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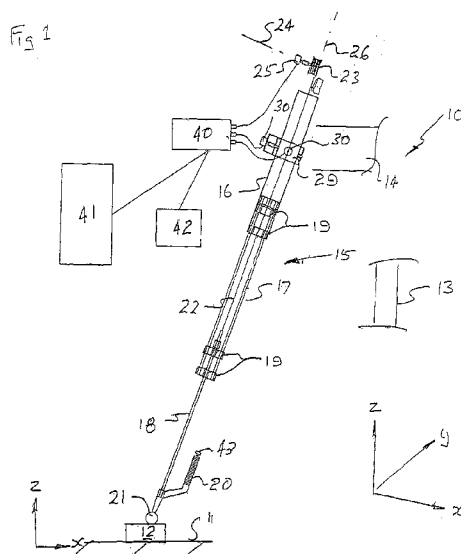
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(54) Title: A VOLUMETRIC MEASURING DEVICE



(57) Abstract: A device (10) to aid in determining the minimum volume of a rectangular prism within which an article can be located. For example, the device (10) may be employed by a postal authority to aid in determining the minimum volume of a "virtual cube".

A Volumetric Measuring Device

Technical Field

The present invention relates to devices that aid in determining the volume of an object and more particularly but not exclusively to aid in determining the minimum
5 volume of a cube that will contain the object.

Background of the Invention

Postal authorities such as Australia Post, frequently base their charging on the density of the parcel. As a particular example Australia Post base their charging on whether the density is greater than 250 kg per cubic metre. Accordingly there is a
10 demand to calculate the density of the object being transported. However that density is calculated relative to a minimum volume of a cube within which the article can be contained. That is, a “virtual cube” that would contain the article.

Methods and devices have been proposed which will provide the volume of the abovementioned “virtual cube”. These methods and devices have failed to meet the
15 demands in respect of standards (accuracy), ease of use and suitability for the work environment.

For example, previous methods have included determining the weight of the article by means of scales and then measuring the various dimensions of the parcel via a tape. A computer is then employed to calculate the “virtual cube” and therefore the
20 density. This method is not only inaccurate but is also time consuming.

Attempts have been made to address the above problems. These attempts have included scanning the article (as an example via laser) and then attempting to calculate the volume of the “virtual cube”. These scanning methods have proven to be inaccurate.

A still further disadvantage is the cost of manufacture of these scanners.

Object of the Invention

25 It is the object of the present invention to overcome or substantially ameliorate at least one of the above disadvantages.

Summary of the Invention

There is disclosed herein a device to aid in calculating the volume of a rectangular prism to contain an article, with the article resting on a base, the device including;

5 a support to be positioned adjacent the base;
 an arm movably mounted on the support, the arm having a portion to be moved into engagement with the article to aid in determining the minimum volume of a rectangular prism that would enclose the article, said portion being movable in X, Y and Z directions relative to said support; and

10 sensors to detect displacement of said portion to provide a horizontal longitudinal length, a horizontal transverse width and a vertical height of the prism.

 Preferably, said device includes transmitters operatively associated with the sensors to provide signals indicative of the length, width and height for delivery to a computer.

15 Preferably, said arm is mounted on said support so that said portion is movable linearly in said directions.

 In an alternative preferred form, said portion is movable angularly about a horizontal X and a horizontal Y axis and is movable upwardly so as to have a vertical direction component of movement.

20 Preferably, said portion is a sphere.

 Preferably, the sphere is located on a lower extremity of said arm.

 Preferably, said rectangular prism is a cube.

 Preferably, said arm is telescopic with at least two telescopic longitudinal sections.

25 In an alternative preferred form, said arm is an elongated flexible element.

 Preferably, said arm is upwardly retractable when released.

