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D E C I S I O N
of 29 March 1995

Case Number: T 0618/94 - 3.4.2

Application Number: 90306977.1

Publication Number: 0430393

IPC: G01G19/08

Language of the proceedings: EN

Title of invention:
Arrangement for weighing a load

Applicant:
TAMTRON OY

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step: yes"

Decisions cited:
-

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Case Number: T 0618/94 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 29 March 1995

Appellant: TAMTRON OY
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Decision under appeal: **Decision of the Examining Division of the European Patent Office dated 23 February 1994 refusing European patent application No. 90 306 977.1 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: E. Turrini
Members: M. Chomentowski
B. J. Schachenmann

Summary of Facts and Submissions

I. European patent application No. 90 306 977.1 (publication No. 0 430 393), with 6 claims, was refused on the ground of lack of inventive step, having regard to D1 = EP-A1-223 384 and D2 = US-A-4 694 921, of the subject-matter of, in particular, the only independent claim, i.e. Claim 1, which reads as follows:

"1. An arrangement in a vehicle or a corresponding unit for measuring the weight of a load placed on a platform and quantities dependent on the weight in an at least slightly raised weighing position of the platform (8), the weighing being based on measuring signals given by at least three sensors installed between the platform and the vehicle chassis;
wherein at least two (1a, 1b) of the sensors use elongate members (15, 16) for measuring the vertical stress component caused by the load force proportions (F1, F2) and for converting them into an electric measuring signal; which sensors are installed at a mutual spacing (P) and made of a substantially continuous metal piece each forming an axle pin for the or a pivot axle (12) of the platform with supporting surfaces on which, when the platform rests in the said weighing position, the pivot articulation (18) attached to the platform, or corresponding cantilever, will bear and with sections rigidly attached to the vehicle chassis (9);
wherein, the measuring point (6) of the third sensor (2) is located, in a direction perpendicular to the said distance (P), at a substantial distance (L) from said pivot axle, whereby the remaining portion (F3) of the load force is transferred to the vehicle chassis generally only via this sensor, the other parts of the platform (8) becoming separated from the chassis

structures (9) under the effect of the lifting, characterised in that said sensors (1a, 1b, 2) are arranged to measure only the load forces (F1, F2, F3; F4, F5);
in that said at least two sensors (1a, 1b) are shear stress sensors wherein said elongate members (15, 16) each have one end part (16) forming said supporting surface and the other end part (15) rigidly attached to the chassis;
in that, starting at the interface (23) between the two parts (15) and
(16) on which interface or in the vicinity of which interface the direct surface pressure of the pivot articulation (18) or the like against the first part (16) ends, and extending toward the second part (15), there are formed horizontal recesses (24a, 24b) in the metal piece for obtaining in this area an I-beam-like portion (S3) substantially symmetrical in relation to the vertical plane (V); and in that signal transducers, such as shear strain gauges (27a, 27b), are attached on both sides of said vertical web (25) of this I-beam-like portion (S3) for measuring the vertical components caused by the load force proportions (F1, F2) and to convert them into an electric measuring signal."

II. In its decision, the Examining Division took the view that the shear stress sensor of D2 was more usual and simpler than the unusual shear stress sensor of D1 and could be substituted for the unusual one in an obvious way.

III. The Appellant (Applicant) lodged an appeal against this decision and requested that the contested decision be set aside and a patent be granted on the same application documents, consisting of:

Description: Pages 1 to 5 and 8 to 11 as filed with letter of 08/02/93; Pages 6 and 7 as filed with letter of 31/01/94; Page 12 as originally filed;
Claims: Nos. 1 and 2 (first part) as filed with letter of 31/01/94; Nos. 2 (second part) and 3 to 6 as filed with letter of 08/02/93;
Drawings: Sheets 1/6 to 6/6 as originally filed. Oral proceedings were requested auxiliarily.

The Appellant submitted the following arguments in support of his request: The arrangement known from D1 corresponds to the closest prior art; the sensors of D1 comprise a pin used as a pivot for the platform and fixed at its both ends to the chassis of the vehicle; the strain gauges are in the middle of said pin at a distance from the points of application of the shear stress by the two supporting pivot members of the platform; thus, said sensors are not shear stress sensors and, moreover, there are frictional forces between the supporting pivot members of the platform and the chassis. The present arrangement comprises pure shear stress sensors which are more precise and provides a vehicle which is capable of having its weight distribution detected by internal means on ground which is other than horizontal without the inclinometer necessary in the arrangement of D1. The arrangement known from D2 is not for solving the same type of problems and its shear strain sensors cannot be substituted for the sensors of D1 because they do not detect the same strains. Therefore, the arrangement of Claim 1 is inventive.

