The invention is a new stuffing box unit comprising a stuffing element (4) and a flange (5) supporting the stuffing element (4) that are suited to be coupled with each other and provided with holes and/or ducts (4.3, 5.4) for discharging the lubricant deposited on the rod (3) onto the block. Said holes and/or ducts (4.3) of said stuffing element (4) are suited to convey the excess lubricant flowing out of the spaces included between said annular grooves and/or recesses (4.2) towards the block. Said flange (5) supporting the stuffing element (4) is provided with channels (5.4) suited to be coupled with said holes and/or ducts (4.3) of said stuffing element (4) and suited to convey the lubricant flowing out of said stuffing element (4) towards the block and away from the rod (3). There is a partition (7) suited to be applied to the rod (3) of the piston in proximity to the crosshead (1) and suited to prevent the flow of lubricant from the crosshead (1) onto the surface of the rod (3) itself.
STUFFING BOX UNIT

DESCRIPTION

TECHNICAL FIELD OF THE INVENTION

CNG mechanical compressors for compressing methane gas to be used in the automotive sector.

STATE OF THE ART

In CNG mechanical compressors for compressing methane gas to be used in the automotive sector, during operation a large quantity of lubricating oil flows from the crank mechanism area to the methane gas sector through the rod that transmits motion from the crosshead to the gas piston, with a consequent drastic decrease in the level of lubricant oil, which is essential for the lubrication of the entire crank mechanism, in the block. Owing to said high consumption of oil, it is necessary to top up the lubricant oil with an average quantity of approximately 4 kg every 24 hours of operation (about 166 grams/hour).

The mechanical compressors that are the subject of the present invention are provided with aluminium crossheads that slide directly in contact with the steel guide jacket and, in order to prevent any seizure, lubricant oil is sprayed from the guide jackets directly onto the contact surface of the crossheads through two nozzles with 3 mm diameter with an adjustable pressure of approximately 2 bars. This type of forced lubrication is practically compulsory if one wants to prevent any seizure of the system. A huge quantity of oil like this, furthermore, is very difficult to be disposed of without having oil sticking to the rod due to the rattling effect, in fact the rod then brings the oil along to the gas phase, where the oil in turn is collected by the gas being compressed and conveyed to the compressed gas accumulation tank, and will never return to the block.

MAIN CHARACTERISTICS OF THE INVENTION

The invention makes it possible to top up lubricating oil with quantities ranging between 6 and 30 grams/hour. The technical invention, the technical drawings of
which are attached hereto, consists in the creation of a system that allows the
crosshead to operate on the guide jacket without resting directly on the latter, as is
presently the case in many mechanical compressors, but resting on special sliding
blocks made of a plastic material with high resistance to friction that therefore need a
very small quantity of lubricant while at the same time guaranteeing that there will
be no seizure problems. This embodiment of the crosshead is complemented by a
stuffing box unit provided with special packings made of a suitable plastic material
that make it possible to hold and discharge into the block large quantities of lubricant
without overheating the rod, even on the first start. It is very important to avoid
overheating the rod, as if this occurred it could in turn "bake" the packings and thus
negatively affect their efficiency. The discharge of the lubricant deposited on the rod
by the packings of the stuffing box unit is guaranteed by special holes and channels,
designed for this purpose, which are located in the stuffing box unit and in the
supporting flange.

The rod will be made with such materials, heat treatments and geometrical shape as
to allow - once it has been tightened to the crosshead with a lock nut - a linear
transmission of motion, guaranteeing that the stuffing box unit holds a larger quantity
of lubricating oil. Using special shutter elements mounted on the lubrication holes in
the steel guide jackets, it is possible to reduce the flow rate of lubricating oil on the
crosshead. Finally, the rod is separated from the crosshead by means of a special
partition, in such a way as to prevent the lubricating oil from being deposited on the
rod as a consequence of rattling.

The drawings of the details are attached hereto.

