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D E C I S I O N
of 12 December 1995

Case Number: T 0325/94 - 3.2.1

Application Number: 87200062.5

Publication Number: 0231965

IPC: F16D 55/14, F16D 65/54

Language of the proceedings: EN

Title of invention:
A device with hydraulic actuator cylinder for directly operating vehicle ball-and-ramp mechanism brakes

Patentee:
SIRMAC OFFICINE MECCANICHE S.p.A.

Opponent:
Lucas Industries public limited company

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - main request (no)"
"Inventive step - auxiliary request (yes)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0325/94 - 3.2.1

D E C I S I O N
of the Technical Board of Appeal 3.2.1
of 12 December 1995

Appellant: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 16 February 1994 revoking European patent No. 0 231 965 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: F. A. Gumbel
Members: P. Alting van Geusau
G. Davies

Summary of Facts and Submissions

I. The mention of the grant of European patent No. 0 231 965 in respect of European patent application No. 87 200 062.5, filed on 16 January 1987, was published on 18 March 1992 (cf. Bulletin 92/12).

II. Notice of opposition was filed on 15 December 1992 on the grounds of Article 100(a) EPC. In respect of an alleged lack of novelty and inventive step, the opposition was supported inter alia by the documents:

D1: DE-A-2 640 092
D2: US-A-2 732 036
D4: US-A-3 343 632
D6: US-A-4 374 554
D8: EP-A-0 040 027

III. By a decision issued in writing on 16 February 1994 the Opposition Division revoked the patent. In the Opposition Division's opinion the subject-matter in accordance with claim 1 of the patent in suit lacked inventive step when taking into account the disclosures of D1 and D2.

IV. On 14 April 1994 the appellants (proprietors) filed a notice of appeal against the above decision and paid the appeal fee on the same day.

The statement of grounds of appeal was filed on 13 June 1994.

V. In response to the statement of grounds of appeal the respondents (opponents) referred to the further prior art document

D11: GB-A-1 494 730

relating to an example of a disc brake arrangement in which a telescopic brake cylinder was mounted between levers actuating on the brake pads.

VI. In a communication dated 20 December 1994 the Board expressed the preliminary opinion that the combination of the teachings of documents D1 and D2 did not appear to lead to the subject-matter of claim 1 of the patent in suit.

It was further stated that D4, rather than D1, appeared to be the most relevant prior art and therefore this prior art document should serve as the starting point for the assessment of inventive step of the subject-matter of claim 1.

Considering the problem of drag referred to in the description of the patent, which apparently also would be encountered with the arrangement disclosed in D4, the Board expressed doubt as to whether the replacement of the known fixed cylinder arrangement in D4 by a cylinder arrangement with telescopic cylinder portions, such as known from D1 or D6, would be inventive.

VII. In their response to the Board's communication, the appellants agreed that D4 should be considered to describe the closest prior art but disputed that either D1 or D6 would give any lead to the solution to the underlying problem of the patent in accordance with the subject-matter claimed.

VIII. Oral proceedings were held on 12 December 1995 in the presence of both parties. During the oral proceedings the appellants filed amended claims 1 to 7 and an adapted description which, together with the drawings as granted, formed an auxiliary request.

The appellants requested that the decision under appeal be set aside and that the patent be maintained as granted (main request) or on the basis of the auxiliary request submitted during the oral proceedings.

The respondents requested that the appeal be dismissed or, should the Board admit the auxiliary request, that the case be referred back to the first instance for further prosecution.

IX. Claim 1 of the appellants' main request reads as follows:

"1. A device for directly operating vehicle ball-and-ramp mechanism brakes of the kind in which a hydraulic cylinder (30) acts between radial lugs (20, 21) of the brake pressure plates (11, 12) located in a housing (10), rotating one of them, such rotation moving them apart by effect of the balls (13) located between the plates (11, 12), bound to said radial lugs (20, 21) for moving them away, said cylinder (30) consisting of two telescopic portions (35, 36) which themselves form the pistons, characterised in that the cylinder (10) is free floating in said housing (10), each plate (11, 12) is rotating in the housing (10) to lean against surface (24, 26) of the housing (10) in the direction opposite to the thrust direction of the cylinder (30) during the braking."

Claim 1 of the auxiliary request reads as follows:

"1. A device for directly operating vehicle ball-and-ramp mechanism brakes of the kind in which a hydraulic cylinder (30) acts between radial lugs (20, 21) of the brake pressure plates (11, 12) located in a housing (10), rotating one of them, such rotation moving them apart by effect of the balls (13) located between the plates (11, 12), bound to said radial lugs (20, 21) for moving them away, wherein each plate (11, 12) is rotating in the housing (10) to lean against a surface (24, 26) of the housing (10) in the direction opposite to the thrust direction of the cylinder (30) during the braking, characterised in that the cylinder (30) consists of two telescopic portions (35, 36) which themselves form the pistons and is free floating in said housing (10) and that the said telescopic portions (35, 36) rest on said lugs (20, 21) through the intermediary of rolling contact surfaces (31)."

