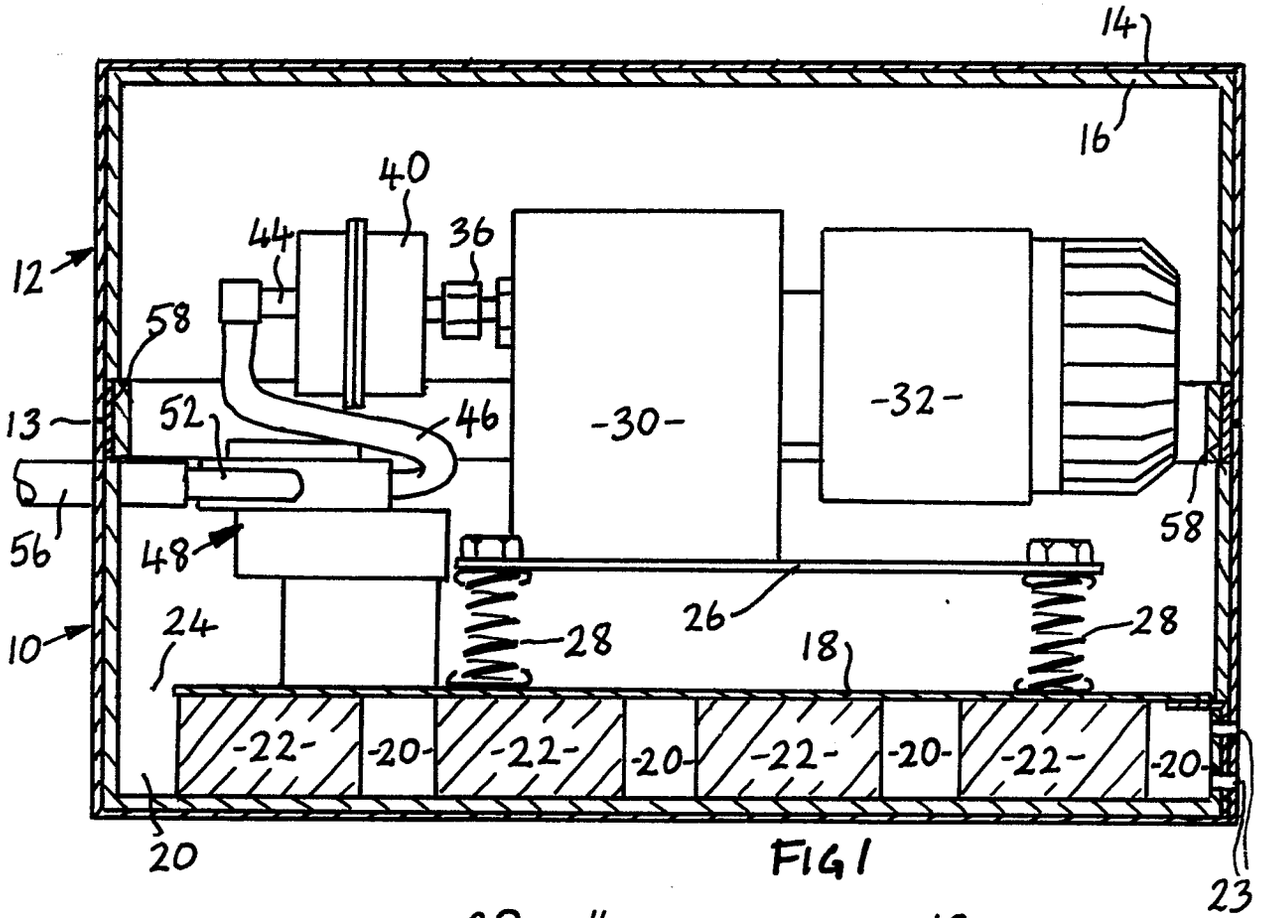
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FIG 1

