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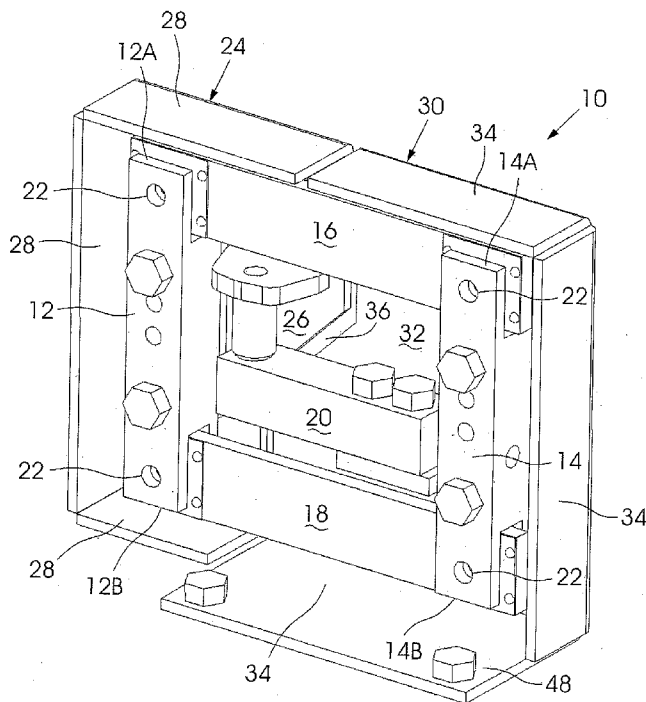
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(54) Title: WEIGHING MODULE



(57) Abstract: The invention provides a weighing module (10) for weighing a load applied to an object. The weighing module is including: at least one first mounting (12) and at least one second mounting (14) being attachable to a primary part of the object; at least one third mounting and at least one fourth mounting being attachable to a secondary part of the object; at least a first bar member (16) having a first end for pivotally mounting to the first mounting and an opposing second end for pivotally mounting to the third mounting; at least a second bar member (18) having a first end for pivotally mounting to the second mounting and an opposing second end for pivotally mounting to the fourth mounting, and one or more load cells (20) attachable between the one or more mountings attachable to the primary part of the object and the one or more mountings attachable to the secondary part of the object.

WO 2013/166527 A1

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**WEIGHING MODULE**

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**BACKGROUND OF THE INVENTION**

THIS invention relates to a weighing module. More specifically, the invention relates to a weighing module, which individually or together with other weighing modules, acts as a single idler weighing apparatus for a conveyor belt assembly.

Many types of single idler weighing apparatus are known. Most however, are not accurate in that the weight recording is influenced by dynamic forces associated with conveyor movement.

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It is therefore an object of the invention to provide a more accurate single idler weighing apparatus that minimises the effects of dynamic forces associated with conveyor movement, both simply and cost effectively.

### SUMMARY OF THE INVENTION

According to the invention there is provided a weighing module for weighing a load applied to an object, the weighing module including:

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at least one first mounting and at least one second mounting being attachable to a primary part of the object such that the first and the second mountings are spaced apart from one another;

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at least one third mounting and at least one fourth mounting being attachable to a secondary part of the object such that the third and the fourth mountings are spaced apart from one another;

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at least a first bar member having a first end for pivotally mounting to the first mounting and an opposing second end for pivotally mounting to the third mounting;

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at least a second bar member having a first end for pivotally mounting to the second mounting and an opposing second end for pivotally mounting to the fourth mounting, each end of the bar members being pivotally mounted on the mounting by a mounting pin passing through correspondingly aligned mounting apertures defined in the respective end of the bar members and the respective mounting so as to retain the first bar and the second bar in a spaced apart and parallel orientation relative to one another; and

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one or more load cells attachable between the one or more mountings attachable to the primary part of the object and the one or more mountings attachable to the secondary part of the object

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such that in use and under load, the bar members and mountings co-operate with one another to substantially nullify any force component acting in a plane coplanar or substantially parallel to a plane in which the bar members lie, thereby to enable the load cell to measure substantially only a strain caused by the weight of the load on the object.

In a first preferred embodiment, each of the mountings is a fork-like mounting formation for receiving the respective end of the respective bar member, the mounting pin pivotally capturing the end of the bar member within the fork-like mounting formation.

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In an alternative embodiment, each of the mountings comprise a male mounting formation and each of the ends of the bar members are fork-like formations for receiving the male mounting formation therein, the mounting pin pivotally capturing the male mounting formation of the mounting within the fork-like mounting formation of the bar members.

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The first and second mountings are typically opposing ends of a common primary mounting member, the common primary mounting member being attachable to the primary part of the object. Furthermore, the third and the fourth mountings are generally opposing ends of a common secondary mounting member, the common secondary mounting member being attachable to the secondary part of the object. Preferably, the mounting pins ride on bearings mounted in the mountings, in the ends of the bar members or in both.

