

Sept. 25, 1945.

G. TOEPPER ET AL

2,385,389

TUBING CONSTRUCTION

Filed Feb. 8, 1941

FIG. 1.

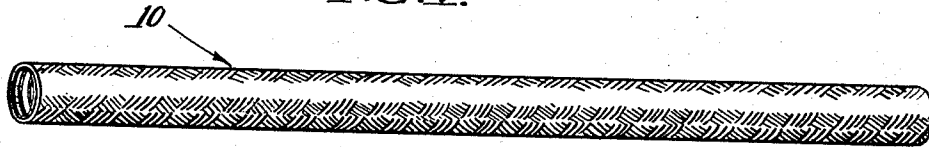


FIG. 2.

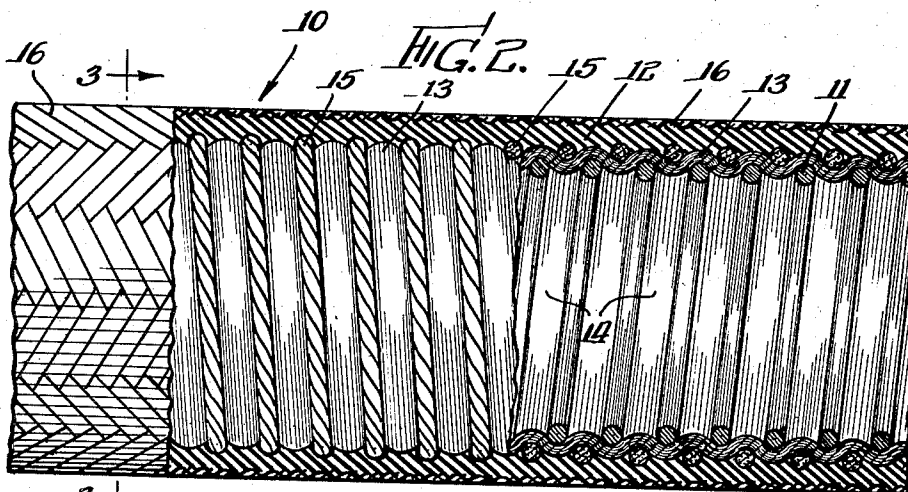


FIG. 5.

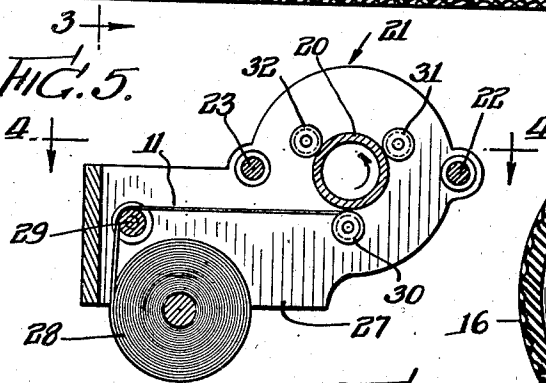


FIG. 3.

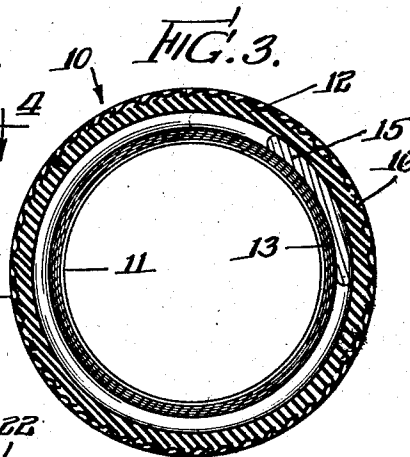
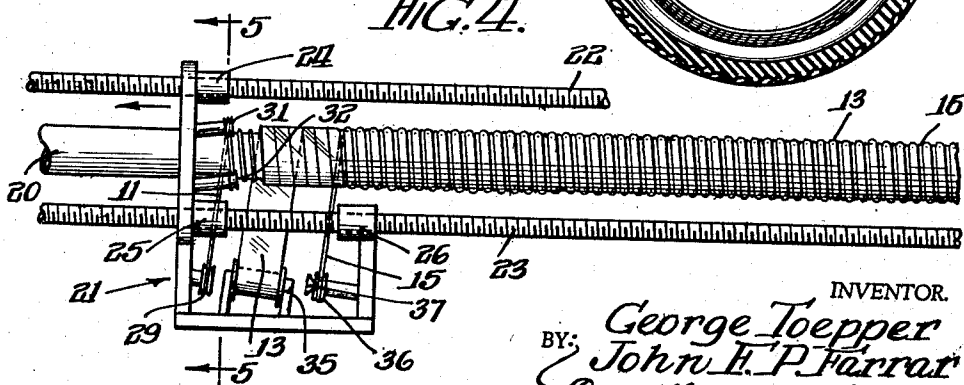


FIG. 4.