Brief Description of the Drawings

A preferred form of the present invention will now be described by way of example with reference to the accompanying drawings wherein:

30 Figure 1 is a schematic front elevation of a device to aid in determining the volume of a rectangular prism;

Figure 2 is a schematic elevation of the device of Figure 1;

Figure 3 is a schematic side elevation of the device of Figure 2;

Figure 4 is a schematic top plan view of the device of Figure 4;

Figure 5 is a schematic side elevation of a modification of the device of Figures
5 1 to 4;

Figure 6 is a schematic front elevation of a modification of the device of Figures
1 to 4;

Figure 7 is a schematic end elevation of the device of Figure 6; and

Figure 8 is a schematic top plan view of the device of Figures 6 and 7.

10 Detailed Description of the Preferred Embodiments

In the accompanying drawings there is schematically depicted a device 10 to aid
in determining the minimum volume of a rectangular prism within which an article can be
located. For example the device 10 may be employed by a postal authority to aid in
determining the minimum volume of the previously mentioned "virtual cube". In this
15 respect it should be appreciated that a rectangular prism encompasses cubes.

The device 10 is intended to be mounted adjacent a generally horizontal surface
(base) 11 upon which an article 12 rests. For example the surface 11 may be part of the
front counter of a postal authority. The surface 11 would need a grid that would provide
for the accurate location of the article 12 in a predetermined position enabling it to be
20 engaged by the device 10, thereby enabling the device 10 to accurately calculate volume.

In this embodiment the article 12 is as cube, however it should be appreciated
that the article 12 may be of other configurations and that the device 10 is intended to
provide the minimum volume of a cube that would encompass the article 12.

The device 10 further has a frame 13 that includes an upper generally horizontal
25 beam 14. The beam 14 supports a telescopic member 15. The telescopic member 15
includes an upper part 16, an intermediate part 17 and a lower part 18. However it should
be appreciated that the member 15 may have two, three or four telescopic parts.
Typically the parts 16, 17 and 18 are telescopically associated with adjacent parts 16, 17
and 18 being supported by linear bearings 19. The part 18 adjacent its lower end is
30 provided with a handle 20 that is gripped by a user to aid in moving the lower extremity

of the part 18. The part 18 at its lower most extremity is provided with a sphere 21 that is used to contact the article 12.

Attached to the upper extremity of the part 18 is an elongated flexible element (wire) 22 that is wound about a spool 23 urged to retract the element 22 onto the spool 23. For example the spool 23 may be operatively associated with a spring that causes rotation of the spool 23 about the axis 24 to wind the element 22 onto the spool 23. Operatively associated with the spool 23 is a rotary encoder (and transmitter) 25 that provides a signal indicative of the angular displacement of the spool 23 about the axis 24. Accordingly the encoder 25 provides a single signal indicative of the displacement of the sphere 21 along the longitudinal axis 26 of the member 15.

Preferably, the telescopic member 15 has the part 18 urged to retract into the part 17, and the parts 17 and 18 urged to retract into part 16.

The member 15 is supported for angular movement about a first axis 27 that is generally horizontal and parallel to the beam 14. The member is also supported for angular movement about a second axis 28 that is also horizontal and generally perpendicular to the axis 27.

The member 15 is mounted on the beam 14 by means of a two axis gimbal 29 that acts as a "universal joint".

Located internally of the gimbal 29 are two angular encoders (transmitters) 30 that provide signals indicative of the angular displacement of the member 15 about the axes 27 and 28.

The encoders 25 and 30 deliver signals to a microprocessor 40 that communicates with a computer 41. Operatively associated with the microprocessor 40 and computer 41 is a touch screen 42 that a user operates to control the device 10.

The computer 41 upon receiving information from the microprocessor 40 and touch screen 42 can calculate the displacement of the ball 21 in the X, Y and Z directions and therefore determine the volume of the cube that would encompass the article 12. That is the ball 21 would be moved to the various extremities of the article 12. Once at each extremity the operator via means of switch 43 would activate the encoders 25 and 30 to send signals to the microprocessor 40.

In the above described preferred embodiment the sphere 21 is employed to aid in more accurately determining the point of contact with the article 12. The sphere 21 will always engage the article 12 at a radial point from the centre of the sphere 21.

The above described preferred embodiment may be modified by providing a
5 counter balance for the member 15.

