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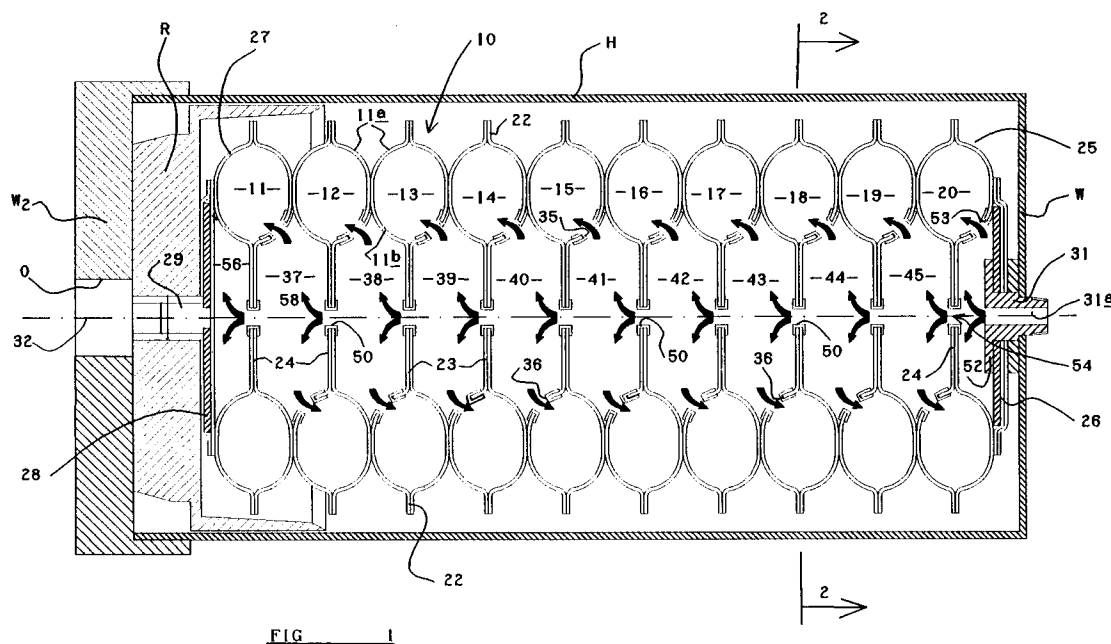
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FORRESTER & BOEHMERT
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W-8000 München 22(DE)(54) **Expandable bag.**

(57) An expandable bag (10) adapted to be expanded in an expansion direction by the introduction of fluid into the bag (10) under a pressure greater than the pressure externally of the bag (10), the bag (10) comprising a plurality of compartments (11-20) each being generally of loop configuration (as herein de-

fined), each compartment (11-20) having at least in part, flexible walls (11a,11b), there being passage means (35,36,50,53,54,58) to permit fluid introduced into the bag (10) at one end thereof, to flow into each of the compartments (11-20).

**FIG. 1****EP 0 468 336 A1**

This invention relates to an expandable bag.

The use of one or more expandable bags as an actuator, is disclosed in German Patent DAS-1148874. However, such arrangements suffer from the disadvantage that in some applications it is not possible accurately to control the direction along which the bag expands when fluid is introduced under pressure.

According to one aspect of the invention we provide an expandable bag adapted to be expanded in an expansion direction by the introduction of fluid into the bag under a pressure greater than the pressure externally of the bag, the bag comprising a plurality of compartments each being generally of loop configuration (as herein defined), each compartment having at least in part, flexible walls, there being passage means to permit fluid introduced into the bag at one end thereof, to flow into each of the compartments.

By "loop configuration" we mean that in plan view the compartments each present a closed figure with a centre void, the outer periphery of the closed figure being one of circular, other curved, polygonal, a combination of at least one curve and at least one straight edge.

It has been found that by providing an expandable bag comprising a plurality of loop configuration compartments suitably arranged, the direction along which the bag expands can accurately be controlled.