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The common primary mounting member may be mounted to a primary mounting body and the common secondary mounting member may be mounted to a secondary mounting body, the primary and the secondary mounting bodies being attachable to the primary and secondary parts of the object respectively.

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Generally, the primary and the secondary mounting bodies are primary and secondary housings for housing the common primary and secondary mounting members respectively, the primary and the secondary housings being spaced apart from one another by the bar members extending there between, so as to define a gap between the primary and the secondary housings.

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Typically, the one or more load cells are connected between the primary and secondary housings across the gap defined there between.

Preferably, the each of the primary and the secondary housings include a base member and a cover member, the base member comprising a base with sidewalls extending outwardly there from, the cover member being engagable with the sidewalls to define, between the base, the sidewalls and the cover member, an inner cavity for  
5 housing the common mounting members and respective ends of the bar members mounted thereto.

In a preferred application of the invention, the object is a conveyor belt assembly, the primary part of the object being an idler assembly and the secondary part of the object  
10 being a runner structure running between the multiple idler assemblies on the conveyor belt assembly. Preferably, the primary housing is attachable to the primary part of the object and the secondary housing is attachable to the secondary part of the object, the primary and the secondary housings being attachable to the object by fasteners. More preferably, the fasteners are nuts and bolts.

15 In accordance with a second aspect of the invention, there is provided a weighing apparatus including a pair of weighing modules in accordance with the preceding description thereof, the secondary housings of the weighing modules being connected to each other on opposing ends of a cross member, such that the primary housings of  
20 each of the weighing modules are attachable to opposing ends of the idler assembly and the secondary housings of each of the weighing modules are attachable to opposing sides of the runner structure of the conveyor belt assembly.

In accordance with a third aspect of the invention, there is provided an idler assembly  
25 for weighing a load passing there over including:

a support bracket for supporting one or more idler mounting sub-brackets on which idlers are supportable;

30 a pair of weighing modules in accordance with any one of claims 11 to 13, the primary housings of each of the weighing modules being attached to opposing ends of the support bracket; and

a cross member attached at each opposing end to the secondary housings of the weighing apparatus, the secondary housings being attachable to opposing sides of a runner structure of a conveyor belt assembly.

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### **BRIEF DESCRIPTION OF THE DRAWINGS**

The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings in which:

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**Figure 1** is a perspective view of a weighing module in accordance with the present invention;

**Figure 2** is a front view of the weighing module of figure 1;

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**Figure 3** is a rear view of the weighing module of figure 1;

**Figure 4** is a side view of the weighing module of figure 1;

20 **Figure 5** is a top view of the weighing module of figure 1;

**Figure 6** is a bottom view of the weighing module of figure 1; and

25 **Figure 7** is a perspective view of the weighing apparatus made up of a pair of weighing modules fitted on an idler assembly.

### **DETAILED DESCRIPTION OF THE DRAWINGS**

30 A weighing module according to a preferred embodiment of the invention is designated generally with reference numeral 10 in figure 1. The weighing module 10 comprises mountings 12,14, first and second bar members 16,18 extending between the mountings 12,14 and a load cell 20. Although the mountings 12,14 have been illustrated in the accompanying figures as common primary and secondary mounting  
35 members 12,14, each of the mountings may be separate and individual mountings.

The common primary mounting member 12 comprises fork-like mounting formations 12A,12B. Similarly, the common secondary mounting member 14 comprises fork-like mounting formations 14A,14B. The fork-like mounting formations 12A,12B,14A,14B are sized and shaped to receive respective ends of the bar members 16,18. The respective  
5 ends of the bar members 16,18 are pivotally captured in the respective fork-like mounting formations 12A,12B,14A,14B in mounting pins (not shown) passing through correspondingly aligned mounting apertures 22 defined in the common primary and secondary mounting members 12,14 and the bar members 16,18. In this configuration, the bar members 16,18 are retained in a spaced apart, parallel orientation with respect  
10 to each other.

Although the common primary and secondary mounting members 12,14 have been illustrated with fork-like mounting formations 12A,12B,14A,14B, it will be appreciated that in an alternative embodiment, the common primary and secondary mounting  
15 members 12,14 could comprise male mounting formations pivotally captured within fork-like formations on the opposing ends of the bar members 16,18. In either embodiment, it is preferable for the mounting pins to ride on bearings (not shown) mounted in the common primary and secondary mounting members 12,14 and/or the bar members 16,18

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The common primary mounting member 12 is mounted on a primary mounting body in the form of a primary housing 24 having a base 26, sidewalls 28 and a cover member (not shown), the cover member being engagable with the sidewalls 28 to define, between the base 26, the sidewalls 28 and the cover member, an inner cavity for  
25 housing at least the common primary mounting member 12 and the respective ends of the bar members 16, 18.

