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(12) # EUROPEAN PATENT SPECIFICATION

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(54) **Motor-compressor unit with its cylinder head formed in parts of different materials.**

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DE-A- 3 332 259
GB-A- 2 199 620

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Description

This invention relates to a motor-compressor unit, in particular for a refrigerator, comprising a cylinder body within which a piston moves to compress a gas, a cylinder head fixed to one end of said cylinder body, and a plate (valve plate) which is interposed between said cylinder head and body and with which usual valves are associated acting on the intake port and delivery port, the cylinder head being formed of at least two hollow portions defining respectively at least one intake cavity and one discharge cavity of which a first portion is constructed of metal and comprises a flat part in which holes are provided to allow the cylinder head to be fixed to the cylinder body and from said flat part extends a raised portion defining the discharge cavity, and comprising a recess to receive a projection from a corresponding part of the second portion defining the intake cavity, said second portion being made of material of low thermal conductivity.

A motor-compressor unit of the type described herebefore is disclosed in EP-A-0195 486 and also in GB-A-2199 620.

An advantage of these known compressor-units is that the flow of heat energy from the gas in the discharge cavity to the gas in the intake cavity is obstructed by the fact that the portion of the cylinder head defining the intake cavity is made of a material, such as a plastics material, having a low thermal conductivity. In this way the efficiency of the compressor process is increased.

A disadvantage of these known compressors is that the second portion defining the intakes cavity is connected to the cylinder block by means of separate spring means (EP-A-0195 486) or by means of separate mechanical connection means (GB-A-2199 620). This complicates the construction and the manufacturing costs of these known compressors.

It is an object of the present invention to provide a motor-compressor unit of the type stated above which is of simple construction, low cost and reliable in operation.

In order to achieve this object the motor-compressor unit according to the present invention is characterised in that on the edge of the recess of the first portion there are provided projecting elements and undercuts arranged to cooperate with indentations and shoulders of the second portion whereas the second portion carries deformable projecting elements arranged to cooperate, by pressing, with seats provided in the first portion.

In this way a very simple and low cost connection of both the first and second portion to the cylinder block is achieved.

The present invention will be more apparent from the accompanying drawing, which is provided by way of non-limiting example and in which:

Figure 1 is a partial view, shown in section on the line I-I of Figure 3, of a motor-compressor unit constructed in accordance with the invention;

Figure 2 is an exploded view from above of part of the motor-compressor unit of Figure 1;

Figure 3 is an assembled view from above of the part shown in Figure 2; and

Figure 4 is a section on the line IV-IV of Figure 2.

With reference to said figures the compressor is indicated overall by 1 and comprises a casing 2 comprising two half-casings 3 and 4 joined together in known manner.

The casing 2 contains a cylinder body 5 (or simply cylinder) within which a usual piston 6 moves, operated by a connecting rod 7 associated with a usual shaft (not shown) driven in known manner. The cylinder 5 is connected in the usual manner to a stator 8, the assembly thus formed being supported by usual springs 9 (only one of which is shown) secured in known manner to the half-casing 4.

A cylinder head 10 is associated with one end of the cylinder 5. Between the cylinder and head 10 there is a plate 11 in which ports 12 and 13 are provided for the intake and discharge of the gas to be compressed respectively, and on which movable valves 14 and 15 (not shown in Figure 4) are positioned. The plate 11 therefore acts as a valve plate and is separated from the head 10 and cylinder 11 by seal members or gaskets 16 and 17.

The body 18 of the cylinder head 10 is provided with holes 19 for receiving usual elements (screws) 19A for fixing the head 10 to the cylinder 5.

A usual gas intake duct 20 is also connected to the head 10.

According to the invention the head 10 comprises at least two hollow portions 21 and 22 to be coupled together, a first portion 21 being constructed of metal and the second portion 22 being constructed of plastics material or in any event a material of low thermal conductivity.

The two portions 21 and 22 are physically separated from each other by a space 23 and comprise cavities 21A and 22A acting as the discharge and intake cavity respectively.

