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(71) Applicant(s):
Dyson Technology Limited
(Incorporated in the United Kingdom)
Tetbury Hill, MALMESBURY, Wiltshire, SN16 0RP, United Kingdom

(72) Inventor(s):
Edward Jonathan Chudleigh

(74) Agent and/or Address for Service:
Dyson Technology Limited
Intellectual Property Department, Tetbury Hill, MALMESBURY, Wiltshire, SN16 0RP, United Kingdom

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(56) Documents Cited:
GB 2458996 A **GB 0828676 A**
GB 0560270 A **EP 0409253 A**
US 4713858 A **US 3006662 A**
US 20070119014 A

(58) Field of Search:
INT CL **A47L, F16L**
Other: **WPI, EPODOC, TXTE**

(54) Title of the Invention: **A flexible hose**
Abstract Title: **A flexible hose**

(57) A flexible hose k for carrying fluid under transport. The hose k is a stretch hose, which is extendable lengthways l from a retracted length l_r to an extended length under a tensile force applied to the hose, the extended length being at least 25% longer than the retracted length. A length of the hose has a hose wall 2 formed by at least one layer of fabric which is sealed to form an impermeable barrier for the fluid carried by the hose. The hose wall 2 may incorporate at least one layer of ripstop fabric and is preferably secured to one or more reinforcing frame elements 3 which may provide a restoring force to return the hose wall from the extended to the retracted position. The hose is particularly suitable for use with a domestic upright vacuum cleaner.

