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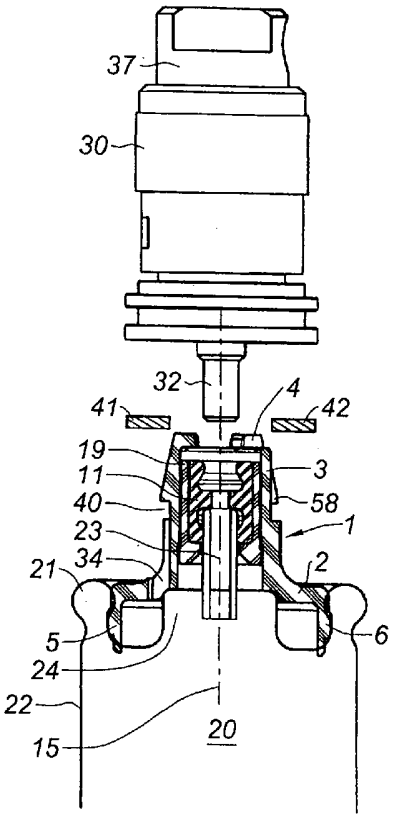
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(54) Title: CONNECTING ADAPTER FOR A GAS CARTRIDGE AND A GAS INDUCTION DEVICE OF A GAS FASTENING APPARATUS, THE CARTRIDGE, THE SOLENOID VALVE AND THE APPARATUS WITH THE ADAPTER



(57) Abstract: The adapter is designed to receive an outlet end (23) of the cartridge (20) and an inlet end (32) of the induction device (30), as well as a seal (11) between the two ends (23, 32). The seal (11) includes an annular transverse portion (53) intended to be interposed between the two ends (23, 32) and the material of the seal (11) is selected from the group consisting of compressible and flexible materials.

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— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for all designations*

— *of inventorship (Rule 4.17(iv)) for US only*

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Connecting adapter for a gas cartridge and a gas induction device of a gas fastening apparatus, the cartridge, the solenoid valve and the apparatus with the adapter

This invention relates to gas fastening apparatus, the gas contained in a cartridge being injected into the combustion chamber of an internal combustion engine by a gas induction device, a priori, a solenoid valve.

The invention relates more particularly to the mounting of the solenoid valve on the gas cartridge.

Both EP 98402916.5 and EP 01402614.0 provide for the mounting of the solenoid valve on the cartridge by means of an adapter. The adapter is designed to receive the two ends of the cartridge and of the solenoid valve, to both of which pressure has to be applied in order to allow for the transfer of gas from the cartridge to the solenoid valve, as well as a seal between the two.

Problems of two kinds may arise with either of the arrangements of the two documents mentioned hereinabove.

The seal may expand and become jammed on the outlet end of the cartridge. In this case, if the cartridge is removed when it is not yet empty, the gas will escape. It will be noted that, when the cartridge is not empty, it is quite easy to remove the cartridge by virtue of the temporary escape of the gas, which ejects it from its housing.

However, when the cartridge is empty, it may be difficult to grip it by its base and remove it from its housing.

Adapting the solenoid valve to a gas cartridge moreover involves a lot of components. Even if the dimensions of each of these components comply with the high tolerance limits, taken as a whole, problems may arise with mounting. Thus, if an annular groove is provided on the cartridge adapter, intended to receive locking means, as instructed by EP 01402614.0, correct mounting of the cartridge in its housing with locking of the adapter may be rendered impossible, with the cartridge not being held in its housing.

Conversely, the cartridge may be placed in its housing, but the series of dimensions is such that it is impossible to slide the end of the cartridge sufficiently for the gas to escape as the impact stroke is insufficient.

The aim of this invention is to solve these problems.

The invention therefore relates to a connecting adapter designed to be mounted on a gas cartridge and on the gas induction device of a gas fastening apparatus and to receive, on the one hand, an outlet end of the cartridge and an inlet end of the induction device and, on the other hand, a seal between the two ends, characterised in that the seal includes an annular transverse portion intended to be interposed between the two ends and the material of the seal is selected from the group consisting of compressible and flexible materials.

When the cartridge is to be removed from its housing, even if it is empty, the resilience of the material of the transverse portion of the seal begins the ejection of the cartridge. In any event, irrespective of whether it is a compressible or flexible material, the nature of the material of the seal makes it possible to compensate for dimensional errors and to always allow the cartridge to be mounted in the apparatus and to ensure the impact stroke of the outlet end of the cartridge and therefore the transfer of the gas from the cartridge to the induction device of the fastening apparatus.