In a further preferred embodiment, the member 15 may be mounted on the beam 14 for linear movement in the X and Y directions, with the member 15 secured so that the axis 26 is always generally vertical. As a further modification there may be linear movement in the X or Y direction and pivoting the other direction.

10 In Figure 5 there is schematically depicted a modification of the device 10. In this embodiment there is provided a device 50. To replace the member 15 there is provided an elongated flexible element 51. The element 51 may be metal wire or other elongated flexible element that is relatively inelastic. The element 51 is wound about the spool 23, with the spool 23 urged to retract the element 51 so that the element 51 is under
15 tension. Again the spool 23 would be mounted on the gimbal 29.

In the above described preferred embodiments, the volume of the virtual cube that would encompass the article 12 can be accurately determined. A further advantage is that the device 10 is easy to operate and easily mounted adjacent a work bench such as a counter of a postal authority. When not in use, the member 15 is telescopically retracted
20 so as to not obstruct the work surface.

In Figures 6 to 8, there is schematically depicted a modification of the device 10. In this embodiment the device 60 has carriage 62 that is linearly moveable in the direction 61 on the beam 14. The member 15 is angularly movable about the horizontal axis 63, the axis 63 being generally parallel to the direction 61.

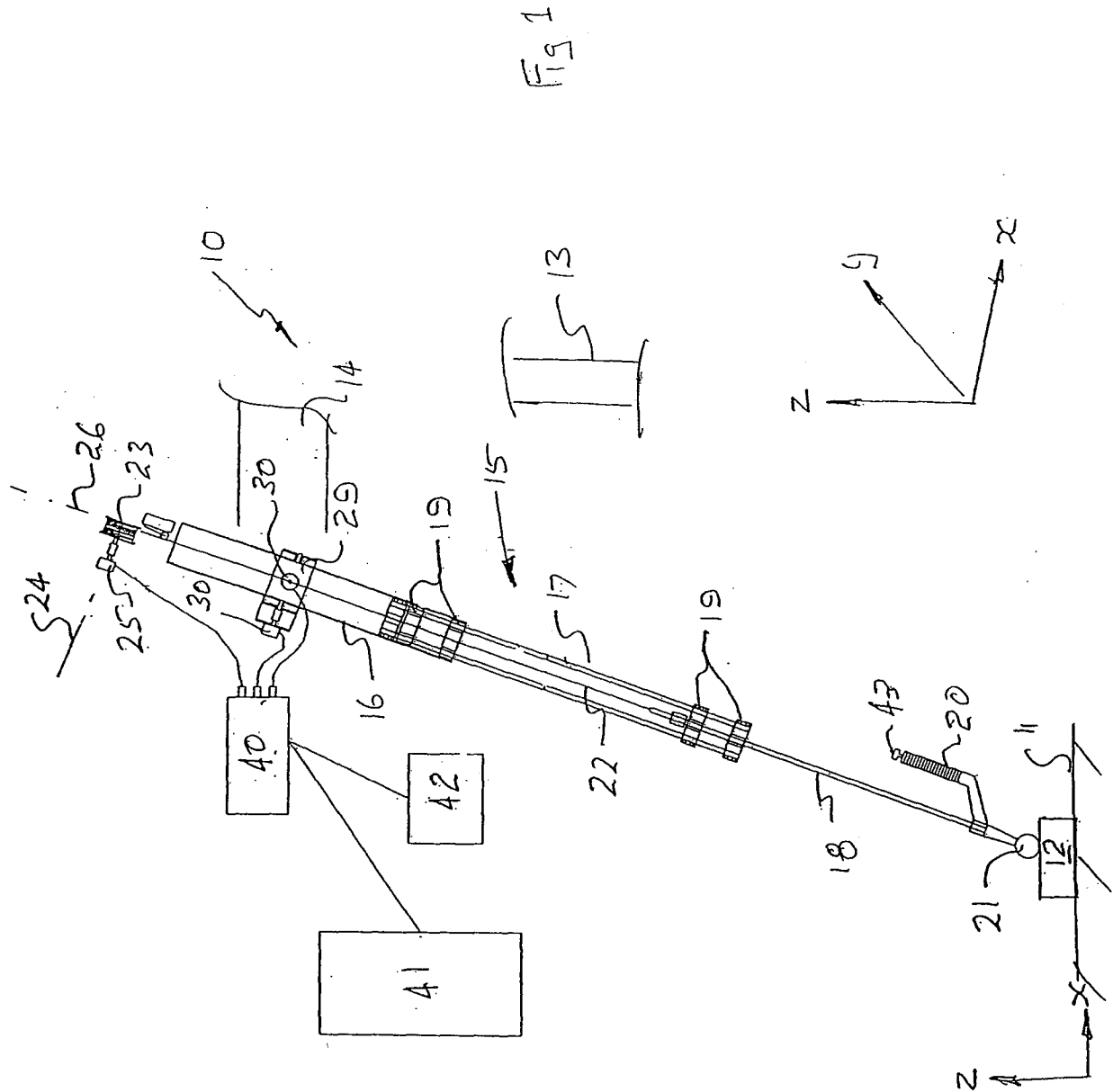
25 Movement of the member 15 in the direction 61 is measured by an encoder 65. The encoder 65 and its associated reel 64 is mounted on the carriage 62 so as to move therewith. An elongated flexible element 66 is attached to a remote end of the beam 14. The reel 64 is urged to retract the element 66. The encoder provides a signal as previously described to indicate the displacement of the carriage 62 and therefore the
30 member 15. A switch 67 provides an indication of the "home" position.