The common secondary mounting member 14 is mounted on a primary mounting body in the form of a secondary housing 30 having a base 32, sidewalls 34 and a cover  
30 member (not shown), the cover member being engagable with the sidewalls 34 to define, between the base 32, the sidewalls 34 and the cover member, an inner cavity for housing at least the common secondary mounting member 14 and the respective ends of the bar members 16, 18. The bar members 16,18 space the primary and the secondary housings 24,30 from one another so as to define a gap 36 between there

between, across which the load cell 20 is operative.

It will be appreciated that the weighing module 10 may be retrofitted directly to an object for the purposes of weighing the load applied to the object. Alternatively, a pair  
5 of weighing modules 10 may be fixed to one another to form a weighing apparatus 200 for weighing the load passing over a single idler assembly 300 on a conveyor belt assembly.

With reference now also to figures 2 to 7, the weighing apparatus 200 is made up of a pair of weighing modules 10 fixed to one another across a cross member 38, fastened  
10 to cross member brackets 40 extending outwardly from the secondary housing 30 of each of the weighing modules 10. To further support the weighing modules 10, brace members 42 are secured between a brace support bracket 44 extending outwardly from the primary housing 30 of each of the weighing modules 10 and the cross member 38.

15 Extending outwardly from each of the primary housings 24 are idler assembly support brackets 46 onto which an idler assembly 300 is supportable. It will be appreciated that the weighing apparatus 200 may be retrofitted to an existing idler assembly on a conveyor belt assembly or purpose built onto an idler assembly, mountable to runners  
20 400 of the conveyor belt assembly on mounting brackets 48 extending outwardly from the secondary housings 30 of each of the weighing modules 10.

In use, the bar members 16,18 and mountings 12,14 co-operate with one another to substantially nullify any force component acting in a plane coplanar or substantially  
25 parallel to a plane in which the bar members 16,18 lie, thereby to enable the load cell 20 to measure substantially only a strain caused by the weight of a load on the idler assembly 300 (or other object).

Although the invention has been described above with reference to preferred  
30 embodiments, it will be appreciated that many modifications or variations of the invention are possible without departing from the spirit or scope of the invention.

For example, it will be appreciated that the mounting pins could be affixed directly to primary and secondary housings 24,30, with the bar members 16,18 pivotally mounted



thereon. However, the direct mounting of the mounting pins 22 to the primary and secondary housings 24,30 is a contributing factor to the possible inaccuracy of the weighing module 10.

- 5 As a result, it has been found that the accuracy of the weighing module 10 can be increased by pivotally mounting the bar members 16,18 on mounting pins passing through correspondingly aligned mounting apertures 22 in the bar members 16,18 and precision manufactured common mounting members 12,14 being fixed to the primary and secondary housings 24,30. Under this new method of manufacturing the weighing  
10 module 10, the mounting pins float in a spaced apart relationship relative to the primary and secondary housings 24,30. It will be appreciated further that the bearings on which the mounting pins ride, further increase the accuracy of the weighing module 10.

**CLAIMS**

1. A weighing module for weighing a load applied to an object, the weighing module including:

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at least one first mounting and at least one second mounting being attachable to a primary part of the object such that the first and the second mountings are spaced apart from one another;

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at least one third mounting and at least one fourth mounting being attachable to a secondary part of the object such that the third and the fourth mountings are spaced apart from one another;

15

at least a first bar member having a first end for pivotally mounting to the first mounting and an opposing second end for pivotally mounting to the third mounting;

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at least a second bar member having a first end for pivotally mounting to the second mounting and an opposing second end for pivotally mounting to the fourth mounting, each end of the bar members being pivotally mounted on the mounting by a mounting pin passing through correspondingly aligned mounting apertures defined in the respective end of the bar members and the respective mounting so as to retain the first bar and the second bar in a spaced apart and parallel orientation relative to one another; and

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one or more load cells attachable between the one or more mountings attachable to the primary part of the object and the one or more mountings attachable to the secondary part of the object

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such that in use and under load, the bar members and mountings co-operate with one another to substantially nullify any force component acting in a plane coplanar or substantially parallel to a plane in which the bar members lie, thereby to enable the load cell to measure substantially only a strain caused by the weight of the load on the object.