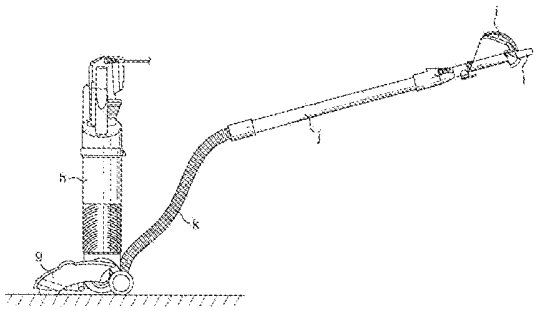

FIG. 2b

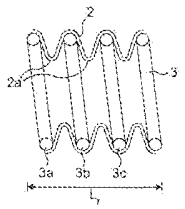

FIG. 4a

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17 06 10

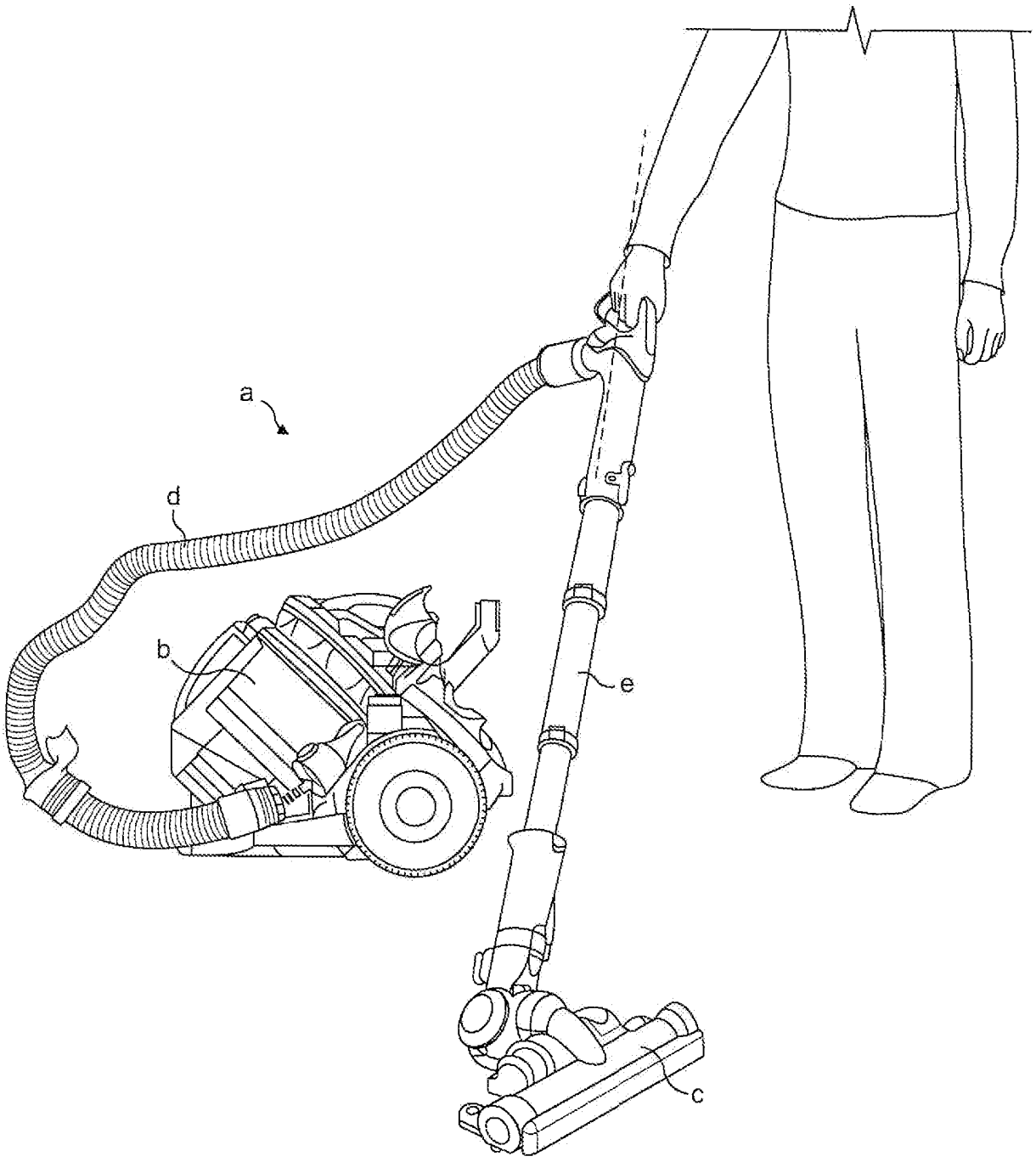

FIG. 1

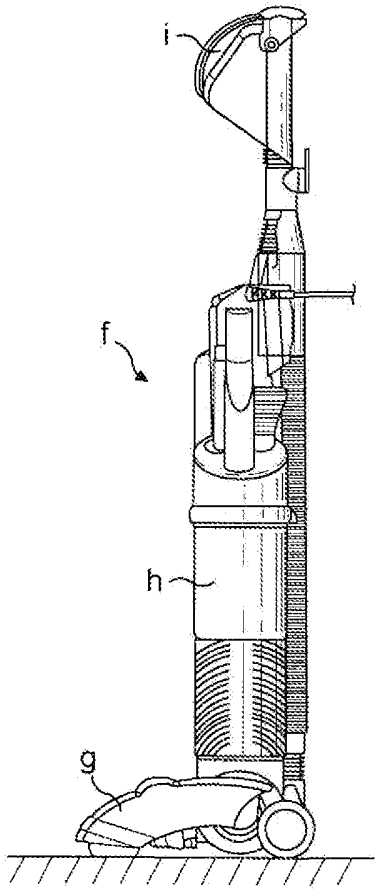

FIG. 2a

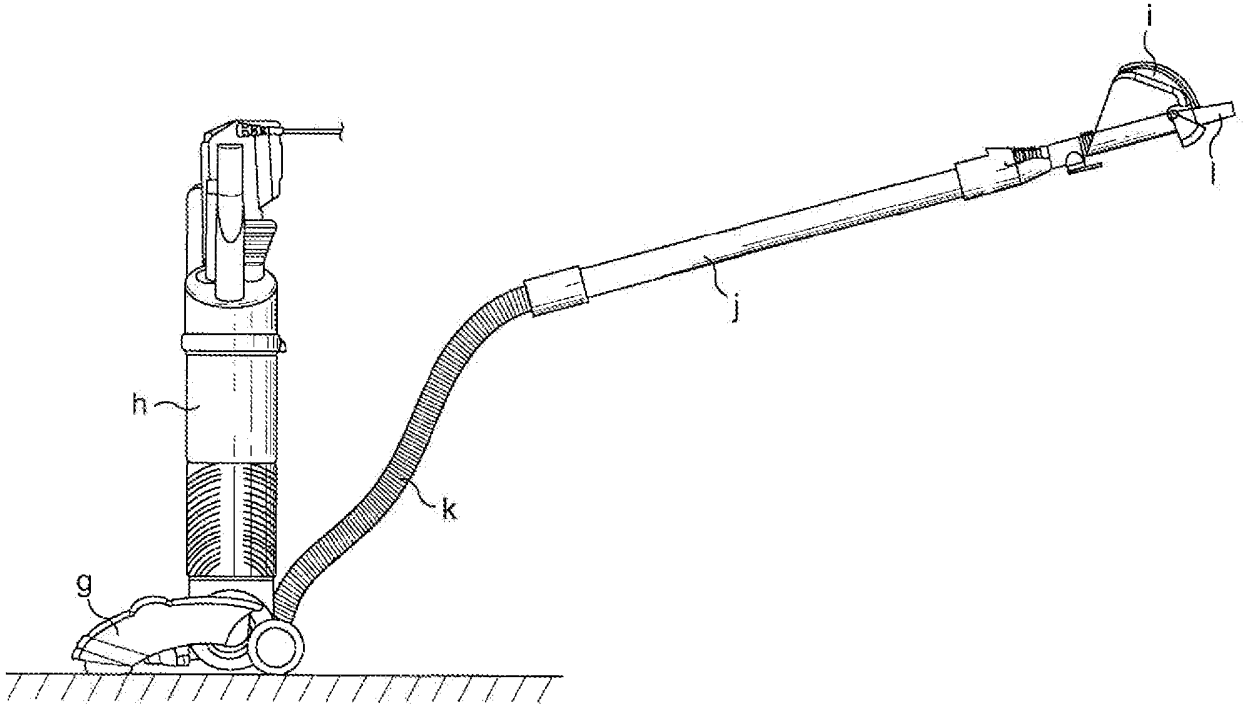

FIG. 2b

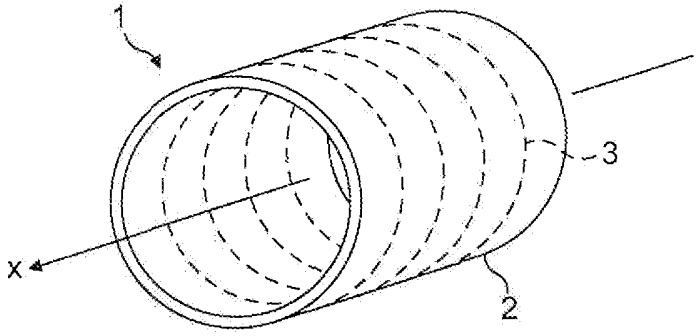

FIG. 3

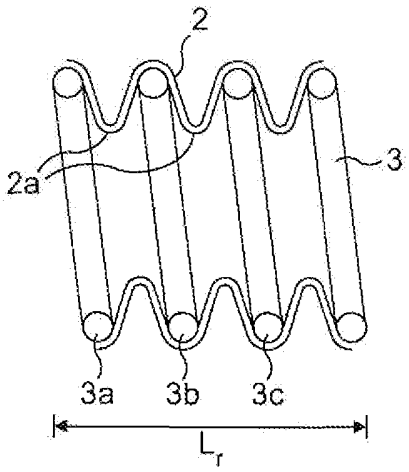

FIG. 4a

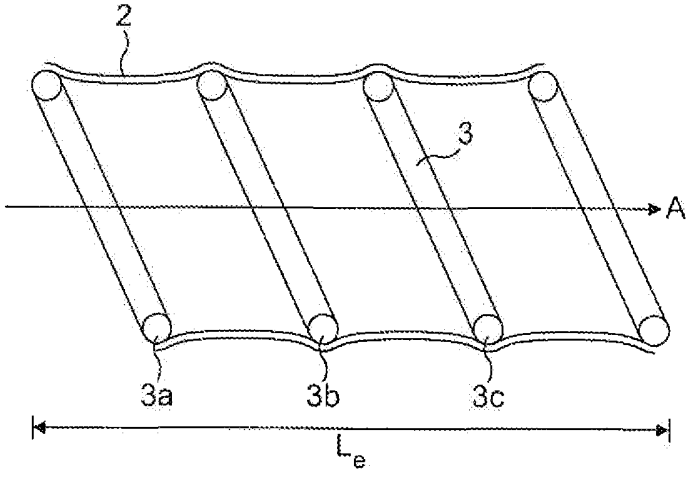

FIG. 4b

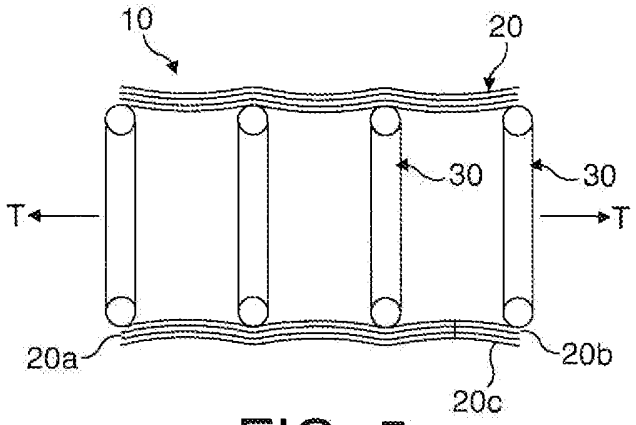

FIG. 5

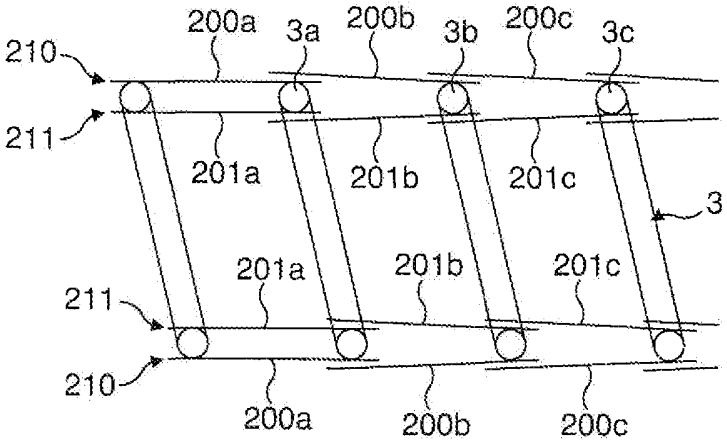

FIG. 6

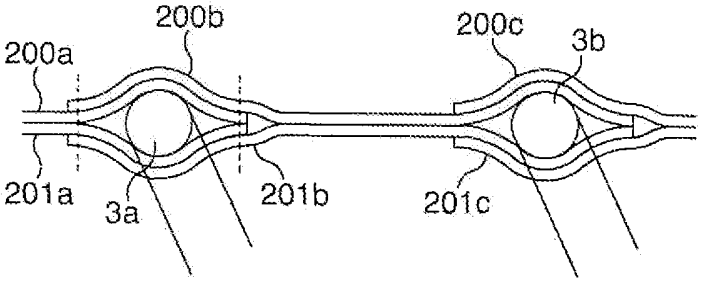

FIG. 7

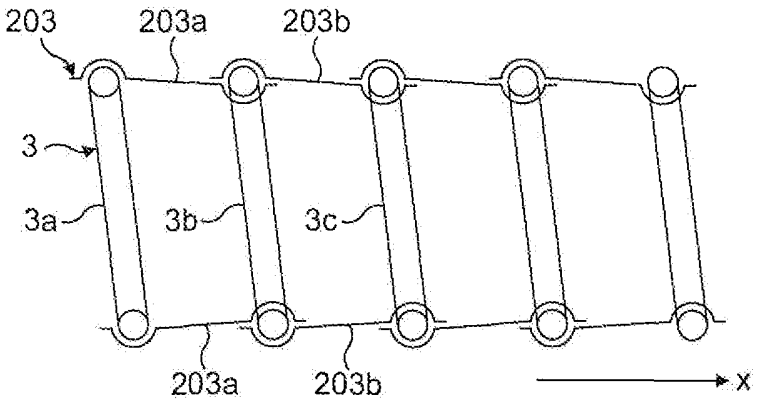

FIG. 8

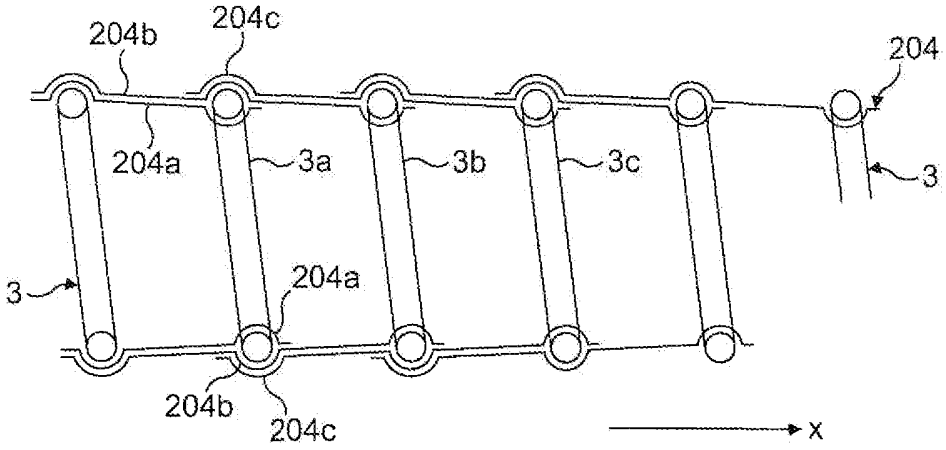

FIG. 9

A Flexible Hose

The present invention relates generally to flexible hoses, and in particular to an extendable flexible hose, or so-called "stretch" hose. The hose may be a stretch hose provided on a surface-cleaning appliance such as a domestic vacuum cleaner, in which case the hose may be incorporated as part of a hose and wand assembly for the surface-cleaning appliance.

Domestic vacuum cleaners, namely those vacuum cleaners which are intended for domestic use, generally fall into two categories: "cylinder" cleaners and "upright" cleaners.

In a typical cylinder cleaner *a*, shown in Figure 1, a main body *b* of the cleaner *a* is fluidly connected to a floor tool *c* via a hose and wand assembly. The hose and wand assembly consists of a relatively in-extendable, flexible hose *d* which is connected at one end to a suction inlet on the main body *b*, and a rigid, hollow, telescopic wand *e* which connects the opposite end of the flexible hose *d* to the floor tool *c*. During normal operation of the cleaner *a*, a user grasps the wand *e* manually to manoeuvre the floor tool *c* across the floor, dragging the main body *b* behind with the in-extendible, flexible hose *d*.