Reasons for the Decision

1. The appeal is admissible.

2. *Inventive step*

2.1 Since no objections concerning formal deficiencies of the text of the present application or lack of novelty of its subject-matter in the sense of Article 54 EPC have been made by the Examining Division, the only point at issue is whether the subject-matter of the only present independent claim involves an inventive step. There has been no contestation that the arrangement known from D1 (see column 1, lines 4 to 6; column 2, line 42 to column 3, line 31; column 5, line 33 to column 6, line 14; column 6, line 33 to 47; column 10, lines 16 to 35; Figure 3 to 6 and 10) represents the closest prior art; indeed, said arrangement concerns a vehicle (1) and is for, in particular, measuring the weight of a load placed on a load carrier, i.e. a platform (7), and quantities dependent on the weight in an at least slightly raised weighing position of the platform (7), the weighing being based on measuring signals given by at least three sensors (12, 12, 17) installed between the platform (7) and the vehicle chassis (3); two (12, 12) of the sensors use elongate members (13, 13') for measuring the vertical stress component caused by the load force proportions and for converting them into an electric measuring signal; said sensors (12, 12), which are installed in respective rear hinges (8), are shown at a mutual spacing and are each made of a substantially continuous piece (13, 13') which is derivable as being made of a material such as metal; each continuous piece (13, 13') forms an axle pin for the or a pivot axle of the platform (7) with supporting surfaces on which, when the platform rests in the said

weighing position, the pivot articulation (15, 15) attached to the platform (7) will bear; the continuous piece (13, 13') is with sections rigidly attached to the vehicle chassis (3) by means of a carrier support member (14) in turn fixed to the chassis (3); the measuring point (6) of the third sensor (17) is located, in a direction perpendicular to the said distance between the sensors (12, 12), at a substantial distance from said pivot axle, whereby the remaining portion of the load force is transferred to the vehicle chassis generally only via this sensor, the other parts of the platform (7) becoming separated from the chassis structures (3) under the effect of the lifting.

2.2. With respect to the features distinguishing the present Claim 1 from the arrangement known from D1, it is to be noted that, in addition to the arguments contained in the statement of grounds of appeal, the Appellant has referred to his argumentation during the examination procedure, which is illustrated by explanatory drawings.

First, in the known arrangement, the sensors (12, 12) in the rear hinges (8) of the vehicle (1) are such that the platform (7) rests by means of its two carrier support members (14) **on both end parts**, i.e. at two separate locations on each of said sensors (12, 12), against the carrier support members (14) where the ends of said sensor (12) are fixed; thus, as convincingly argued by the Appellant, said sensors (12, 12) are also submitted to friction strains arising because of the action of the pivot articulation (15, 15), which consists of **two pivot members** (15, 15) acting on the surface of each corresponding carrier support member (14) on which, especially **when the vehicle is laterally tilted**, one of said pivot members (15, 15) is **supported**; therefore, in particular in this case, the action on both ends of the sensor (12) is asymmetric and, moreover, there is an

essential loss in the vertical component of the force so that, contrary to the arrangement of present Claim 1, the sensors (12, 12) in the known arrangement are not arranged to measure **only the load forces.**

Moreover, in each of said two sensors (12, 12) of the known arrangement, which are mentioned in D1 as shear pin sensors, the platform rests on both ends (13) of said pin (13, 13') at a distance from the strain gauges (16), which are in the middle part of the elongate pin (13, 13'); the Appellant has argued that the effect of the shear action of the platform (7) on the sensors (12) at both ends (13) of said sensors rigidly attached to the chassis (14, 3) at said both ends results in a strain in the middle of the strain gauge (12) which results from the flexural deflection of said middle part (13') and is different from a shear strain, so that the sensor (12) is not a shear stress sensor; incidentally, it is to be noted that the Examining Division has considered the shear stress sensor of D1 as being an "unusual one". Therefore, taking into account the meaning of the term "shear stress sensor" derivable from the content of the present application (see for instance Fig. 3 and 4) wherein the shear stress sensor (27) is located in the immediate vicinity of the shear stress, the Appellant's argument can be accepted and it can be concluded that, although in D1 the platform (7, 15) acts by shear effect on the pin (12), the sensor (12) is not a shear stress sensor in the sense of the present patent application. Moreover, the part of the substantially continuous pin (13, 13') forming said supporting surface does not form one part, but consists of **two** separated **parts**, and, additionally, since the ends of the pin (13) are rigidly attached to the chassis (14), none of said parts, i.e. of said supporting surfaces, is at an end of the substantially continuous pin (13, 13'). Thus, contrary to the presently claimed arrangement, said at

least two sensors (1a, 1b) in the known arrangement are not shear stress sensors wherein said elongate members (15, 16) each have one end part (16) forming said supporting surface and the other end part (15) rigidly attached to the chassis.