2. A weighing module according to claim 1, wherein each of the mountings is a fork-like mounting formation for receiving the respective end of the respective bar member, the mounting pin pivotally capturing the end of the bar member within the  
5 fork-like mounting formation.
3. A weighing module according to claim 1, wherein each of the mountings comprise a male mounting formation and each of the ends of the bar members are fork-like formations for receiving the male mounting formation therein, the mounting pin  
10 pivotally capturing the male mounting formation of the mounting within the fork-like mounting formation of the bar members.
4. A weighing module according to any one of claims 1 to 3, wherein the first and second mountings are opposing ends of a common primary mounting member, the  
15 common primary mounting member being attachable to the primary part of the object.
5. A weighing module according to claim 4, wherein the third and the fourth mountings are opposing ends of a common secondary mounting member, the common  
20 secondary mounting member being attachable to the secondary part of the object.
6. A weighing module according to claim 5, wherein the mounting pins ride on bearings mounted in the mountings, in the ends of the bar members or in both.
- 25 7. A weighing module according to claim 6, wherein the common primary mounting member is mounted to a primary mounting body and the common secondary mounting member is mounted to a secondary mounting body, the primary and the secondary mounting bodies being attachable to the primary and secondary parts of the object respectively.  
30
8. A weighing module according to claim 7, wherein the primary and the secondary mounting bodies are primary and secondary housings for housing the common primary and secondary mounting members respectively, the primary and the secondary housings being spaced apart from one another by the bar members

extending there between, so as to define a gap between the primary and the secondary housings.

9. A weighing module according to claim 8, wherein the one or more load cells are connected between the primary and secondary housings across the gap defined therebetween.

5

10. A weighing module according to claim 8 or claim 9, wherein the each of the primary and the secondary housings include a base member and a cover member, the base member comprising a base with sidewalls extending outwardly there from, the cover member being engagable with the sidewalls to define, between the base, the sidewalls and the cover member, an inner cavity for housing the common mounting members and respective ends of the bar members mounted thereto.

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11. A weighing module according to claim 10, wherein the object is a conveyor belt assembly, the primary part of the object being an idler assembly and the secondary part of the object being a runner structure running between the multiple idler assemblies on the conveyor belt assembly.

15

12. A weighing module according to claim 11, wherein the primary housing is attachable to the primary part of the object and the secondary housing is attachable to the secondary part of the object, the primary and the secondary housings being attachable to the object by fasteners.

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13. A weighing module according to claim 12, wherein the fasteners are nuts and bolts.

25

14. A weighing apparatus including a pair of weighing modules in accordance with and one of claims 11 to 13, the secondary housings of the weighing modules being connected to each other on opposing ends of a cross member, such that the primary housings of each of the weighing modules are attachable to opposing ends of the idler assembly and the secondary housings of each of the weighing modules are attachable to opposing sides of the runner structure of the conveyor belt assembly.

30

15. An idler assembly for weighing a load passing there over including:

a support bracket for supporting one or more idler mounting sub-brackets on which idlers are supportable;

5 a pair of weighing modules in accordance with any one of claims 11 to 13, the primary housings of each of the weighing modules being attached to opposing ends of the support bracket; and

10 a cross member attached at each opposing end to the secondary housings of the weighing apparatus, the secondary housings being attachable to opposing sides of a runner structure of a conveyor belt assembly.

16. A weighing module substantially as herein described and illustrated.

15 17. A weighing apparatus substantially as herein described and illustrated.

18. An idler assembly substantially as herein described and illustrated.

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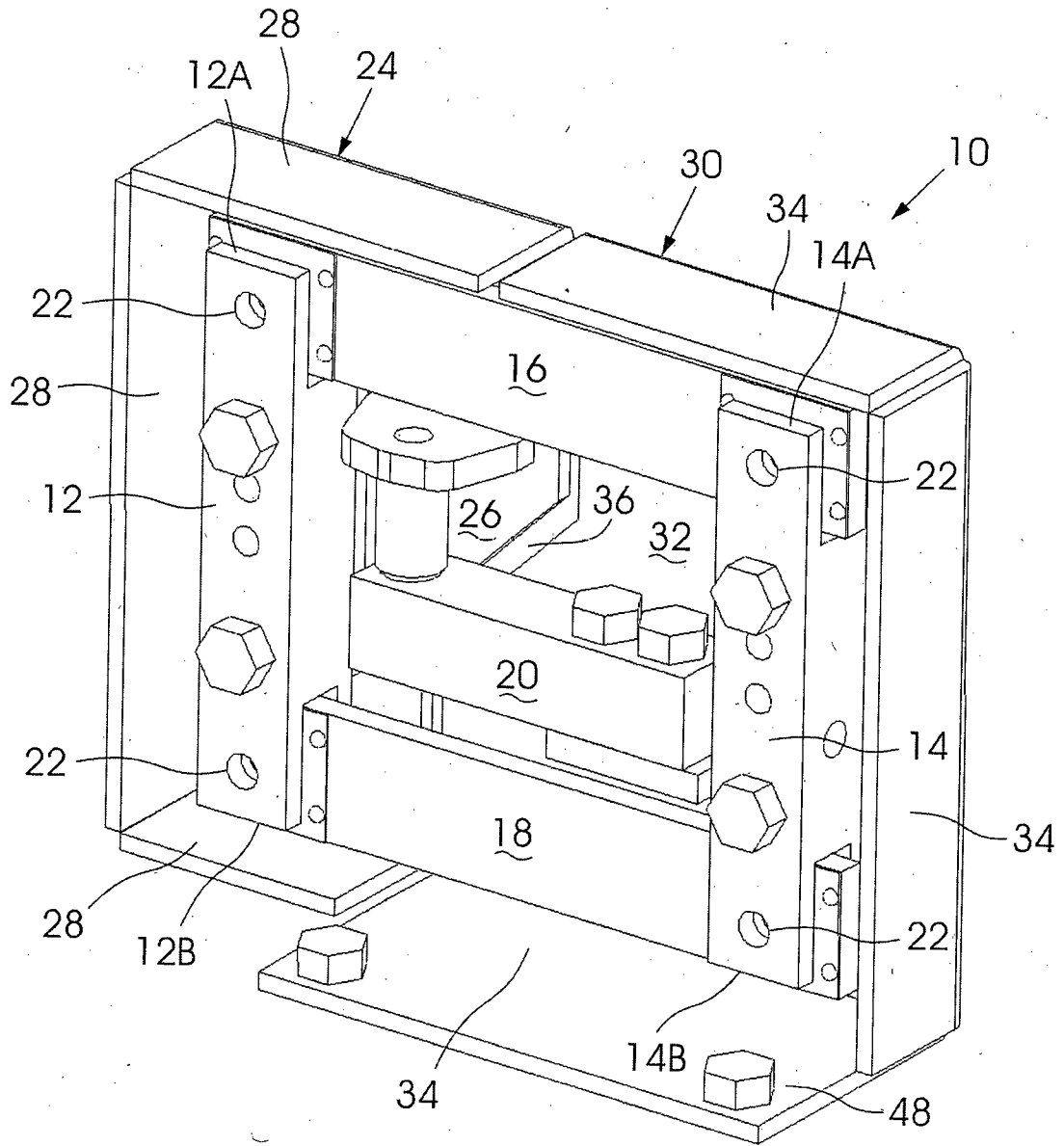