X. In support of their requests the appellants essentially relied on the following submissions:

It should be noted that in the type of brake concerned, both the common rotation of the two plates to reach the abutment and the cylinder stroke increased with wear. Such wear had the effect that the lugs of the brake plates not only had to be moved far in the circumferential direction of the brake but also in the axial direction due to the increased rotation of the brake plates over the ball and ramp mechanism. All the cited documents showed the reluctance of the skilled person to leave the cylinder free to "float" in such a braking arrangement.

The brake disclosed in D6 was a drum brake and hence of a different type and because the stroke of the cylinder was extremely small and the movement was in one plane only, the skilled person would not be led to consider this document when looking for a solution to the underlying problem of the patent. Moreover, since the shoe in this brake had a body formed by an arc-shaped sheet of metal carrying the circumferential support for the pads, the confronting ends of the shoes were flat and therefore could not be considered to disclose that the telescopic portions rested on the lugs through the intermediary of spherical surfaces.

The cylinder in the brake disclosed in D1 was not free-floating because it was fastened to one of the plates, which itself was fastened to the hub. Again the skilled person did not have any reason to use the telescopic cylinder shown in D1 to replace the fixed cylinder shown in D4 and such an allegation could therefore only be based on hindsight. Clearly in D2 the cylinder was fixed and thus also not mounted to ensure free variation of support orientation.

Considering the free variation of support orientation achieved with the device in accordance with the present patent, the advantages of this solution were evident and given the facts that the brake technology was a very crowded art and that the cited documents dated from many years ago these further facts all pointed in the direction that the proposed solution involved an inventive activity.

XI. The respondents disputed the appellants' views and argued substantially as follows:

Although the subject-matter of the claims 1 in accordance with the main and auxiliary requests could be considered as novel it lacked an inventive step having regard in particular to the documents D1, D2 and D6. Firstly, the term "free-floating" used in the claims did not exclude a connection such as disclosed in D2, in which a cylinder comprising telescopic parts was free-floating in the housing to act between projections on rotatable discs, or the mounting shown in D1, utilising an actuator which is free to articulate in any direction by virtue of universal couplings.

Since the knowledge of the brake specialist was not restricted to one type of brake only, also the arrangement shown in D6 would be considered by the skilled person when trying to find a solution to the problem stated. Clearly in D6 the cylinder was free floating and comprised means for free variation of support orientation in a manner as defined in claim 2 of the patent.

However, if a special meaning of "rolling contact surfaces" would be decisive for the decision of the Board in the sense that constructions as shown in D2 and D6 would be excluded, further time was requested for carrying out an additional search since such a new interpretation would in fact change the subject of the invention in a manner that could not have been foreseen.

A further example of a telescopic piston and cylinder assembly mounted between two levers similar to the cylinder mounting defined in the claims of the patent in suit, was further known from D11, a document also relating to brakes.

The cited documents thus showed that the use of free floating telescopic cylinders for brake actuation was well known to the skilled person and therefore it did not need any inventive activity to replace the brake cylinder in the construction shown in D4 by a free floating brake cylinder as claimed.

Reasons for the Decision

1. The appeal is admissible

2. *Novelty*

Novelty of the subject-matter of claim 1 as granted and claim 1 of the auxiliary request follows from the fact that none of the cited documents discloses a device for directly operating vehicle ball-and-ramp mechanism brakes in which the actuating cylinder is free floating and consists of two telescopic portions which themselves form the pistons.

Novelty was in fact not any longer in dispute.

3. *Inventive step (main request)*

3.1 There was agreement that D4, rather than D1 which the Opposition Division considered to be the closest prior art, was the most relevant prior art available.

This conclusion was essentially based on the fact that D4 discloses a similar type of brake arrangement to that in the present patent with a stationary housing, whereas in D1 the "housing" is the rotating brake drum.

The device in accordance with claim 1 of the main request differs from this known arrangement in that the cylinder is free floating and consists of two telescopic portions, which themselves form the pistons.

3.2 In respect of the meaning of the term "free floating" the Board relies on the explanations in column 4, lines 13 to 18 of the description of the patent in suit, according to which the cylinder is in no way restricted to the housing and is mounted between the two lugs for free variation of support orientation with minimum friction.

3.3 The prior art disclosed in D4 is in agreement with the prior art discussed in the introductory part of the description of the patent in suit, setting out the disadvantages encountered with such known design.

