Nov. 19, 1963 E. P. SENNÉ 3,110,922

HOSE CONSTRUCTION

Filed Oct. 26, 1959 3 Sheets-Sheet 1

Fig. 1.

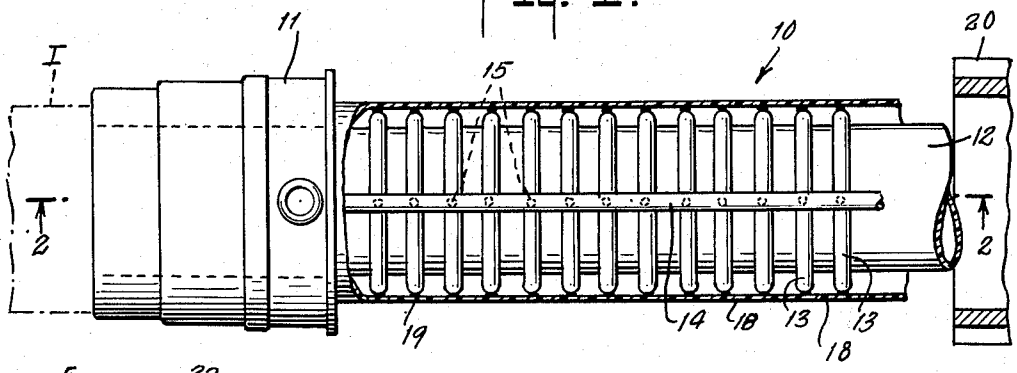


Fig. 2.

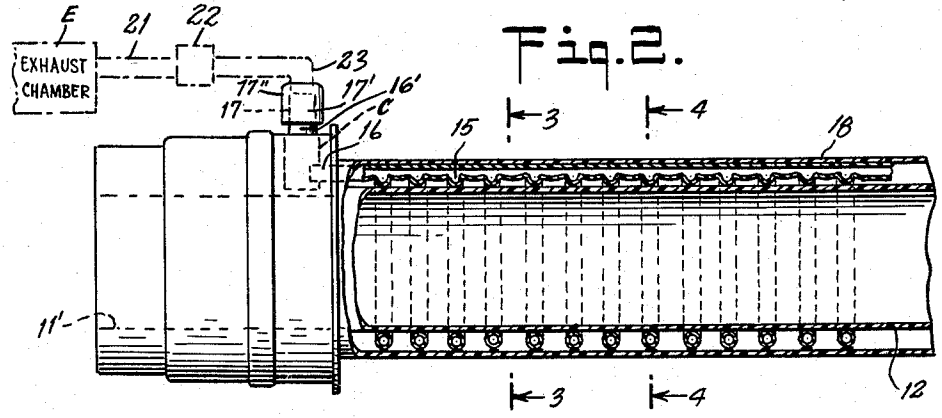


Fig. 3.

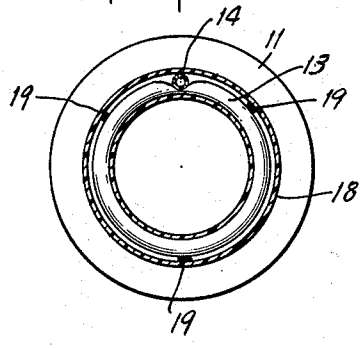
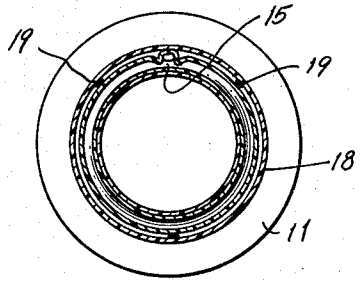


Fig. 4.



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Fig. 5.

