

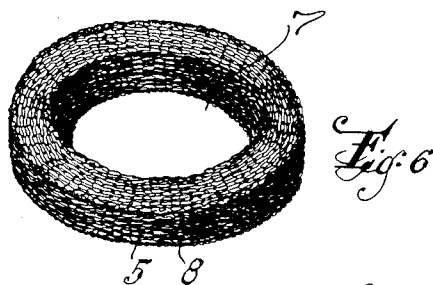
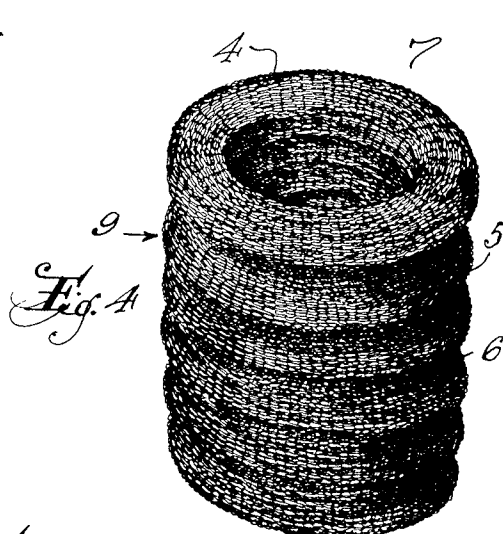
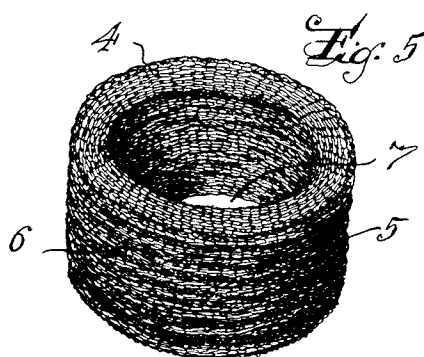
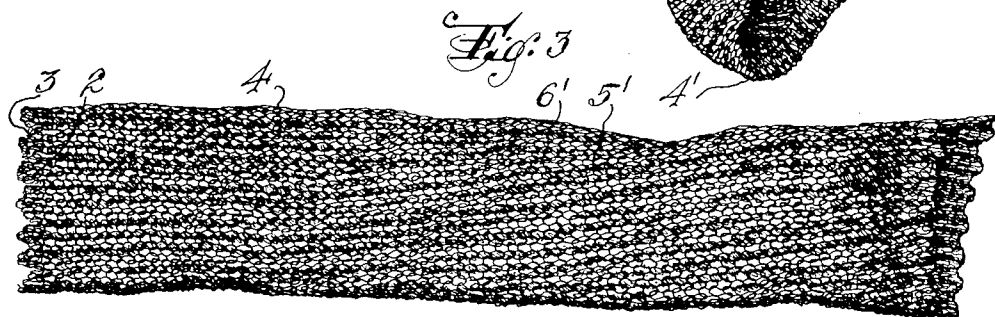
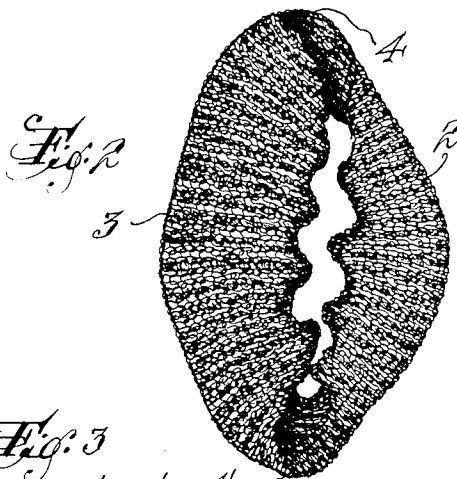
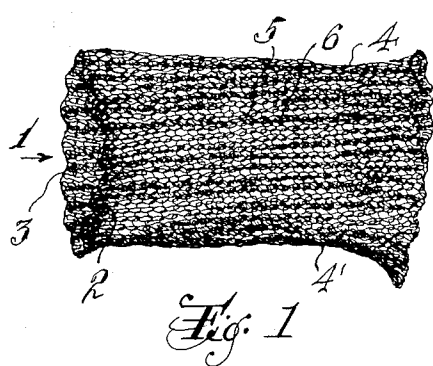
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ELASTIC METAL MESH TUBULAR BELLOWS

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ELASTIC METAL MESH TUBULAR BELLOWS

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3 Claims. (Cl. 267—1)

This invention relates to the production of densitized elastic metal mesh bellows, using flexible knitted or woven wire sheet material, corrugated in a specific manner, as will be hereinafter set forth.