In a typical upright cleaner *f*, shown in Figure 2a, a cleaner head *g* is permanently attached to the main body *h* of the vacuum cleaner and the user maneouvres the cleaner head *g* and the main body *h* together across the floor using a handle *i*. Historically, only cylinder cleaners were provided with a suction hose: upright cleaners relied solely on the cleaner head permanently attached to the main body of the cleaner. More recently, manufacturers have started to provide upright vacuum cleaners with a hose and wand assembly, in addition to the cleaner head, so that the upright cleaner can optionally be operated in the manner of a cylinder cleaner. Figure 2b shows a particularly compact form of hose and wand assembly, used generally on models from the Dyson range of upright vacuum cleaners, in which a telescopic wand *j* is integrated with the handle *i*

and can be released from the main body *h* by operating a catch. A so-called "stretch" hose *k* attaches the wand *j* to a suction inlet (not shown) on the main body *h*; the stretch hose *k* is stored on-board the main body *h* in a retracted position and can then be manually extended, or "stretched", as desired following release of the wand *j* (with the handle *i*) in order to increase the useful reach of the wand *j*. A suitable floor tool *l* can be attached to the suction inlet on the wand *j*, as desired.

Hoses for early models of cylinder cleaner were often constructed using rubber, an example of which is described in UK Patent No. GB836407. These rubber or rubber-based hoses were, however, superseded relatively quickly by plastic suction hoses, typically comprising a moulded thermoplastic hose wall having a series of corrugations to provide the requisite flexibility for the hose, as appropriate. The use of plastic significantly reduces the weight of the hose compared to a corresponding rubber or rubber-based hose, and the moulded plastic suction hose has become the well-established industry norm for domestic vacuum cleaners, whether in the form of a relatively in-extendible suction hose on a cylinder cleaner or a stretch hose on modern upright cleaners.

Moulded plastic hoses are also commonly used as a suction or blow pipe in industrial (non-domestic) surface-cleaning appliances, and are used in other fields in which it is likewise desirable to provide a hose which is relatively lightweight and low-cost to produce.

An object of the present invention is to seek generally to provide an improved stretch hose which offers an advantageous alternative to a conventional moulded plastic stretch hose, and in particular seeks to provide a stretch hose which can advantageously be provided on a surface-cleaning appliance, particularly an upright domestic vacuum cleaner, possibly as part of a hose and wand assembly for the appliance.

According to the present invention there is provided a flexible hose for carrying fluid under transport, a length of the hose being extendable lengthways from a retracted

length to an extended length under a tensile force applied to the hose, the extended length being at least 25% longer than the retracted length, wherein said length of the hose has an extendable hose wall formed at least in part by one or more layers of fabric, at least one layer of fabric being sealed to form an impermeable barrier for the fluid carried by the hose.

