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(12) # EUROPEAN PATENT APPLICATION

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(71) Applicant: **TONNES FORCE (TESTING SERVICES) LIMITED, Cradley House Cambridge Road, Sawbridgeworth Hertfordshire (GB)**

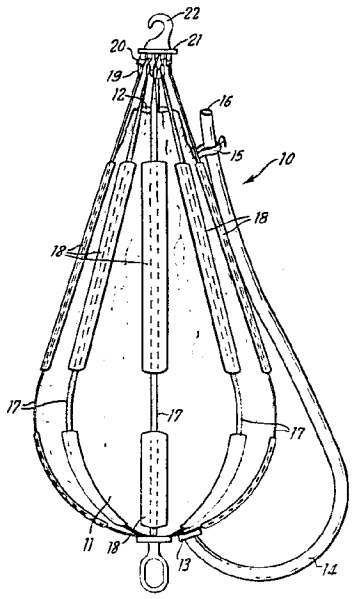
(72) Inventor: **Arthur, Graham Abraham, Cradley House Cambridge Road, Sawbridgeworth Hertfordshire (GB)**

(74) Representative: **Jenkins, Richard Gray et al, R.G.C. Jenkins & Co. Chancery House 53-64 Chancery Lane, London, WC2A 1QU (GB)**

(54) **Improvements in and relating to weight testing methods and apparatus.**

(57) A method of testing the strength of a structure such as a crane comprising the steps of:

providing a bag (10) comprising a flexible envelope (11) of predetermined size made from a liquid impervious material and having a closable liquid outlet (13) adjacent one end of the envelope and a liquid inlet (12) adjacent the opposite end of the envelope, suspending the bag from the structure to be tested, and filling the bag with liquid through the liquid inlet to a predetermined level thereby applying a predetermined weight to the structure.



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IMPROVEMENTS IN AND RELATING TO WEIGHT TESTING METHODS AND APPARATUS

The present invention relates to weight testing methods and apparatus and particularly to methods and apparatus for testing the lifting strength of hoists, winches, cranes and similar lifting devices.

Hitherto, weight testing equipment has comprised heavy and bulky weights of metal or concrete having means for attachment to a carrying structure which incorporates a dynamometer or other load measuring meter which indicates the total load borne by the hoist or crane and the inertial stress due to acceleration of the rate of lifting. Such testing equipment has frequently to be transported to a site or work centre for use. This can involve the transportation of weights which may be of the order of 40 tonnes or more and the storage of these weights when they are not in use. Both the transportation and storage of weights of this order creates many problems and costs.

It is an object of the present invention to provide a weight testing method and apparatus which obviates or substantially reduces the problems inherent in transporting and storing bulky and heavy weights and further to provide weight testing apparatus which is easily transportable by air, for instance by helicopter to an oil rig which is moored at sea.

In accordance with one aspect of the present invention we therefore provide a weight testing bag comprising a flexible envelope of liquid impervious material, a closable liquid outlet adjacent one end of the envelope and a liquid inlet adjacent the other end of the envelope and means for suspending the bag from a support.

In accordance with another aspect of the invention we also provide a method of testing the strength of a structure such as a crane comprising the steps of:

providing a bag comprising a flexible envelope of predetermined size made from a liquid impervious material and having a closable liquid outlet adjacent one end of the envelope and a liquid inlet adjacent the opposite end of the envelope;

suspending the bag from the structure to be tested, and

filling the bag with liquid through the liquid inlet to a predetermined level thereby applying a predetermined weight to the structure.

The bag may include a plurality of flexible strengthening elements on the outside of the flexible envelope extending from the bottom of the envelope and each having means for attachment to a support.

The bag may further include a flexible outlet tube, the outlet tube extending from the bottom of the flexible envelope and being of a length such that its outer end can be positioned above the upper end of the flexible envelope.

The bag may be open topped and can then be filled easily through the open top and emptied through the flexible outlet tube. The flexible outlet tube can be attached to the side of the flexible envelope with the top of the tube located adjacent the top of the envelope during the filling operation and when the bag is in use.

The bag can be adapted to support a second bag suspended below the first by providing a load carrying cable which extends through the flexible envelope from top to bottom, the lower end of the

cable which is located outside and below the flexible element carrying means for suspending another bag therefrom and the upper end of the cable having means for attachment to a support. Preferably the cable extends through a sleeve which is jointed in a fluid sealed relationship to the bottom of the flexible envelope and which extends upwardly to a point adjacent the upper end of the flexible envelope.

