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FLEXIBLE CONDUCTOR OR FLEXIBLE PARTS OF CONDUCTORS

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Fig. 1.

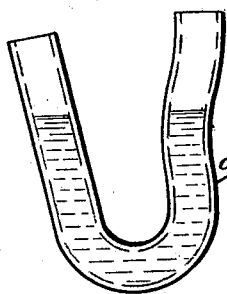


Fig. 2.

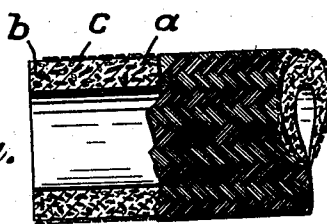


Fig. 1a.



Fig. 3.

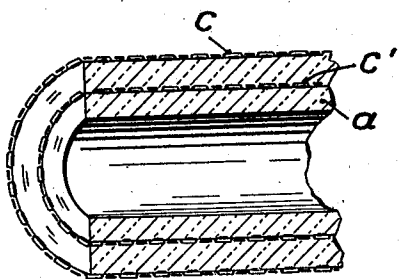
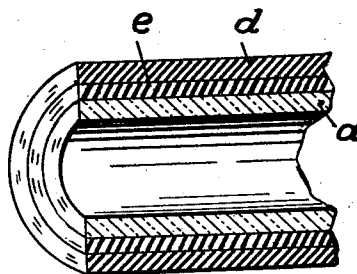


Fig. 4.



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FLEXIBLE CONDUCTOR OR FLEXIBLE
PARTS OF CONDUCTORSErnst Schnabel, Berlin-Lichterfeld,
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10 Claims. (Cl. 138—76)

The present invention relates to conductors or parts of conductors which have to be flexible or elastic.

There is a growing need in the chemical industry, in the motor car and aeroplane trades, in the machine tool manufacturing trade and in their various ancillary trades for flexible conductors (tubes) which are resistant to the action of organic solvents, alcohol, mixtures thereof, oils and acids, and which will withstand great pressure and vacuum. It is impossible to employ the usual rigid metal conductors where there is need for movement or where there is vibration as such conductors are liable to fracture. It is also necessary for certain parts of conductors, such as the packings and the like to be both elastic and resistant to chemical action.

According to the invention this object is attained by manufacturing the articles wholly or for the main part of polyvinyl alcohol.

Conductors made of this material are quite insoluble in organic solvents, alcohol, mixtures thereof, oils and in acids usually contained in such liquids. They are furthermore extremely flexible and have a high mechanical resistance—an ordinary tube made of polyvinyl alcohol with a 1 m. m. wall is capable of resisting a pressure of 120 atmospheres—while furthermore they can be treated just like rubber hose, that is to say, they can be cut off and drawn over the ends of tubes or applied to connecting members. As compared with rubber the material has, however,—apart from its insolubility—the considerable advantage that it does not age, that is to say, it does not become fragile and furthermore can be made transparent so that the streaming action can be observed.

Tubing made of polyvinyl alcohol is furthermore seamless and is perfectly smooth on the inside so that in comparison with tubing provided with a fabric or wire lining it presents considerably less resistance to flow, while in addition there is an entire absence of the breaking away and carrying off of small pieces of fabric or soluble parts of the impregnation which is unavoidable in known tubing of the kind described. This advantage is particularly important in connection with the supply of liquid fuels to apparatus having very fine orifices (such for example as carburetors and injector nozzles of Diesel engines) which are easily choked. Furthermore tubing made of polyvinyl alcohol is not attacked by the oils for Diesel engines, frequently containing acids, even when these oils are at a high temperature. Whereas the known flexible con-

ductors quickly become dirty because small particles easily adhere to the fabric, coiled wire and the like, this is impossible with tubing made of polyvinyl alcohol because of the smooth inner surface; moreover, such tubing can be easily cleaned by rinsing.

A tube made of polyvinyl alcohol can be deformed in any way because of its elasticity, and it has a resistance against cracking which is scarcely inferior to that of rubber hose.

If, for example, in a workshop with conductors lying on the ground, such a conductor, say a pressure hose of a filling station, is trodden on and pressed flat, it cannot regain its correct shape if being a tube reinforced with coiled wire, whereas tubing manufactured according to the invention returns unimpaired into its original shape in the manner of a rubber hose. For this reason tubing produced according to the invention can be simply closed in the way usual in chemical works by means of a clip.

What has hereinbefore been said with regard to tubing applies equally well to other tube parts such as packing. Thus polyvinyl alcohol is a suitable substance from which to manufacture packing sleeves and washers, which display elasticity, resistance to pressure and capacity for being deformed like packing made of rubber, but are entirely free from ageing phenomena and remain insoluble in organic solvents, alcohol, oils and the like.