The present invention is concerned with stretch hoses, which have an extended length which is significantly longer than their retracted length in the context of the use of the hose. Thus, the extended length will be at least 25% longer than the retracted length (e.g. an extended length of 125cm versus a retracted length of 100cm), but may typically be in the range of 2 to 6 times the retracted length of the hose, and possibly up to 20 times the retracted length of the hose.

In a conventional moulded plastic stretch hose, the hose wall can suffer from cyclic fatigue caused by repeated extension and retraction of the hose, increasing the risk of the hose splitting. The fatigue life of the hose can be increased by increasing the thickness of the hose-wall, but this often carries with it a weight penalty, and may also critically reduce the flexibility and/or extensibility of the hose in certain applications. The use of a fluid-tight fabric layer in accordance with the present invention is aimed at providing a layer which is both impermeable, highly flexible and has a relatively high tolerance to cyclic fatigue, thus advantageously improving the useful life of the hose as compared to a comparable, conventional plastic hose, without critically affecting the flexibility or weight of the hose.

The hose may be extendable in response to a manual tensile force, for example a force exerted manually by the user of a vacuum cleaner.

The hose wall may be a fabric hose wall i.e. constructed solely from one or more layers of fabric. This sort of relatively simple fabric construction offers a lightweight, highly flexible alternative to a conventional moulded plastic hose offering comparable fatigue life.

One or more of the layers of fabric may be substantially inelastic, and may incorporate sufficient slack for non-elastic lengthways extension of the hose wall from the retracted length to the extended length. At least some of the slack may conveniently be provided by a series of corrugations or folds in the fabric.

The fabric hose-wall may comprise woven, braided or knitted plastic or plastic coated filaments.

The hose wall may incorporate at least one layer of ripstop fabric, being a fabric which is interwoven with a pattern of reinforcing yarns, typically a cross-hatch pattern, and which consequently exhibits high resistance to the formation and spread of tears and runs in the fabric. The ripstop fabric may be ripstop nylon or ripstop polyester, but the invention is not limited to any particular fabric. The reinforcing yarns in the ripstop fabric do not necessarily need to be the same material as the bulk fabric.

The layer of ripstop fabric provides a tear and puncture resistance layer in the hose-wall. The layer of ripstop fabric itself may be relatively thin, possibly less than 0.1mm in the case of a hose for a domestic cleaning appliance, and therefore does not add any significant weight to the hose. The ripstop fabric is also highly flexible.

The hose-wall may be supported on one or more frame elements, providing increased crush strength and stiffness for the hose. This helps to maintain an open flow passage through the hose. Increased stiffness may be particularly desirable in a hose for a domestic cylinder cleaner, because in cylinder cleaners it is also preferable that the hose is sufficiently stiff for guiding or "leading" the main body of the cleaner across the floor.

The frame elements are arranged for lengthways movement relative to one another to accommodate extension of the fabric wall from the retracted length to the extended

length. The frame elements may be resiliently connected to one another for providing a restoring force to return the fabric wall from the extended length to the retracted length.

One or more of the frame elements may be sandwiched radially in-between either two separate layers of fabric in the hose wall or, alternatively, two plies of fabric (which may be formed by doubling over a single layer of fabric), so that the frame element(s) is (are) not exposed on the outside of the hose wall.

During use of the hose, frictional wear of the fabric may occur, principally along the contact interface between the frame elements and the fabric, which may eventually lead to breach of the hose wall (and consequent loss of suction in the case of a suction hose for a surface cleaning appliance). The provision of two sandwiching layers or plies of fabric reduces the effect of this frictional wear by increasing the effective thickness of the hose wall. At the same time, providing the inner sandwiching layer (or ply) on the inside of the frame element has the advantage that this inner sandwiching layer is not exposed to the relatively high levels of frictional wear which typically occur around the outside of the frame elements.

The layers or plies of fabric may be bonded to one another, axially either side of the respective frame element, to encapsulate the frame element between the layers or plies of fabric, thus conveniently retaining the frame elements in their predetermined positions. The fabric making up the hose wall may additionally or alternatively be arranged to form a multi-ply or multi-layer overlap around the outside of one or more of the frame elements, further improving the external wear resistance of the hose.

It has also been found that coating the frame elements with a relatively compliant or low-friction material (i.e. compliant or low-friction relative to the material making up the frame elements) has a significant effect on the wear resistance of the hose. For example, if the frame elements are steel, the wear resistance of the hose can be improved significantly by coating the frame elements with a plastic e.g. polyurethane (PU), thermoplastic polyurethane (TPU) or polytetrafluoroethylene (PTFE)

The hose wall may comprise a wound fabric tape. In a particular embodiment, the hose wall comprises a wound fabric tape, and one or more of the frame elements are sandwiched radially in-between two axially-overlapping passes of the wound fabric tape. The respective overlapping passes of the fabric may be bonded to one another, axially either side of the corresponding frame element in order to encapsulate the frame element. Additionally or alternatively, the wound fabric tape may be arranged so that two or more axially overlapping passes if the fabric tape form a respective multi-ply overlap around the outside of one or more of the frame elements. These winding arrangements are considered to be particularly effective for reducing the effects of frictional wear; this is particularly the case during use on a typical domestic vacuum cleaning appliance, where preliminary tests indicate that winding a ripstop fabric tape in the manner described above can dramatically increase the life of the hose compared to a conventional moulded plastic hose. The winding arrangements described above also present a relatively smooth internal surface to the hose, tending to limit the thickness of the boundary layer flow through the hose.