In use, the bag can be transported to the site in an empty flat, folded or rolled up condition, suspended from the winch or crane to be tested and then filled with water to a predetermined level necessary for the application of the specified testing load. When the test has been completed, the bag can be emptied by lowering the flexible outlet tube, the empty bag removed from the winch, packed and transported to the next site of use.

In many circumstances, where very heavy loads are required, it is envisaged that a plurality of the flexible fluid impervious bags of the present invention may be suspended from a support frame comprising a node and a plurality of arms extending outwardly from the node, the arms being equiangularly spaced around the node and each arm having means adjacent its outer end for attaching a bag thereto.

The outer ends of the adjacent arms of the support frame may be joined by links adapted to spread a transverse load applied to any one arm equally throughout the structure and the support frame may be suspended from a single load carrying boss by a plurality of cables each of which extends from the boss and through a sleeve at or adjacent an outer end of an arm.

In order to fill the plurality of bags suspended from the support frame, an inlet manifold may be provided on the support frame for filling the bags.

A preferred form of the present invention will now be described with reference to the accompanying drawings, in which:-

Figure 1 is an elevation of a weight testing bag in accordance with the present invention;

Figure 2 is a plan view of the bag shown in Figure 1;

Figure 3 is a vertical section through the bag of Figures 1 and 2;

Figure 4 is a perspective view showing two of the bags of Figures 1 to 3 in use suspended from a support;

Figure 5 is a perspective view showing a plurality of the bags of Figures 1 to 3 suspended from a support frame;

Figure 6 is a diagrammatic plan view of the support frame of Figure 5; and

Figure 7 is a diagrammatic elevation showing the support frame of Figure 5 carrying two tiers of bags.

In Figures 1 to 3 a weight testing bag of the present invention is indicated generally at 10. The weight testing bag 10 comprises a flexible envelope 11 which is generally pear shaped and which is made from a fluid impervious material such as reinforced polyvinyl chloride or neoprene. The envelope 11 is open topped at 12 and has an outlet 13 at the bottom leading to a flexible outlet tube 14. The flexible outlet tube 14 is of a length such that it can be raised and attached to the side of the envelope by a strap 15 so that its upper end 16 is located above the upper end of the envelope 11.

The envelope 11 is supported by a plurality of strengthening straps 17 made of webbing or any other similar material. The straps 17 extend from the bottom of the envelope upwardly through sleeves 18 which are attached to the outer surface of the envelope. Each strap terminates in an eye 19 which is attached to a shackle 20 which is itself mounted on a support boss 21 having an upwardly

extending hook 22 which enables the bag to be easily suspended from a piece of apparatus to be weight tested. The hook 22 may alternatively be replaced by a conventional shackle arrangement if this is preferred.

A load carrying cable 23 extends through the envelope 11 from top to bottom. The upper end of the cable 23 terminates in a hook 24 which can be easily attached to a hook or eye 25 which is integral with the boss 21 and the lower end of the cable 23 terminates in an eye 26 which enables a second bag to be suspended below the first bag. The cable 23 extends through a sleeve 27, the bottom end of which is joined in a fluid sealed relationship to the bottom of the envelope 11 so as to form an outlet 28 at the bottom of the envelope for the cable 23. The upper end of the sleeve 27 extends approximately to the upper end of the envelope 11 so that the cable is sealed from the contents of the bag at all times.

In use, the bag in its unfilled condition can be attached to a winch or other piece of apparatus to be weight tested by means of the hook 22. The outlet tube 14 is then attached in its upright position by means of the strap 15 and the bag can be filled with water or any other liquid through the open top of the envelope 11. The capacity of the bag

10 will be known and it can be filled to an extent sufficient to provide the required weight test. When the test has been completed, the bag can be quickly and easily emptied by releasing the outlet tube 14 and allowing it to fall away from the upper end of the bag. The bag is then emptied under gravity through the outlet tube 14. When the bag has been emptied it can then be removed from the apparatus being tested, folded and transported to its next site of use.

As can be seen from Figure 4, two or more of the bags 10 may be suspended from a single hook or eye 29 and a second tier of bags suspended below the first tier from the eyes 26. However, the number of bags which can be suspended from a single hook or eye is limited because of the bulk of the bags when they are filled with water and we therefore provide a frame for spacing a plurality of bags below the same load carrying point. This spacing frame is indicated generally at 30 in Figures 5 to 7. The spacing frame 30 comprises a central node 31 carrying six similar arms 32 which extend radially outwardly from the node 31. The arms 32 are slotted into sockets provided in the node 31 and are equiangularly

positioned around the node. The outer ends of the arms 32 are joined by links 34 which are adapted to spread a load applied to any one arm equally throughout the support frame. The frame 30 is suspended from a single load carrying boss 35 by a plurality of load carrying cables 36 each one of which extends from the boss 35 to an outer end of an arm 32, where it passes through a sleeve 37. The end of each cable 36 carries an eye 38 from which a bag 10 can be suspended by its hook 22.

