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D E C I S I O N
of 17 December 2002

Case Number: T 0348/01 - 3.2.1

Application Number: 92303713.9

Publication Number: 0511000

IPC: F16L 27/12, F16L 27/10, F16L 51/02

Language of the proceedings: EN

Title of invention:
Flexible coupler apparatus

Patentee:
Senior Investments AG

Opponent:
IWK Regler + Kompensatoren AG

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
"Novelty (yes)"
"Inventive step (no)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0348/01 - 3.2.1

D E C I S I O N
of the Technical Board of Appeal 3.2.1
of 17 December 2002

Appellant: (Proprietor of the patent)
Senior Investments AG
Fronwagplatz 10
CH-8200 Schaffhausen (CH)

Representative:
Rutetzki, Andreas, Dipl.-Ing.
Müller-Boré & Partner
Patentanwälte
Grafinger Strasse 2
D-81671 München (DE)

Respondent: (Opponent)
IWK Regler + Kompensatoren GmbH
Lorenzstrasse 2-6
D-76297 Stutensee (DE)

Representative:
Lempert, Jost, Dipl.-Phys. Dr. rer.nat.
Patentanwälte
Dipl.-Ing. Heiner Lichti,
Dipl.-Phys. Dr. rer.nat. Jost Lempert,
Dipl.-Ing. Hartmut Lasch,
Postfach 41 07 60
D-76207 Karlsruhe (DE)

Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 30 January 2001 revoking European patent No. 0 511 000 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: F. Pröls
Members: S. Crane
H. Preglau
M. Ceyte
G. Weiss

Summary of Facts and Submissions

I. European patent No. 0 511 000 was granted on 2 January 1997 on the basis of European patent application No. 92 303 713.9.

II. The granted patent was opposed by the present respondents on the grounds that its subject-matter lacked novelty and/or inventive step (Article 100(a) EPC).

The state of the art relied upon included the following pre-published documents:

(D1) EP-A-0 398 086

(D2) US-A-4 792 161

(D3) EP-A-0 208 128

(D4) EP-A-0 282 689

(D5) US-A-2 934 095

(D6) US-A-3 420 553

(D7) FR-A-2 324 866

(D8) DE-A-2 655 091

(D9) DE-U-7 638 030

(D10) DE-A-4 016 453

(D11) EP-A-0 432 436

III. With its decision posted on 30 January 2001 the Opposition Division held that the subject-matter of granted claim 1 lacked novelty with respect to document D1 and revoked the patent.

IV. A notice of appeal against that decision was filed on 22 March 2001 and the fee for appeal paid at the same time. The statement of grounds of appeal was filed on 11 June 2001.

V. Oral proceedings before the Board were held on 17 December 2002.

The appellants (proprietors of the patent) requested that the decision under appeal be set aside and the patent be maintained in amended form on the basis of claim 1 according to the main request or auxiliary requests I to III all submitted at the oral proceedings. They also requested reimbursement of the appeal fee.

Claim 1 according to the main request reads as follows:

> "A flexible coupler apparatus (10) for connecting the adjacent ends of two successive pipes in order to direct fluid flow from one of the two pipes to the other of the two pipes, the flexible coupler apparatus (10) including an inner sleeve member (17) being a substantially cylindrical hollow tube and having an end (18) operably affixable to one of the two pipes, and a free end (30), an outer sleeve member (16) being a substantially cylindrical hollow tube and having an end (42) operably affixable to the other of the two pipes, and a free end (29), the inner and the outer sleeve members