The underlying problem of the patent to be solved by the features of claim 1 can be seen in the obviation of the cited drawbacks of this prior art arrangement (see column 3, lines 17 to 19 of the patent in suit), in particular the reduction of excessive drag caused by an out-of-line actuation of the fixed cylinder which result from the increase in the angle between the two pressure plates with lengthening of piston travel. In this respect, it is to be noted that with increased wear of the brake discs the piston travel becomes large while at the same time also the points of contact between the piston rods and pressure plate lugs shift out of the plane of the cylinder, this causing unwanted side-force components working on the pistons and lugs.

3.4 In the Board's opinion, the negative effects of an out-of-line actuation are well known to the skilled person acquainted with brake actuation in general. Not only does an out-of-line actuation increase wear and risk of

leakage of the cylinder, but also the increased friction caused by such actuation may result in unequal forces being transmitted to the brake shoes or segments with the resulting risk of unpredictability of the brake function. In this respect, attention can be drawn to D6, which confirms the general knowledge that an actuator carried solely by the brake shoes, thus without intermediate force-transmitting elements such as shown in D4, ensures the application of equal and opposite forces to the brake shoes (column 4, lines 54 to 61 of D6).

3.5 The use of a telescopic cylinder acting directly between the lugs of a ball-and-ramp mechanism brake is also known from D1.

Therefore, in the Board's opinion, when seeking a solution to the problems encountered with the brake actuation known from D4, which problems are directly recognisable by the skilled person as being the result of the known cylinder assembly with intermediate elements for transfer of the force from each piston to the lugs (see point 3.4 above), the skilled person would not need inventive ingenuity to replace this known cylinder by the telescopic cylinder known from D1 with a principal aim of ensuring equal actuation of the brake plates also in the case when wear of the friction surfaces implies a large stroke of the cylinder.

3.6 The appellant submitted that the cylinder known from D1 was not "free-floating" because one of the brake plates was not rotatable but fastened to the housing.

In this respect, it is to be noted that the cylinder assembly known from D1 is in no way restrained in so far as the free variation of support orientation is concerned, which is in fact the essential issue when

considering the reduction of drag. When replacing the cylinder assembly known from D4 by the cylinder assembly known from D1, with a view to ensuring drag-free actuation of the brake plates also in an extended position of the piston, there is no reason for the skilled person also to transmit other features of D1, such as the fixing of one brake plate, because this particularity concerns the different construction of the housing and brake plates when compared to these details in D4 and bears no relation whatsoever to the free variation of support orientation during actuation of the brake.

3.7 To summarise, the Board concludes that the skilled person would on the basis of his general knowledge immediately recognise that the cylinder arrangement disclosed in D1, which document concerns a similar brake arrangement to that in D4, would provide a solution to the problem relating to the reduction of drag in case of extended piston travel and that therefore the use of the cylinder arrangement disclosed in D1 would not require any inventive activity.

Since such obvious adaptation of the brake known from D4 would immediately lead to a device in accordance with the broad wording of claim 1 as granted, this device lacks an inventive step and therefore the claimed subject-matter is not patentable (Article 100(a) and Article 56 EPC).

4. *Inventive step (auxiliary request)*

4.1 Claim 1 in accordance with the auxiliary request is essentially a combination of the granted claims 1 and 2, which are based on the originally filed claims 1 and 2.

The dependent claims 2 to 7 are repetitions of the granted claims 3 to 8 and the originally filed claims 3 to 8, respectively.

In view of these assessments, no objections under Article 123(2) and (3) EPC arise against these new claims.

4.2 Also in respect of the subject-matter of claim 1 of the auxiliary request D4 is considered to be the closest prior art available.

Claim 1 is satisfactorily related in its precharacterising portion to this closest prior art so that also the requirements of Rule 29(1) EPC are complied with.

The subject-matter of claim 1 of the auxiliary request differs from the prior art disclosed in D4 in that the cylinder consists of two telescopic portions which themselves form the pistons and is free floating in said housing and that the said telescopic portions rest on said lugs through the intermediary of rolling contact surfaces.

4.3 The underlying problem to be solved by the amended patent can again be seen in the obviation of the cited drawbacks of this prior art arrangement (see column 3, lines 17 to 19 of the patent in suit), in particular the reduction of excessive drag caused by an out-of-line actuation of the fixed cylinder caused by the increase in the angle between the two pressure plates with a lengthening of piston travel.

In addition to the features already taken into account above when considering inventive step of the subject-matter of claim 1 of the main request, claim 1 in

accordance with the auxiliary request further comprises the feature that the said telescopic portions rest on said lugs through the intermediary of rolling contact surfaces.