In use, an empty bag 10 is suspended on a cable 36 beneath each of the six arms 32 and the boss 35 is then suspended from the piece of apparatus to be weight tested by means of a U-shaped hook 39 which extends upwardly from the boss 35. When the frame and the bags suspended therefrom are in position, each of the bags is filled with water up to the required weight.

In order to minimise the strain on the frame 30 the bags should be filled uniformly. The support frame 30 may therefore be provided with three inlet manifolds which are not shown but which may be mounted on the arms 32 and adapted to fill two diametrically opposite bags simultaneously. This ensures that a substantial weight imbalance cannot occur as the bags are filled.

If a greater weight is required than can be provided by a first tier of bags 10 suspended from the support frame 30 then a second tier of bags 10a can be suspended below the first tier of bags as shown in Figure 7.

By varying the size of the bags employed and by controlling the rate of fill to each bag it is possible to fill a plurality of different sizes of bags simultaneously without overspill or waste. The manifolds on the support frame are also preferably designed to minimise turbulence in the filling of the bags.

In order to minimise the weight of the apparatus and to resist oxidation, the metal components may be made as far as possible from duralumin so as to provide a rust-resistant extremely lightweight construction in relation to the weight or mass provided when the bag or bags are filled to the required extent.

It will be understood that minor modifications may be made to the shape, design, structure and materials disclosed herein without departing from the spirit and scope of the present invention which is more clearly defined in the following claims.

CLAIMS:

1. A weight testing bag comprising a flexible envelope of liquid impervious material, a closable liquid outlet adjacent one end of the envelope and a liquid inlet adjacent the other end of the envelope and means for suspending the bag from a support.

2. A weight testing bag as claimed in claim 1 wherein the bag includes a plurality of flexible strengthening elements on the outside of the flexible envelope extending from the bottom of the envelope and each having means for attachment to a support.

3. A weight testing bag as claimed in claim 1 or claim 2 wherein each of the strengthening elements is attached to a load carrying boss.

4. A weight testing bag as claimed in any preceding claim wherein the flexible envelope is generally pear shaped and open topped.

5. A weight testing bag as claimed in any preceding claim wherein the bag includes a flexible

outlet tube the outlet tube extending from the bottom of the flexible envelope and being of a length such that its outer end can be positioned and retained above the upper end of the flexible envelope.

6. A weight testing bag as claimed in any preceding claim wherein the bag includes a load carrying cable which extends through the flexible envelope from top to bottom, the lower end of the cable being located outside and below the flexible envelope and carrying means for suspending another bag therefrom and the upper end of the cable having means for attachment to a support.

7. A weight testing bag as claimed in claim 6 wherein the cable extends through a sleeve which is joined in a fluid sealed relationship to the bottom of the flexible envelope and which extends upwardly to a point adjacent the upper end of the flexible envelope.

8. Weight testing apparatus comprising a plurality of flexible fluid impervious bags for carrying water or other fluid as claimed in any preceding claim suspended from below a spacing frame comprising a node and a plurality of arms extending outwardly from the node, the arms being equiangularly spaced around the node and means associated with each arm adjacent the outer end of the arm for suspending a bag therefrom.

9. Weight testing apparatus as claimed in claim 8 wherein the support frame comprises an even number of arms.

10. Weight testing apparatus as claimed in claim 8 or claim 9 wherein the outer ends of adjacent arms are joined by links adapted to spread a transverse load applied to any one arm equally throughout the structure.

11. Weight testing apparatus as claimed in any of claims 8 to 10 wherein the spacing frame is suspended from a single load carrying boss by a plurality of cables each of which extends from the boss to an outer end of an arm.

12. Weight testing apparatus as claimed in claim 11 wherein each cable extends below an arm and is provided at its end with the said means for suspending a bag therefrom.

13. Weight testing apparatus as claimed in any of claims 8 to 12 and including a fluid inlet manifold on the support frame for filling the bags with fluid.

14. Weight testing apparatus as claimed in claim 13 wherein the fluid inlet manifold is adapted to fill diametrically oppositely positioned bags simultaneously.

15. A method of testing the strength of a structure such as a crane comprising the steps of:

providing a bag comprising a flexible envelope of predetermined size made from a liquid impervious material and having a closable liquid outlet adjacent one end of the envelope and a liquid inlet adjacent the opposite end of the envelope,

suspending the bag from the structure to be tested, and

filling the bag with liquid through the liquid inlet to a predetermined level thereby applying a predetermined weight to the structure.