(17, 16) being separated by an annular space (34, 35) (36, 37) to permit angular displacement therebetween, the free end of the outer sleeve member (16) being operably arranged to slidingly receive the free end of the inner sleeve member, a portion of the outer sleeve member (16) thereby concentrically overlapping a portion of the inner sleeve member (17), and the outer and inner sleeve members (16, 17) being further operably arranged for axial and angular movement relative to each other to, in turn, accommodate axial and angular movement relative to each other and the two pipes to which the apparatus (10) may be connected, and a vibration absorbing, spacer member (48) positioned between the inner and outer sleeve members (17, 16) within the annular space (34, 35) (36, 37), for maintaining the inner sleeve member (17) and the outer sleeve member (16) in space relation to each other along the overlapping portions of the outer and inner sleeve members (16, 17), and for precluding the transmission of vibrations from the inner and outer sleeve members to each other, wherein the spacer member (48) is a non-sealing porous member and wherein a resilient sealing member (19) is affixed to the outer sleeve member (16) and to the inner sleeve member (17) for maintaining the two pipes to which the apparatus (10)may be connected in a flexibly joined relation to each other and to accommodate and enable substantial compressive and extensive axial movement as well as angular movement of the outer (16) and inner (17) sleeve members relative to each other in order to preclude further the transmission of vibrations of the outer and the inner sleeve members (16,17) to each other and to preclude the

escape of fluid from the flexible coupler apparatus (10) and wherein the porous spacer member (48) is not affixed to the exterior of the inner sleeve member (17), or the interior of the outer sleeve member (16), to enable its sliding along either of the inner and outer sleeve members (17, 16), maintaining air gaps (29a 29b; 30a 30b) between the inner and the outer sleeve members (17, 16) more or less constant radial thickness in the absence of any lateral forces."

Claim 1 according to auxiliary request I includes the additional feature incorporated at the end of the claim:

"and a flexible closure member (23) for enclosing and protecting the resilient member (19) and the free overlapping ends of the outer (16) and inner (17) sleeve members."

Claim 1 according to auxiliary request II has been derived from claim I according to auxiliary request I by the addition of the further feature:

"wherein end caps (11, 12) are arranged to snugly fit over the closure member (23), the resilient sealing member (19) and the respective ends of the sleeve members (16, 17)."

Lastly, claim 1 according to auxiliary request III includes the further additional feature in comparison with claim 1 of auxiliary request II:

"and wherein the flexible member (23) includes a braided metal wire tube (31), having two ends, one

of the ends being operably affixed to the outer sleeve member (16) and the other of the ends being operably affixed to the inner sleeve member (17), the braided metal wire tube (31) being configured to accommodate axial compression and extension, as well as any twisting and bending movements of the outer and inner sleeve members (16, 17) relative to each other."

In support of their requests the appellants argued substantially as follows:

In view of the amendments made to claim 1 of the main request there could now be no doubt that its subject-matter was novel with respect to both document D1 and also the other cited prior art documents.

On the question of inventive step document D1 represented the closest state of the art, it being the only document of the many cited which suggested the combined use of a non-sealing spacer member and a resilient sealing member, notwithstanding the fact the document was concerned with a joint formed directly between the ends of two pipes rather than a separate coupler apparatus for connecting two pipe ends together. The spacer member was however located between respective recessed portions of specially shaped overlapping pipe ends, which seriously restricted the amount of relative axial movement which the pipe ends could undergo. Furthermore, the special form of the pipe ends was not conducive to a smooth flow of fluid through the pipe and entailed the use of an additional conduit part within the joint. These problems were solved by arranging the spacer member for sliding movement within substantially cylindrical inner and

outer sleeve members of the coupler apparatus in the manner claimed. There was nothing in the state of the art which could lead the person skilled in the art to this solution. The teachings of document D2, particularly relied upon by the respondents in this respect, were clearly not compatible with those of document D1 since document D2 specifically proposed the use of a sealing spacer member to avoid the need for a resilient sealing number.

Although it was known *per se* in the art to protect the resilient sealing member of a pipe joint or pipe end coupler apparatus with a flexible closure member of braided metal wire, such a proposal was clearly inconsistent with what was taught in documents D1 and D2, and it was only in the particular construction of the claimed coupler apparatus that a flexible closure member of simple construction could fully perform its intended function. Furthermore, the use of end caps to attach and protect the end region of the closure member and the resilient sealing member could also not be derived from the cited state of the art. Accordingly, each of the features added to the respective claim 1 of the auxiliary requests I to III made a further inventive contribution to the art.