Figure 1

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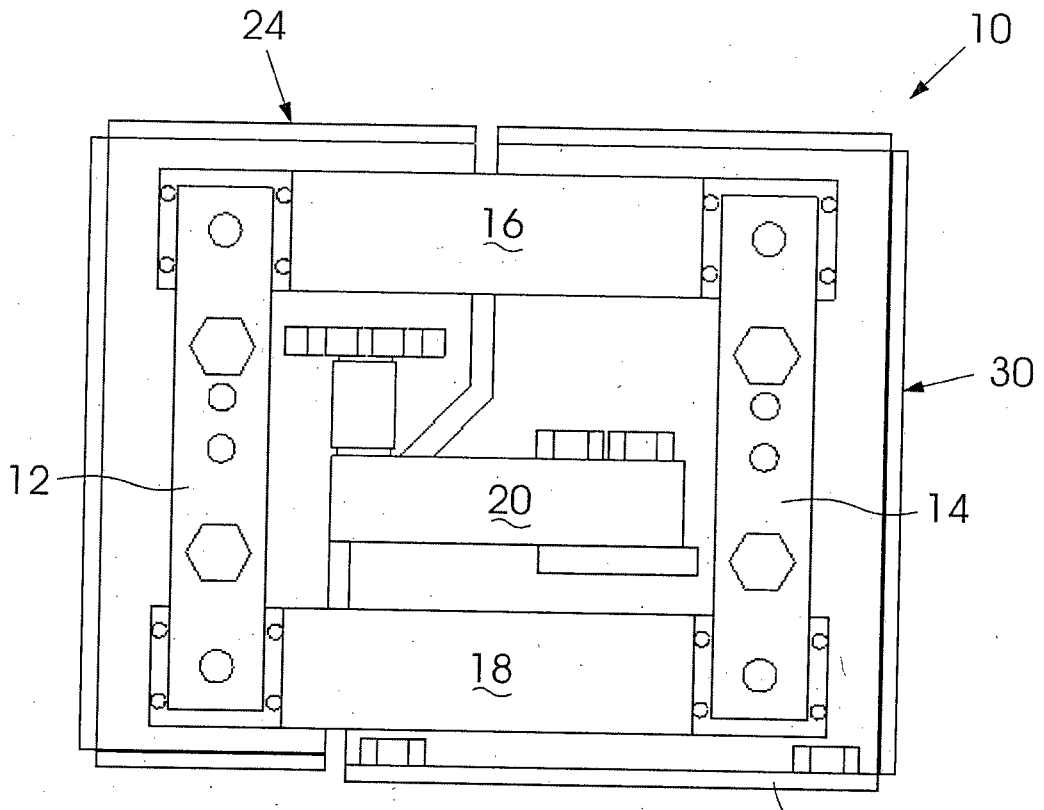