The production of knitted or woven wire mesh in sheet or sleeve form is an established industry, and various materials such as filters and strainers have been made by densitizing or compressing such material in a die. It has been proposed in the art to corrugate such mesh fabric transversely (i. e. across the narrow portion), and to fold over the fabric, so that the corrugations cross each other. When such corrugated and folded-over fabric is rolled into a tube or cylindrical form and compressed into a denser mass, it is claimed that an interlocking of the mesh takes place giving a more rigid, non-extensible structure.

In the present invention, one or more strips of knitted or woven wire fabric are corrugated longitudinally, i. e. along the long portion of the fabric, and this corrugated material is rolled into a hollow cylinder in a peripherally nesting relation, on a mandrel, and the cylinder is compressed in a cylindrical die, by an annular ram while still on the mandrel, to produce a densitized elastic bellows of flexible knitted fabric, which has been found to be particularly well suited for a number of uses, such as in vibration dampeners, shock mounts, flexible cables, electrical shielding and the like. A die including a ram, i. e. a die limiting the external and internal dimensions of the mesh cylinder also may be used.

When knitted wire is employed, the fabric made therefrom is generally made in the form of a sleeve. This sleeve may be pressed or rolled into a double-layer sheet of knitted fabric, which may be employed as the starting material for the products and process of the present invention.

The invention may be more readily understood by reference to the drawing in which Figure 1 represents a longitudinally-corrugated flattened sleeve comprising a double layer of knitted fabric, the end view of which is depicted in Figure 2. Figure 3 shows a double layer of fabric similar to that in Figure 1 in which the corrugations are slightly inclined to provide a helically conformed bellows, as will be hereinafter more fully described. Figure 4 illustrates the sheets shown in Figure 1 after they have been rolled around a mandrel, while Figure 5 depicts the rolled cylinder of Figure 4 after it had been densitized by compressing it into bellows form in a cylindrical die around a mandrel. In Figure 6 is shown the bellows in Figure 5 densitized still further by compressing it in the same manner until only the outer convolutions of the bellows are visible from the outside. Similar numerals refer to similar parts in the various figures.

Referring again to the drawing, numeral 1 represents a flattened sleeve of knitted wire textile comprising sheets 2 and 3 interconnected at edges 4 and 4'. The flattened sleeve 1 carries corrugations 5 disposed longitudinally, i. e. along the long dimension or axis of the sleeve.

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Such corrugations may be made by passing the sleeve 1 between corrugating rolls.

The corrugated sheets 1 are then rolled (around a mandrel) with the corrugations in nesting relation with each other, producing a loosely nested, hollow cylinder 9 in which the outer convolutions 5 and the inner convolutions 6 form the tubular bellows-shape around hollow core 7. Cylinder 9 and the mandrel therein are then inserted in a hollow cylindrical die having an internal diameter approximating the outer corrugation diameter of cylinder 9. Thereafter, pressure is applied upon upper surface 4 of cylinder 9, compressing the cylinder to a denser, bellows-shaped cylinder, such as that shown in Figure 5, or even to a still denser form as in Figure 6 wherein the inner convolutions 6 are not visible and the outer convolutions 5 are perceived as adjacently disposed layers separated by line boundaries 8.

If it is desired to make the convolutions of the bellows in the form of a spiral, the corrugations are applied on the fabric sheets at a slight incline as in Figure 2, so that the outer convolutions 5' and the inner convolutions 6' therebetween form, when the sheets are rolled in nesting relation to each other and compressed as aforesaid, a helical or screw bellows which may be screwed onto a support or the like.

By applying the aforesaid technique it is possible to produce easily and readily, extensible, flexible, elastic bellows of practically any shape, density, or form, by use of proper dies and pressures. If a fine flexible wire of small diameter is employed in producing the fabric, the resulting bellows possesses exceptionally long life due to the fact that the individual fibers, when in use, are not subjected to stress or strain beyond their elastic limits. The wire may be of any suitable metal such as stainless steel, bronze, brass, silver, and so forth, or it may be intermixed or interwoven with other non-metal fibers such as those of glass, plastic such as polysilicone, nylon, polyacrylonitrile, and its copolymers, and so forth, or natural textile fiber such as cotton, wool, and the like, care being taken not to dilute the metal fibers to such an extent that the bellows lose their elasticity or resiliency.