Expanded polystyrene is a possible compressible material. An elastomer material is a very suitable flexible material.

In order to prevent the seal from becoming jammed in the adapter as a result of deformation and keeping the end of the cartridge in the discharge position, in the preferred embodiment of the adapter of the invention, the seal is disposed in a sleeve of rigid material for maintaining the shape of the seal, advantageously mounted to move in the adapter.

This application of course also relates to any gas fastening apparatus provided with the adapter and to any gas cartridge or any gas induction device of a gas fastening apparatus provided with the adapter.

The invention will be more readily understood with the aid of the following description of an assembly consisting of a solenoid valve and a gas cartridge with the adapter of the invention, with reference to the accompanying drawings, in which:

Figure 1 is a view of the solenoid valve and of the cartridge provided with the adapter shown in axial section, before it is mounted on the solenoid valve;

Figure 2 is a view similar to that of Figure 1, during mounting on the solenoid valve, and

Figure 3 is a view similar to those of Figures 1 and 2, after mounting on the solenoid valve.

A fastening apparatus for fastening elements having a piston driven by compressed gas comprises an internal combustion engine comprising a combustion chamber intended to be supplied with compressed gas from a gas cartridge 20 in order to drive the piston for driving fastening elements.

In the particular example of the description, the connecting adapter is intended to connect a solenoid valve 30 for the admission of the compressed gas into the combustion chamber of the fastening apparatus and the compressed gas cartridge 20.

The cartridge 20 of generally cylindrical shape is provided in an internal casing with the compressed gas in the liquid state and between the internal casing and an external casing 22 with a propellant. A circular edge 21 forms a continuation of the external cylindrical wall of the cartridge 20 at one of the ends of the latter. A male outlet end 23 connected to the internal casing projects from the cartridge by means of a base 24 situated in the centre of the circle described by the edge 21.

The solenoid valve 30 of generally cylindrical shape is provided at one of its ends with an inlet end 32 connected in the interior of the solenoid valve to an outlet end (not shown) projecting from a head 37 at the other end of the solenoid valve.

The inlet end 32 is in this case a male end.

The adapter 1 is a seal holder intended to receive the male outlet end 23 of the cartridge 20 and the male inlet end 32 of the solenoid valve 30. The adapter 1, made in one piece from plastic, includes a plane supporting base 2, in this case circular, supporting the chamber 3 for housing a seal 11 and a sleeve 19, open at both ends and extending along an axis 15 perpendicular to the supporting base 2 on one side of the latter. The free end edge 4 of the chamber 3 is folded down at a right angle towards the interior of the chamber 3 and forms an opening for the passage of the inlet end 32

of the solenoid valve 30, having a cross section substantially equal to that of the end 32.

Fastening legs 5, 6 connected to the supporting base 2 at one of their ends and in this case symmetrical in relation to axial planes extend along parallel planes perpendicular to the supporting base 2 on the side opposite that of the chamber 3. The spacing of the legs 5, 6 is substantially equal to the internal diameter of the edge 21 of the fuel cartridge 20. The legs 5, 6 are moreover each provided at their free ends with a boss intended to engage with the internal wall of the edge 21.

The chamber 3 of the adapter 1 is provided on its exterior close to the edge 4 with a plurality of ramps 58 and close to the supporting base 2 with a plurality of ribs 34. The ramps 58 and the ribs 34 form between them an annular hooking groove 40 for a locking mechanism with hooks 41, 42, as instructed by the document EP 01402614.0.

The seal 11 has a generally tubular shape with annular sealing lips 51, 52 at both ends. It includes an annular transverse portion 53 forming a passage 54 and giving the seal an H-shaped axial section. The seal 11 is in this case made of a relatively flexible elastomer material.

The seal 11 is mounted in the interior of the rigid sleeve 19. It is also a tubular component provided on the side of the cartridge 20 with an internal annular retaining flange 55 for the seal 11. The external diameter of the sleeve 19 is substantially equal to the internal diameter of the chamber 3 of the adapter. Its internal diameter is substantially equal to the external diameter of the seal 11. The internal axial length of the sleeve 19 between its edge 56 and its flange 55 is substantially equal to the axial length of the seal 11. Its external axial length is smaller than that of the chamber 3 so that it can slide freely inside the chamber.

The connection between the inlet end 32 of the solenoid valve 30 and the outlet end 23 of the gas cartridge 20 will now be described.

In order to mount the adapter on the cartridge 20, the fastening legs 5, 6 are inserted into the edge 21 of the cartridge 20. The bosses of the legs 5, 6 are hooked and clipped on to the internal wall of the edge 21.