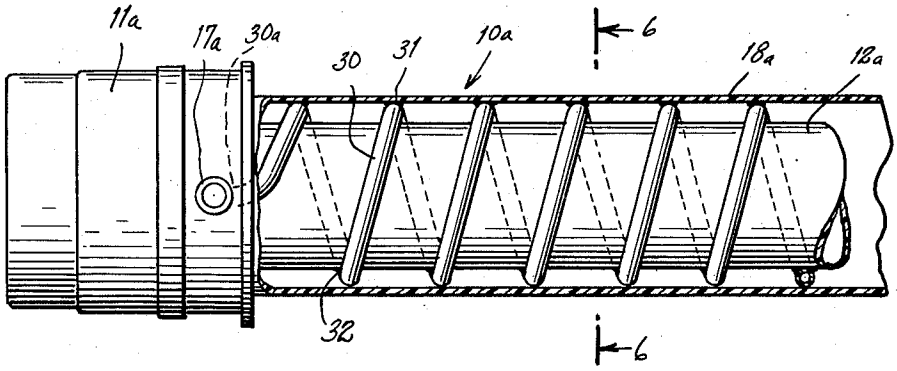


Fig. 6.

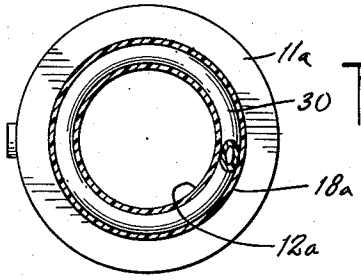
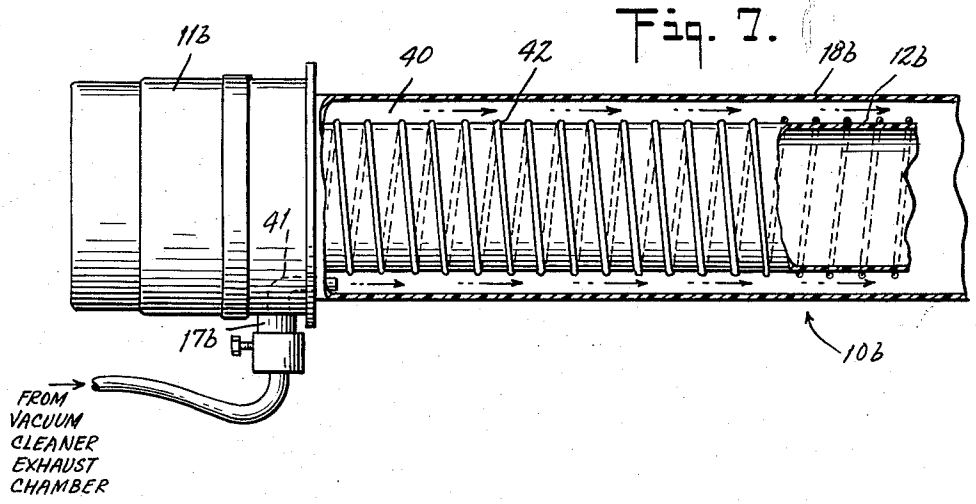


Fig. 7.



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Fig. 8.

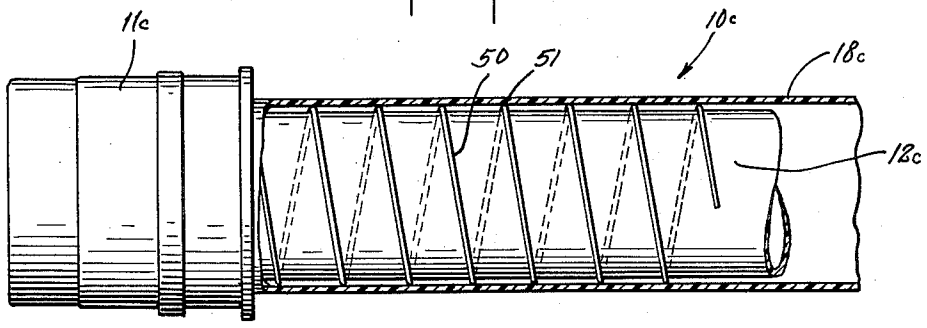


Fig. 9.