According to a second aspect of the invention, we provide in combination, a bag according to the first aspect of the invention, and an elongate housing which contains a reaction member which is moved along the longitudinal axis of the housing by the bag as the bag expands.

The invention will now be described with reference to the accompanying drawings in which:

FIGURE 1 is a side sectional view through a bag in accordance with the invention, shown in an expanded condition, in an elongate housing,

FIGURE 2 is an end sectional view of the bag only taken on the line 2-2 of Figure 1.

Referring to the drawings, an expandable bag 10 comprises a plurality of loop shaped compartments 11-20, each of which in plan view presents a generally closed figure with a centre void, the outer periphery P of the figure being in this example, generally circular. Each compartment 11-20 has flexible side walls 11a, 11b, which in this example comprises polurethane coated nylon fabric, but may comprise PVC, polypropylene or other unsupported rubber or plastic film or plastic or rubber covered fabric sheet which is welded or adhered to the other side wall as indicated at 22 and 23 to provide the compartments 11-20.

Across the centre voids of each of the loop configuration compartments 11-20 extends a web

24 which comprises a double thickness of material fixed together again by welding or adhesive.

At one end 25 of the bag 10, a relatively rigid end element 26 is provided, and at the other end 27 of the bag 10, a further generally rigid end element 28 is provided.

The element 28 is provided with a threaded stud 29 to enable the element 28 to be secured to a reaction member R.

The end element 26 is provided with a central opening in which is received an inlet assembly 31 comprising a boss having an inlet passageway 31a which is adapted to be connected to a source of pressurised fluid, in this example, compressed air. Alternatively the opening could be offset from the centre axis 32.

The loop configuration compartments 11-20 are arranged so that their centres lie along the common centre axis 32, with the side walls 11a, 11b, of adjacent loop configuration compartments 11-20 being secured together by welding and/or adhesive as desired. Extending from each of the compartments 11-20 are first passages 35,36, of a passage means, which passages 35,36, permit the flow of fluid between the compartments 11-20.

Further compartments 37-45 are defined between the webs 24 of adjacent compartments 11-20, and second passages 50 of the passage means are provided from each of the compartments 37-45 into the next adjacent further compartment, again to provide for the flow of fluid throughout the bag 10.

It can be seen that an end compartment 52 is provided between the web 24 of the compartment 20 and the element 26, there being further a passage 53 between the compartment 20 and the end or inlet compartment 52, and a yet further passage 54 is provided from the further compartment 45 and compartment 52, to permit fluid which is introduced through the inlet assembly 31 to flow into each of the loop configuration compartments 11-20 and further compartments 37-45.

At the end 27 of the bag 10, a further end compartment 56 is provided between the web 24 of the compartment 11 and the end element 28, with still further passages 58 from compartment 37 into end compartment 56.

It will be appreciated that the bag 10 may be collapsed from the condition shown to a flatter condition when fluid is expelled from the bag 10, but that the bag 10 may be expanded to the condition shown by introducing fluid through the inlet assembly 31 under a pressure greater than the pressure externally of the bag, the fluid flowing into each of the loop configuration compartments 11 to 20 and further compartments 37 to 45 and end compartments 52 and 56 to expand the bag in a direction generally common with the axis 32.

It has been found that by providing a bag with the multi-loop configuration compartments construction described, the bag 10 will expand in the direction of axis 32 in a controlled manner whereas with a bag which has a single compartment, expansion of the bag in any particular direction is unpredictable.

With the construction shown, an expansion ratio of up to 14:1 has been achieved, although preferably a bag in accordance with the invention will be able to achieve an expansion ratio of at least 4:1 and more preferably at least 7:1.

Each of the passages 35,36,50,53,54 and 58 may have an eyelet support element as indicated in the drawings, which eyelets serve to seal the edges of the material at the periphery of the passages.