16. A method as claimed in claim 15 including the steps of suspending a plurality of the said bags from a structure to be tested.

17. A method as claimed in claim 16 wherein the said plurality of bags are suspended in horizontally spaced relationship from a supporting frame.

18. A method as claimed in claim 16 wherein at least some of the bags are suspended one beneath the other.

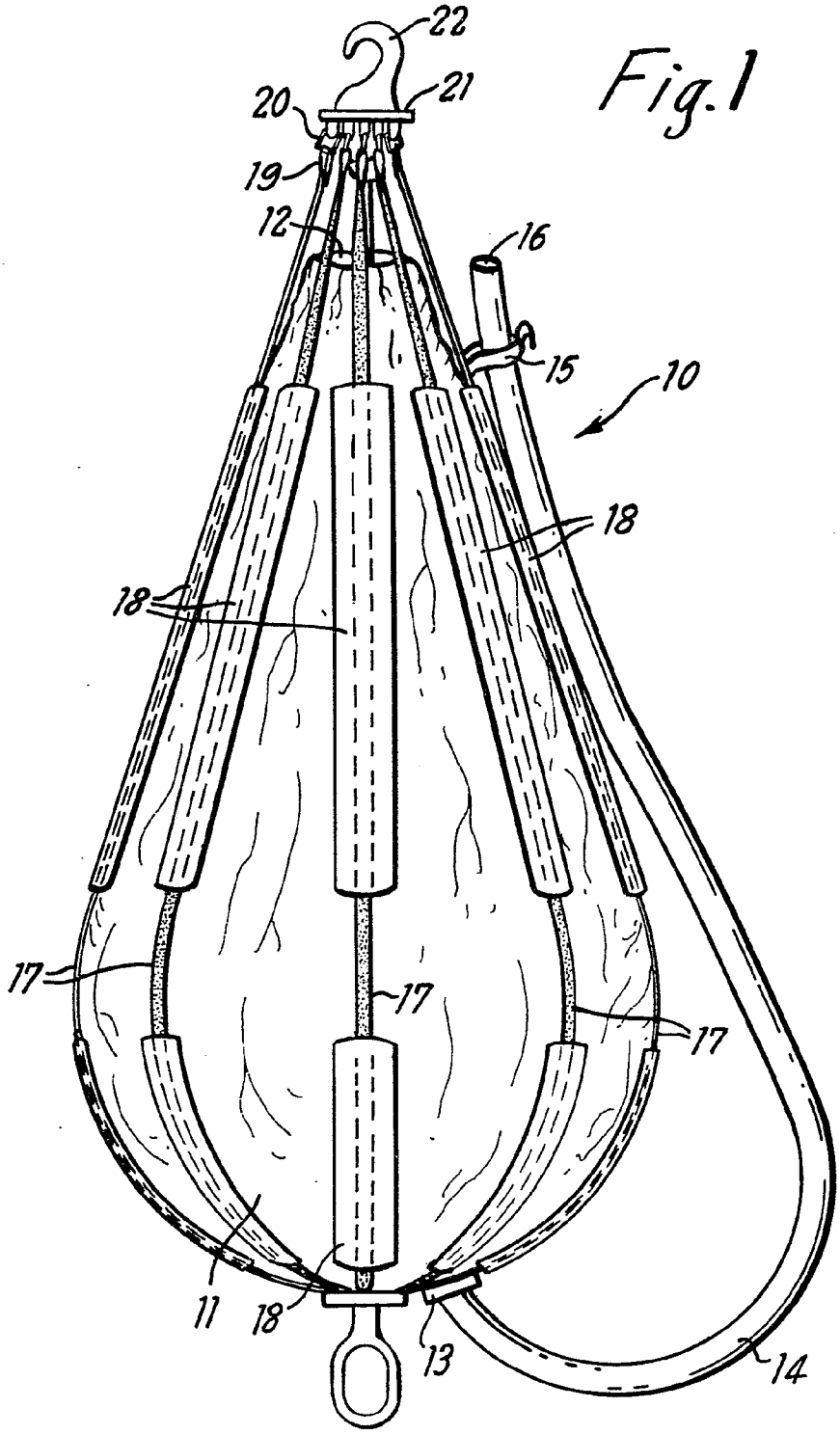
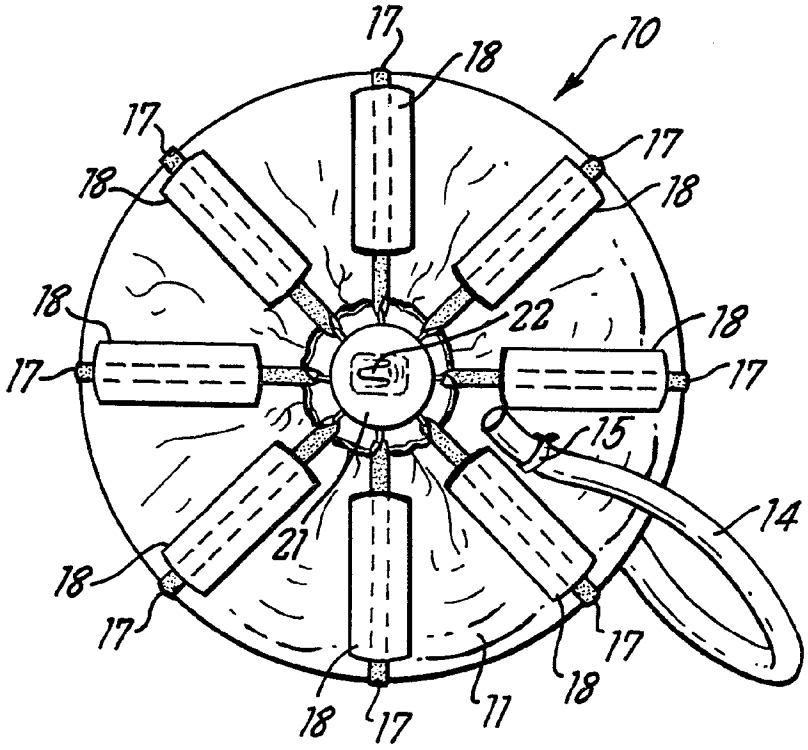