DESCRIPTION OF THE DRAWINGS

Figures 1.1 and 1.2 respectively show an axonometric view and a sectional view of
the new crosshead (1).

The new crosshead (1) is generically parallelepiped in shape, with genetically
rectangular cross section.
The two short sides (1.1) of said cross section of said crosshead (1) are arched and are provided with recesses or seats (1.1a) suited to house anti-friction elements or sliding blocks, not illustrated in the figure, suited to facilitate the sliding movement of said crosshead (1) in the corresponding guide jacket in the block.

Inside said crosshead (1) there is a compartment (1.2) that is suited to house the big end of the connecting rod allowing the movement of the crosshead (1) itself, while the long sides (1.3) of the generically rectangular cross section are provided with holes (1.3a) suited to house the pin of the connecting rod.

In the side of the crosshead (1) opposite the side where the connecting rod is inserted there is a threaded hole (1.4) that houses an element (2) ensuring connection with the rod.

Figures 2.1 and 2.2 respectively show a front view and a sectional view of the new connection element (2) suited to ensure connection with the piston rod.

The new connection element (2) is tubular in shape and has a flat ring (2.1) at the level of one of its two ends, said ring (2.1) being orthogonal to the axis of the cylindrical portion.

Said new connection element (2) is provided with a threaded centre hole (2.2) for connection to the rod (3), while its outer surface (2.3) is threaded in order to allow it to be introduced in and connected to the threaded hole (1.4) of the crosshead (1).

Figure 3 shows a side view of the connection rod (3) ensuring connection between the piston and the crosshead (1) through the relative connection element (2).

Figure 4.1 shows a sectional view of the stuffing element (4), while Figures 4.2 and 4.3 show two axonometric views of the same stuffing element (4).

Said stuffing element (4) has a generically cylindrical shape with a coaxial centre hole (4.1) for the passage of the rod (3).

Inside said coaxial centre hole (4.1) there is a first series of annular grooves and/or recesses (4.2) suited to house sealing elements and/or packings.

Suitable holes and ducts (4.3) present in the body of the stuffing element (4) place
the spaces between said first annular grooves or recesses (4.2) of the sealing elements and/or packings in communication with the circular surface (4.4) of the body of the stuffing element (4) facing towards the crosshead (1) and towards the block.

On the same circular surface (4.4) of the body of the stuffing element (4) facing towards the crosshead there are holes (4.5) suited to ensure connection and union with the flange (5) that supports the stuffing element (4).

Inside said coaxial centre hole (4.1) and in proximity to its end opposite the crosshead (1), the stuffing element (4) is provided with a second series of annular grooves and/or recesses (4.6) suited to house sealing elements and/or packings intended to prevent any blow-by of gas towards the sliding jacket of the crosshead (1).

There is a further duct (4.7) suited to connect the space of the centre hole (4.1) of the stuffing element (1) included between the sealing elements and/or packings provided for the lubricant and the sealing elements and/or packings provided for the gas with the outside of the stuffing element (1) and with external ducts and sensors, in such a way as to detect any gas leakages through the stuffing element (1) due to the wear of the gas sealing elements and/or packings.

Figures 5.1, 5.2, 5.3 respectively show a front view, a sectional view and an axonometric view of the flange (5) that supports the stuffing element (4), said flange (5) being constituted by a disc-shaped element provided with a centre hole (5.1) for the passage of the rod (3), having holes (5.2) for the screws providing connection with the stuffing element (4) and having channels (5.4) suited to convey the lubricant flowing through the holes (4.3) in the stuffing element (4) towards the block.

Figure 6 shows a shutter element (6) with hexagonal head (6.1), threaded body (6.2) and a cylindrical projection (6.3). Two or more shutter elements (6) are suited to decrease and/or adjust the flow rate of lubricant on the crosshead (1). Said shutter elements (6) are mounted on the ends of each guide jacket in which the crosshead
Figures 7.1 and 7.2 respectively show a side view and a front view of the withdrawable partition (7) comprising two semi-circular elements (7a, 7b) suited to be connected to each other so that they are fixed to the rod (3) in proximity to the crosshead (1).