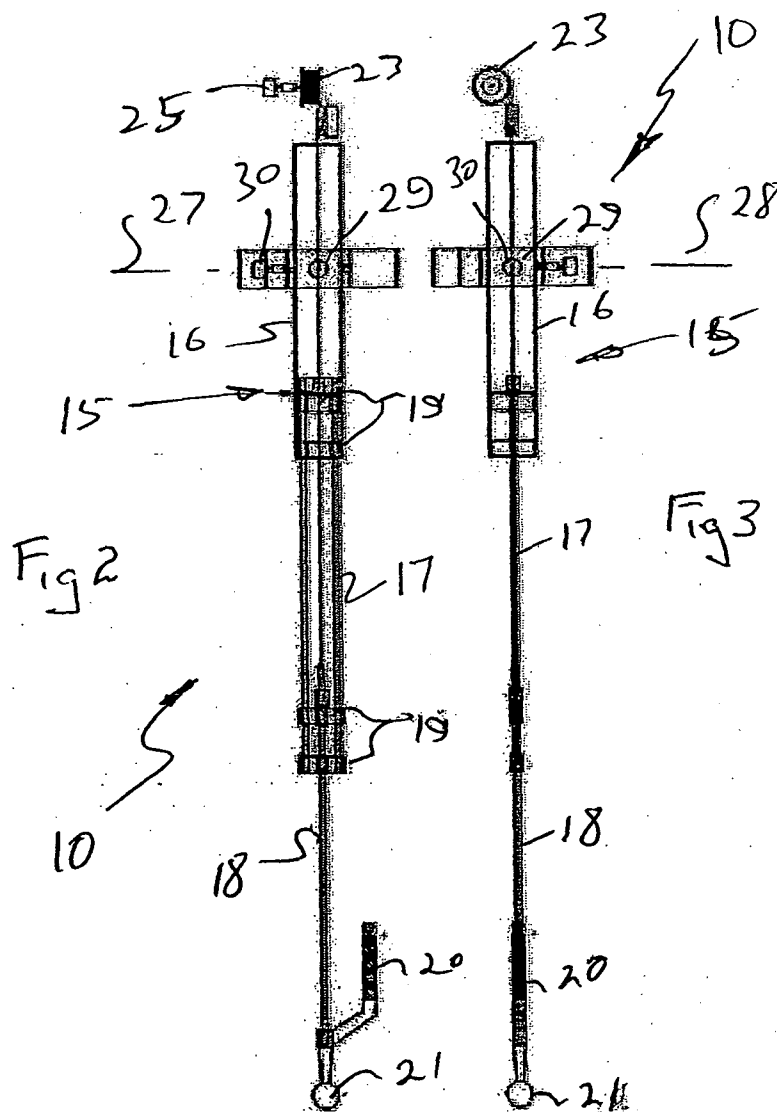
CLAIMS:

1. A device to aid in calculating the volume of a rectangular prism to contain an article, with the article resting on a base, the device including;
a support to be positioned adjacent the base;
5 an arm movably mounted on the support, the arm having a portion to be moved into engagement with the article to aid in determining the minimum volume of a rectangular prism that would enclose the article, said portion being movable in X, Y and Z directions relative to said support; and
sensors to detect displacement of said portion to provide a horizontal
10 longitudinal length, a horizontal transverse width and a vertical height of the prism.
2. The device of claim 1, further including transmitters operatively associated with the sensors to provide signals indicative of the length, width and height for delivery to a computer.
3. The device of claim 1 or 2, wherein said arm is mounted on said support
15 so that said portion is movable linearly in said directions.
4. The device of claim 1 or 2, wherein said portion is movable angularly about a horizontal X and a horizontal Y axis and is movable upwardly so as to have a vertical direction component of movement.
5. The device of any one of claims 1 to 4, wherein said portion is a sphere.
- 20 6. The device of claim 1, wherein the sphere is located on a lower extremity of said arm.
7. The device of any one of claims 1 to 6, wherein said rectangular prism is a cube.
8. The device of any one of claims 1 to 7, wherein said arm is telescopic
25 with at least two telescopic longitudinal sections.
9. The device of any one of claims 1 to 8, wherein said arm is an elongated flexible element.

10. The device of any one of claims 1 to 9, wherein said arm is upwardly retractable when released

11. A device to aid in calculating the volume of a rectangular prism substantiates hereinbefore described with reference to the accompanying drawings.