Fig. 1

Fig. 2



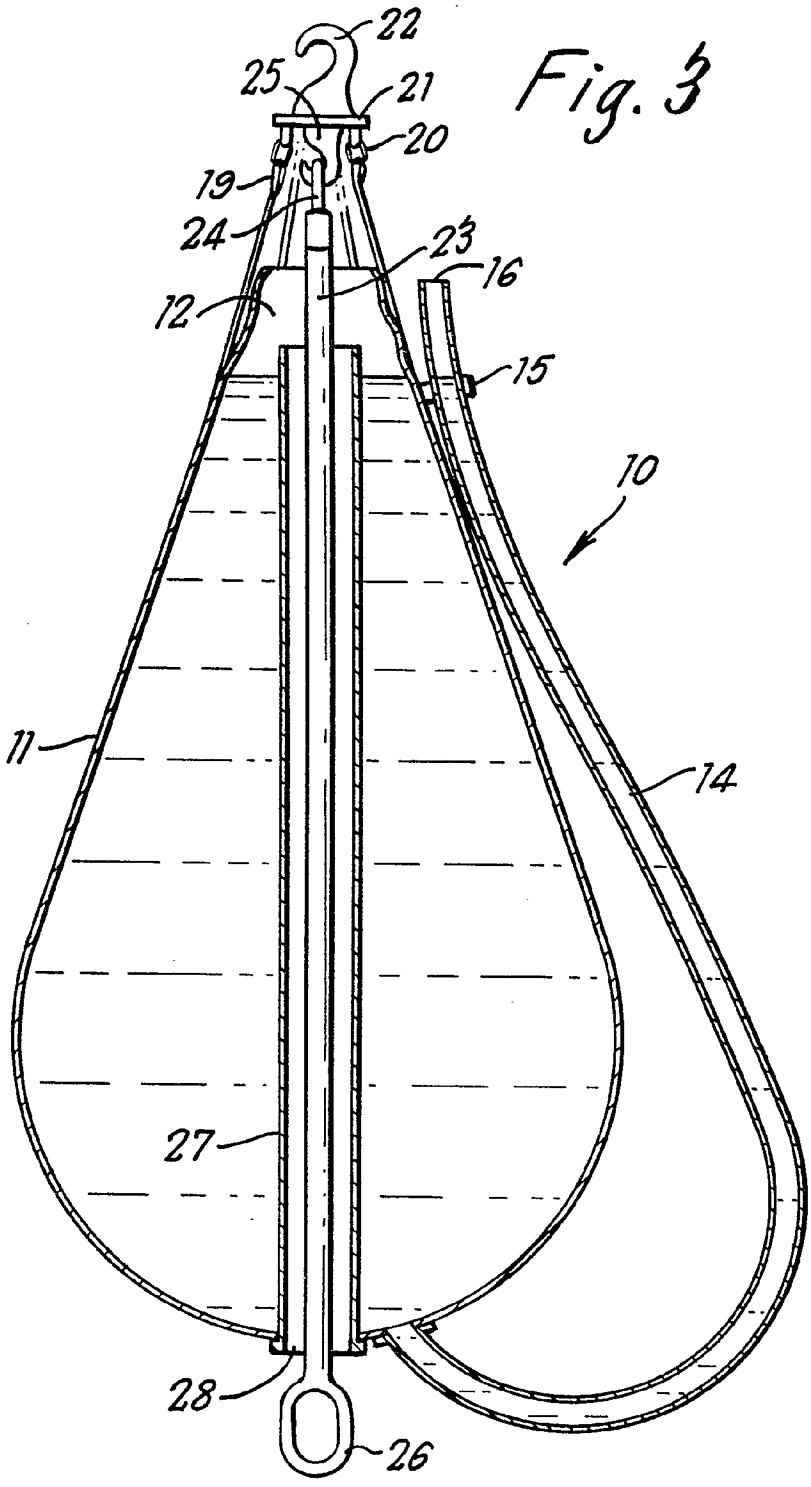