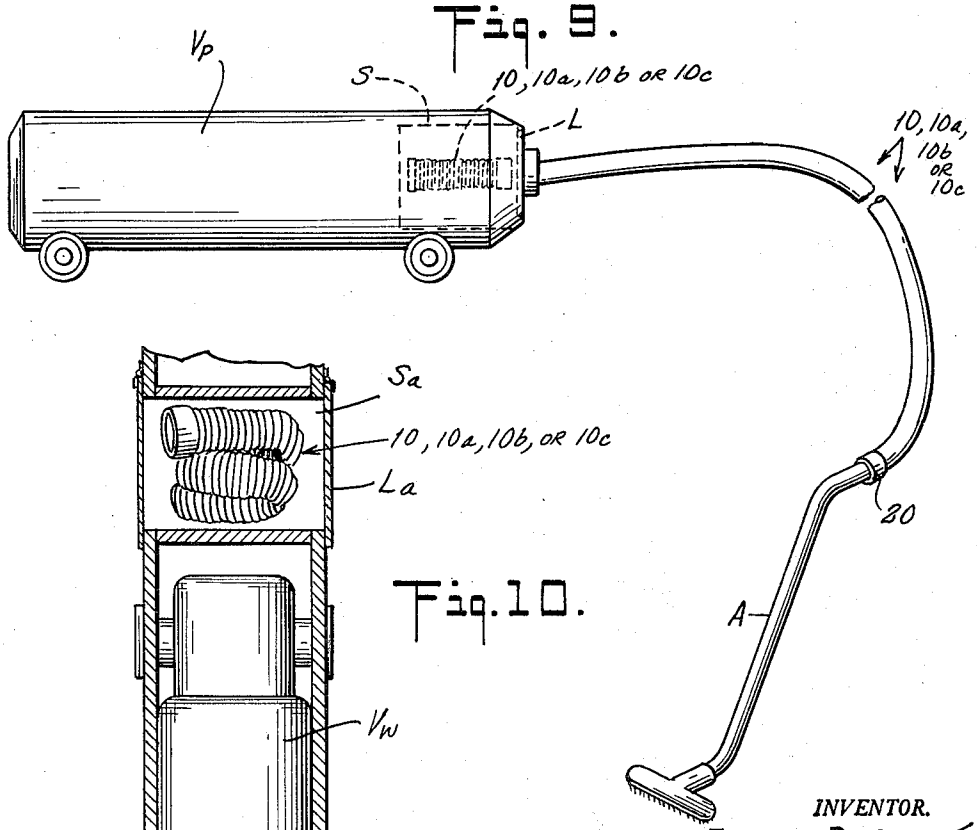


Fig. 10.

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HOSE CONSTRUCTION

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Filed Oct. 26, 1959, Ser. No. 848,588
8 Claims. (Cl. 15—327)

This invention relates to vacuum cleaners and more particularly to hose constructions for use with portable cleaners or with wall installed cleaners designed to provide cleaning service for multiple adjacent rooms. It also relates to hose constructions of general utility.

In my copending application S.N. 767,372, filed October 15, 1958, now Patent No. 3,023,447, a wall installed cleaner of the type just mentioned has been described. While the hose of the instant invention is adapted for use with the cleaner described in said application its uses with other cleaners or in fact for fluid conveying purposes of any type are contemplated and intended.

Difficulties encountered with vacuum cleaners utilizing hose between the cleaner unit and the cleaning site involve among other things, rigidity of the hose, undue heaviness, unwieldability in use and, in addition, space consuming storage problems. Although modern hose type vacuum cleaners of the stationary or portable types have become paragons of compactness and themselves require little storage space, the auxiliary equipment and primarily the hose between the cleaner and the cleaning site, has heretofore been required to be coiled up for storage when not in use. The relatively large diameters of such hoses as well as their relative rigidity has required coiling in large turns or loops and relatively massive storage space. For example, in known equipment, a hose six feet long and but two inches in diameter may on being coiled for storage purposes require as much as two or more cubic feet of storage space. Larger hose lengths require even more storage space. In addition, the metallic spring reinforcement commonly utilized in cleaner hoses makes them unwieldy to handle in coiling and to maintain in coiled condition for storage.