It is also to be noted that, in each of said two sensors (12) of the known arrangement, there are **two interfaces** between the external part (13) of the sensor fixed to the chassis and the internal part (also 13) on which is formed a supporting surface for the platform (7), i.e. the surface on which the direct surface pressure of the pivot articulation against the first part ends, i.e. is exerted; moreover, there are formed **vertical recesses** in the substantially continuous pin (13, 13') at a distance from the parts (13) of the pivot articulation, so that, in this area, a recessed portion substantially symmetrical in relation to the **horizontal plane** is obtained. Therefore, contrary to the presently claimed arrangement, starting in the known arrangement at any of both of the interfaces between the two parts on which interface or in the vicinity of which interface the direct surface pressure of the pivot articulation against the first part ends, and extending towards the second part, there are **not** formed horizontal recesses in the metal piece for obtaining in the area an I-beam-like portion substantially symmetrical in relation to the vertical plane.

It is further to be noted that, in the known arrangement, there are indeed signal transducers, such as shear strain gauges (16), which are attached on both sides of the web (13') of the recessed portion for measuring inter alia components caused by the load force proportions and to convert them into an electric measuring signal; however, as already mentioned here above, contrary to the presently claimed arrangement,

these signal transducers, i.e. the strain gauges (16), are not attached on both sides of a **vertical web** (25) of the I-beam-like portion **for measuring the vertical components caused by the load force proportions** and to convert them into an electric measuring signal.

2.3 As credibly submitted by the Appellant, the present invention provides a vehicle which is capable of having its weight distribution detected by internal means on ground which is other than horizontal; indeed, the arrangement of D1 (see column 2, line 42 to column 4, line 45; column 10, lines 16 to 35; see also column 11, lines 21 to 23, 34 to 36 and 48 to 57; Fig. 2a, 2b, 10a and 10b) is also concerned with the problem of loading or unloading a vehicle on ground which is not horizontal, and in particular takes into account during the weighing operation the inclination of the vehicle (1) and/or the platform (7) by using inclinometers (18, 19, 20) and computing the result of the measurements by the sensors and the inclinometers; however, the present arrangement needs no such inclinometer because its pure shear stress sensors are more precise than the sensors of D1 wherein the load is applied at a distance from the strain gauges (16) and comprises frictional components.

2.4 Another arrangement in a vehicle (10) for measuring the weight of a load placed on the vehicle (10) and quantities dependent on the weight, is known from D2 (see column 1, lines 5 to 9; column 1, lines 52 to column 2, line 55; column 3, line 13 to column 6, line 22; Fig. 1 to 4); the weighing is based on measuring signals given by two sensors installed between the wheels (20) of the vehicle (10) and the vehicle chassis (30, 14);

these two sensors use elongate members, i.e. beams (30, 26) for measuring the vertical stress component caused by the load force proportions and for converting them into an electric measuring signal; said two sensors are installed at a mutual spacing and made of a substantially continuous metal piece each forming an axle pin (26) for the or a pivot axle of the wheel (20) with supporting surfaces on which the pivot articulation, or corresponding cantilever, will bear; it is to be noted that said pivot articulation consists of a non-rotating part of a hub (22) attached to the threaded end of the pin (26), and of an outer part of said hub (22) being supported by bearings for rotation relative to the stationary part of the hub, so that the wheel (20) is able to rotate on the ends of the pin (26); it is also to be noted that sections of said pin (26) are rigidly attached to the vehicle chassis; in said arrangement of D2, said sensors are arranged to measure only the load forces, i.e. there is no derivable indication that other strain components are specifically measured;

said two sensors are shear stress sensors wherein said elongate members (26) each have one end part, i.e. the part of the pin (26) near the wheel (20) forming said supporting surface, and the other end part, i.e. the part of the pin (26) rigidly attached to the tube (34) of the chassis (30, 34, 14) of the vehicle (10);

starting at the interface between said two parts, i.e. at the location of the vertical end plate (28) of the tube (34) of the chassis, on which interface (28) or in the vicinity of which interface (28) the direct surface pressure of the pivot articulation against the part of the pin (26) near the wheel (20) ends, and extending towards the part of the pin (26) fixed to the wheel, there are formed horizontal recesses (40) in the metal

piece or pin (26) for obtaining in this area an I-beam-like portion (48, 50, 52) substantially symmetrical in relation to the vertical plane;

signal transducers, such as shear strain gauges (56), are attached on both sides of said vertical web (52) of this I-beam-like portion (48, 50, 52) for measuring the vertical components caused by the load force proportions and to convert them into an electric measuring signal.