The Opposition Division had erred in not admitting the auxiliary requests of the appellants into the proceedings after the finding of lack of novelty with respect to document D1 had been made. This justified reimbursement of the appeal fee.

The respondents requested dismissal of the appeal and argued substantially as follows:

Novelty of the subject-matter of claim 1 of the main request with respect to document D1 could be conceded but nevertheless there was still full anticipation by document D3. In particular, both the inner and outer sleeve members of the coupler apparatus shown in Figure 9 and 10 of this document were substantially cylindrical and it was apparent that both of the spacer members provided would be capable of sliding along the sleeve members in relative axial movement of these sleeve members in respective different directions.

If novelty were to be recognised then the subject-matter of the claim in question in any case lacked inventive step with respect to the teachings of documents D1 and D2. As for the claims according to the auxiliary requests these all concerned features which were well known in the relevant art and were not of inventive significance.

Reasons for the Decision

1. The appeal complies with the formal requirements of Articles 106 to 108 and Rules 1(1) and 64 EPC. It is therefore admissible.

2. *Main request*

2.1 Background

The contested patent relates to coupler apparatus for joining the adjacent ends of successive lengths of pipe, more particularly in a vehicle exhaust system. As explained in the introductory description of the patent specification it is advantageous that such a coupler

apparatus be flexible in order to reduce the transmission of forces and vibrations between the pipe lengths. As stated there an example of such a flexible coupler apparatus is to be found in document D2.

This document discloses a coupling arrangement in which the adjacent pipe ends have overlapping inner and outer sections (Figure 1) or one pipe has a sleeve member attached thereto which overlaps the end of the other pipe (Figure 2). An annular flexible sealing member made of steel wool, asbestos, ceramic fibre or the like, is disposed between the overlapping parts. A flexible mechanical connection between the two pipe ends is maintained by a co-axially arranged pair of coil springs which surround the overlapping parts and the flexible sealing members and which are connected to the pipe ends by welding or the like. Document D2 portrays this arrangement as being superior to the prior art shown in its Figure 3, which comprises a flexible metal sealing bellows extending between the pipe ends, surrounding and protected by a flexible metal "net". According to document D2 the known arrangement suffered from fatigue or impact fracturing of the sealing bellows, with consequent leakage of exhaust gas.

As set out in the present patent specification the proposals of document D2 are unsatisfactory for a number of reasons. In particular, the coil springs are subject to corrosion and mechanical damage, and since gaps can open up between the turns of the coils these do not fully protect the coupling arrangement. Also, the flexible sealing ring deteriorates with time and can no longer guarantee a tight seal. Against this background the aim of the claimed invention is to

provide flexible coupler apparatus which is durable and not subject to premature breakdown of the seal. In general terms this is achieved by arranging a porous, non-sealing, vibration absorbing annular spacer member between the overlapping portions of inner and outer sleeve members fixable to the respective ends of the pipe lengths to be joined, with a resilient sealing member, in particular a metal bellows, affixed to the inner and outer sleeve members. This configuration has on the one hand the advantage that the properties of the annular spacer member can be specifically selected with the goal of obtaining optimum mechanical qualities, since there is no need that it also provides a seal. On the other hand, the bulk of the external forces applied to the coupler apparatus are taken up by the annular spacer member and not by the resilient sealing member, so that the risk of this suffering mechanical damage is reduced.

2.2 Novelty

At the oral proceedings before the Board the respondents conceded the novelty of the subject-matter of claim 1 of the main request with respect to document D1, but pursued the objection of lack of novelty with respect to document D3.

This prior art document also relates to flexible coupler arrangements for use in a vehicle exhaust system. In some of the embodiments disclosed there the coupling is directly between suitably shaped and adapted pipe ends. In other embodiments, for example Figures 9 and 10, there is an identifiable coupler apparatus comprising overlapping inner and outer sleeve members each one connected to a respective pipe end.