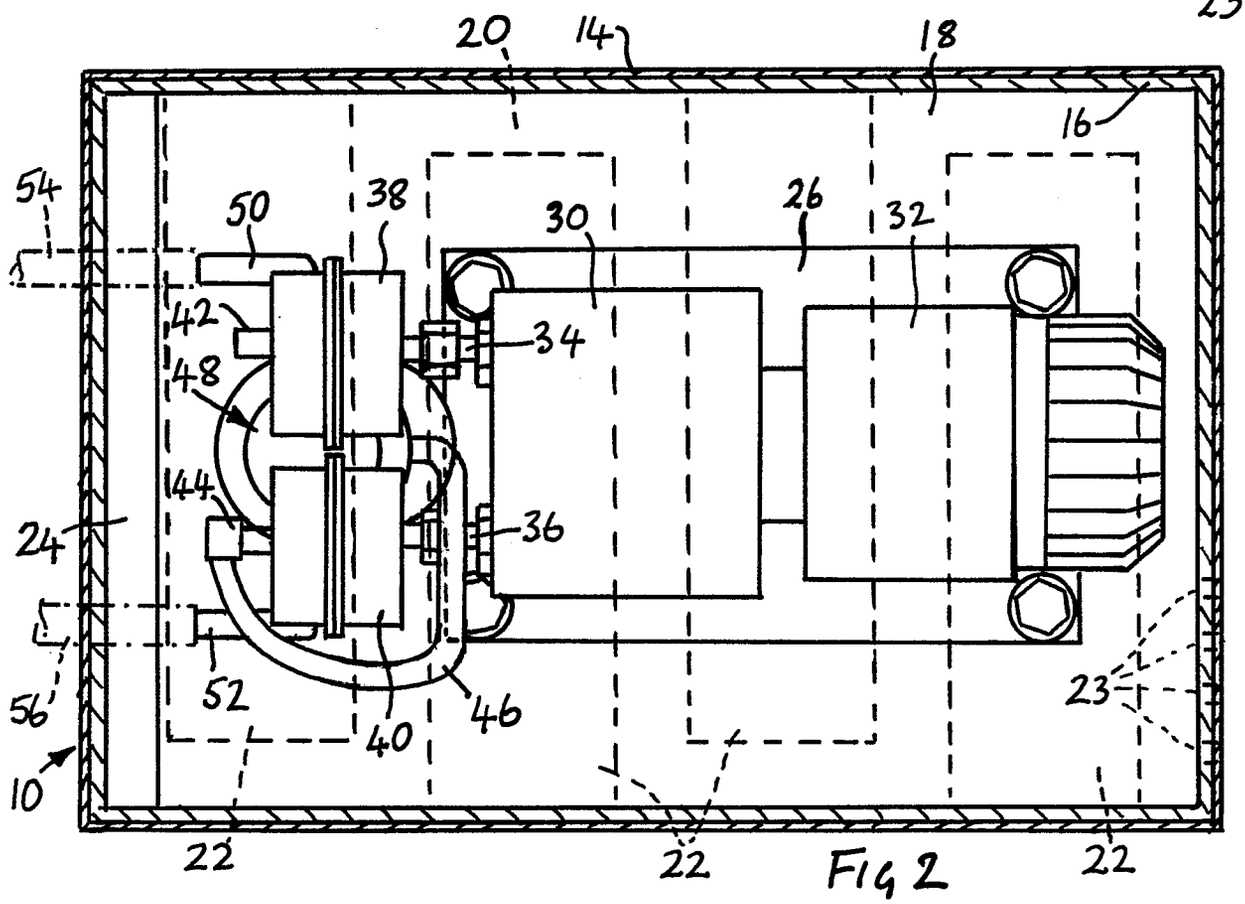
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FIG 2