The hose-wall may be bonded to the frame elements, for example using an adhesive. If the frame elements are formed from an electrically conductive material, the adhesive may be cured by resistance-heating the frame elements.

The frame elements may be coils on a helical supporting member, which may be a helical metal wire. The fabric may conveniently be wrapped around the helical supporting member using any suitable wrapping arrangement.

According to another aspect of the present invention, the flexible hose is incorporated as part of a domestic cleaning appliance, for example as part of a hose and wand assembly for the cleaning appliance. The use of the flexible hose on a domestic cleaning appliance breaks with the long-established norm of utilizing a hose having a moulded plastic hose-wall.

Embodiments of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a schematic, perspective view of a conventional cylinder cleaner incorporating a flexible suction hose;

Figures 2a and 2b are schematic, side views of a conventional upright cleaner incorporating a flexible suction hose;

Figure 3 is a schematic perspective view of a retracted length of flexible, extendable hose in accordance with the present invention;

Figure 4a is a sectional view of the hose shown in Figure 3, taken along the line A-A;

Figure 4b is a sectional view corresponding to Figure 4a, but showing the hose in an extended configuration;

Figure 5 is a sectional view showing an alternative form of hose in accordance with the present invention, in which the hose wall has a multi-layer fabric construction;

Figure 6 is a sectional view showing an alternative form of hose, in which the hose wall is constructed from wound fabric tape;

Figure 7 is a sectional view through part of the fabric hose wall shown in Figure 6;

Figure 8 is a sectional view through a length of hose, illustrating an alternative hose wall configuration utilizing a wound fabric tape; and

Figure 9 is a sectional view through a length of hose, illustrating a further alternative hose wall configuration utilizing a wound fabric tape.

Referring first of all to Figure 3, an extendable length of hose 1 comprises a hose-wall 2 which is supported on a helical supporting member 3.

The helical supporting member 3 is resiliently extendable lengthways (along the axis x in Figure 3) from a retracted length L_r, shown in Figure 4a, to an extended length L_e, shown in Figure 4b.

The hose wall 2 consists of a single layer of substantially inelastic fabric, which is sealed to prevent escape of fluid through the hose-wall 2. The hose-wall 2 thus represents an impermeable barrier for containing a fluid under transport, indicated by the flow arrow A through the hose 1 in Figure 4b. The fabric may be ripstop fabric, for example ripstop Nylon or polyester.

The fabric hose-wall 2 is secured to the helical supporting member 3, but is provided with sufficient axial slack to accommodate substantially non-elastic lengthways extension from the retracted length L_r to the extended length L_e. Thus, with the helical supporting member 3 at its retracted length L_r, the fabric hose-wall forms a series of corrugations in between the successive coils of the helical supporting member 3, which corrugations are then taken up during lengthways extension of the hose-wall to the extended length L_e, as illustrated in Figure 4b. The fabric hose-wall 2 may be arranged to fold along pre-determined lines, so that the hose-wall tends to form a series of tighter, predefined folds between successive coils of the helical supporting member 3 rather than the more 'loose' corrugations shown in Figure 4a.

The fabric hose wall 2 may be sealed by impregnating, spray-coating or dip-coating the fabric with a sealant such as polyurethane (PU), a thermoplastic polyurethane (TPU) or polyvinyl chloride (PVC), or in general by using any suitable plastification process.

The fabric may be sheet fabric, produced for example by weaving, braiding or knitting, in which case the sheet fabric may be wrapped around the outside of the helical supporting member 3 to form the tubular hose-wall 2. The fabric may be wrapped

tightly to form a compression-fit on the helical supporting member 3 (but still providing the necessary axial slack for lengthways extension of the hose wall 2). The hose-wall 2 may be securely bonded to the helical supporting member 3, for example using a heat-curable adhesive such as a suitable solvent-based or epoxy adhesive, which may be applied to one or both of the hose-wall 2 and the helical supporting member 3, possibly as a pre-coating prior to wrapping of the fabric. If the helical supporting member 3 is in the form of a coil of metal wire, the adhesive may conveniently be heat-cured by resistance-heating the wire using a suitable electric current.

In an alternative arrangement, the ripstop fabric is produced as a seamless, tubular fabric, produced for example by tubular-weaving, tubular-braiding or tubular-knitting, and the hose-wall 2 is formed by rolling the fabric tube lengthways onto the helical supporting member 3. A pre-form fabric tube may also be produced from sheet fabric by initially wrapping the fabric around a cylindrical mandrel and bonding the sheet fabric along a seam to form the tube. Again, the relative diameter of the hose-wall 2 may be controlled to form a slight compression-fit on the helical supporting member 3 and the hose-wall may be securely bonded to the helical supporting member 3 using a heat-curable adhesive.

In Figures 4a and 4b, successive coils 3a, 3b, 3c of the helical supporting member 3 constitute a continuous set of frame elements for supporting the hose-wall 2. Figure 5 shows an alternative arrangement, in which a length of stretch hose 10 has a hose-wall 20 supported on a non-continuous set of frame elements, in the form of individual frame rings 30 which are bonded separately to the inside of the hose-wall 20.

The stretch hose 10 is shown at an extended length Le in Figure 5, with the hose-wall 20 being pulled taut between the frame rings 30, under the tensile force T. The frame rings 30 are separate from one another and do not therefore provide any restoring force for returning the hose to a retracted length. A suitable restoring force may nevertheless be provided, if desired, by using an elastic fabric in the hose wall 2. Upon return of the

length of hose 10 to its retracted length, the hose wall 20 assumes a corrugated profile, similar to the profile of the hose wall 2 shown in Figure 4a.