The free end of the outer sleeve members is widened to form a socket in which the free end portion of the inner sleeve member is located with a flexible annular spacer member positioned therebetween. The gap between the free end of the outer sleeve member and the outer surfaces of the inner sleeve member is substantially closed by an annular plate attached to the outer sleeve and this, together with an outer corrugation on the inner sleeve member and a shoulder of the socket portion of the outer sleeve member, effectively forms two compartments within which the flexible spacer member is confined. A flexible metal bellows is attached at one end to the annular closure plate and at the other to the end of the pipes (Figure 9) or to the end of the inner sleeve members attached to the end of the pipe length (Figure 10). The flexible annular spacer member may be formed from compressed ceramic or metal fibres in for example knitted or woven form.

The respondents argued that since the preferred form of annular spacer member described in the present patent specification was also formed of compressed metal mesh then the annular spacer member of document D3 would inevitably exhibit the required properties of being porous and non-sealing. However, document D3 itself makes clear that one of the functions of the annular spacer member described there is to seal the space between the inner and outer sleeve members (see for example column 2, lines 41 to 52), the function of the flexible metal bellows on the other hand is to protect the annular spacer member from external environmental influences. The Board sees no contradiction in a compressed fibrous material being used to form an effective seal for exhaust gases, a corresponding teaching is to be found in document D2, discussed

above. It is therefore apparent that the combination of a non-sealing porous annular spacer member and a resilient sealing member for the exhaust gases, as defined in claim 1, is not taught by document D3.

Furthermore, claim 1 requires that the inner and outer sleeve members be "substantially cylindrical" hollow tubes and that the annular spacer member be capable of "sliding along either of the inner and outer sleeve members". The respondents have taken issue with the meaning of the term "substantially cylindrical" and argue that it is so broad as to encompass the form of the sleeve members disclosed in Figures 9 and 10 of document D3. However, within the context of the patent specification as a whole it is apparent that the cylindrical nature of the inner and outer sleeve members is functionally related to the ability of the annular spacer member to slide between them when the ends of the pipes move axially with respect to each other. To enable this at least those overlapping regions of the inner and outer sleeve member within which the annular spacer member is capable of sliding are plain cylinders. In document D3 on the other hand there is no suggestion of a sliding movement of the annular spacer member on relative axial movement of the pipe ends. Instead, the sleeve members are formed with radial shoulders or projections which confine the annular spacer member axially so that in both directions of relative axial movement of the pipe ends one part of the annular spacer member is compressed.

It is thus apparent that a flexible coupler apparatus having all the features of claim 1 is not disclosed in document D3 and is thus novel (Article 54 EPC).

2.3 Inventive step

The closest state of the art for the evaluation of inventive step is that disclosed in document D1.

At issue before the Opposition Division, which held that the subject-matter of granted claim 1 lacked novelty with respect to document D1, was the question of whether the arrangements disclosed there could fairly be considered as "flexible coupler apparatus" affixable to the adjacent ends of two pipes to be connected. There was no dispute that the use of a non-sealing porous annular spacer member and a surrounding resilient sealing member for the exhaust gases could be derived from the document. The appellants argued however that there were no inner and outer sleeve members as such and that it was the adjacent ends of the pipes themselves which had to be especially adapted to receive the annular spacer member and resilient sealing member. The Opposition Division reasoned on the contrary that the free ends of the pipes were in turn suitable for affixing to other pipes, so that the lengths of pipe involved effectively constituted inner and outer sleeve members as required by the claim.

The arguments of the appellants are the more convincing in this respect. What the relevant embodiments of document D1 disclose are arrangements for flexibly coupling the adjacent ends of successive pipes and not "flexible coupler apparatus" within the meaning of claim 1 either as granted or presently under consideration. However, for the evaluation of inventive step, there is little distinction. It is commonplace in the art of pipe couplings to apply the same principles both to connections made between suitable modified pipe

ends and to connections involving the use of a separate coupling element disposed between and joined to the pipe ends. A typical example can be seen in document D3, discussed above, which discloses embodiments of both types all having the same basic construction. For the person skilled in the art it is thus immediately apparent that the arrangements disclosed in document D1 can be modified without any technical difficulty to constitute flexible coupler apparatus comprising inner and outer sleeves affixable to the adjacent ends of two pipes to be connected.

