Attachment device (10, 110, 210, 310) to connect an end (11, 311) of a mechanical member (12, 312) to a component (13, 313) of a fixed structure, wherein the end (11, 313) is provided with a through hole (15). The attachment device (10, 110, 210, 310) comprises a pivoting element (16) able to be connected to the component (13, 313) and coupling means (22, 56, 57, 229) able to be inserted into the through hole (15) in order to define a housing seating (30, 130, 230) in which an end (21) of the pivoting element (16) is able to be housed.
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
ATTACHMENT DEVICE FOR A MECHANICAL MEMBER, SUCH AS A GAS SPRING, A LEVER, OR OTHER

FIELD OF THE INVENTION

The present invention concerns an attachment device to connect an end of a mechanical member, such as for example a gas spring, a lever, a rigid rod or other, to a component of a fixed structure, in order to make a closing mechanism, a lever mechanism, an articulated transmission, or other.

In the following description, purely as an example, not restrictive of the present invention, we shall refer to an attachment device able to fix the end of a gas spring to a closing structure consisting of a fixed component and a movable component, such as for example the frame and respectively the movable part of a furnishing element, of a closing element, a door, a gate, or the door of a means of transport, or suchlike.

BACKGROUND OF THE INVENTION

Attachment devices are known, hereafter called simply "attachments", to connect an end of a gas spring to a component of a closing structure, which comprise a pin fixed to the component of the closing structure and able to be inserted in a hole made at the end of the gas spring, so that the latter can rotate around the axis of said pin, when the closing structure is opened or closed.

Known attachments have the disadvantage, however, that they do not offer a sufficient level of freedom to the gas spring, but oblige the latter to rotate only on a plane perfectly perpendicular to the axis of the pin, without any possibility of making angled movements, even minimal, in other directions.

This disadvantage entails the risk of reciprocal jamming of the elements that comprise known attachments, with
consequent dangers of malfunction or breakage. In fact, the end of the gas spring, at the point of attachment, is generally subject to considerable stresses and vibrations, and there is therefore a risk that its limited freedom of movement might cause, in the long run, damage and breakage to the attachment.

Attachment devices of an articulated type are also known, which, although they allow angular movements of a certain freedom, require dedicated working to be connected to the body, or shaft, of the gas spring, thus entailing an increase in the production costs and times.

One purpose of the present invention is to achieve an attachment device which is adaptable both to a simple through hole made at the end of a known mechanical member, such as for example a gas spring, a lever or other, and also to different application requirements of the mechanical member, so as to allow the user to select the type of attachment, for example rigid or articulated, which is more suitable for his requirements.

Another purpose of the present invention is to achieve an attachment device which does not require expensive mechanical workings and which will allow the gas spring not only to rotate around the axis of pivoting, but also to have a certain degree of freedom, in order to incline as far as a determinate angle of amplitude, in another direction and thus support possible stresses and loads which occur during the opening and closing of the closing structure with which the spring gas is associated.

Another purpose of the present invention is to achieve an attachment device for a gas spring that can be easily dis-assembled and re-assembled by any user, for possible operations of repair or replacement of the gas spring, or when the closing structure has to be dis-assembled.
Another purpose of the present invention is to achieve an attachment device which, apart from ensuring a stable attachment between the end of the gas spring and the pin, consists of a limited number of components and is simple and economic to make.

Another purpose of the present invention is to achieve an attachment device that can be efficaciously used in the construction of levers and/or transmissions wherein the join points require a great degree of freedom of movement.

Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

The present invention is set forth and characterized in the main claim, while the dependent claims describe other characteristics of the present invention or variants to the main inventive idea.

In accordance with the above purposes, an attachment device according to the present invention is able to connect an end of a mechanical member, such as for example a gas spring, a lever, a rigid rod or other, provided with a through hole, to a component of a fixed structure.

The attachment device according to the invention comprises a pivoting element connected to the component of the fixed structure.

According to a characteristic of the present invention, the attachment device comprises coupling means able to be inserted into the through hole of the end of the mechanical member, to define a housing seating in which an end of the pivoting element is able to be housed, advantageously with play.