The present invention contemplates among its objects and features, the provision and use of collapsible hose structure which may be stored compactly in a minimally dimensioned storage compartment located adjacent the cleaner unit itself, e.g., in a wall provided receptacle if the cleaner is of the wall installed type or in small volume compartment directly provided on a cleaner unit of the portable type. It also contemplates the elimination of the necessity for providing internal solid metallic springs for hose reinforcement purposes. It also contemplates among its features and objects, use of a part of the air developed at the cleaner for inflation of the collapsible hose to impart necessary erection thereof for use with a cleaner as well as required rigidity of the hose in its extended condition to permit use of the hose with the conventional cleaning attachments commonly available.

Additionally, the invention contemplates as features and objects a major reduction in the weight of the hose in comparison with weights of hose presently extant because of the elimination among other things of the need for rigid heavy reinforcements in the form of metallic springs now commonly used.

Further objects and features of the invention are the provision of collapsible hose which may be expanded into operative condition by the use, if desired, of buoyant gases such as helium or other lighter than air gases to provide still further reduction in weight of the collapsible hose, a problem of considerable importance especially where the collapsible hose is extremely long.

While the principles embodied in this invention are described particularly with respect to hose for use in conjunction with vacuum cleaner hoses, use is not restricted

to such applications. For example, long hoses extant for loading purposes in ship to shore installations which are cumbersome to manipulate as well as extremely bulky and heavy may be replaced readily by hoses embodying this invention and collapsed hoses stored conveniently in small space dockside when not in use and readily and quickly expanded for use when required. Such hoses will also be much lighter than the hoses extant and use of air or lighter than air gases for inflation and expansion purposes will provide sufficient buoyancy to float long lengths of hose between ship and shore or ship and ship installations thus relieving weight on the dock and ship couplings as well as reducing materially the size and strength required for booms and derricks now commonly used to manipulate hoses for attachment between ship and shore or ship and ship.

Other applications of the hoses embodying this invention for example, to aeronautic uses, e.g., use for fuel transfer purposes between planes or space ships become apparent to persons skilled in the art and such applications all are contemplated as features and objects of this invention.

Additional objects and features of the invention include economy of use, simplicity of hose construction, and low production cost.

Further objects and features of the invention will become apparent from the following specification and the accompanying drawings forming a part hereof wherein:

FIGURE 1 is a partially broken away elevational view of a fragmentary length of one form of hose, embodying the invention;

FIGURE 2 is a partial longitudinal sectional view taken along the plane of line 2—2 of FIGURE 1 and viewed in the direction of the arrows;

FIGURE 3 is a transverse cross section taken along the plane of line 3—3 of FIGURE 2 also viewed in the direction of the arrows;

FIGURE 4 is a transverse cross section taken along the plane of line 4—4 of FIGURE 2 again viewed in the direction of the arrows;

FIGURE 5 is a partially broken away elevational view of another form of hose embodying the invention;

FIGURE 6 is a transverse section taken along the plane of line 6—6 of FIGURE 5 and viewed in the direction of the arrows;

FIGURE 7 is a partially broken away elevational view of still a further form of hose embodying the invention, illustrating use thereof with a vacuum cleaner as the source of air supply for inflation of the hose for use;

FIGURE 8 is a partially broken away elevational view of still a further form of hose;

FIGURE 9 illustrates hose of the invention as used with a portable vacuum cleaner; and

FIGURE 10 is a vertical section of a wall installed vacuum cleaner equipped with hose embodying the invention.