INVENTOR.

George Toepper
BY: John H. P. Farrar
Cox Moore & Olson attys.

UNITED STATES PATENT OFFICE

2,385,389

TUBING CONSTRUCTION

George Toepper and John F. P. Farrar, Maywood, Ill., assignors to Chicago Metal Hose Corporation, Maywood, Ill., a corporation of Illinois

Application February 8, 1941, Serial No. 378,106

1 Claim. (Cl. 138—59)

This invention relates to tubing constructions, and more particularly to flexible tubings of the type fabricated of a plurality of different materials.

It is an object of the invention to provide a fluid conducting flexible tubing of new and improved construction, and more particularly to provide new and improved structures, and methods of fabrication, for flexible tubings of the type composed of a plurality of different materials or elements arranged and associated in the composite structure in a particular manner so as to enable each such material or element to best perform its intended function and impart its desired characteristic to the structure.

Further objects of the invention are to provide flexible tubing structures, particularly adapted for transmitting hydrocarbon fluids, of increased flexibility, decreased weight, and lower cost.

Various additional objects, advantages and features of the invention will appear from the following specification when taken in connection with the accompanying drawing, wherein a preferred embodiment of the invention is set forth for purposes of illustration.

In the drawing, wherein like reference numerals refer to like parts throughout:

Fig. 1 is a general assembly view of a flexible tubing structure or construction fabricated in accordance with the principles of the invention;

Fig. 2 is a view of the tubing of Fig. 1, on an enlarged scale, and shown partly in longitudinal section;

Fig. 3 is a transverse, sectional view, on the line 3—3 of Fig. 2;

Fig. 4 is a view, somewhat diagrammatic in form, illustrating a method of fabricating the tubing, in accordance with the principles of the invention, Fig. 4 being taken on the line 4—4 of Fig. 5; and

Fig. 5 is a sectional view through the apparatus of Fig. 4, and taken on the line 5—5 thereof.

Referring more particularly to the drawing, and first to Figs. 1, 2 and 3 thereof, it will be seen that the tubing structure illustrated, generally indicated by the numeral 10, comprises an inner metal core construction 11, an outer cover construction 12, and an intermediate wall structure 13 interposed between the core and the outer cover and adapted to form a separation barrier therebetween.

More specifically, the metal core 11 comprises a metal wire formed into a series of spiral or helical convolutions, the convolutions being in

spaced relationship whereby to provide a series of spaces or the like 14 between the individual wire coils. The wire 11 may be of any suitable metal such, for example, as copper or the like.

The intermediate wall structure 13, in the particular embodiment illustrated, comprises a series of superposed sheets of regenerated cellulose, the sheets being sufficient in number and relation to form a fluid-impregnable wall structure encompassing the core wire 11. To maintain the cellulosic wall structure 13 in intimate association with the wire core, and also to impart a wave-like cross section to the wall whereby to permit the flexing of the hose, a cord 15 of any suitable fiber or the like is provided in encompassing relation to the wall 13, the cord being convoluted and so wrapped about the wall as to cause its convolutions to lie between the convolutions of the wire 11, as best shown in Fig. 2. The cord 15 is wrapped tightly around the wall 13, holding it in position, and imparting to it the wave-like formation shown in Fig. 2.

The outer cover 12 in the particular embodiment illustrated comprises a wall of rubber or like material vulcanized onto the wall 13 and the cord 15 in encompassing relation as shown. If desired, the external surface of the wall 12 may be provided with a layer of rubber-impregnated fabric or the like 16 to increase resistance of the structure to external abrasion or abuse.

In the operation of the structure, in use, it will be noted that the metal core construction comprising the spirally or helically arranged wire 11, forms a core structure of minimum weight and of maximum flexibility. At the same time the wire coil constitutes a firm base for the intermediate and outer wall structures, and imparts the necessary body and strength to the hose structure. The spacing between the coil convolutions permits of a relatively large flexibility of the structure, as compared with hose constructions incorporating a continuous inner metal wall, for example of interlocked spiral metal tubing. Additionally, the spacing of the wire convolutions, which spacing may be varied as desired in accordance with the requirements of any particular installation, imparts to the metal core structure a minimum weight and mass. In other words, the strength of the metallic core is utilized while eliminating the inherent difficulties of weight and decreased flexibility.