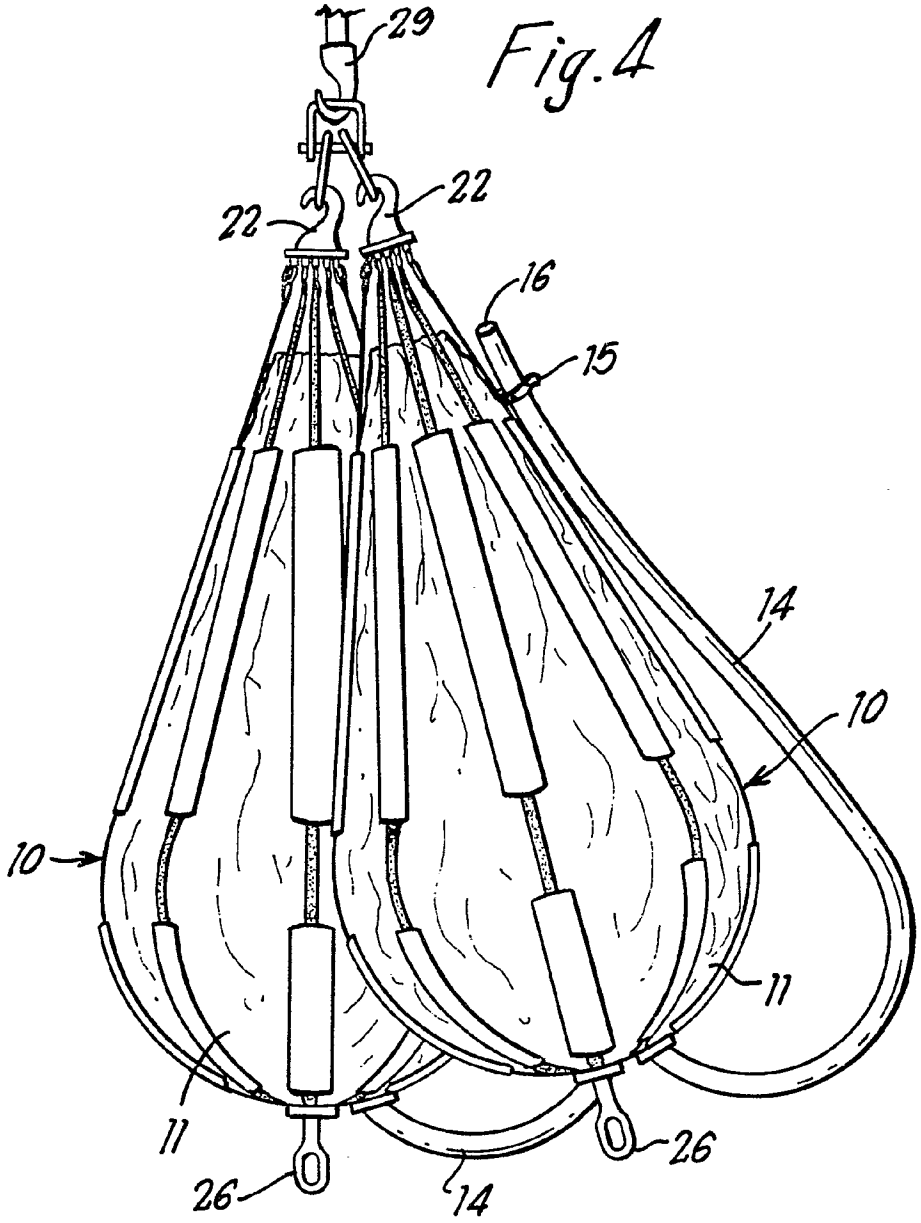