Referring to the drawing and first to FIGURES 1–4, inclusive, the reference character 10 denotes generally a collapsible hose embodying the invention. This hose comprises a tubular fitting or coupling member 11 at one end of the hose and by which it may be connected to any desirable device such as the suction inlet 1 for example, of any type of vacuum cleaner. A collapsible, inner tubular skin or liner 12 for example of polyethylene, latex or other conventional lightweight synthetic or natural material having characteristics of strength and air or gas impermeability similar to that of polyethylene or latex is provided. This liner or skin has any desired selected length from about 6 feet upwards to 50 or more feet as required. One end of this liner or skin 12 is secured as by cementing or clamping in leakproof manner in any conventional way to the fit-

ting 11 to communicate with an opening 11' of said fitting so that free communication exists between the tubular passage defined by the liner or skin 12 and the opening 11' of said fitting without leakage at the joint. A group of independent tubular rings or tubular toroidal elements 13 preferably of the same material as skin 12 are disposed at spaced apart points along the length of the liner or skin 12. These rings or elements 13 are joined by a common tubular duct 14 also preferably of the same material as said rings or elements 13 and extending longitudinally in the direction of the tubular inner skin or liner 12. Each ring or element 13 communicates at openings 15 with the common duct 14 so that inflation of the rings 13 from a common source with air, or inert lighter than air gas such as helium, or any other desired gas may be effected. One open end 16 of the duct 14 terminates in a small chamber C provided internally of a wall of the fitting 11, and is in communication there with an inflating valve 17 of conventional type. This valve 17 is mounted in the wall of fitting 11. The valve has a part 16' which protrudes outwardly of the fitting 11 which is provided with a cap 17'' which is removable so that a gas inflation source, such for example as exhaust chamber E, may be connected to valve part 17' to effect inflation to desired pressure of the rings 13 via said valve 17, said chamber C and said duct 14.

An outer protective skin or cover 18 surrounds the rings 13. This cover 18 likewise of tubular form is preferably of the same rugged, light, pliant, collapsible material as the inner skin or tube 12 namely, polyethylene, latex or the other materials mentioned. Its weight and thickness may be comparable to that of the inner liner. In the alternative because of its being subject to greater wear and tear than the inner liner 12, the outer skin or cover 18 may have wear resisting reinforcement as by being thicker-walled where needed. The annular tubular rings or tubular toroidal elements 13 by preference are of the same material as that of the outer and/or inner skins. The spacing between rings or elements 13, which as shown is substantially uniform, is maintained conveniently by securing the outer surface of each ring at conveniently located points 19 for example 120° apart respectively to the inner surface of the outer skin 18 and to the outer surface of the inner skin 12 (see FIGURES 3 and 4). The securement may be by cementitious adhesion, fusion or by any other convenient means sufficiently strong to provide secure attachment and resistance to separation despite frequent inflation of the rings or elements 13 with gases admitted via the valve 17 and collapse or deflation at intervals between usages of the hose 10.

The other end of the collapsible hose 10 is equipped with a suitable end coupling member 20 to which both skins are secured. In the case of a vacuum cleaner hose the member 20 will mount removably the conventional different attachments, such for example as denoted at A in FIGURE 9, which are commonly used by a housewife for cleaning purposes. Where the hose is intended for other types of use, the end coupling 20 as well as the end coupling 11 may be modified to meet necessary conditions for attachment to any desired receptacle or attachment.

In idle periods, the tubular rings 13 as well as the duct or conduit 14 are uninflated and assuming that valve 17 has been opened to bleed gas previously injected into these members, the hose 10 is in a collapsible state. Then because of the nature of the materials of its inner and outer skins 12 and 18, rings 13 and duct 14, the hose 10 may be compactly folded or collapsed into a package of extremely small volumetric dimensions. Such collapsed or folded hose 10 may be then fitted into a very small storage compartment S (FIGURE 9) provided for example, as an adjunct of a portable

vacuum cleaner Vp or a similar compartment Sa adjacent a wall installed cleaner Vw (FIGURE 10). In either event the compartment S or Sa is provided with an access lid or door L or La which when closed both protects and conceals the collapsed hose 10 stored within the particular compartment.

When it is desired to utilize the collapsed hose 10 with vacuum cleaner Vp or Vw or for any other purpose it is readily removed from the storage chamber S or Sa by opening the lid or door L or La as the case may be. Its rings 13 are then inflated via valve 17 and duct 14 by connecting a source P of inflating gas to the valve 17.