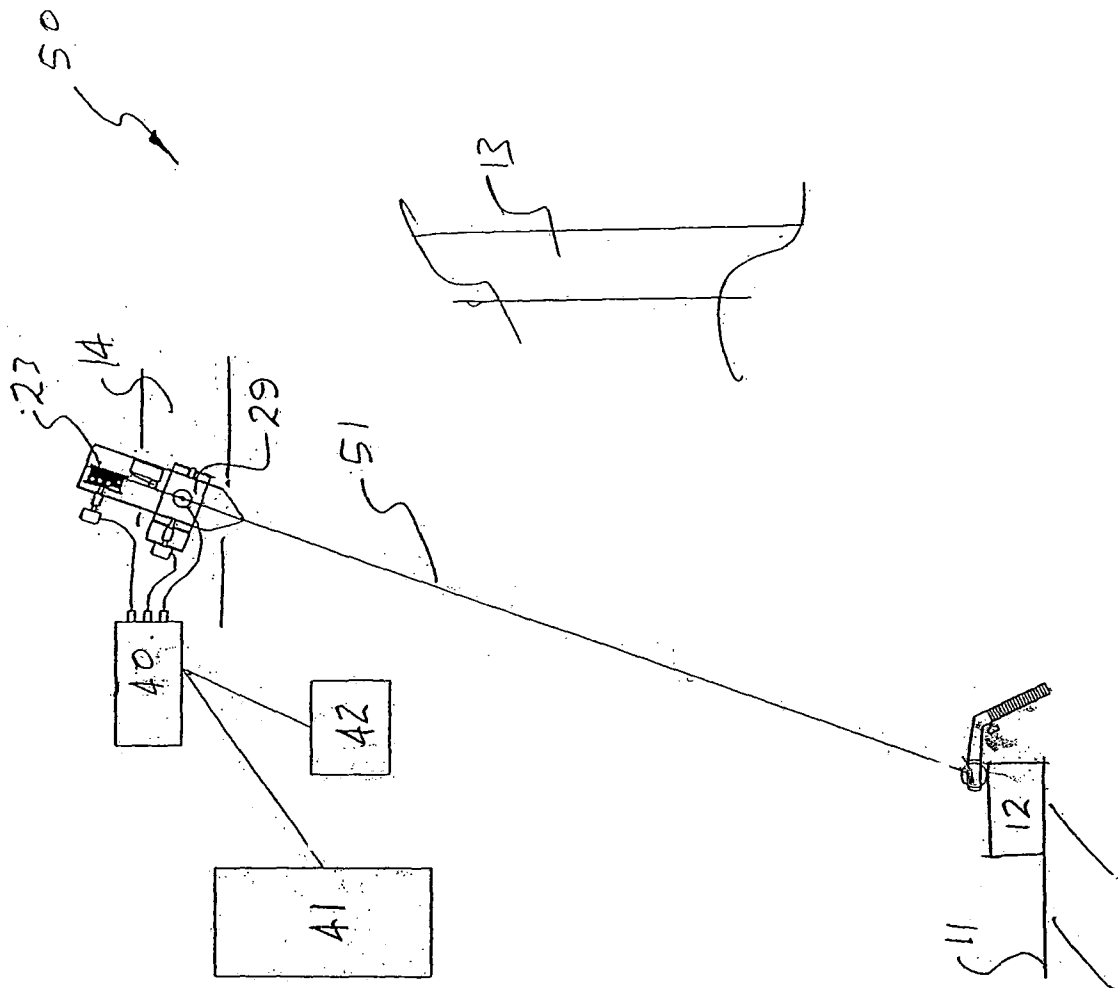