Figure 2

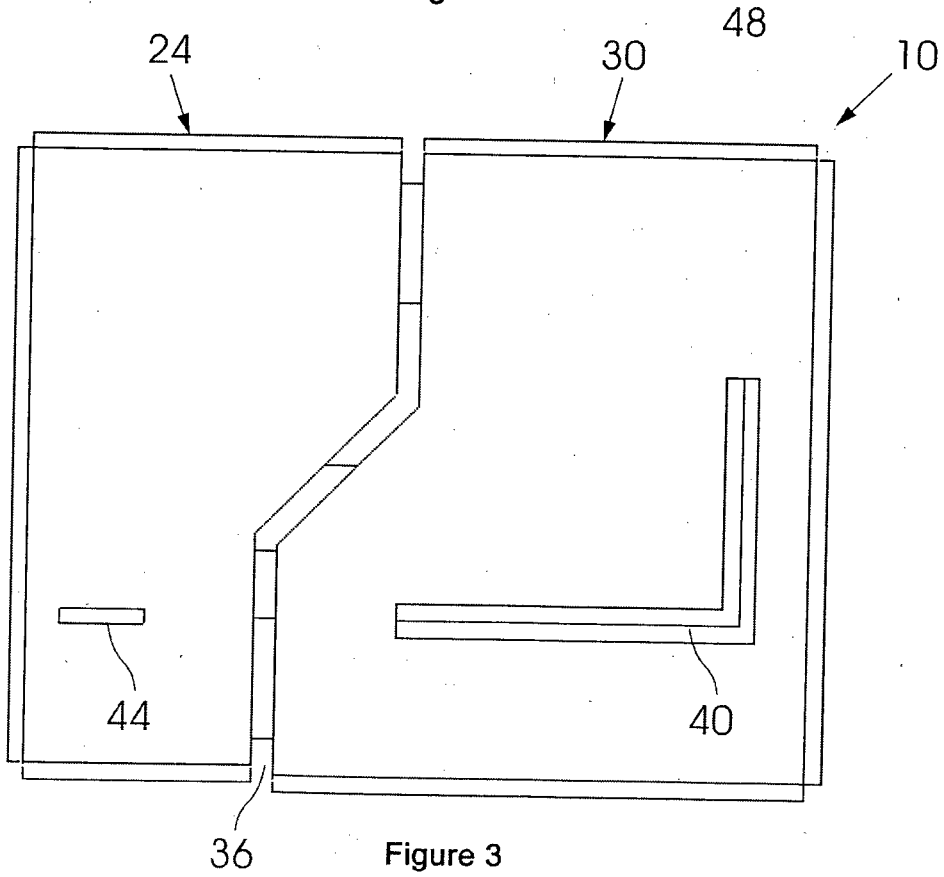


Figure 3

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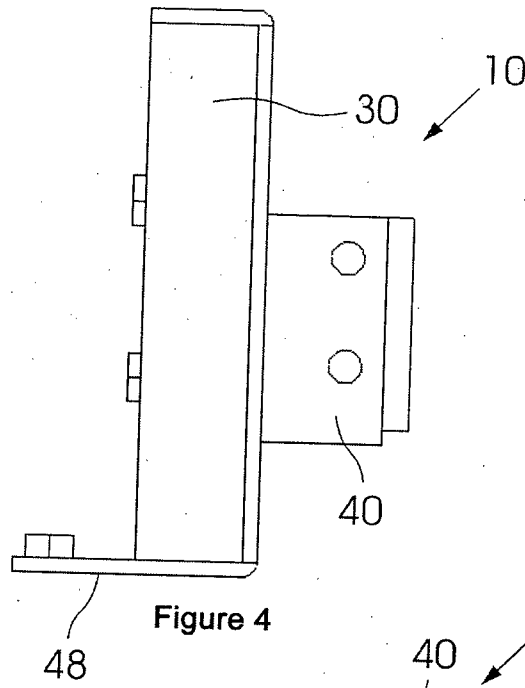