The source of inflating gas in the case of a vacuum cleaner conveniently may be air tapped from the conventional dirt exhaust chamber or blower end of the particular vacuum cleaner via a small tap conduit 21 including a pressure regulating valve 22 (FIGURE 2). The tap conduit 21 has an outlet 23 which is connectable either manually or automatically to the valve 17 after or immediately upon attachment of coupling 11 to the suction intake inlet I of the vacuum cleaner. Thus immediately when the cleaner is turned on inflating air derived from the exhaust chamber E is directed via valve 17, chamber C and duct 14 to the inflatable rings 13 causing the erection of the hose assembly 10. Rigidity is controlled by the inflation pressure as monitored for example by the pressure regulating valve 22. This valve of conventional type may be interconnected in conventional ways with valve 17 to provide for automatic bleed of the inflation gas from the rings or elements 13 whenever the vacuum cleaner is turned off.

When the hose is utilized for other than vacuum cleaner purposes, other inflation gases may be utilized for example helium or other non-dangerous lighter than air gases. In such event the valve 17 is conveniently of the spring type commonly used on, for example, automobile tires and its intake part 17' after removal of cap 17'' is readily connectable to a nozzle (not shown) on a conduit from a pressurized source (e.g. a tank, not shown) of the lighter than air gas. Inflation to desired pressure and rigidity is readily effected by use of conventional control valves and pressure gauges. The lighter than air gas used for inflation of the rings 13, then serves to provide a buoyant effect in addition to its inflation effect and to thus reduce the weight of the hose as a function of the particular lighter than air gas used, as compared with the weight of the hose 10 when ordinary air inflation is used. This is of importance particularly where light weight hose of long length is requisite as in hose used with stationary wall installed vacuum cleaners for large or multi-room cleaning or as in hose between planes for the transfer of fuel or other fluids between them while in flight. If extremely long lengths are utilized for vacuum cleaning purposes, the buoyancy effected by inflation with helium or other lighter than air gas may be utilized to achieve a material net weight reduction and thus facilitate maneuverability of a long hose by a housewife or other user of such hose.

Alternative modes of embodying the invention as has been stated above are also possible. One such embodiment is illustrated in FIGURES 5 and 6. Therein the collapsible hose 10a has some components substantially identical with those described with respect to FIGURES 1–4, inc. These components bear the same reference characters as their counterparts in the first embodiment with the added suffix *a*. In the embodiment of FIGURES 5 and 6, however, a tubular snake or spiral 30 replaces the tubular rings 13 and duct or conduit 14 of FIGURES 1–4, inc. This snake or spiral 30 lies between the inner and outer skins 12a and 18a. It is of the same light weight, durable material as said skins e.g. polyethylene, latex or equivalent synthetic or natural material as hereinbefore mentioned. Preferably this tubular snake 30 is secured at selected intervals 31 and 32 to the inner surface of outer skin 18a and to the outer sur-

face of inner skin 12*a* in any of the ways described with respect to the securement of tubular rings 13 to the skins 12 and 18. An open end 30*a* of this tubular snake 30 is coupled to the valve 17*a* so that inflation of snake 30 may be effected in the same way as rings 13 for the purpose of erecting the hose 10*a* for use. The number of turns of snake per unit length of hose is selected so that inflation of the snake 30 to a selected safe pressure will maintain desired rigidity and longitudinal erect elongation of the hose during its use. As with the first embodiment, the snake 30 in deflated condition permits compact crumpling or folding of the hose 10*a* into small storage spaces S or Sa as illustrated in FIGURES 9 and 10, while in inflated condition it serves to maintain the hose 10*a* extended and in a sufficient state of rigidity to permit its performing as a vacuum cleaning conduit for cleaning purposes if attached to a vacuum cleaner V*p* or V*w* or as a conduit for fluid delivery or withdrawal for any intended purposes. If the inflation medium is lighter than air gas, the added buoyancy provided by such gas serves again to provide a substantial weight reduction in the hose assembly 10*a* as compared with a like one using air for inflation.