Specifically, the first portion 21 comprises a flat part 25 containing the holes 19 for the elements or screws 19A for its fixing to the cylinder 5. From the part 25 there extends a raised part 26 (in which the discharge cavity 21A is formed) comprising a recess 28 to receive a projecting part or projection 29 of the second portion 22, which has a sunken

part 31 from which there extends a raised part 32 provided with the projection 29. In this latter there is provided the intake cavity 22A, which is connected to other cavities 22B and 22C. The projection 29 is prolonged so that the intake cavity is positioned over the port 12 in the valve plate 11.

On the edge 28A of the recess 28 there are projections 33 facing the interior of said recess, and undercuts 34. The projections are intended to cooperate with indentations 35 in the projection 29, whereas the undercuts 34 are intended to cooperate with shoulders 36 provided on the sides of said projection.

In addition, on the end of this latter there is a depression 38 from which there extends a foot 39 intended to cooperate with a hollow seat 40 provided in the portion 21.

This latter also comprises further lateral hollow seats 41 and 42 intended to cooperate with feet 44 provided on the sunken part 31 (overlying this latter). The cooperation between the feet 39 and 44 and the seats 40, 41 and 42 maintains the two portions 21 and 22 coupled to each other on tightening the screws 19A, and maintains the plastics portion 22 clamped against the gasket 16 and against the valve plate 5.

In this respect, after suitably engaging the portions 21 and 22 with each other (by inserting the foot 39 and feet 44 in the seats 40, 41 and 42) the assembly is placed on the valve plate 11 on which the gasket 16 is present.

Then by inserting the screws (or other fixing members) through the holes 19 and tightening them, the portion 21 is clamped against this gasket.

Via the seats 40, 41 and 42, the portion 21 presses against the foot 32 and feet 44. In this manner the clamping force of the screws against said portion 21 is also transferred to the portion 22, which is pressed against the gasket 16. By this means the portion 22 is secured to the body of the cylinder 5.

It should be noted that the feet 39 and 44 can deform under the action (pressing towards the plate 11) of the portion 21, ie under the clamping force of the screws in the holes 19.

The feet 39 and 44 deform elastically by an amount which can be previously evaluated and be chosen by the designer.

In this respect, the relationship between deformation and elastic reaction of the material and the relationship between the elastic reaction and temperature of the material as a function of time enables the designer to determine the dimensions of the feet, the system for fixing the portion 22 onto the plate 11 and hence the dimensions of this portion and of its feet in a very reliable manner.

With such a construction it is not the clamping force of the screws but the elastic reaction of the component plastics material of the portion 22 and said feet which ensures a sufficient force to keep the portion 22 retained (clamped) against the gasket 16 and plate 11.

The construction of the cylinder head 10 is apparent from the aforegoing description.

During the use of the compressor, as the portion 22 is constructed of a material of low thermal conductivity (ie a poor heat conductor) and as it is physically separated from the metal portion 21 (by the space 23), there is no heat passage between said portions 21 and 22.

Heat passage is further impeded by the presence of the usual refrigerant gas within the casing 2 of the motor-compressor unit and thus within the space 23.

High temperature is therefore not reached within the intake cavity 22A of the cylinder head 10 of the motor-compressor unit 1. This prevents heating of the intake gas and improves the thermodynamic compression efficiency.

In addition, the portion 22 acts as a silencer as it does not function as a resonance box for the sounds generated by the fluid passing through it. This may allow the silencer present in known motor-compressor units to be dispensed with, thus reducing construction time, and contributes to noise reduction.

In any event, to further increase noise reduction a plastics muffler (indicated by 50 in Figure 4) can be provided, associated with the portion 22.

The motor-compressor unit is of simpler construction than known units, is of lower cost than these and is very reliable in use.

In addition, with the plastics portion 22 there are no mechanical strength problems associated with the cylinder head, as the gas present in the portion 22 is of low temperature and pressure such as not to generate within the head any stresses harmful to its mechanical integrity.