2.5 The Examining Division has considered that the shear pin sensor of Fig. 6 of D1 is **unusual**, that the shear pin sensor of Fig. 2 and 3 of D2 is more common or usual and also **simpler**, and that by directly replacing the unusual one by the **usual** or **more common** one, a straightforward use of the more common and simpler sensor directly leads to the arrangement of present Claim 1, and in particular to the features of the I-beam structure and its location.

However, although it is derivable from D2 (see column 1, lines 52 to 63) that I-beam structures of shear sensors are generally known, yet the author of D2 stresses that, to his knowledge, **I-shaped shear beams have not been used** in the past in weight axle transducers or any other mobile scale application, one reason being that the I-beam configuration is ill suited for the cylindrical beam shape that is characteristic of axles and spindles on which wheels are mounted. Therefore, since there is no other information in this respect, it cannot be concluded that, in the technical field of D2 and thus in the related field of D1, the sensor of D2 was in any way more usual or more common than that of D1. Incidentally, it is to be added that, as convincingly argued by the Appellant and mentioned here above, the sensor of D1 is not an "unusual" shear stress sensor, but is no shear sensor at all in the sense of the present application

because its strain gauges (16), in the middle part of the pin (12), detect strain resulting from the deflection of the middle part of the pin, and not the shear stress at the point of application of said shear stress.

Moreover, the I-beam shear sensor of D2 is indeed simpler than the sensor (12) of D1 because a single fixed part (26) achieves a simpler construction with respect to a pivot axle as compared to a construction with both end parts (13, 13) fixed. However, such a comparison of sensors is effective only if it makes sense for an obvious substitution of the sensor of D2 for the sensor of D1 in the arrangement of D1, i.e. for sensors having the same functions or achieving the same results. Yet, as convincingly argued by the Appellant, the sensing arrangement of D1 measures strains comprising the weight of the platform **and frictional forces** due to, in particular, the movement of the pivoting members (15) of the platform (7) along the guiding carrier support members (14) fixed to the chassis; on the contrary, there is no indication about frictions in the sensor of D2 since, in particular, it is not derivable that the surface of the non-rotating part of the hub (22) attached to the only rotating part, i.e. the wheel (20) and its bearings, is in contact with or supported laterally in any manner by the surface of the end plate (28) of the chassis of the vehicle and thus produces frictional forces, even when the vehicle is laterally inclined. Therefore, since the sensors of D1 and D2 do not fulfil the same functions and thus cannot be substituted directly in the arrangement of D1, the fact that the sensors of D2 are of **simpler construction** than those of D1 is irrelevant for the person skilled in the art of D1.

2.6 Indeed, the person skilled in the art of D1 was aware of the teaching of D2. As convincingly argued by the Appellant, D2 (see column 2, lines 40 to 44) aims in particular at providing a shear beam with a configuration which permits the spindle to remain relatively short and small without sacrificing structural integrity, and is not concerned with the problem of having the weight distribution in the vehicle being detected by internal means on ground which is other than horizontal. On the other hand, this particular problem of D2 is not derivable from D1. Moreover, without already knowing the present application and the problems it solves, i.e. without ex-post facto reasoning, no technical problem related to the above-mentioned **frictional forces** between the platform support (15) and the chassis members (14), on both sides of the sensor (12) of D1, is derivable either from D1 or D2. Therefore, since the subject-matter of present Claim 1 does not result from an obvious substitution of the sensor of D2 for the sensor of D1, it involves an inventive step in the sense of Article 56 EPC.

3. Thus, Claim 1 is allowable (Art. 52(1) EPC). Therefore, the oral proceedings requested auxiliarily are not necessary and a patent can be granted (Art. 97(2) EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to grant a patent on the basis of the Appellant's request and consisting of the following documents:

Description: Pages 1 to 5 and 8 to 11 as filed with letter of 8 February 1993; Pages 6 and 7 as filed with letter of 31 January 1994; and Page 12 as originally filed;

Claims: Nos. 1 and 2 (first part) as filed with letter of 31 January 1994; Nos. 2 (second part) and 3 to 6 as filed with letter of 8 February 1993;

Drawings: Sheets 1/6 to 6/6 as originally filed.

The Registrar: The Chairman:

P. Martorana E. Turrini

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