According to a preferential form of embodiment of the present invention, the device also comprises a support
element able to be removably coupled with the end of the mechanical member, and shaped so as to define an insertion seating for the coupling means, in order to keep the latter coupled with the end of the mechanical member.

Advantageously, the support element comprises retaining means able to retain, through interference, the coupling means associated inside the insertion seating, and is provided with a containing seating for the end of the mechanical member.

According to a variant, the coupling means are made in the support element.

In another form of embodiment, the end of the pivoting element is spherical and its coupling with said housing seating allows the support element, and hence the end of the mechanical member, both to rotate around the axis of said pivoting element, and also to freely incline, without constraints, with respect to the end of the pivoting element.

Moreover, in a preferential embodiment, the coupling means comprise a plurality of elastically deformable attachment petals arranged on a circumference coaxial with the axis of the through hole and angularly offset from each other, so as to allow them to be elastically coupled in the through hole.

The attachment device according to the present invention can thus be assembled simply by inserting the coupling means and the end of the mechanical member respectively into the insertion seating and the containing seating of the support element, and subsequently by inserting the pivoting element in snap-in manner into the housing seating defined by the coupling means.

In another preferential embodiment, the attachment petals are provided on their inner side with relative shoulders,
which cooperate in use with the leading end of the pivoting element in order to keep it inside the housing seating.

According to a variant, the attachment petals can also be provided with other relative shoulders made on their outer side, which cooperate in use with the end of the mechanical member.

According to another form of embodiment of the present invention, both the coupling means and also the pin element and the support element are made by molding plastic material, so that they are easy to make and limited in cost. Alternatively, the pin element can be made of metal.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other characteristics of the present invention will become apparent from the following description of some preferential forms of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a lateral view of an attachment device according to the present invention;
- fig. 2 is a three-dimensional view from below of a first enlarged detail of the attachment device of fig. 1 in a first form of embodiment;
- fig. 3 is a three-dimensional view from below, partly in section, of a second enlarged detail of the attachment device in fig. 1 in a first form of embodiment;
- fig. 4 is a longitudinal section of the attachment device in fig. 1 in a first form of embodiment;
- fig. 5 is a three-dimensional view from below of the attachment device in fig. 1 in a second form of embodiment;
- fig. 6 is a longitudinal section of the attachment device in fig. 5;
- fig. 7 is a partly sectioned view of a variant of the
device in fig. 1;

- fig. 8 is an applicational variant of the attachment device in fig. 1.

DESCRIPTION OF SOME PREFERENTIAL FORMS OF EMBODIMENT OF THE INVENTION

With reference to the attached figures, an attachment device 10 according to the present invention is able to connect an end 11 of a gas spring 12 to a component 13 of a closing structure, such as for example the movable or fixed wall of a furnishing element. In this case, the end 11 has a flat and rounded shape and is provided with a through hole 15 having an axis X substantially orthogonal to that of the gas spring 12.

To be more exact, the attachment device 10 is able to be fixed to the component 13 of the closing structure by means of a pin 16, having a cylindrical shaped base end 17, an abutment element 18, a conical neck 19 and a head 21, substantially spherical in shape. The base end 17 is able to be fixed in a mating hole of the component 13 of the closing structure.

According to the form of embodiment shown in figs. 2, 3 and 4, the attachment device 10 according to the present invention comprises a bushing 22 and a supporting half-shell 23, able to be selectively associated with each other and advantageously made by molding plastic material.

The bushing 22 (fig. 3) comprises a cylindrical base 25, provided with a tapered surface 26 and an axial through hole 27, and a plurality of attachment petals 29, in this case four, elastically deformable, made in a piece on the cylindrical base 25, on the opposite side with respect to the taper, and arranged angularly offset around the axial hole 27 so as to define with the latter a housing seating 30, at least partly spherical, for the head 21 of the pin
16. Each attachment petal 29 comprises in this case a shoulder 31 able to cooperate with the head 21 in order to keep it stably inside the housing seating 30. The attachment petals 29 are able, in use, to be arranged inside the through hole 15 of the end 11 of the gas spring 12, so that the axial hole 27 is coaxial with said through hole 15.