The hose-wall 20 has a multi-layer fabric wall construction, consisting of an intermediate layer of fabric 20a sandwiched between an inner and outer layer of fabric 20b, 20c. The layers of fabric 20a, 20b, 20c do not need to consist of the same fabric; for example, layer 20a may be a ripstop fabric, whereas layers 20b and 20c may be some other fabric intended to impart a desirable property to the hose wall e.g. chemical or fire resistance. At least one of the layers 20a, 20b, 20c is sealed to prevent escape of fluid through the hose-wall 20.

Each of the layers of fabric 20a, 20b, 20c may be formed from either sheet fabric or tubular fabric. For example, the fabric layer 20a may be formed as a seamless, tubular fabric, and the layers 20b and 20c may be formed from sheet fabric which is successively wrapped around the inner, tubular fabric layer 20a. The fabric layers 20a, 20b, 20c may be bonded to one another using a heat-curable adhesive, which may be cured by resistance-heating each frame ring 30 separately, possibly using some sort of switching circuit. Alternatively, where surface-sealing of the layer or layers of fabric, 20a, 20b, 20c is by impregnation, the impregnating sealant may also be used effectively to bond the fabric layers 20a, 20b, 20c.

Figure 6 is a sectional view illustrating a multi-layer fabric hose wall formed using two ripstop fabric tapes 200 and 201.

Each of the fabric tapes 200 and 201 is wound around to form a respective fabric layer along the length of the helical supporting member 3. In the case of the fabric tape 200, this forms a respective fabric layer 210 on the outside of the helical supporting member 3 consisting of a series of axially-overlapping passes of fabric 200a, 200b, 200c etc. In the case of fabric tape 201, this forms a respective fabric layer 211 on the inside of the helical supporting member 3 consisting of a series of overlapping passes of fabric 201a, 201b, 201c etc.

The coils 3a, 3b, 3c etc. of the helical supporting member 3 are sandwiched radially in-between the two fabric layers 210, 211. For example, the coil 3a is sandwiched between the passes 200a, 201a, the coil 3b is sandwiched between the passes 200b, 201b and so on. In addition, overlapping passes of the fabric tape 200 form a series of double-ply overlaps on the outside of the coils 3a, 3b, 3c etc. For example, the overlapping passes 200a and 200b form a double-ply overlap on the outside of the coil 3a, the overlapping passes 200b and 200c form a double-ply overlap on the outside of the coil 3b and so on. In the arrangement shown in Figure 6, overlapping passes of the fabric tape 201 additionally form corresponding double-ply overlaps on the inside of the coils 3a, 3b, 3c, but the double-ply-overlaps on the outside of the helical supporting member 3 are considered to be particularly advantageous for a suction hose on a domestic cleaning appliance, because they are associated with regions of the hose-wall that are typically subject to relatively high frictional wear.

The fabric tapes 200, 201 may be pre-wound on a mandrel and then fitted onto the helical supporting member 3 in similar manner to a pre-form fabric tube, possibly following bonding of the overlapping passes of fabric to consolidate the pre-wound configuration of the fabric tape.

The overlapping passes 200a, 201a are bonded to one another axially either side of the coil 3a, as indicated by the vertical dotted lines in Figure 7, in order to encapsulate the coil 3a between the fabric tapes 200, 201. In addition, the passes 200a, 201a are bonded respectively to the passes 200b, 201b.

The fabric tapes 200, 201 are wound around the helical supporting member 3 with the helical supporting member stretched to its extended length L_e, shown in Figure 6, under an applied tensile force. Following winding of the fabric tapes 200, 201 the applied tensile force is then removed, and the helical supporting member returns to its retracted length, with the hose wall assuming a generally corrugated profile, similar to the profile of the hose wall 2 in Figure 4a.

Figure 6 illustrates one possible winding arrangement using fabric tape, but other arrangements are possible. Thus, in Figure 8, a single ripstop fabric tape 203 is wound onto the helical supporting member 3, along the direction x, with a trailing portion of the fabric tape 203 running around the outside of the coils 3a, 3b, 3c and a leading portion of the fabric tape 203 running around the inside of the coils 3a, 3b, 3c. In this case, each of the coils 3a, 3b, 3c is sandwiched radially in-between overlapping passes of the single fabric tape 203, without the need for a second fabric tape. For example, the coil 3b is sandwiched between overlapping passes 203a and 203b, which may be bonded to one another axially either side of the coil 3b in order to encapsulate the coil 3b in position.

A single ripstop fabric tape may be wound additionally to form a multi-ply overlap on the outside of a frame element. Figure 9 illustrates one such "dual function" winding arrangement; the arrangement shown in Figure 9 is similar to the arrangement shown in Figure 8, but utilises a relatively wide ripstop fabric tape 204 additionally to form a series of double-ply overlaps on the outside of the coils 3a, 3b, 3c. In this case, the ripstop fabric tape 204 is arranged such that each of the coils 3a, 3b, 3c is sandwiched radially in-between first and second overlapping passes of the fabric tape 204, whilst the second overlapping pass additionally overlaps a third pass of the fabric tape 204 to form a double-ply layer overlap on the outside of the coil. For example, the coil 3a is sandwiched between successive overlapping passes 204a and 204b, whilst pass 204b additionally forms a double ply overlap with successive overlapping pass 204c. The overlapping passes 204a and 204b may be bonded to one another axially either side of the coil 3a to encapsulate the coil in position. In addition, the overlapping passes 204b and 204c may be bonded to one another in the region of the respective double-ply overlap.