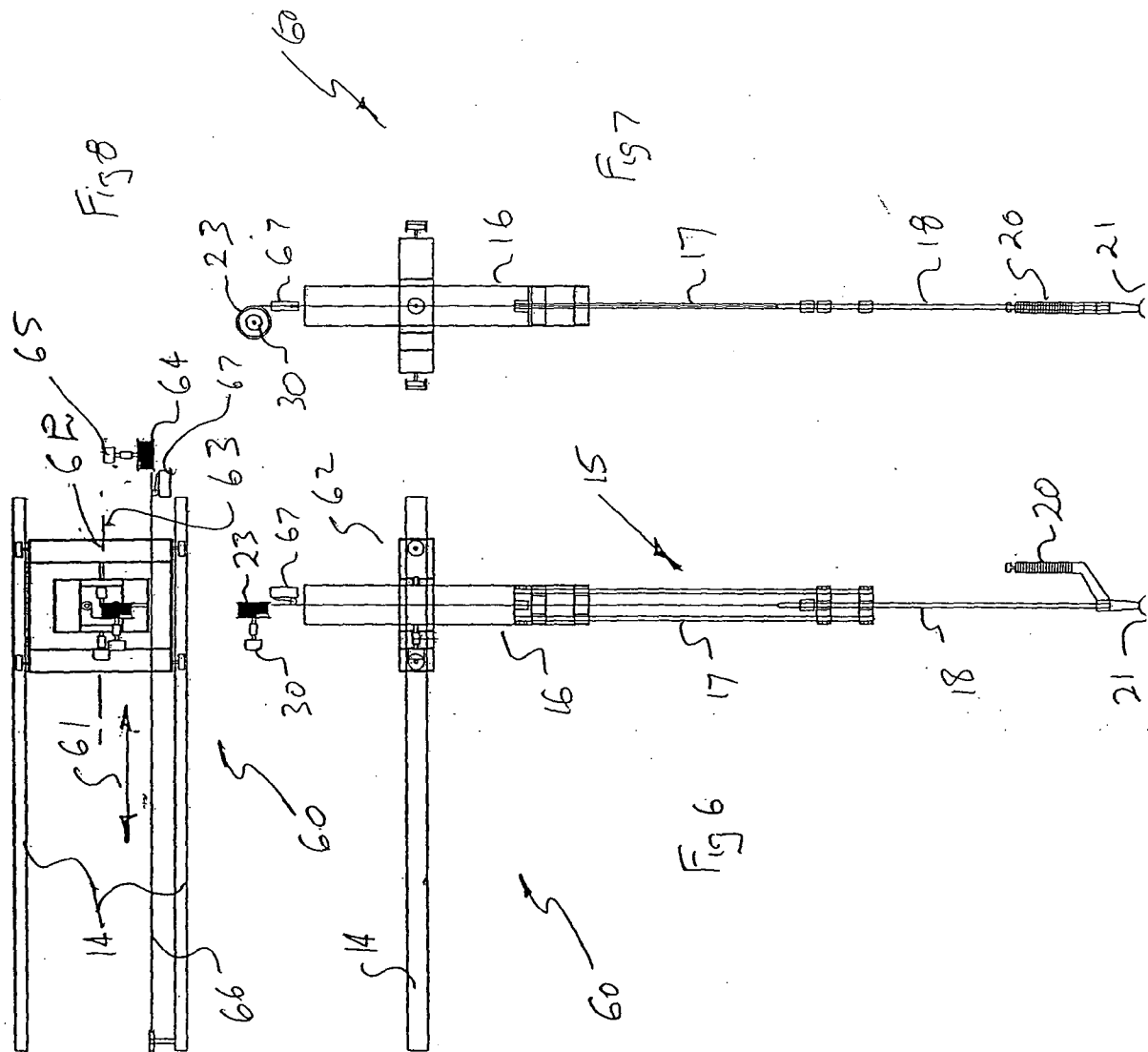