Figure 8 shows a sectional view illustrating the various parts mentioned above when joined and connected to one another.

These are the schematic outlines that are sufficient to any person skilled in the art to carry out the invention; consequently, on practical application variants may be developed that do not affect the substance of the innovative concept expressed herein.

Therefore, with reference to the above description and the attached drawings, the following claims are expressed.
CLAIMS

1. Stuffing box unit, characterized in that it comprises a stuffing element (4) and a flange (5) supporting the stuffing element (4) that are suited to be coupled with each other, and wherein said stuffing element (4) and said flange (5) comprise holes and/or ducts (4.3, 5.4) for discharging the lubricant deposited on the rod (3) into the block.

2. Stuffing box unit according to the preceding claim, wherein said stuffing element (4) has a cylindrical shape with a centre hole (4.1) for the passage of the rod (3), and wherein on the inner surface of said centre hole (4.1) there are annular grooves and/or recesses (4.2) suited to house sealing elements and/or packings, characterized in that said holes and/or ducts (4.3) of said stuffing element (4) are suited to convey the excess lubricant flowing out of the spaces included between said annular grooves and/or recesses (4.2) towards the block.

3. Stuffing box unit according to the preceding claims, characterized in that said flange (5) supporting the stuffing element (4) is provided with channels (5.4) suited to be coupled with said holes and/or ducts (4.3) of said stuffing element (4), and wherein said channels (5.4) of said flange (5) are suited to convey the lubricant flowing out of said stuffing element (4) towards the block and away from the rod (3).

4. Stuffing box unit according to the preceding claims, characterized in that it comprises a partition (7) suited to be applied to the rod (3) in proximity to the crosshead (1) and suited to prevent the flow of lubricant from the crosshead (1) onto the surface of the rod (3) itself.

5. Stuffing box unit according to the preceding claims, characterized in that it comprises several shutter elements (6), each one of which is suited to be mounted in a lubrication hole of the guide jacket of the block, and wherein said shutter elements (6) are suited to decrease and/or adjust the flow rate of lubricant oil on the crosshead (1).
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

INV. F16J15/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F16J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>AT 510 171 A4 (HOERBIGER KOMPRESSORTECH HOLD [AT]) 15 February 2012 (2012-02-15) the whole document</td>
<td>1-5</td>
</tr>
<tr>
<td>X</td>
<td>US 2008/012236 Al (REILLY DECLAN [GB]) 17 January 2008 (2008-01-17) the whole document</td>
<td>1-5</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C. X See patent family annex.

* Special categories of cited documents:

A: document defining the general state of the art which is not considered to be of particular relevance
E: earlier application or patent but published on or after the international filing date
L: document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified).
O: document referring to an oral disclosure, use, exhibition or other means
P: document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevancy, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevancy, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"A" document member of the same patent family

Date of the actual completion of the international search | Date of mailing of the international search report
--- | ---
6 February 2015 | 19/02/2015

Name and mailing address of the ISA:
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016

Authorized officer
Narmi ni o, Adri ano

Form PCT/ISA/210 (second sheet) (April 2005)
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT 510171 A4</td>
<td>15-02-2012</td>
<td>AT 510171 A4</td>
<td>15-02-2012</td>
</tr>
<tr>
<td>CN 102644754 A</td>
<td>22-08-2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EP 2489907 A1</td>
<td>22-08-2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JP 2012172847 A</td>
<td>10-09-2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US 2012211945 A1</td>
<td>23-08-2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US 6932351 B1</td>
<td>23-08-2005</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2008012236 A1</td>
<td>17-01-2008</td>
</tr>
</tbody>
</table>