The embodiment of hose structure set forth is particularly adapted for conducting hydrocarbon fluids, such as gasoline, and other motor fuels and the like, and to that end it will be noted

that the cellulosic wall 13 forms an impregnable barrier between the inner surfaces of the hose and the outer rubber wall 12. Accordingly, the rubber material, which has the characteristic of being attacked and deteriorated by hydrocarbon fluids, such as gasoline, is protected from the fluids transmitted through the hose and maintained at all times out of contact therewith. The superposed layers or sheets of regenerated cellulose, maintained in intimate and firm contact, form an impregnable fluid-tight seal. In order that the wall structure 13 shall not in any way interfere with the flexibility of the hose, it will be noted that the cord 15 is provided, whereby to maintain the cellulosic wall in wave-like contour, permitting of ready flexing or flexibility. The cord 15 not only imparts this shaping to the cellulosic wall, but also aids in maintaining the superposed cellulosic sheets in firm contact and in intimate relation to the wire 11. Additionally, the cord, upon application, maintains the parts in position to facilitate the application of the vulcanized rubber cover wall 12.

The outer rubber cover wall 12 and the associated rubber-impregnated fabric layer 16 protects the hose structure from external abrasion and abuse, without impairing the hose flexibility.

In Figs. 4 and 5 there is illustrated improved methods and apparatus for fabricating the hose structure. It will be seen that the apparatus comprises a rotatable mandrel 20 upon which the hose structure is adapted to be wrapped or formed, and a head structure generally indicated by the numeral 21 and adapted to be longitudinally transported along the length of the mandrel 20 by means of a pair of rotatable lead screws 22 and 23. Suitable means, not shown, may be provided for rotating the mandrel 20 and the lead screws 22 and 23 in synchronized relation. The head structure is adapted to be mounted upon the lead screws 22 and 23 by a series of threaded bosses 24, 25 and 26.

The head 21 is arranged to carry, on its lower frame 27, supply rolls of wire, regenerated cellulose tape, and cord, for forming the wire core 11, cellulosic wall 13, and convoluted cord wrapping 15, respectively, the wire supply roll 28 being illustrated in Fig. 5. From the supply roll 28, the wire 11 is led upwardly over a guide roller 29 and onto the mandrel 20, and is properly positioned on the mandrel in spaced helical arrangement by a series of positioning rollers 30, 31 and 32 carried by the head structure and arranged in substantially equal relation around the mandrel periphery. The positioning of these rollers is correlated with the speed of rotation of the mandrel 20 in relation to the speed of translation of the head, to determine the pitch which the wire convolutions will assume upon application to the mandrel structure.

The regenerated cellulose tape is led from its supply roller or drum upwardly over a guide roller 35 and onto the mandrel, in superposed relation with the convolutions of the wire 11. It will be noted that the width of the regenerated cellulose tape is several times greater than the pitch of the wire 11, so that as the tape is progressively wound

onto the wire by rotation of the mandrel, a cellulose wall structure of several layer thickness will be formed. By proportioning the width of the tape with respect to the wire pitch, or the speed of rotation of the mandrel 20 in relation to the translation speed of the head, a wall structure of any desired thickness may be formed.

The fiber cord 15 is similarly led upwardly from its supply drum over a roller 36 and onto the mandrel, in superposed relation to the regenerated cellulose sheets, and in this instance the roller 36 has associated therewith an adjustable friction device 37 so that the roller serves not only as a guiding means, but also as a means for imparting a predetermined drag upon the cord as it is drawn onto the mandrel. The magnitude of drag may be adjustably predetermined by adjustment of the friction means 37. Accordingly, as the cord is drawn onto the cellulosic sheets, due to the drag imparted thereto, the cord will draw the cellulosic wall between the wire convolutions 11 and into the shape shown in Fig. 2 of the drawing.

In the operation of the apparatus, as the mandrel 20 is rotated, counterclockwise as indicated by the arrow in Fig. 5, and as the head 21 is translated, to the left as indicated by the arrow in Fig. 4, it will be seen that the wire 11, the cellulosic wall 13, and the cord 15 will be simultaneously applied to the mandrel forming the hose structure in a single continuous operation. The several guide rollers insure the proper positioning of the several structural parts upon the mandrel, and the operation is rapid and economical. After a predetermined length of hose has been formed, the tubing may be withdrawn from the mandrel by a slight reverse rotation thereof, opening or relaxing the gripping action of the tubing convolutions. The rubber cover 12 is then applied and vulcanized on the tubing by suitable means and methods which will be well understood by those skilled in the art.

It is obvious that various changes may be made in the specific embodiments set forth and described without departing from the spirit of the invention. Accordingly, the invention is not to be limited to the specific embodiments shown and described, but only as indicated in the following claim.

The invention is hereby claimed as follows:

A composite hose structure comprising an inner core of spiral wound wire, a wall comprising a plurality of layers of cellulose tape spirally wound about said core, a filament of spirally wound about said tape under sufficient tension to force spaced portions of said wall inwardly between the convolutions of said core whereby to impart to said wall an undulating configuration, and an outer jacket of flexible material molded directly onto said filament and said wall and conforming to the contour thereof, whereby upon the thermofixing of said moldable material the outer jacket is securely anchored to said wall to effect the sealing of the tape convolution edges.

GEORGE TOEPPER.
JOHN F. P. FARRAR.