Claims

1. A motor-compressor unit, in particular for a refrigerator, comprising a cylinder body within which a piston moves to compress a gas, a cylinder head fixed to one end of said cylinder body, and a plate which is interposed between said cylinder head and body and with which usual valves are associated acting on the intake port (12) and delivery port (13), the cylinder head (10) being formed of at least two hollow portions (21, 22) defining respectively at least one intake cavity (22A) and one discharge cavity (21A) of which a first portion (21) is constructed of metal and comprises a flat

part (25) in which holes (19) are provided to allow the cylinder head (10) to be fixed to the cylinder body (5), from said flat part (25) extends a raised portion (26) defining the discharge cavity (21A) and comprising a recess (28) to receive a projection (29) from a corresponding part (32) of the second portion (22) defining the intake cavity (22A), said second portion (22) being constructed of material of low thermal conductivity, characterised in that on the edge (28A) of the recess (28) of the first portion (21) there are provided projecting elements (33) and undercuts (34) arranged to cooperate with indentations (35) and shoulders (36) of the second portion (22) whereas the second portion (22) carries deformable projecting elements (39, 44) arranged to cooperate, by pressing, with seats (40, 41, 42) provided in the first portion (21).

Patentansprüche

1. Motorkompressoraggregat, insbesondere für einen Kühlschrank, mit einem Zylinderkörper, in dem sich ein Kolben zur Kompression eines Gases bewegt, mit einem an einem Ende des Zylinderkörpers befestigten Zylinderkopf und mit einer Platte, die zwischen dem Zylinderkörper und dem Zylinderkopf angeordnet ist und der übliche, auf die Einlaßöffnung (12) und die Auslaßöffnung (13) wirkende Ventile zugeordnet sind, wobei der Zylinderkopf (10) durch mindestens zwei hohle Teile (21, 22) gebildet ist, von denen das eine mindestens einen Einlaßraum (22A) und das andere mindestens einen Auslaßraum (21A) darstellt und von denen das erste Teil (21) aus Metall besteht und einen Flachteil (25) aufweist, in dem Löcher (19) zur Befestigung des Zylinderkopfs (10) am Zylinderkörper (5) vorgesehen sind und von dem ein erhabener, den Auslsßraum (21A) bildender Teil (26) ausgeht, der eine Ausnehmung (28) zur Aufnahme eines Vorsprungs (29) aufweist, der von einem entsprechenden Teil (32) des den Einlaßraum (22A) bildenden, aus einem Material mit niedriger thermischer Leitfähigkeit hergestellten, zweiten Teils (22) hervorsteht, **dadurch gekennzeichnet**, daß an der Kante (28A) der Ausnehmung (28) des ersten Teils (21) vorspringende Elemente (33) und Hinterschneidungen (34) vorgesehen sind, die derart angeordnet sind, daß sie mit Vertiefungen (35) und Schultern (36) des zweiten Teils (22) Zusammenwirken, und daß der zweite Teil (22) verformbare, hervorspringende Elemente (39, 44) trägt, die derart angeordnet sind, daß sie durch Druck mit Sitzen (40, 41, 42) zusammenwirken, die im ersten Teil (21) vorgesehen sind.

Revendications

1. Ensemble à moteur et compresseur, en particulier destiné à un réfrigérateur, comprenant un corps de cylindre dans lequel se déplace un piston qui comprime un gaz, une culasse fixée à une première extrémité du corps de cylindre, et une plaque disposée entre la culasse et le corps et à laquelle sont associées des soupapes habituelles agissant sur un orifice d'admission (12) et un orifice de distribution (13), la culasse (10) étant formée d'au moins deux parties creuses (21, 22) délimitant respectivement au moins une cavité d'admission (22A) et une cavité d'évacuation (21A), dont la première partie (21) est formée d'un métal et comprend une partie plate (25) dans laquelle les trous (19) sont réalisés pour la fixation de la culasse (10) au corps (5) du cylindre, une partie (26) en saillie dépassant de la partie plate (25), délimitant la cavité (21A) d'évacuation et comprenant une cavité (28) destinée à loger une saillie (29) d'une partie correspondante (32) de la seconde partie (22) qui délimite la cavité d'admission (22A), cette seconde partie (22) étant construite en un matériau de faible conductibilité thermique, caractérisé en ce que, au bord (28A) de la cavité (28) de la première partie (21), des éléments en saillie (33) et des évidements (34) sont disposés et sont destinés à coopérer avec des évidements (35) et des épaulements (36) de la seconde partie (22), alors que la seconde partie (22) porte des éléments déformables en saillie (39, 44) destinés à coopérer par pression avec des sièges (40, 41, 42) placés dans la première partie (21).