The half-shell 23 is open on one side and defines, inside itself, an insertion seating 32 (figs. 2 and 4) able to allow the bushing 22 to be inserted, and provided with two guides 33 made longitudinally and of a shape mating with the end 11, so as to allow the latter to be inserted by sliding inside the half-shell 23.

The half-shell 23 also comprises a transverse wall 35 provided with a retaining tooth 36 facing towards said attachment petals 29 and able to retain, by means of interference with the latter, the bushing 22 inside the insertion seating 32.

The insertion seating 32 is shaped so as to ensure a precise coupling with the end 11, and in this case has a horizontal protrusion 37, made in a piece in correspondence with the front edge of the half-shell 23.

Moreover, on an inner surface thereof, the half-shell 23 has a longitudinal rib 39, also made by molding, and functioning as a guide for the insertion of the bushing 22.

The half-shell 23, together with the end 11 of the gas spring 12, is thus free to rotate stably around the axis X without any risk of the head 21 of the pin 16 accidentally coming out.

Moreover, the at least partly spherical shape of the housing seating 30 and the head 21 of the pin 16 allows the end 11 of the gas spring 12 to move with play, and with a
determinate amplitude of oscillation around the head 21, which can thus also incline slightly without impediment in the event of possible stresses during the opening and closing of the gas spring 12 itself. Furthermore, the spherical shape of the head 21 and the elastic configuration of the attachment petals 29 allow the attachment device 10 to be easily dis-assembled and re-assembled, simply by removing the pin 16.

In this way we obtain an attachment device 10 that is easy to make, wherein all the elements can be made by molding plastic material, do not have any undercut parts and, at the same time, are easy to assemble and ensure a stable connection between the end 11 of the gas spring 12 and the component of the closing structure.

The attachment device 10 as described heretofore is assembled as follows.

First of all the bushing 22 is inserted, by means of its attachment petals 29, inside the through hole 15 of the end 11 of the gas spring 12. The end 11 and the bushing 22 thus coupled are inserted axially inside the half-shell 23, making the cylindrical base 25 slide inside the insertion seating 32 until the end 11 is taken completely inside the insertion seating 32 and in cooperation with the horizontal protrusion 37.

During this sliding the attachment petals 29 are progressively deformed elastically in order to pass below the transverse wall 35, and to move into cooperation with the retaining tooth 36.

In the embodiment shown in figs. 5 and 6, the attachment device is indicated with the reference number 110 and comprises a supporting half-shell 24 advantageously made by molding plastic material, open on one side, which defines inside itself a containing seating 50 to contain and
protect the end 11 of the gas spring 12, not shown here.

The containing seating 50 is shaped so as to ensure a precise coupling with the end 11 and in this case has a pair of horizontal protrusions 51, made in a piece in correspondence with the edge of the half-shell 24, a pair of vertical protrusions 52 and an inner shoulder 53. The vertical protrusions 52 and the inner shoulder 53 are made in a piece and in a position opposite the horizontal protrusions 51 with respect to a plane P passing through the end 11, so as to ensure a stable positioning of the latter with respect to the half-shell 24.

Moreover, towards the open side, the half-shell 24 has a transverse rib 55, also made by molding, with the function of stiffening the half-shell 24.

Moreover, the attachment device 110 comprises, advantageously made on the inner side of the half-shell 24, a first pair of attachment elements 56 and a second pair of attachment elements 57, able to be coupled in the through hole 15 of the end 11 when the latter is arranged in the containing seating 50. The attachment elements 56 and 57 are arranged angularly offset around the axis X, and this allows to obtain an elastic coupling thereof in the through hole 15.

The first and the second attachment elements 56 and 57 also define a housing seating 130, inside which the head 21 of the pin 16 is able to be housed.