A still further embodiment is illustrated in FIGURE 7 and herein parts corresponding substantially identically to those of FIGURES 1–4 bear like reference characters with the added suffix *b*. Herein, again the inflatable rings 13 of FIGURE 1 are eliminated entirely and the chamber 40 defined between the inner and outer skins 12*b* and 18*b* is in direct communication with the valve 17*b* via a short passage conduit 41 in coupling 11*b* so that inflation gas delivered to valve 17*b* in any of the ways hereinabove described will serve to fill the chamber 40 and expand the outer hose skin 18*b* to a desired state of elongation and rigidity. The inner skin 12*b* is preferably surrounded by a light weight spiral spring 42 of round or flat cross section and preferably of the same material, synthetic or natural material, as that of said skin, namely, polyethylene, latex or any of the other suitable light weight materials hereinabove mentioned. The pitch of the spring and the diameter or thickness of the material composing it are selected within ranges imparting sufficient strength to said spring to reinforce the inner liner or skin 12*b* against collapse in use as a vacuum line or against diametrical expansion when the hose is used as a filling line. The inner spring surfaces are secured entirely or at selected intervals to the outer surface of the inner skin 12*b* by cementing, or fused junction or in any other suitable ways to effect these purposes. In addition the spring strength in relationship to its direction of axial compression is extremely light so that in uninflated conditions of the chamber 40, the hose assembly may be longitudinally compressed and collapsed to fit within a small storage space like spaces S or S*a* of FIGURES 8 and 9 maintained therein by a lid or door closure L or L*a*. Upon opening of said lid or door, the resilient spring 41 will tend automatically to discharge the longitudinally compressed and collapsed hose 10*b* from its storage space to facilitate its preparation for use. Inflation thereafter of the chamber 40 via valve 17*b* with air or lighter than air gas to desired pressures in any of the ways described as regards FIGURES 1–4 or 5 and 6 will impart required rigidity to the hose assembly by expansion of the outer skin 18*b*. The spring 42 will preclude flattening collapse of the inner skin 12*b* because of its attachment thereto and reinforce it against blowout towards the outer skin 18*b*.

In still a further embodiment illustrated diagrammatically in FIGURE 8, and in which parts corresponding substantially identically to those of FIGURE 1, bear the same reference characters with the added subscript *c*, the inner skin 12*c* and the outer skin 18*c* lie in close proximity. These outer and inner skins are reinforced by a spiral preferably rectangularly cross sectioned spiral spring 50 of material similar to that of spring 42 of FIGURE 7. Spring 50 lies between the two skins. Herein, again, the spring 50 has its outer surface secured either entirely or at selected intervals 51 along its length both to the inner surface of skin 18*c* and to the outer surface of skin 12*c*. The thickness of the material forming the spring 50 and the number of its turns per unit length are selected to provide radial strength to the spring for reinforcement of the skins sufficiently to prevent collapse of the skins 12*c* and 18*c* when the hose 10*c* is used as a vacuum line or to prevent over expansion when the hose 10*c* is used as a conductor of fluids even under pressure. The spring 50, however, is collapsible in longitudinal axial direction so as to permit longitudinal collapse of the hose 10*c* into small storage space e.g. space S of FIGURE 9 or space S*a* of FIGURE 10 when not in use, and, being of light weight material, in conjunction with the lightness of weight of the skins 12*c* and 18*c* itself does not provide an unwieldy heavy burden to the user of the hose in cleaning or other purposes. At the same time the spring 50 permits compact storage of the hose 10*c* when not in use and facilitates its ready and quick expansion on opening of the lid or cover L or L*a* of the storage space S or S*a* in which the idle hose has been stored.

In the hose of FIGURES 7 and 8, manual pressures necessary to compress the springs 41 or 50 axially for collapse of the respective hoses 10*b* and 10*c* should not exceed 4 or 5 p.s.i., a convenient pressure the average housewife can exert without undue effort.