The bag 10 is shown received within a housing H with the end element 26 fixed relative to an end wall W of the housing H and the end element 28 of the bag 10 and the reaction member R being free to move within the housing H in the direction of the axis 32. The stud 29 may be affixed to the reaction member R so as to move the reaction member R along the housing 11 longitudinally in the direction of centre axis 32, in the manner of a piston in a cylinder.

In the preferred embodiment, the compartments 11-20 are each generally annular in configuration and thus the housing H may be generally cylindrical. However other configurations are possible, the outer periphery P of each compartment 11-20 being circular or other curved, polygonal or any combination of at least one curve and at least one straight edge.

The bag 10 may have any number of loop configuration compartments 11-20 as desired preferably centred on the axis 32 so that the bag will expand in the direction of axis 32.

Although as described, the bag 10 comprises PVC, polypropylene or other plastic film or plastic covered fabric e.g. nylon material, the bag may be made in other materials, and constructed in another appropriate manner. For example, it is envisaged that the bag could be made by moulding at least parts of the bag to a desired configuration.

Many other modifications are possible without departing from the scope of the invention.

In the drawings, arrows show the fluid flow paths during expansion of the bag. To collapse the bag 10, fluid is withdrawn from the bag 10 via inlet assembly 31 such that fluid flow is in an opposite direction to the arrows.

The reaction member R may be used to push an item along the housing H, or to extrude a substance through an opening O in an end wall W2 of the housing H, although the expansion bag 10 described has many other uses as an actuator.

Although as described, the bag 10 expands in a linear direction, in another example, the bag 10 may be adapted to expand in any other direction e.g. along a curve or another preset path.

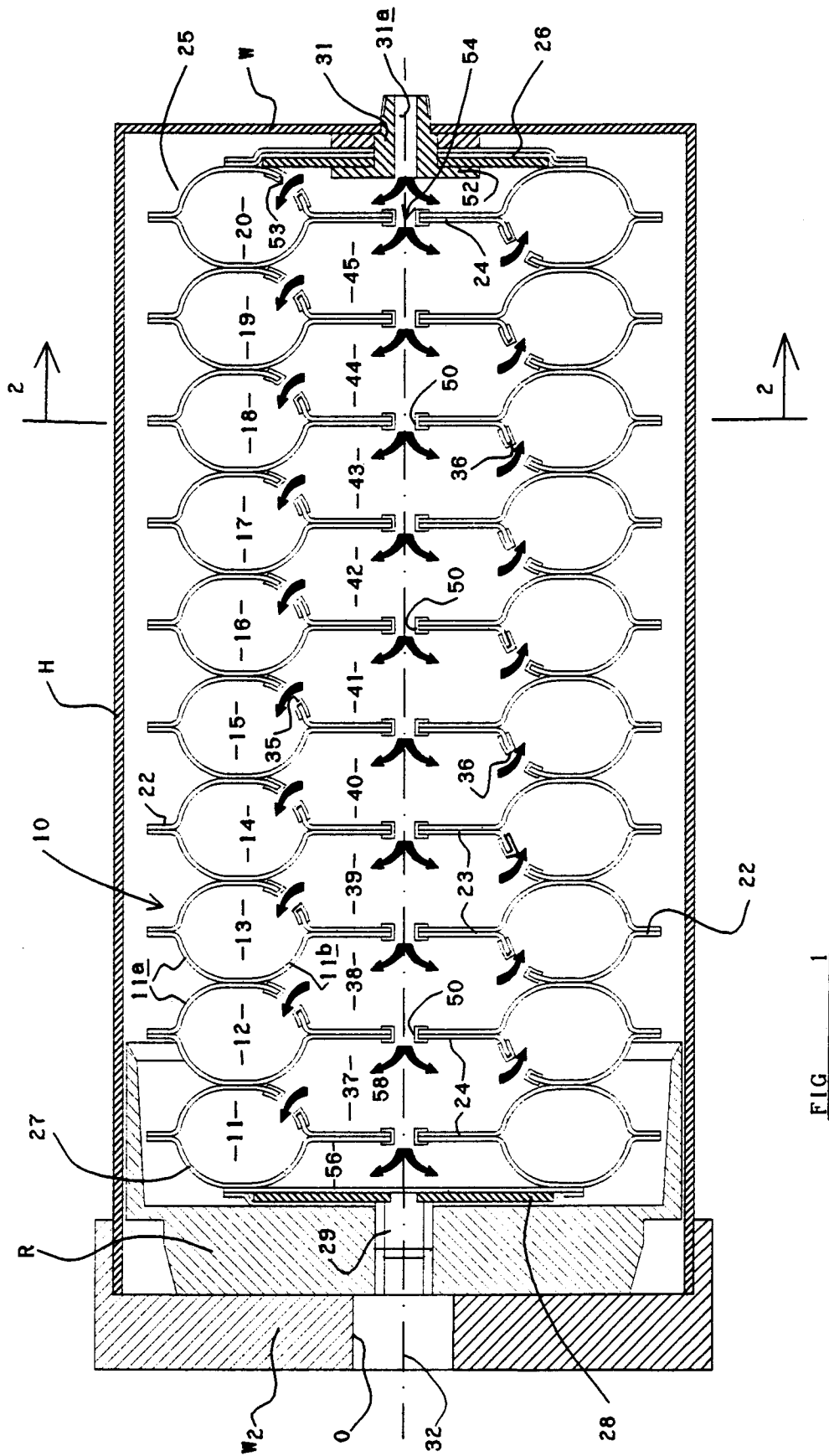
The features disclosed in the foregoing description the following claims or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, or a class or group of substances or compositions, as appropriate, may, separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

