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IMPERVIOUS FABRIC

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This invention relates to impervious fabrics, more particularly to oil impregnated fabrics, and even more particularly to such fabrics as are to be used for fuel-pump diaphragms.

Diaphragms for fuel pumps are usually made from a closely woven cotton fabric relatively free from starch which has been impregnated with a suitable drying oil or mixture of oils, said impregnation conferring upon the fabric a high degree of impermeability to air, gasoline, etc. The impregnated fabric must be flexible enough to undergo repeated flexings without injury, and obviously must be substantially insoluble in gasoline and other liquid fuels which may pass through the fuel pump. At low operating temperatures, such coated fabric diaphragms tend to lose flexibility, particularly on aging, resulting in impaired efficiency of the fuel pump, that is, the quantity of liquid fuel which the pump was originally capable of handling is materially lessened. A similar loss of flexibility exists in the case of oil impregnated clothing such as slickers, gloves, hats, and the like.

An object of the present invention is the preparation of such a fabric having improved flexibility at low temperatures. A still further object is the preparation of such fabric with improved flexibility retention, a further object is the preparation of improved oil pump diaphragms, clothing, and the like. Other objects will appear hereinafter.

These objects are accomplished by the following invention wherein the fabric is impregnated with an oil composition containing a material such as phenyl-α-naphthylamine, p-hydroxydiphenyl, catechol, α-naphthol, creosole or a diarylguanidine, such as diphenylguanidine, di-o-tolylguanidine, dixylylguanidine, tritolylguanidine, or triphenylguanidine.

In the preparation of the improved fuel pump diaphragms which represent one embodiment of the present invention, a suitable cloth such as a closely woven mercerized cotton fabric of at least 80 threads per inch in each direction, having preferably less than 1% of starch and 1% of moisture, and free from traces of acid, is fed through rollers into a tank containing the material for the first or base coat and then passed through a drying oven. Two coats are applied to each side of the cloth and drying is carried out between each successive coating. Various types of oils may be used, for example linseed oil, China-wood oil, sunflower seed oil, rubber seed oil, soya bean oil, perilla oil, citioica oil, menhaden (fish) oil, etc., or suitable mixtures of such oils. The oil or mixture of oils as commonly used is generally given a preliminary bodying treatment involving blowing with air at a temperature of approximately 212° F. or heat treating in the substantial absence of air at a more elevated temperature, for example 500–600° F. The resulting bodied oil is usually thinned with raw oil, (linseed, China wood, sunflower seed, etc.) or with a thinner such as mineral spirits, turpentine, or solvent naphtha, before being used for impregnating the fabric. The oil or oils may be used either with or without driers, but driers are commonly used.

The diphenylguanidine or other agent used is preferably incorporated with the hot oil but, dissolved in a suitable solvent such as butyl alcohol, may be added to the cold oil. The amount of agent used is of the order of 0.25% to 2.0%, based on the oil. In general, 0.5% affords optimum results. In impregnating the fabric with the oil, the fabric is preferably passed between the rolls beneath the surface of the oil, the excess oil being squeezed out by passing the fabric between another pair of rolls above the surface of the oil. For the first coat thinned oil is generally used, but for the second and third coats the oil is preferably used unthinned since the dried first coat is less soluble in unthinned oil than in oil plus thinner. Following each impregnation of the fabric, excess oil is squeezed out as indicated above, after which the oil remaining in or on the fabric is dried by heating to 140–160° F. for 4 to 10 hours, depending upon which coat is being dried, the type of oil or oils used, the amount of drier, etc. The first coat is usually dried for 4 to 5 hours, the second coat, 5 to 7 hours, and the third coat for 8 to 10 hours, each at around 160° F. In general, the drying is carried no further than is necessary to secure an oil film of suitable physical characteristics including relatively high insolubility in gasoline or other liquid fuel, since prolonging drying leads to inflexibility of the oil film in or on the coated fabric. For fabrics of the type commonly used for fuel pump diaphragms, the three coatings of oil increase the weight of the original fabric by about 4 to 6 oz. per yard.

Other oil impregnated fabrics which have somewhat the same problem of flexibility retention include oil clothing, such as "slickers", gloves, hats, and the like. These garments lose flexibility on aging and are particularly inflexible at low temperatures. This flexibility at low temperatures leads to cracking and loss of imperviousness in wearing. In the manufacture of such articles, a suitable fabric is impregnated with a drying oil such as linseed oil in much the same way as the pump diaphragms above disclosed. The use of the treated oil of the present invention in the manufacture of these "slickers," etc., leads to a superior flexibility on aging, this flexibility being particularly noticeable at low temperatures.

Examples illustrating oils suitable for these purposes, and particularly for the preparation of oil pump diaphragms are shown below.