Tubing and packing made of pure polyvinyl alcohol can be used wherever it does not come into contact with water or damp air. Otherwise additional means are advisable for preventing the slightly hygroscopic material from absorbing water and swelling. In many cases it is sufficient to keep the swelling down in moderate limits by mixing filling substances such as asbestos fibre with the polyvinyl alcohol. Complete protection for conductors is obtained by forming the conductors of a number of layers, the polyvinyl alcohol being for example converted at the surface into a different condition (so-called "hardening") or joined with water-tight layers of different material, which, however, in the present case combine intimately with the tubing of polyvinyl alcohol and do not affect the capacity of the conductor for being handled in the manner of rubber hose.

Example I

Hose and packing made of polyvinyl alcohol, to which have been added, if necessary, softening agents (glycerine, glycol, sugar, and the like) or

fillings (asbestos, textile fibres, and the like), are manufactured by known processes, the product of this composition being squirted by means of known devices and being protected against atmospheric influences by applying to it, while it is in an unfinished condition, a fabric covering, which is intimately joined to the lining, that is to say to the layer of polyvinyl alcohol.

Example II

Hose and the like, as in Example I, are covered with an impregnated fabric as protection against atmospheric and mechanical influences, surrounded with a spinning of yarn or metal threads, or wound round with strips of metal foil or fabric.

Example III

Hose, as in Examples I and II is hardened by known processes—for example by being treated with formalin or by the application of heat—to protect it from the absorption of water or swelling.

Example IV

Hose can be produced by known processes, and by applying a layer of polyvinyl alcohol on fabric or working it into the material, after which the hose is provided with a covering of simple fabric or an impregnated fabric, or is surrounded with braided yarn or metal threads or wound round with strips of metal or fabric, or hardened by known processes as in Example III.

Example V

Hose made of polyvinyl alcohol as in Examples I and IV is covered with rubber or a rubber tube provided with polyvinyl alcohol by known processes such as squirting and the like, a mixture of, for example, latex and polyvinyl alcohol being injected between the layers of rubber and polyvinyl alcohol and the hose then vulcanized by known processes. The hose then forms a composite mass, all the layers binding together homogeneously and adhering closely together.

In the drawing the invention is illustrated by some examples of the new tubing. In Fig. 1 a piece of a hose of pure polyvinyl alcohol is shown that is presumed to be made transparent in its manufacturing. Fig. 2 represents another piece of tubing being manufactured from polyvinyl alcohol, indicated by *a*, with fillings *b* of other substances and with an envelopment *c* of a fabric that may either be made of textile or of metallic threads. In Fig. 3 a tube or hose is shown with two layers of fabric, the one *c* being applied to the outside and the other *c'* within the wall *a* made of polyvinyl alcohol. The hose illustrated in Fig. 4 comprises an inner layer *a* of polyvinyl alcohol and an outer layer *d* of rubber, a third layer *e* being interposed between

the inner and the outer layer to improve the transition and the coherency between the two materials, this intermediate layer being of latex.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A hose, resistant to organic solvents, alcohol, oils and acids contained therein, the wall of said hose consisting of a single layer of polyvinyl alcohol.

2. A hose, resistant to organic solvents, alcohol, oils and acids contained therein, the wall of said hose consisting of a single layer of polyvinyl alcohol and being hardened at least at one of its surfaces.

3. Flexible and elastic tubing for the manufacture of hoses and packings that are resistant to organic solvents, alcohol, oils and acids contained therein, this tubing being made of a material containing polyvinyl alcohol with fillings of particles of an unhygroscopic material.

4. A hose, resistant to organic solvents, alcohol, oils and acids, comprising two layers of different material intimately combined one with another, one layer consisting of polyvinyl alcohol and the other of a water-tight and water-resisting material.

5. A hose, resistant to organic solvents, alcohol, oils and acids, comprising two layers of different material intimately combined one with another, one layer consisting of polyvinyl alcohol and the other of rubber.

6. A hose, resistant to organic solvents, alcohol, oils and acids, comprising two layers of different material intimately combined one with another, one layer consisting of polyvinyl alcohol and the other of impregnated fabric.

7. A hose, resistant to organic solvents, alcohol, oils and acids, consisting of a material containing polyvinyl alcohol surrounded with a souple envelopment of a material resistant against water.

8. A hose, resistant to organic solvents, alcohol, oils and acids, consisting of a material containing polyvinyl alcohol surrounded with a spinning, said spinning consisting of threads of a material resistant against water.

9. A hose, resistant to organic solvents, alcohol, oils and acids, comprising two layers of different material intimately combined one with another, one layer consisting of polyvinyl alcohol and the other of a water-tight material, the outer of the two layers being surrounded with a souple envelopment of a material resistant against water.

10. A hose, resistant to organic solvents, alcohol, oils and acids contained therein, comprising a layer of polyvinyl alcohol, adjacent to it a layer of latex and adjacent to the latter a layer of rubber, all the layers being bound closely together.

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