The first attachment elements 56, opposite each other with respect to the axis X, comprise on their outer side first shoulders 59, or teeth, which are able to cooperate, in use, with the end 11 of the gas spring 12, while the second attachment elements 57, also opposite each other with respect to the axis X, comprise on their inner side second shoulders 131 (fig. 6), which are able to cooperate
with the head 21 in order to keep it stably inside the housing seating 130. This cooperation between the attachment elements 56 and 57, the end 11 of the gas spring 12 and the head 21 of the pin 16 is facilitated by the elastic configuration of the attachment elements 56 and 57 themselves.

The half-shell 24, together with the end 11 of the gas spring 12, is thus free to rotate stably around the axis X without risk of the head 21 of the pin 16 accidentally coming out.

Moreover, as in the previously described form of embodiment, the circular shape of the housing seating 130 allows the end 11 of the gas spring 12 to move with play and with a determinate amplitude of oscillation around the head 21, which is thus also able to incline slightly without impediment in the event of possible stresses during the opening and closing of the gas spring 12 itself. Moreover, the spherical shape of the head 21 and the elastic configuration of the attachment elements 56 and 57 allow the attachment device 110 to be easily dis-assembled and re-assembled, simply by removing the pin 16.

It is clear, however, that modifications and/or additions of parts may be made to the attachment device 10 as described heretofore, without departing from the field and scope of the present invention.

For example, according to a simpler form of embodiment, shown in fig. 7, an attachment device 210 comprises a pin 16 and a support 224. The pin 16 has a cylindrical end 17, able to be inserted into a component 13 of the closing structure, and a spherical end 21.

The support 224 is provided with four attachment elements 229, which have both outer teeth 259 and also inner teeth 231, which are able to collaborate with the end 11 of the
gas spring 12 and, respectively, with the spherical end 21 of the pin 16.

The attachment elements 229 are arranged angularly offset around an axis X of the through hole 15 and define a substantially semi-spherical housing seating 230 where the spherical end 21 of the pin 16 is arranged with play, thus allowing a movement with a greater degree of freedom of the end 11 of the gas spring 12 with respect to the pin 16.

According to the applicational variant shown in fig. 8, the attachment device 310 is able to connect an end 311 of a first lever 312 to a pin 16 of a second lever 313, so as thus to form the articulation of a lever mechanism.

It is also clear that, although the present invention has been described with reference to specific examples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of attachment device for a gas spring, all of which shall come within the field and scope of the present invention.
CLAMS

1. Attachment device to connect an end (11, 311) of a mechanical member (12, 312) to a component (13, 313) of a fixed structure, wherein said end (11, 313) is provided with a through hole (15) and wherein said device comprises a pivoting element (16) able to be connected to said component (13, 313), characterized in that it comprises coupling means (22, 56, 57, 229) able to be inserted into said through hole (15) in order to define a housing seating (30, 130, 230) in which an end (21) of said pivoting element (16) is able to be housed.

2. Attachment device as in claim 1, characterized in that it also comprises a support element (23) shaped so as to define at least an insertion seating (32) inside which said coupling means (22) are able to be inserted in order to be coupled with said end (11, 311) of said mechanical member (12, 312).

3. Attachment device as in claim 2, characterized in that said support element (23) comprises retaining means (36) able to retain said coupling means (22) through interference inside said insertion seating (32).

4. Attachment device as in claim 3, characterized in that said insertion seating (32) comprises at least a guide (33) to guide said end (11, 311) of said mechanical member (12, 312).

5. Attachment device as in claim 3, characterized in that said coupling means comprise a bushing (22) having a base element (25) able to be selectively arranged inside said insertion seating (32), and a plurality of attachment means (29) which branch off from said base element (25), able to attach said end (21) of said pivoting element (16).

6. Attachment device as in claim 5, characterized in that said attachment means comprise a plurality of elastically
deformable petals (29) arranged on a circumference coaxial with a longitudinal axis (X) of said through hole (15), angularly offset with respect to each other and defining said housing seating (30) for said end (21) of said pivoting element (16).

7. Attachment device as in claim 6, characterized in that each of said petals (29) comprises at least a shoulder (31), able to keep said end (21) inside said housing seating (30).

8. Attachment device as in claims 3 and 5, characterized in that said retaining means comprise at least a tooth (36) able to act against one of said attachment means (29).