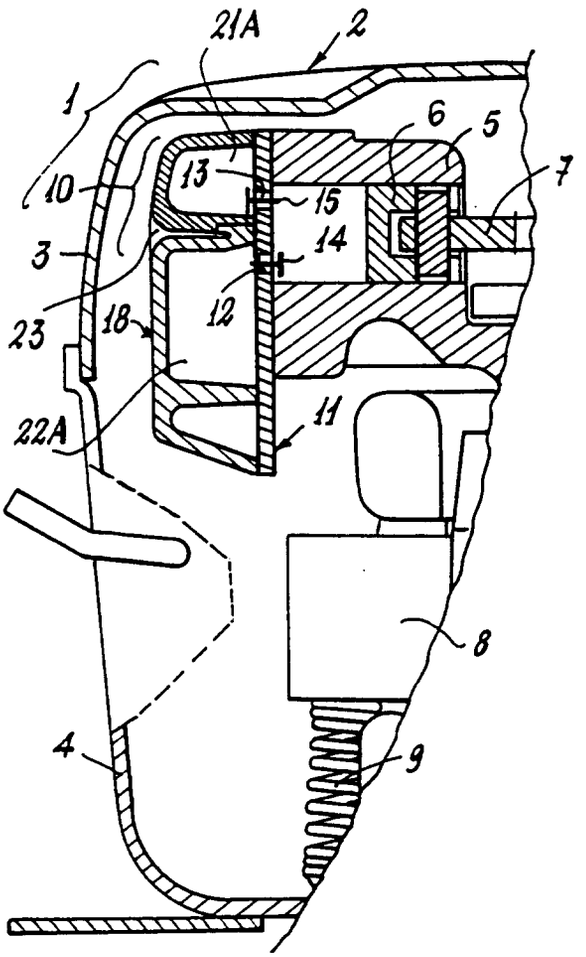
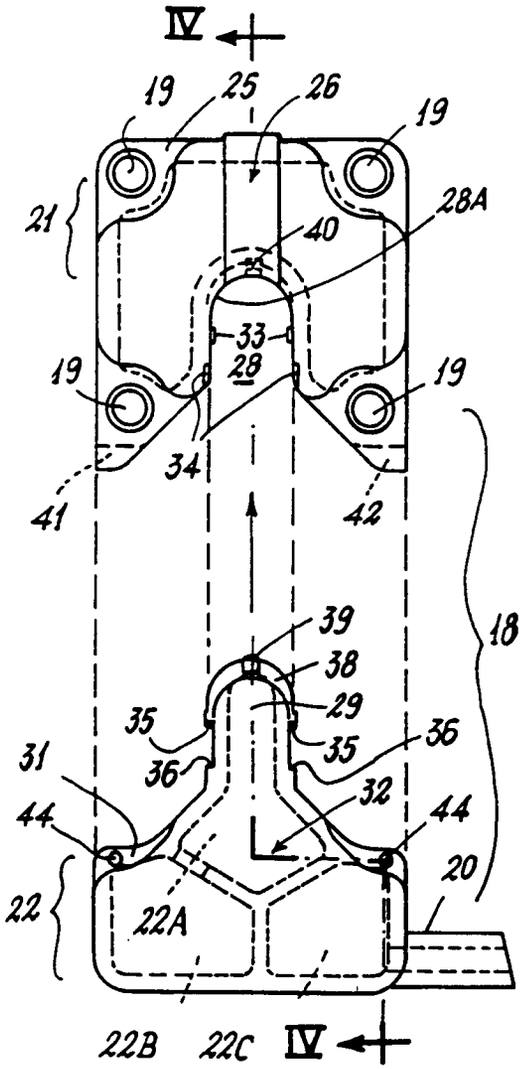