The differences between such a flexible coupler apparatus and that defined in claim 1 under consideration are to be found in the form of the inner and outer sleeve members and the arrangement of the annular spacer member therebetween. As disclosed in document D1 the overlapping ends of the pipes are formed with facing annular channels so as to locate the annular spacer member positively. In the view of the appellants this arrangement is unsatisfactory in particular because it reduces the ability of the coupling to allow the pipe ends to move axially with respect to each other. Furthermore, the significant deformations of the pipe ends are said to disturb the flow of exhaust gas, requiring the use of an additional inner tubular element. In the light of the state of the art according to document D1 the technical problem addressed by the claimed invention is thus to be seen in the provision of a flexible coupler apparatus of simple construction which accommodates substantial relative axial movement of the pipe ends in both directions. To achieve this the inner and outer sleeve members take the form of substantially cylindrical hollow tubes and the annular spacer member is not

affixed to the sleeve members thus enabling it to slide along them. The person skilled in the art confronted with the technical problem discussed above will be familiar with the teachings of document D2. The arrangement of the annular spacer member with respect to the pipe ends disclosed there corresponds essentially to what is set out in claim 1 under consideration. Although not specifically stated in the document it is apparent from general considerations that the annular spacer member is not affixed to the extensive overlapping cylindrical portions of the pipe ends between which it is disposed and will slide along them when the pipes move axially with respect to each other. The adoption of these simple geometric principles in a flexible coupler apparatus deriving from the teachings of document D1 to solve the technical problem involved must therefore be seen as being obvious for the person skilled in the art and will lead directly to apparatus having all the features of claim 1 under consideration.

The subject-matter of claim 1 according to the main request therefore lacks inventive step (Article 56 EPC).

3. *Auxiliary requests*

Claim 1 according to the first auxiliary request contains the additional feature that a flexible closure member encloses and protects the resilient sealing member and the free overlapping ends of the outer and inner sleeve members. In the embodiments described in the patent specification the flexible closure member is comprised of metal wire braid disposed around the metal bellows constituting the resilient sealing member.

Since flexible metal bellows are of necessity formed of relatively thin material they are easily susceptible to physical damage and it is conventional in the art to provide an enclosing protective member, for example of braided metal wire. All of the documents D2 (prior art shown in Figure 3) and D4 to D11 show such a combination. The additional feature of the first auxiliary request cannot therefore make an inventive contribution to the subject-matter claimed.

As for the second auxiliary request this concerns the provision of end caps arranged to fit snugly over the closure member, the resilient sealing member and the respective ends of the sleeve members. It is apparent that in an arrangement where a flexible metal bellows is surrounded by a flexible protective member suitable means for protecting the ends of these elements from damage will also be of advantage. Such means may take the form of end caps as shown for example in documents D9 to D11. Thus, the incorporation of end caps as required by the second auxiliary request can also not be seen as involving an inventive step.

Lastly, claim 1 according to the third auxiliary request sets out that the flexible closure member is a braided metal wire tube and has its ends attached one to the inner sleeve member and the other to the outer sleeve member. As already indicated above, the provision of a tubular braided metal wire protective member for a flexible metal bellows is wholly conventional in the art and in the situation at hand, where the bellows is attached to inner and outer sleeve members of a coupling it is obvious that the braided metal wire tube should also be affixed, either directly or indirectly, to those sleeve members. The subject-

matter of the third auxiliary request correspondingly also lacks an inventive step.

4. *Appeal fee*

According to Rule 67 EPC the reimbursement of an appeal fee is contingent in the first place upon the Board deeming the appeal allowable. Since this is not the case no further examination of the appellant's request in this respect is necessary.

Order

For these reasons it is decided that:

1. The appeal is dismissed.

2. The request for reimbursement of the appeal fee is refused.

The Registrar: The Chairman:

S. Fabiani F. Pröls