In accordance with the description of the patent in column 6, lines 3 to 7, by these means drag can still further be reduced, since the shape of the cylinder head and lug recesses have been developed in such a way that their profiles are to the greatest possible extent matched, with the result that drag-free rolling is obtained.

4.4 The question arose during the oral proceedings whether the term "rolling contact surfaces" was limited to actual rolling only or would include a swivelling action of hemispherical support surfaces such as is the case with the force transmitting pins in D4 and D2.

In view of the explanations given by the appellant during the oral proceedings and considering the embodiment shown in Figure 3 of the patent in suit, the Board is of the opinion that the skilled person would interpret this feature immediately to be in line with the usual swivelling action in hemispherical matched profiles such as shown in D2 and D4, which is essentially a combination of rolling and sliding movements.

4.5 Considering the obvious combination (see point 3 above) of the brake arrangement disclosed in D4 in which the known cylinder assembly is replaced by the cylinder assembly disclosed in D1, no suggestion is derivable from these documents to support the telescopic portions of the cylinder in a manner that they (directly) rest on the lugs through the intermediary of rolling contact surfaces. In combination with the other features of the

claim, such support provides for a simple construction of the brake plate actuation while ensuring drag free variation of the support orientation of the cylinder over the whole extension range.

It is to be noted that the Opposition Division considered the features of claim 2 to be known from D1 (see point 4 of the decision under appeal). However granted claim 2 clearly stipulates that the telescopic portion directly **rests on the lugs** through the intermediary of rolling contact surfaces. In contrast thereto D1 shows a fixed connection of cylinder and brake plates by means of forked cylinder ends and ball-joints posed therebetween (see Figure 4(C-D) in D1), which is not only a more complicated construction also considering assembly of the brake parts, but because of the forked construction obviously limits the maximum amount of support orientation of the cylinder.

4.6 Document D2, relied upon by the respondent as an example of a cylinder that was free floating and connected through the intermediary of rolling contact surfaces, is not considered to be pertinent either. This known cylinder clearly is not free floating because it is fixed at one end (left end in Figure 1) to the brake plate without the possibility of free variation of support orientation with minimum friction of the cylinder. The orientation variation is achieved by means of a swivelling thrust pin, actuated by the piston, which pin is not part of the cylinder and cannot be considered to give the skilled person any suggestion in the direction of providing telescopic cylinder portions with rolling contact surfaces since this known thrust pin leads to the same disadvantages with respect to drag as the thrust pins in the cylinder arrangement shown in D4.

4.7 Indeed D6 and D11 disclose cylinders which have telescopic portions resting on the actuating elements of the brakes, but these documents are related to brake actuation in which the cylinder orientation during actuation rests in the same plane and therefore the problems relating to a sideways out-of-line actuation do not arise. Moreover, although D11 also discloses in Figure 1A hemispherical contact surfaces for the telescopic cylinder portions, it is clear from the description and embodiment in accordance with Figure 1 that cylinder orientation is very limited so that, objectively seen, the skilled person would not find any teaching in this document to help him overcome the disadvantages of the actuation by means of the fixed cylinder in D4.

4.8 In summary, in the Board's judgement, the proposed solution to the technical problem underlying the patent in suit defined in the independent claim 1 according to the subsidiary request cannot be derived in an obvious manner from the available prior art and is inventive and therefore this claim as well as its dependent claims relating to particular embodiments of the invention in accordance with Rule 29(3) EPC, can form the basis for maintenance of the patent (Article 52(1) EPC).

Thus taking into account the amendments made by the appellant, the patent and the invention to which it relates meet the requirements of the EPC and the patent as amended may be maintained in this form (Article 102(3) EPC).

5. The respondents' request for remittal of the case to the first instance

5.1 In accordance with this case law of the Board of Appeal there is normally no need for remittal to the department of first instance in the case of amendments being made to a patent in opposition-appeal proceedings, if such amendments could have been expected. Considering that granted claim 2 further clarifies the extent of the feature "free-floating" of granted claim 1 such clarification is indeed an amendment that could have been foreseen in opposition proceedings.

5.2 With reference to the above point 4.4, it is further to be noted that the interpretation of the feature "rolling contact surfaces" is not different from the interpretation given to it by the respondent and in view of the fact that the subject-matter of claim 2 has already been considered in the first instance proceedings (see point 4 of the decision under appeal) also for this reason there is no basis for remittal of the case to the first instance.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The main request is rejected.

3. The case is remitted to the first instance with the order to maintain the patent with the following documents:

   - claims 1 to 7 and description as submitted during the oral proceedings;
   - drawings as granted.

The Registrar:

S. Fabiani

The Chairman:

F. Gumbel