FIG.1


IV
19
25
26
19
21
28A
40
33
28
19
19
34
41
42
18
39
38
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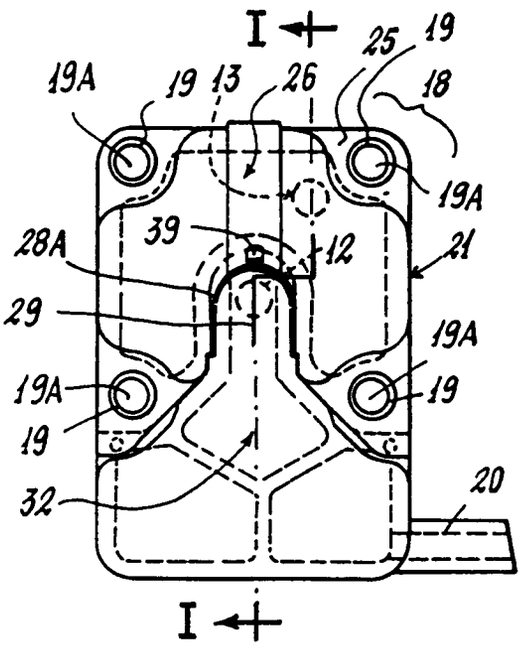
35
36
35
36
31
32
44
44
20
22
22A
22B
22C
IV

FIG.2


I
19A
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13
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25
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19A
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32
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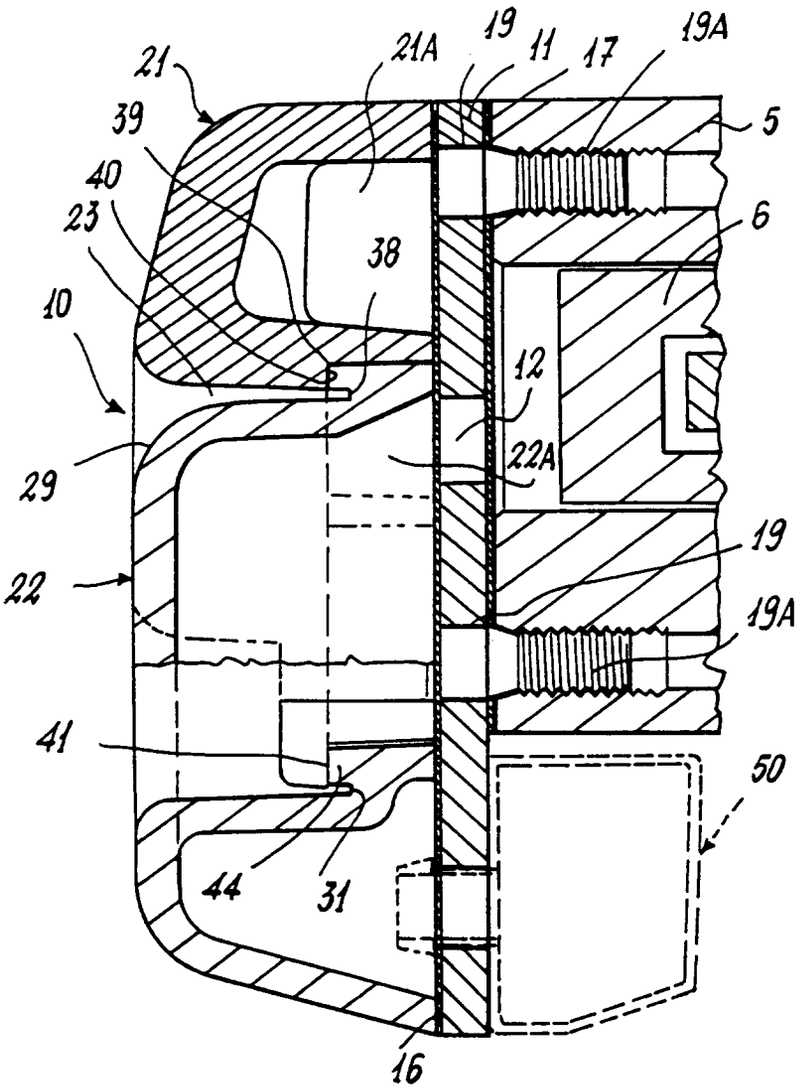
I

FIG.3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21A
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11
17
19A
5
39
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23
38
6
10
12
22A
29
19
22
19A
41
50
44
31
16

FIG. 4