Fig 5



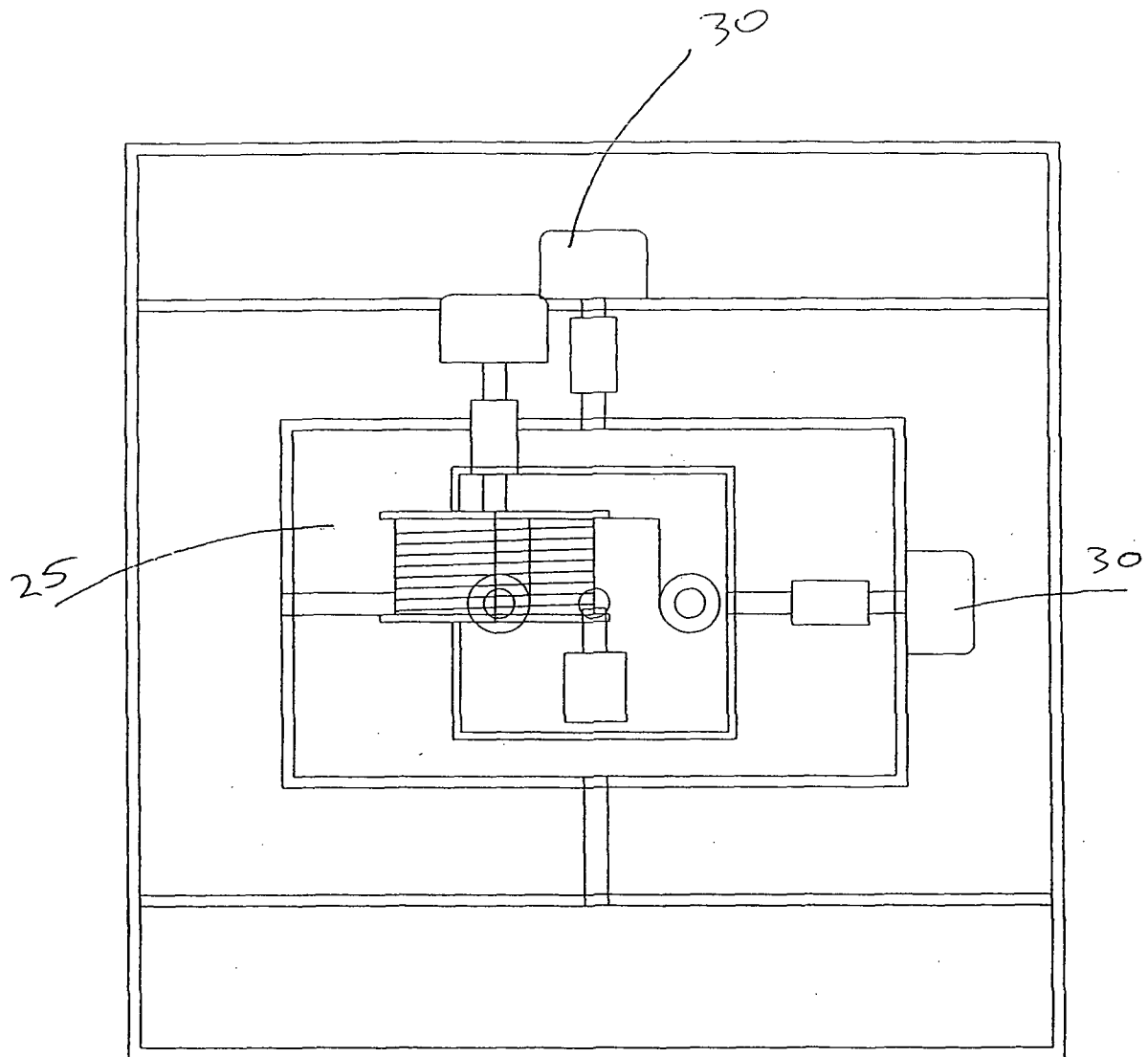


FIG 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2010/000616

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

G01B 5/004 (2006.01)

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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI (Search terms: measure, calculate, determine, volume, size, dimension, coordinate, move, pivot, position, translate, rotate, articulate, arm, part, piece, member, contact, touch, engage, article, object, item, box, prism, cube, and similar terms)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4888877 A (ENDERLE et al.) 26 December 1989. Abstract; Fig. 3; Fig. 5; Fig. 6; column 3, lines 34-53; column 5, line 46 ; column 6, lines 3-6, 19-47.	1-2, 4-7, 10
Y	as above	9
X	US 4961267 A (HERZOG) 9 October 1990. Abstract; Fig. 5; column 9, line 14.	1-3, 5, 7
Y	as above	9
X	Patent Abstracts of Japan, JP 01-302106 A (NISHIYAMA:KK) 6 December 1989, English Abstract and the original drawings. Abstract; Fig. 1 – Fig. 5.	1-2, 7-8, 10

☒ Further documents are listed in the continuation of Box C☒ See patent family annex

* Special categories of cited documents:

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

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"P" document published prior to the international filing date but later than the priority date claimed

Date of the actual completion of the international search
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2010/000616

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2006/0053648 A1 (RUIJL et al.) 16 March 2006. Abstract; Fig. 1; Fig. 2.	9
A	US 3402594 A (BERTHIAUME et al.) 24 September 1968. See entire document, in particular Fig. 1 – Fig. 3; column 1.	
A	EP 1441194 A1 (MITUTOYO CORPORATION) 28 July 2004. See entire document, in particular Abstract; Fig. 1; Fig. 2A-B; Fig. 6.	
A	US 4910446 A (MCMURTRY et al.) 20 March 1990. See entire document, in particular Abstract; Fig. 1; Fig. 2.	

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. ☒ Claim No.: **11**
because it relates 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:

Claim 11 does not comply with Rule 6.2(a) because it relies on references to the description and/or drawings.
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.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2010/000616

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
US	4888877	DE	3740070	EP	0317967	JP	1156616
US	4961267	DE	3717459	EP	0317592	EP	0342267
		EP	0456276	WO	8809478		
JP	1302106	NONE					
US	2006053648	AU	2003263516	EP	1563249	KR	20050063790
		US	7316076	WO	2004040232		
US	3402594	NONE					
EP	1441194	CN	1517675	JP	2004226298	US	2004148126
		US	7155364				
US	4910446	EP	0268659	WO	8707711		
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.							
END OF ANNEX							