When the adapter is fastened to the cartridge 20, the outlet end 23 of the cartridge 20 is guided by the bevelled flange 55 of the sleeve 19 into the seal 11 on one side of the transverse portion 53.

The adapter 1 is then slid over the male inlet end 32 of the solenoid valve, guided by the edge 4, the end engaging in the seal 11 on the other side of the transverse portion 53.

The adapter 1 is finally mounted on the cartridge 20 and on the solenoid valve 30 by relative translational movements of the three elements.

When the adapter engages with the inlet end 32 of the solenoid valve 30, the ramps 58 pass the locking hooks 41, 42 which are received in the groove 40 irrespective of the tolerance errors, as the latter can be compensated for by the spring action of the transverse portion 53 of the seal 11 which can thus be compressed as a result of its elasticity, as shown in Figure 3. Once the ramps 58 of the adapter have passed the locking hooks 41, 42, the two ends 23, 32 are perfectly engaged in the seal 11 in the pushed-back discharge and intake positions, bearing against the transverse portion 53, the edge 4 of the chamber 3 of the adapter being engaged on a bottom sleeve 57 of the inlet end 32 having an enlarged diameter.

Once the cartridge 20 has been used and is empty, the resilience of the transverse portion 53 of the seal 11 triggers its removal from the housing of the apparatus.

If, for some reason, it is desired to remove it from its housing before it is empty, although the sealing force of the sealing lips 51, 52 is high, the seal 11 will remain held in the adapter 1 by the sleeve 19 and the outlet end 23 will resume its closing position prior to mounting;

The seal 11 is mounted within the sleeve 19. It could be interesting to mounting it therein to form an assembly in one piece. Securing one to the other could be achieved by gluing, welding, ultra-sounds, biomaterial injection, moulding, etc.

CLAIMS

1. Connecting adapter designed to be mounted on a gas cartridge (20) and on the gas induction device (30) of a gas fastening apparatus and to receive, on the one hand, an outlet end (23) of the cartridge (20) and an inlet end (32) of the induction device (30) and, on the other hand, a seal (11) between the two ends (23, 32), characterized in that the seal (11) includes an annular transverse portion (53) intended to be interposed between the two ends (23, 32) and the material of the seal (11) is selected from the group consisting of compressible and flexible materials.

2. Connecting adapter according to claim 1, in which the seal (11) is disposed in a sleeve (19) of rigid material for maintaining the shape of the seal (11).

3. Adapter according to claim 2, in which the sleeve (19) is mounted to move in the adapter.

4. Adapter according to one of claims 2 and 3, in which the sleeve (19) includes a retaining flange (55) for the seal (11).

5. Adapter according to one of claims 1 to 4, in which the seal (11) has an H-shaped cross section.

6. Adapter according to one of claims 1 to 5, including a chamber (3) provided on its exterior with locking ramps (58).

7. Adapter according to claim 6, in which the chamber (3) of the adapter is provided on its exterior with ribs (34) which, together with the ramps (32), form an annular groove (40) for receiving locking means (41, 42) for the fastening apparatus.

8. Adapter according to one of claims 2 to 7, in which the seal (11) and the sleeve (19) form a one piece assembly.

9. Gas cartridge for a gas fastening apparatus, characterised in that it is provided with an adapter according to one of claims 1 to 8.

10. Solenoid valve for the admission of propellant for a piston for driving fastening elements of a gas fastening apparatus, characterised in that it is provided with an adapter according to one of claims 1 to 8.

11. Gas fastening apparatus comprising a solenoid valve (30) for the admission of gas into the combustion chamber of an internal combustion engine for a piston for driving fastening elements and a gas cartridge (20) for supplying the solenoid valve (30) with gas, characterised in that the solenoid valve (30) and the cartridge (20) are connected by an adapter according to one of claims 1 to 8.