Figure 4

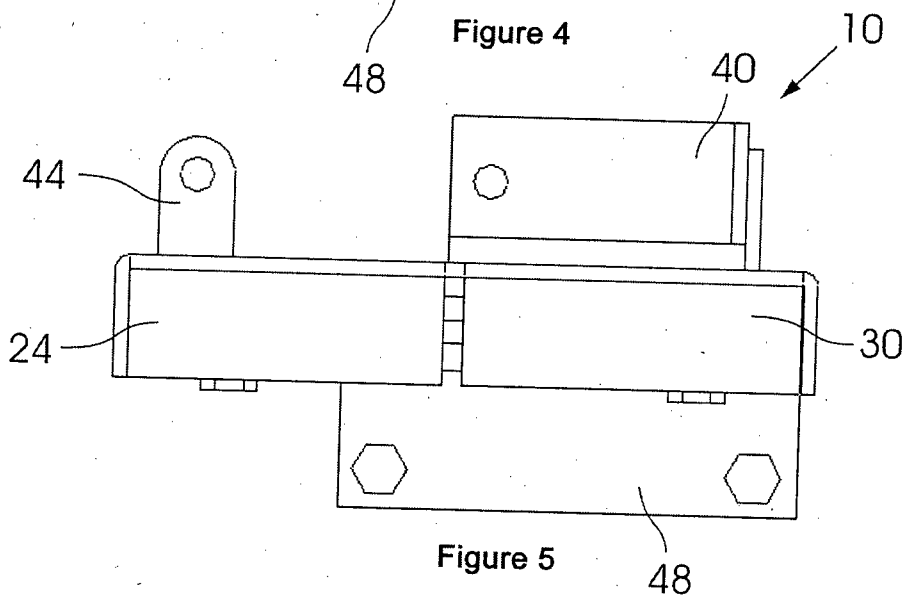


Figure 5

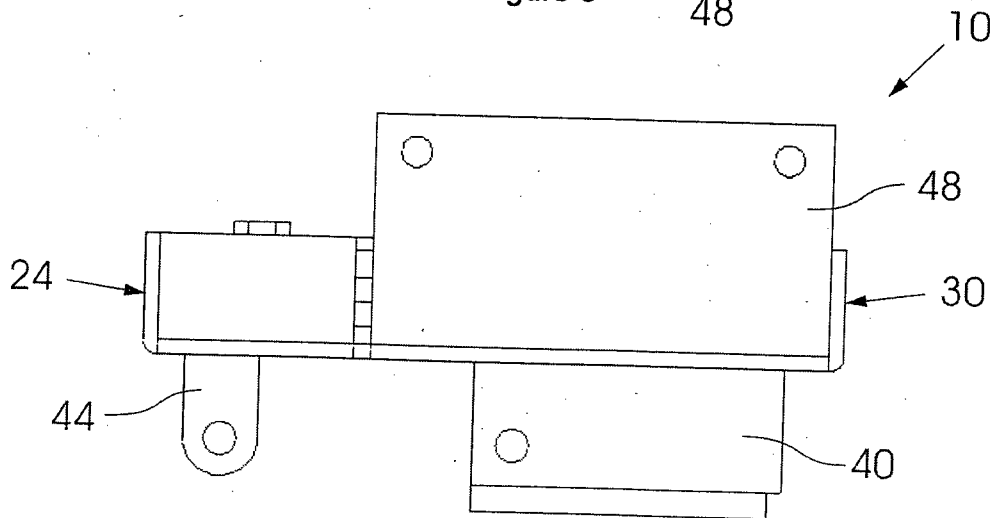


Figure 6



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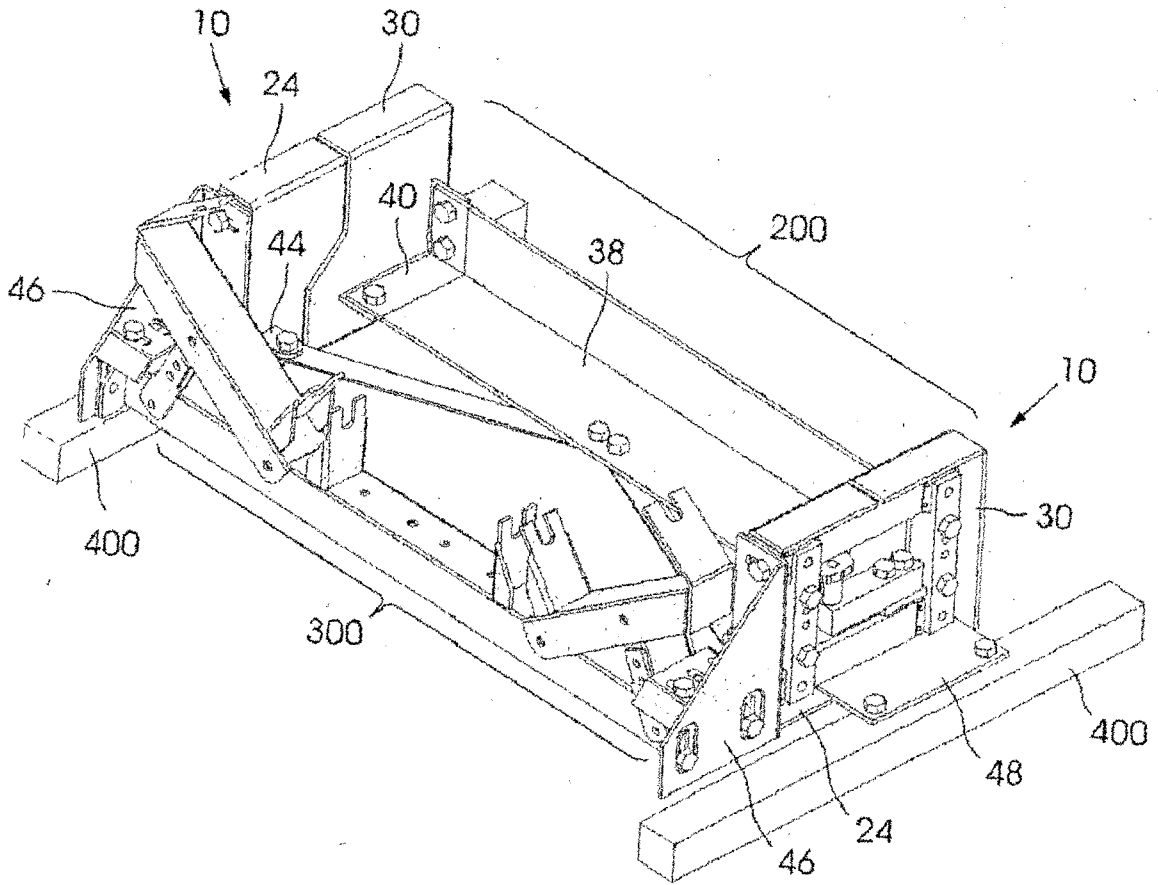