While specific embodiments of the invention have been described, many variations in structural detail within the scope of the appended claims are possible and are contemplated. There is no intention, therefore, of limitation to the exact details herein above set forth.

What is claimed is:

1. In a fluid flow apparatus having a fluid flow discharge opening and at least an additional fluid flow opening, a collapsible hose device comprising a collapsible inner skin, a collapsible outer skin, said outer skin substantially enclosing and being spaced from said inner skin to form an inflatable chamber between said skins, and means for connecting said chamber to said flow discharge opening to inflate said chamber independently of the interior of said inner skin, and means for connecting the interior of said inner skin to said additional opening, whereby the fluid from said discharge opening will inflate said chamber relative to the pressure without said outer skin to cause said collapsible hose device to become erect and resistant to deformation.

2. A fluid hose comprising a collapsible inner tubular skin, a collapsible outer tubular skin substantially encircling said inner tubular skin, said outer skin spaced from said inner skin to form a chamber between said skins, and means to inflate said chamber including a source of fluid under pressure and a tubular conduit within said chamber in communication with said source of fluid pressure, whereby when said conduit is inflated with said fluid under pressure said hose becomes erect and resistant to deformation.

3. A fluid hose comprising a collapsible inner tubular skin, a collapsible outer tubular skin substantially encircling and spaced from said inner skin thereby forming a chamber between said skins, a collapsible tubular conduit within said chamber, said conduit being in contact with said inner skin and with said outer skin, whereby when said conduit is inflated with fluid under pressure said hose becomes erect and resistant to deformation.

4. A fluid hose comprising a collapsible inner tubular skin, a collapsible outer tubular skin substantially encircling and spaced from said inner tubular skin to define a chamber between said skins, a collapsible tubular conduit within said chamber and in contact with said outer skin and said inner skin, said tubular conduit being wrapped around said inner skin, whereby when said conduit is inflated with fluid under pressure said hose becomes erect and resistant to deformation.

5. A fluid hose comprising a collapsible inner tubular skin, a collapsible outer tubular skin spaced from said inner skin to form an annular chamber between said skins, interconnected collapsible tubular rings deployed in said chamber in contact with said inner skin and said outer skin, whereby when said rings are inflated said hose becomes erect and resistant to deformation.

6. A fluid hose comprising a collapsible inner tubular skin, a collapsible outer tubular skin substantially encircling and spaced from said inner tubular skin to form an annular chamber between said skins, a source of fluid under pressure, a plurality of spaced apart independent collapsible tubular rings in said chamber, each of said rings wrapped around said inner tubular skin and attached to both said inner tubular skin and said outer tubular skin, a tubular duct in communication with each of said tubular rings and with said source of fluid under pressure, whereby when said tubular rings are inflated through said tubular duct by fluid under pressure from said source said hose will become erect and resistant to deformation.

7. In a vacuum cleaner having an exhaust outlet, a collapsible suction hose comprising a collapsible inner tubular skin, a collapsible outer tubular skin substantially coaxial with and spaced from said inner tubular skin to form a chamber between said skins, a collapsible tubular conduit within said chamber and in contact with said outer skin and said inner skin, said tubular conduit deployed to encircle said inner skin, a second conduit in communication at one end with said exhaust outlet and at its other end with said tubular conduit, whereby the air from said exhaust will inflate said tubular conduit to cause said hose to become erect and resistant to deformation.

8. In a vacuum cleaner having an exhaust outlet, a collapsible suction hose comprising a collapsible inner tubular skin, a collapsible outer tubular skin substantially coaxial with and spaced from said inner tubular skin to form a chamber between said skins, a plurality of spaced apart independent collapsible tubular rings in said chamber, each of said rings encircling said inner tubular skin and attached to both said inner tubular skin and said outer tubular skin, a tubular duct in communication with each of said tubular rings, a conduit in communication with said tubular duct and with said exhaust outlet whereby the air from said exhaust will inflate said tubular rings causing said suction hose to become erect and resistant to deformation.

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