Example 1

	Parts by weight
Linseed oil	60.0
China-wood oil	40.0
Diphenylguanidine	0.5
Lead-manganese liquid drier*	0.5

*Concentration such as to give about 0.025% lead and 0.007% manganese each as metal on the basis of total oil.

Forty parts of the linseed oil are heated with 40 parts of the China-wood oil to about 580° F. and held for short string (about 15–20 minutes). The remaining 20 parts of linseed oil are then added and heating discontinued. The body of the oil (and therefore the cooking schedule) may vary within rather wide limits depending upon the particular application of a given oil, but for impregnating the cotton fabric diaphragms of fuel oil pumps, an oil having a viscosity of around 36 to 42 poises at 77° F., (before reducing with a thinner as indicated below) has been found to be quite suitable. The diphenylguanidine may be added directly to the oil on the down heat, preferably at temperature below the decomposition point (about 338° F.) of diphenylguanidine. When other agents are used, the agent should be added when the oil is at a temperature below the decomposition temperature of the particular agent used. The agent may also be added in solution in a suitable solvent, for example in alcohol in the case of diphenylguanidine, after the oil has cooled. The liquid drier should be added on the down heat, preferably after the oil is substantially at room temperature.

For the first coat the oil composition is thinned with the desired amount, usually 10–30%, of a suitable thinner such as mineral spirits, raw China-wood oil, raw perilla oil, raw rubber seed oil, raw soya bean oil, raw sunflower seed oil, etc. For the second and third coats the oil may be used without thinning. Instead of diphenylguanidine, a substantially equal amount of other di- or tri- substituted guanidines may be used, for example, di-o-tolylguanidine, di-xylyl-guanidine, di-naphthylguanidine, tri-phenylguanidine, etc., or a substantially equal amount of catechol, creosole, alpha-naphthol, phenylnaphthylamine, or p-hydroxydiphenyl.

Fuel pump diaphragms impregnated with a treated oil such as that of Example 1 are not only highly flexible initially, but also exhibit a definitely higher degree of flexibility on aging than do diaphragms coated with a similar oil mixture but without diphenylguanidine or similar agent. Such superior retention of flexibility is particularly noted when the pump operating with such a diaphragm is being operated at lower temperatures, minus 20° F. or lower.

Example 2

	Parts by weight
Rubber seed oil	50.0
Oiticica oil	50.0
Phenyl-α-naphthylamine	0.5
Lead-Cobalt liquid drier*	0.5

*Concentration such as to give about 0.025% lead and 0.005% cobalt, each as metal on the basis of the total oil.

The oil is treated as in Example 1.

The coating operation is carried out as in Example 1.

Example 3

	Parts by weight
China-wood oil	30.0
Linseed oil	50.0
Soya bean oil	20.0
p-Hydroxydiphenyl	0.75
Lead-manganese-cobalt liquid drier*	

*Concentration such as to give about 0.025% lead, 0.005% manganese, and 0.002% cobalt, each as metal on the basis of the total oil.

The mixture of oils is heated to about 550° F. and held at this temperature for about five hours, that is, to short string. The oil is then cooled to about 200° F. and blown with air at this temperature for about 2 hours, the blowing ceased and p-hydroxydiphenyl stirred in until completely dissolved. The oil composition is then cooled and the drier added. The coating operation is the same as in Example 1.

Example 4

	Parts by weight
China-wood oil	50.0
Linseed oil	50.0
Di-o-tolylguanidine	0.5
Lead-manganese liquid drier*	0.5

*Concentration such as to give about 0.025% lead and 0.007% manganese, each as metal on the basis of total oil.

The heating of the oil and the coating of the fabric are carried out as in Example 1.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that I do not limit myself to the specific embodiments thereof except as defined in the appended claims.

I claim:

1. An oil pump diaphragm of improved flexibility retention, comprising a fabric impregnated with a drying oil containing from 0.25 to 2.0% of an agent from the class consisting of polyaryl guanidines, phenyl-α-naphthylamine, p-hydroxydiphenyl, catechol, α-naphthol, and creosole, and then dried.

2. An oil pump diaphragm of improved flexibility retention, comprising a fabric impregnated with a drying oil containing from 0.25% to 2.0% of a polyarylguanidine, and then dried.

3. An oil pump diaphragm of improved flexibility retention, comprising a fabric impregnated with a drying oil containing from 0.25% to 2.0% of diphenylguanidine, and then dried.

4. An oil pump diaphragm of improved flexibility retention, comprising a fabric impregnated with a drying oil containing from 0.25% to 2.0% of phenyl-α-naphthylamine, and then dried.

5. An oil pump diaphragm of improved flexibility retention, comprising a fabric impregnated with a drying oil containing from 0.25% to 2.0% of catechol, and then dried.

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