Figure 7

**INTERNATIONAL SEARCH REPORT**

International application No.

PCT / ZA 2013/000028

<p><b>A. CLASSIFICATION OF SUBJECT MATTER</b>                  IPC: <b>G01G 3/12</b> (2006.01); <b>G01G 3/13</b> (2006.01); <b>G01G 3/14</b> (2006.01); <b>G01G 21/23</b> (2006.01)                  According to International Patent Classification (IPC) or to both national classification and IPC</p>		
<p><b>B. FIELDS SEARCHED</b></p>		
<p>Minimum documentation searched (classification system followed by classification symbols)  <b>G01G</b></p>		
<p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p>		
<p>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  <b>EPODOC; TXT NN</b></p>		
<p><b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b></p>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 2120022 A1 (FINZE & WAGNER INGENIEURGESELLSCHAFT UDI MBH) 18 November 2009 (18.11.2009) abstract; figs. 1-5	1-15
A	DE 3641410 A1 (HAENNI & CIE AG) 16 July 1987 (16.07.1987) abstract; figs. 1-2	1-15
A	DE 19859992 A1 (METTLER-TOLEDO GMBH) 29 June 2000 (29.06.2000) abstract; figs. 1-3	1-15
A	US 5343000 A (GRIFFEN ET AL) 30 August 1994 (30.08.1994) abstract; figs. 1-6	1-15
<p><input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.</p>		
<p>* Special categories of cited documents:</p> <p>“A” document defining the general state of the art which is not considered to be of particular relevance</p> <p>“E” earlier application or patent but published on or after the international filing date</p> <p>“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>“O” document referring to an oral disclosure, use, exhibition or other means</p> <p>“P” document published prior to the international filing date but later than the priority date claimed</p> <p>“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>“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</p> <p>“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</p> <p>“&amp;” document member of the same patent family</p>		
<p>Date of the actual completion of the international search                  19 July 2013 (19.07.2013)</p>		<p>Date of mailing of the international search report                  12 August 2013 (12.08.2013)</p>
<p>Name and mailing address of the ISA/AT                  Austrian Patent Office                  Dresdner Straße 87, A-1200 Vienna                  Facsimile No. +43 / 1 / 534 24-535</p>		<p>Authorized officer                  BABUREK G.                  Telephone No. +43 / 1 / 534 24-352</p>

**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:

because they relate to subject matter not required to be searched by this Authority, namely:

2.  Claims Nos.: 16-18

because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

According to Article 6 PCT taken in combination with Rules 6.3 (a) and 6.3 (b) PCT, the claims should be clear and concise, and defined in terms of technical features of the invention, which are missing in claims 16-18.

According to Rule 6.2 (a), claims shall not rely on references to the description or drawings, which is missing in claims 16-18.

3.  Claims Nos.:

because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2.  As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

No protest accompanied the payment of additional search fees.

**Box No. IV**      **Text of the abstract (Continuation of item 5 of the first sheet)**

The invention provides a weighing module (10) for weighing a load applied to an object. The weighing module is including:  
at least one first mounting (12) and at least one second mounting (14) being attachable to a primary part of the object;  
at least one third mounting and at least one fourth mounting being attachable to a secondary part of the object;  
at least a first bar member (16) having a first end for pivotally mounting to the first mounting and an opposing second end for pivotally mounting to the third mounting;  
at least a second bar member (18) having a first end for pivotally mounting to the second mounting and an opposing second end for pivotally mounting to the fourth mounting,  
and one or more load cells (20) attachable between the one or more mountings attachable to the primary part of the object and the one or more mountings attachable to the secondary part of the object.

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.

PCT / ZA 2013/000028

Patent document cited in search report			Patent family member(s)			Publication date
EP	A1	2120022	CN	A	101581599	2009-11-18
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