The bellows produced according to this invention may be impregnated with plastic, rubber, or other impervious material to serve as a conduit, hose or cable of exceptionally high resiliency and suffering practically no damage upon lateral or vertical collapse thereof.

When produced according to the method outlined herein, the metal mesh bellows serve admirably as shock mounts or vibration dampeners and have advantages over rubber or plastic elements because they do not become brittle at excessively low temperatures and thus remain serviceable, even at elevated temperature which cannot be withstood by most organic or inorganic cushioning materials.

The term "woven" employed herein shall include knitted material.

From the aforesaid description, it is apparent that the amount of weight or force necessary to produce a specified bellows movement will depend upon the size and nature of the wire used in the mesh fabric. The larger or stiffer the wire, the greater will be the load necessary for deformation, and it is possible, by selecting the proper size and stiffness of wire, density of mesh, diameter of bellows, width of corrugations, number of peripheral layers of fabric, pressure of densitization, etc., to produce a bellows for practically any shock cushioning uses.

Although a cylindrical bellows shape is preferred, it is possible to produce, by proper selection of dies and mandrels, tubes having a square, oval, rectangular, or any other section, and the internal shape may be made

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different from the external by changing the shape of the die and/or mandrel.

As to the production of the helical bellows by corrugating the fabric at a slight incline with respect to the long axis of the fabric, it is possible to produce a helical form of any desired diameter by adjusting the extent of the inclination of the corrugations so that, when nested peripherally in a cylindrical shape, the desired outer dimensions are obtained.

It is to be understood, also that the springiness of these densitized wire mesh bellows may be improved by incorporating in said bellows, a spring or other elastic component, preferably one having the same general shape as the bellows. For example, a helical wire spring may be incorporated within the peripheral layers of a corrugated bellows similar to that shown in Figure 4 made of fabric such as that shown in Figure 3, the wire of the spring fitting into the corrugations of the fabric. Thereafter, the bellows may be densitized by the method already outlined, thus incorporating the spring as an integral member of the bellows wall to give the wall speedier recoil characteristics.

In using the present bellows elastic elements for vibration dampening or shock mounts, the ends of the bellows are preferably mounted or anchored to the members involved, i. e. one end would be mounted on or anchored to the base while the other end would be mounted on or anchored to the instrument or other device to be protected against vibrations. The term "vibration dampener" used herein shall include shock mounts and similar devices.

The densitized bellows disclosed herein, also may be extended longitudinally to any desired point beyond their elastic limit to produce a longer bellows which are capable of giving a greater elastic deflection with lighter loads.

The superiority of the present bellows element over conventional compressed mass elements depends to a great extent upon the fact that, due to the bellows shape, deflection of the entire element takes place responsive to the load, the individual mesh components moving independently only to adjust themselves to the overall movement of the element, whereas in the case of the compressed non-bellows mass elements, response to a load is taken up to the greatest extent by deflection of the

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individual components, with very little response being taken up by the complete element as a whole.

As mentioned heretofore, the compressed bellows may be stretched after compression to impart greater elasticity and making the unit adaptable to handling light loads without deformation of the mesh structure.

We claim:

1. An elastic bellows-shaped tube having corrugated walls, comprising a plurality of peripherally nested layers of woven flexible metal wire mesh fabric, said nested layers having been compressed into densitized form and corrugated at right angles to the axis of the tube.

2. A process for producing elastic bellows-shaped tubes in densitized form, comprising corrugating wire mesh fabric along the length of the fabric, rolling said fabric into a hollow cylinder with the corrugated fabric peripheral layers nesting into each other, placing the cylinder into a die having limiting means for limiting the external and internal diameters of said cylinder, and compressing said cylinder in said die.

3. A process for producing elastic bellows-shaped tubes in densitized form, comprising corrugating wire mesh fabric along the length of the fabric, rolling said fabric into a hollow cylinder with the corrugated fabric peripheral layers nesting into each other, placing the cylinder into a die having limiting means for limiting the external and internal diameters of said cylinder, compressing said cylinder in said die, and stretching said cylinder in the direction of its axis to impart further elasticity thereto.

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