9. Attachment device as in any claim hereinbefore, characterized in that said support element comprises a half-shell (23) open on one side.

10. Attachment device as in claim 9, characterized in that said half-shell (23) comprises at least a horizontal protrusion (37) able to ensure a stable positioning of said end (11, 311) of said mechanical member (12, 312) in said insertion seating (32).

11. Attachment device as in any claim hereinbefore, characterized in that said coupling means (56, 57, 229) are made in a support element (24, 224) able to be removably coupled with said end (11, 311) of said mechanical member (12, 312).

12. Attachment device as in claim 11, characterized in that said support element (24) is shaped so as to define a containing seating (50) for said end (11, 311) of said mechanical member (12, 312).

13. Attachment device as in claim 11 or 12, wherein said through hole (15) has an axis (X) substantially perpendicular to that of said mechanical member (12, 312), characterized in that said coupling means comprise
attachment elements (56, 57, 229) angularly offset to each
other with respect to said axis (X) and provided with
shoulders (59, 131, 259, 231), able to cooperate with said
end (11, 311) of said mechanical member (12, 312) and with
said end (21) of said pivoting element (16).

14. Attachment device as in claim 12 or 13, characterized
in that said coupling means comprise first attachment
elements (56), which are opposite each other with respect
to said axis (X), and second attachment elements (57) which
are opposite each other with respect to said axis (X) and
angularly offset with respect to said first attachment
elements (56).

15. Attachment device as in claim 14, characterized in that
said first attachment elements (56, 229) comprise, on an
outer side, first shoulders (59, 259) which are able to
cooperate, in use, with said end (11, 311) of said
mechanical member (12, 312).

16. Attachment device as in claim 14 or 15, characterized
in that said second attachment elements (57) comprise, on
an inner side, second shoulders (131) which are able to
cooperate, in use, with said end (21) of said pivoting
element (16).

17. Attachment device as in any claim from 11 to 16
inclusive, characterized in that said housing seating (130,
230) is substantially cylindrical in shape.

18. Attachment device as in any claim from 12 to 17
inclusive, characterized in that said support element
comprises a half-shell (24) open on one side.

19. Attachment device as in claim 18, characterized in that
said half-shell (24) has a transverse rib (55) for
stiffening purposes in correspondence with one open side.

20. Attachment device as in claim 18 or 19, characterized
in that said support element (24) comprises protrusions
(51, 52, 53) made on one inner side and arranged on opposite sides with respect to a plane (P) passing through said end (11, 311) of said mechanical member (12, 312), in order to ensure a stable positioning of said mechanical member (12, 312) with respect to said support element (24).

21. Attachment device as in any claim hereinbefore, characterized in that said end (21) of said pivoting element (16) comprises an at least partly spherical outer surface, and in that said housing seating (30, 130, 230) comprises an at least partly spherical inner surface.

22. Attachment device as in any claim hereinbefore, characterized in that said pivoting element (16) has a base end (17) substantially cylindrical in shape, which is able to be inserted in a mating hole of said component (13, 313) of said fixed structure.

23. Attachment device as in any claim hereinbefore, characterized in that said pivoting element (16), said coupling means (22, 56, 57, 229) and said support element (23, 24) are obtained by molding plastic material.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 F16C11/06

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 B60S F16C F16F

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

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<th>Category</th>
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<th>Relevant to claim No.</th>
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<td>DE 198 13 721 A (FICO CABLES SA) 7 October 1999 (1999-10-07) column 3, lines 38-68; figures</td>
<td>1-3,5-9, 21,22 23</td>
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Further documents are listed in the continuation of box C.

Special categories of cited documents:

*A* document defining the general state of the art which is not considered to be of particular relevance

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**X** document of particular relevance; 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 relevance; 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.

**X** document member of the same patent family

Date of the actual completion of the international search

30 November 2004

Date of mailing of the international search report

07/12/2004

Name and mailing address of the ISA

European Patent Office, P.B. 5815 Patentlaan 2 NL - 2280 HV Rijswijk Tel (+31-70) 340-2040, Tx. 31 651 epos nl Fax (+31-70) 340-3016

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