Although in the embodiments described, the frame elements are located on the inside, or encapsulated within, the hose-wall, the invention is not intended to be limited to such

arrangements and the frame elements may alternatively be provided on the outside of the hose wall.

The invention finds particular application as a stretch hose for a domestic vacuum cleaning appliance, in which case the hose may be incorporated as part of a hose and wand assembly for the appliance, and in any event may be fitted to a main body of the appliance using conventional fittings. The main body of the appliance may in particular be a conventional upright body on a domestic upright cleaner, such as the main body *h* in Figures 2a and 2b.

Although in the embodiments described the hose incorporates a fabric hose-wall i.e. a hose wall constructed entirely from one or more layers of fabric, in its broadest sense the invention is not limited to arrangements wherein the stretch hose has a fabric hose-wall. The hose wall may, for example, additionally incorporate an extruded or injection-moulded plastic protective sheath or lining. Nevertheless, it is believed that the use of an impermeable fabric layer in the hose-wall will improve the resistance of the hose wall to cyclic fatigue and thus improve the useful life of the hose as compared to a conventional extruded or injection-moulded plastic stretch hose.

CLAIMS

1. A flexible hose for carrying fluid under transport, a length of the hose being extendable lengthways from a retracted length to an extended length under a tensile force applied to the hose, the extended length being at least 25% longer than the retracted length, wherein said length of the hose has an extendable hose wall formed at least in part by one or more layers of fabric, at least one layer of fabric being sealed to form an impermeable barrier to the fluid carried by the hose.

2. A flexible hose according to claim 1, wherein the hose wall is a fabric hose-wall consisting of one or more layers of fabric, at least one of the layers of fabric being sealed to form an impermeable barrier to the fluid carried by the hose.

3. A flexible hose according to claim 1 or 2, wherein one or more of said layers of fabric is substantially inelastic and incorporates sufficient slack for non-elastic, lengthways extension of the hose wall from the retracted length to the extended length.

4. A flexible hose according to claim 3, wherein at least some of the slack is provided by a series of corrugations or folds in the fabric.

5. A flexible hose according to any of claims 1 to 3, wherein at least one of the layers of fabric is woven, braided or knitted at least in part from plastic filaments.

6. A flexible hose according to any preceding claim, wherein the hose-wall incorporates at least one layer of ripstop fabric.

7. A flexible hose according to any preceding claim, wherein the hose-wall is secured to one or more reinforcing frame elements arranged for lengthways movement relative to one another in order to accommodate extension of the hose wall from the retracted length to the extended length.

8. A flexible hose according to claim 6, wherein the frame elements are resiliently connected to one another for providing a restoring force to return the hose wall from the extended length to the retracted length.

9. A flexible hose according to claim 7 or 8, wherein one or more of the frame elements is sandwiched radially in-between layers or plies of fabric forming part of the hose wall.

10. A flexible hose according to any of claims 7 to 9, wherein said layers or plies of fabric are bonded to one another, axially either side of the respective frame element, to encapsulate the frame element between the layers or plies of fabric.

11. A flexible hose according to any of claims 7 to 10, wherein the fabric in the hose wall is arranged to form a multi-ply or multi-layer overlap around the outside of one or more of the frame elements.

12. A flexible hose according to claim 7 or 8, wherein the hose wall comprises a layer consisting of a wound fabric tape.

13. A flexible hose according to claim 12, wherein one or more of the frame elements is sandwiched radially in-between two axially-overlapping passes of the wound fabric tape.

14. A flexible hose according to claim 12 or 13, wherein two or more axially overlapping passes of the wound fabric tape form a respective multi-ply overlap around the outside of one or more of the frame elements.

15. A flexible hose according to any of claims 7 to 14, wherein the frame elements are coils on a resilient helical supporting member.

16. A flexible hose substantially as herein described with reference either to Figures 4a and 4b; Figure 5; or Figures 6 and 7.

17. A flexible hose according to any preceding claim, incorporated as part of a hose and wand assembly for a surface-cleaning appliance.

18. A flexible hose according to any preceding claim, provided as part of a surface-cleaning appliance.

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Claims searched:	1-18	**Date of search:**	17 November 2009

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X,E	1, 2, 3, 4, 7, 15, 18	GB2458996 A (GIBSON) See especially Figures 1-3 and page 5, paragraph 1.
X	1, 2, 3, 4, 7, 9, 10, 11	GB560270 A (MORRIS) See especially page 1, lines 31-38 and 85-88.
X	1, 2, 3, 4, 7, 15, 18	US2007/119014 A (GORDON) See especially Figures and paragraph 0009.
X	1, 2, 3, 4, 7	US3006662 A (HIDEO) See especially column 1, lines 29-33 and column 2, lines 11-16 and Figures.
X	1, 2, 3, 4, 7	GB828676 A (HIDEO) See especially Figures and column 1, lines 12-30.
X	1, 2, 3, 4, 7, 15, 18	US4713858 A (KELBER) See especially column 3, lines 63-68 and column 4, lines 1-4
A	-	EP0409253 A (KLAUS)

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

A47L; F16L

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC, TXTE

International Classification:

Subclass	Subgroup	Valid From
F16L	0011/02	01/01/2006
A47L	0009/24	01/01/2006