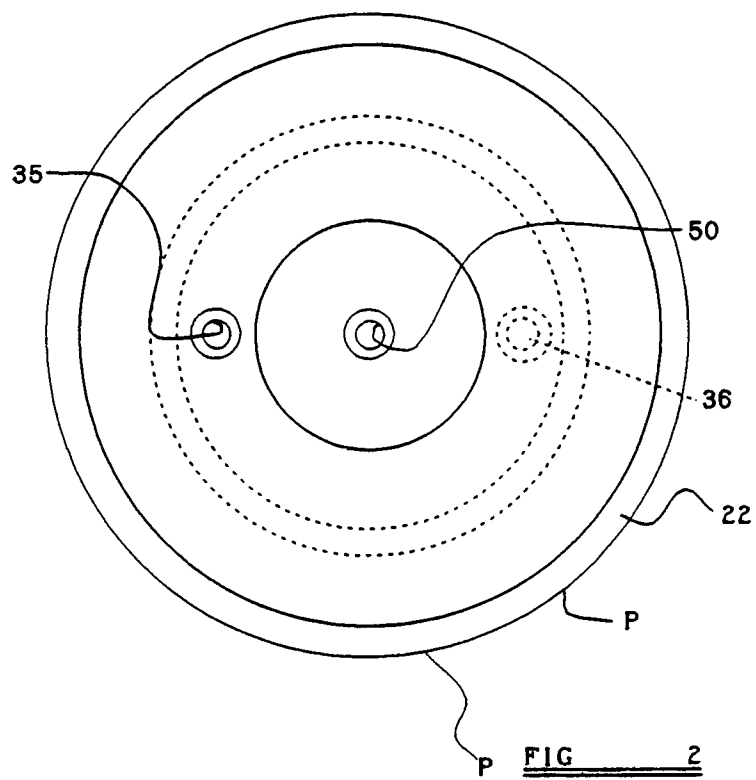
Claims

1. An expandable bag (10) adapted to be expanded by the introduction of fluid into the bag (10) under a pressure greater than the pressure externally of the bag, characterised in that the bag (10) comprises a plurality of compartments (11-20) each being generally of loop configuration in which, in plan view, the compartments (11-20) each present a closed figure with a centre void, the outer periphery (P) of the closed figure being one of circular, other curved, polygonal, or a combination of at least one curve and at least one straight edge, and each compartment (11-20) having at least in part, flexible walls (11a,11b) there being passage means (35,36,50,53,54,58) to permit fluid introduced into the bag (10) at one end (25) thereof, to flow into each of the compartments (11-20) whereby the bag (10) expands in an expansion direction.
2. A bag according to claim 1 characterised in that the loop configuration compartments (11-20) are arranged so that at least prior to the bag (10) being expanded, the centres of the loops are arranged along a common axis (32).
3. A bag according to claim 2 characterised in that the bag (10) expands linearly, the common axis (32) extending in the same direction as that along which the bag (10) expands.
4. A bag according to any one of claims 1 to 3 characterised in that the side walls (11a,11b) of the loop configuration compartments (11-20) are connected together to form the bag (10), a web extending across each of the centre voids of the loop configuration compartments (11-20).
5. A bag according to claims 3 or claim 4 where appendant to claim 3, characterised in that the webs (24) each extend generally parallel to

one another in a direction transverse to the common axis (32) along which the bag (10) expands further compartments (37-45) being defined between the webs (24) of adjacent loop configuration compartments (11-20), the passage means comprising first passages (35,36) between the loop configuration compartments (11-20) and the further compartments (37-45), and second passages (50) between adjacent further compartments (37-45).