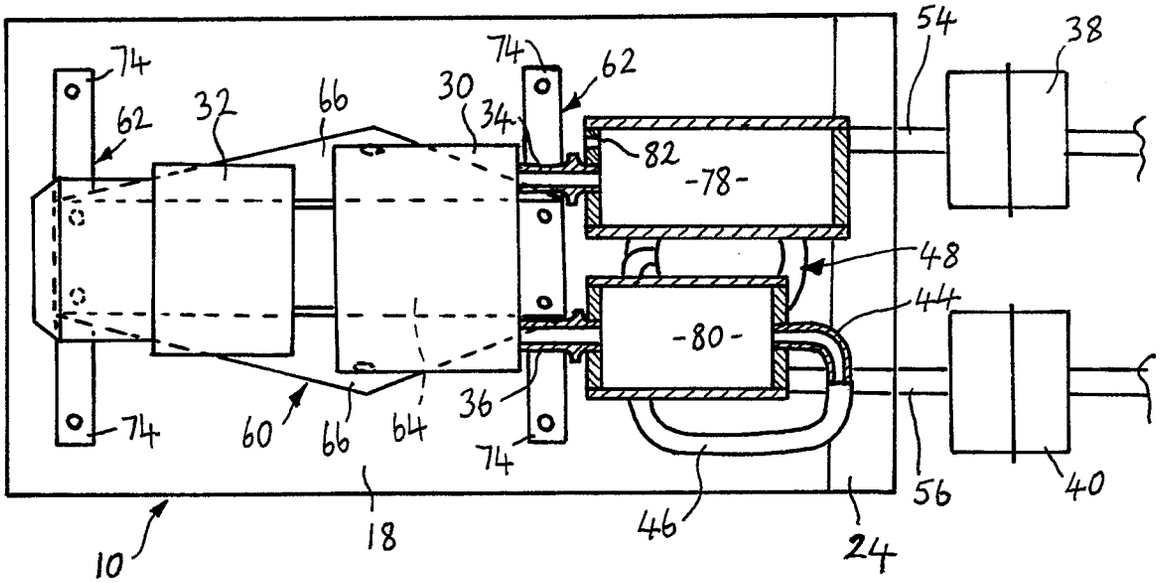

FIG 3

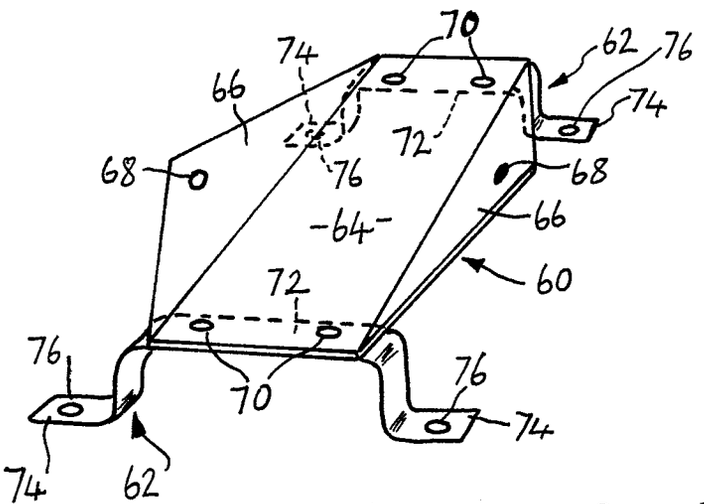

FIG 4

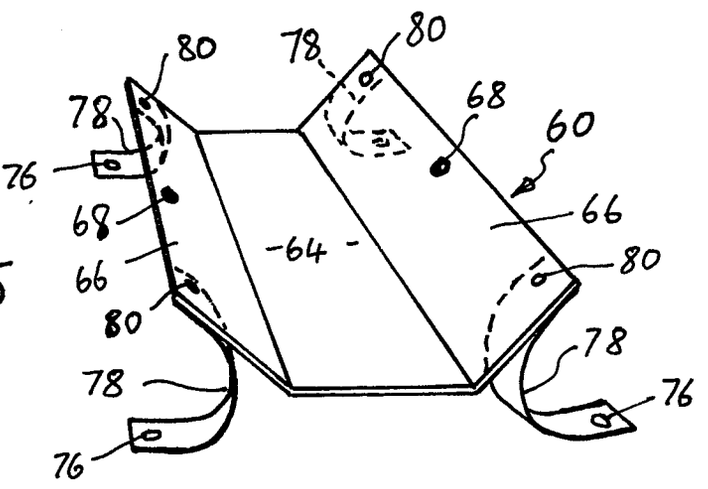

FIG 5

European Patent Office

EUROPEAN SEARCH REPORT

0014085
Application number
EP 80 30 0186

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	GB - A - 1 306 386 (MEDICOR) * Page 2, lines 6-28, 66-77; figure 1 *	1,5
	US - A - 3 602 332 (HOLLENBECK) * Column 1, lines 51-59; column 2, lines 6-25 *	1,7,8
	GB - A - 1 412 403 (QUIETFLO) * Page 1, lines 66-93; page 2, lines 5-12; figures 1,3 *	2
	GB - A - 768 597 (BOSCH) * Page 1, lines 66-92; page 2, lines 1-13; figure *	5,6
	US - A - 2 548 472 (GIBSON) * Column 1, lines 14-33; figure *	6
	FR - A - 1 586 178 (BERNARD) * Page 3, lines 26-28; page 5, lines 11-13; figure 4 *	1,9
P	GB - A - 1 556 494 (HOLYWELL) * Page 2, lines 19-69; figure 1 *	1,4-6
A	DE - A - 2 264 058 (BERLIET) * Whole document *	1

CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)

F 04 B 39/00
G 10 K 11/16

TECHNICAL FIELDS SEARCHED (Int.Cl. ³)

F 04 B
F 04 C
C 04 B
G 10 K

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	02-05-1980	HEINLEIN

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