Fig. 3

Fig. 4



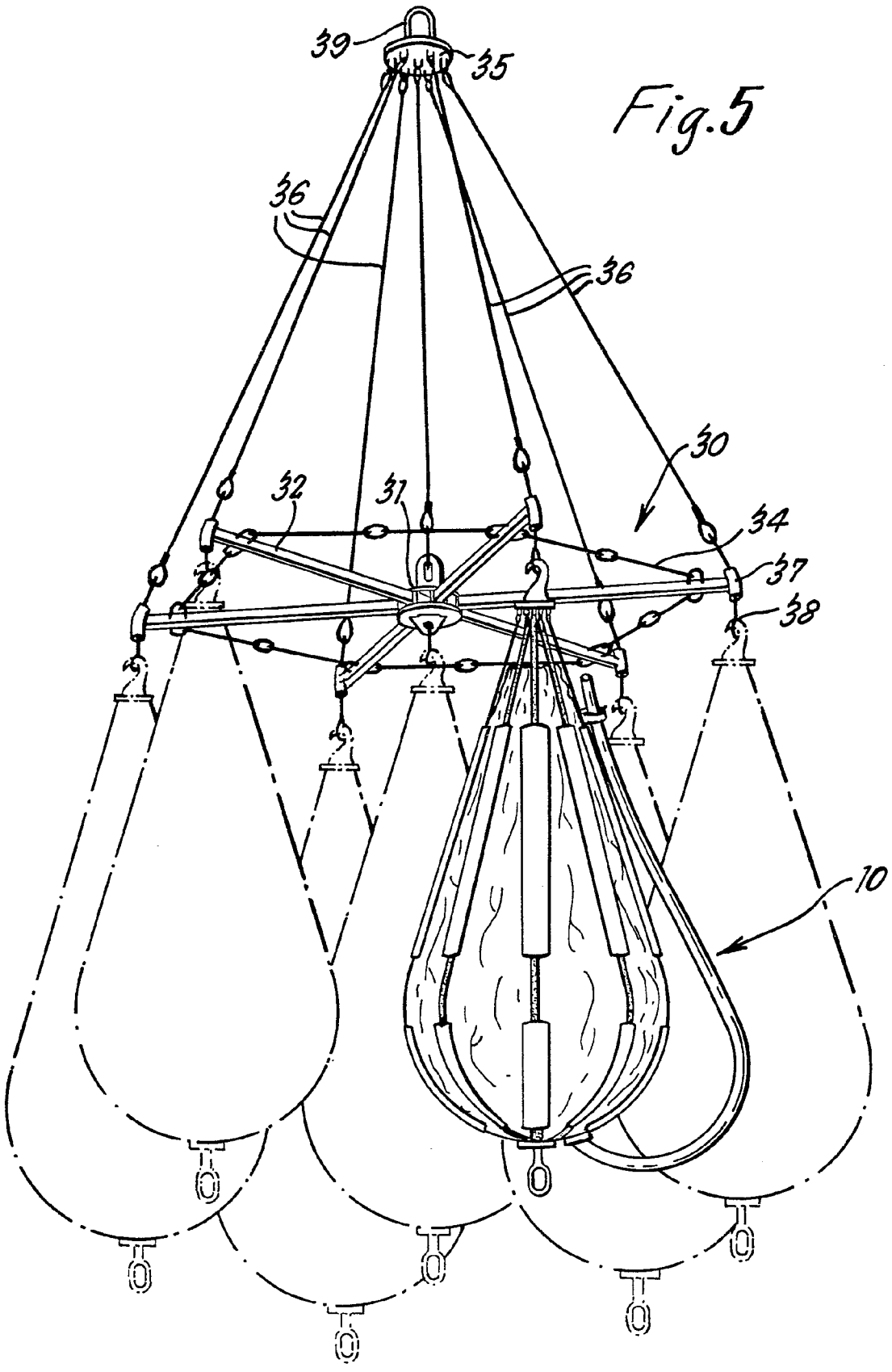


Fig.5

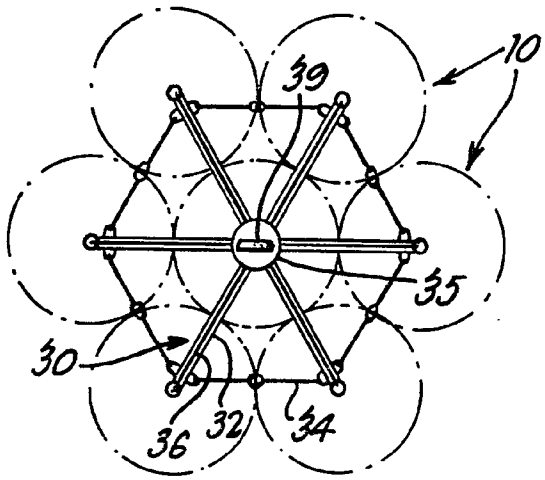


Fig. 6

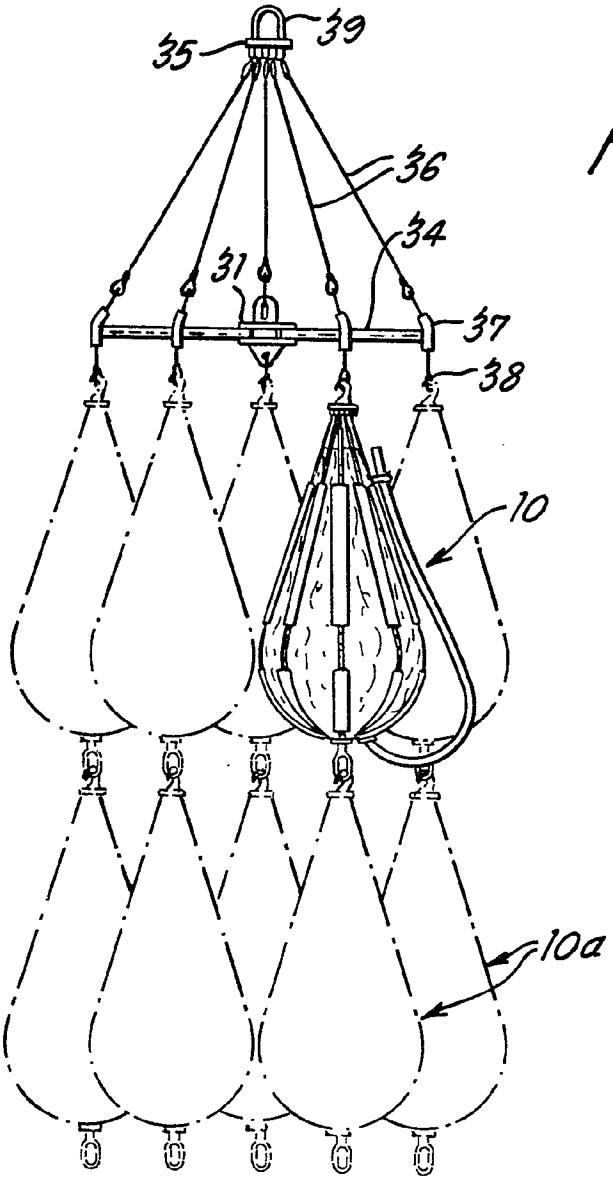


Fig. 7

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EUROPEAN SEARCH REPORT

0018075
Application number

EP 80 30 0725.1

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	FR - A1 - 2 296 171 (DELATTRE-LEVIVIER) * claims 1, 4, 10; fig. * --	1,6-10, 15-18
	FR - A - 1 484 956 (CLOUET) * fig. 1, 2 * --	1,8,15
	DE - A - 2 140 779 (PIETZSCH) * claim 3 * --	1
	GB - A - 783 407 (U.S. RUBBER CO.) * claim 1; fig. 1 * --	1
	CH - A - 362 980 (POLIET & CHAUSSON) * fig. 4, 6 * --	2-4
P	DE - A1 - 2 804 404 (FISCHER) * claim 1 * --	1
A	DE - A - 1 911 962 (REUTER) * claim 1 * --	1
A	DE - A - 1 756 844 (VEB SCHWERMASCHINENBAU S.M. KIROW) * claim 1 * --	1
A	DE - C - 976 872 (LIEBHERR) * claim 1 * --	1

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CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

B 66 C 23/90
B 65 D 88/16
G 01 M 19/00

TECHNICAL FIELDS SEARCHED (Int.Cl.³)

B 65 D 33/00
B 65 D 88/00
B 66 C 15/00
B 66 C 23/00
G 01 M 5/00
G 01 M 19/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Berlin	24-06-1980	KANAL

EPO Form 1503.1 06.78

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	DE - C - 759 995 (BARNER) * fig. 4 * --	1	
A	DE - C - 10 466 (AG FÜR EISENINDUSTRIE UND BRÜCKENBAU) * claim 1 * ----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.³)