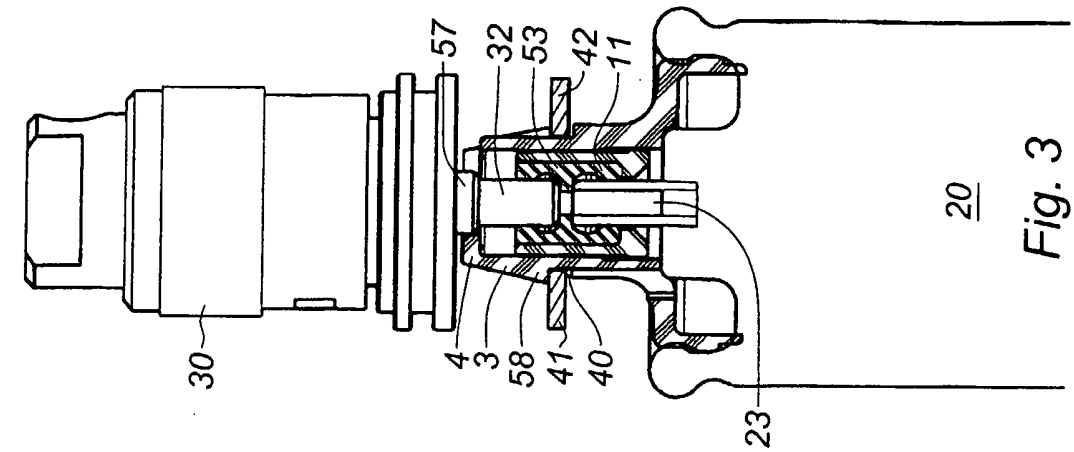


Fig. 3

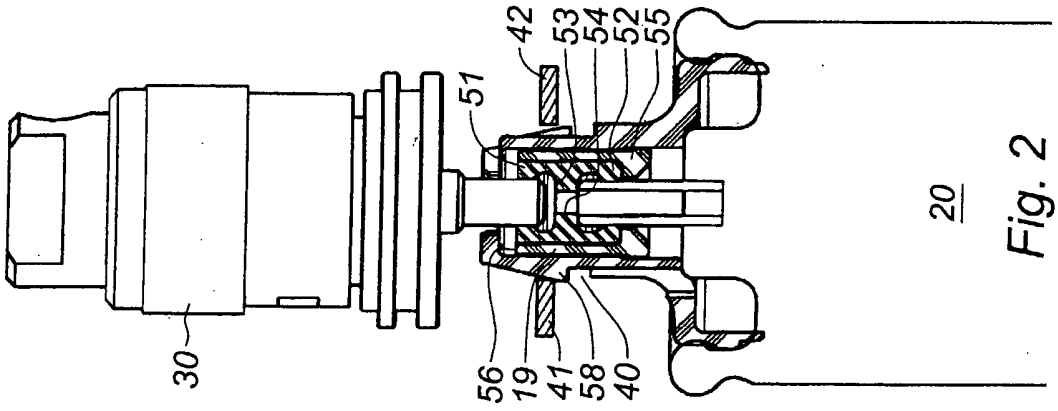


Fig. 2

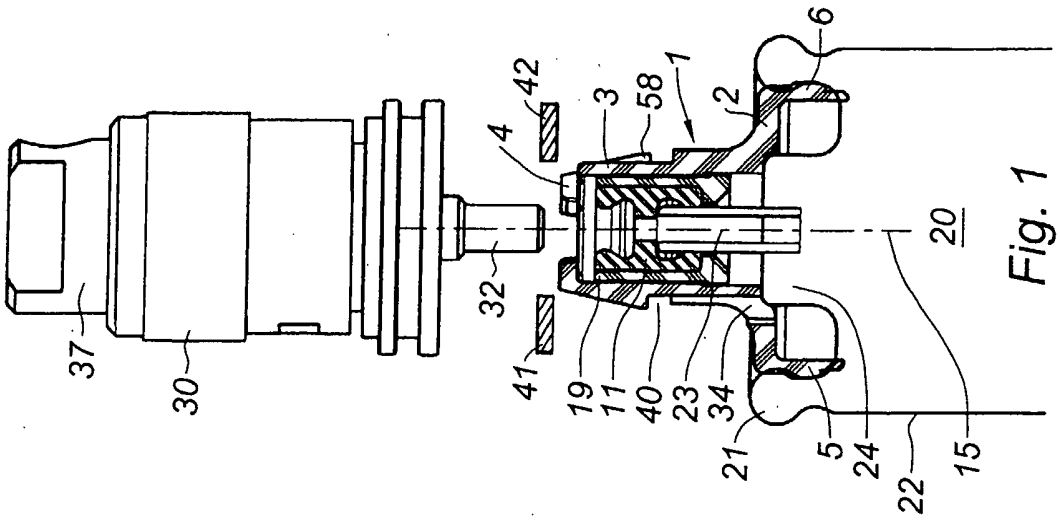


Fig. 1

INTERNATIONAL SEARCH REPORT

International Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16L37/00

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)
IPC 7 F17C

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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 197 299 A (ILLINOIS TOOL WORKS) 17 April 2002 (2002-04-17) cited in the application the whole document	1-4,6-11
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
12 September 2005	28/09/2005

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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