6. A bag according to claim 5 characterised in that one first passage (35) opens from each loop configuration compartment (11-20) into a further compartment (37-45) at one side of the web (24) extending across the respective centre void of the loop shaped compartment (11-20) and another first passage (36) opens from each of the loop configuration compartments (11-20) into a further compartment (37-45) at the other side of the web (24) extending across the respective centre void of the loop shaped compartment (11-20).
7. A bag according to any one of claims 1 to 6 characterised in that the loop configuration compartments (11-20) are generally annular, and the webs (24) are circular.
8. A bag according to claim 7 characterised in that the bag (10) at least when expanded, is generally of cylindrical outer configuration.
9. A bag according to any one of the preceding claims characterised in that the means (31,31a) which permit of the introduction of fluid into the bag (10) at the one end (25) thereof, comprises an inlet assembly (31) having a rigid element (26) secured to the bag (10), the rigid element (36) including an inlet passageway (31a) therethrough, the inlet passageway (31a) extending into an inlet compartment (52) of the bag (10) from where fluid may pass into the loop configuration compartments (11-20) and where appropriate, the further compartments (37-45) of the bag (10).
10. In combination, a bag (10) according to any one of claims 1 to 9, and an elongate housing (H) which contains a reaction member (R) which is moved along the longitudinal axis (32) of the housing (H) as the bag expands, the bag being contained within the elongate housing (H) with the one end (25) of the bag (10) at which fluid is introduced into the bag (10) being fixed relative to the housing (H).







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EUROPEAN SEARCH REPORT

Application Number

EP 91 11 1788

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y,A	FR-A-1 155 697 (FISCHER) * page 2, left-hand column, paragraph 5 right-hand column, paragraph 2; figure 1 * - - -	1-4,9,10, 7,8	F 15 B 15/10
Y	US-A-2 456 869 (FOWLER) * column 2, lines 7 - 36; figures 1-5 * - - -	1-4,9,10	
A	DE-C-671 148 (BRENDLIN) * page 1, left-hand column, last paragraph page 2, left-hand column, paragraph 1; figures 1, 2 * - - -	1-3,7,8, 10	
A	DE-A-2 061 596 (DAIMLER-BENZ) - - - - -		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F 15 B
The present search report has been drawn up for all claims			
Place of search Berlin		Date of completion of search 07 November 91	Examiner THOMAS C L
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