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GASKET MATERIAL

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The invention relates to a novel and improved synthetic composition for use, for example, in the manufacture of gaskets. It particularly relates to a composition of this nature containing substantial amounts of wood flour and of an oil resistant butadiene copolymer such as butadiene-acrylonitrile.

One of the major applications for gaskets is the furnishing of oil-tight and gas-tight seals, for instance in internal combustion engines. For this purpose gaskets containing a large percentage of natural rubber are undesirable since natural raw rubber is not sufficiently resistant to solvent attack by hydrocarbon fuels and lubricants and natural cured rubber absorbs hydrocarbon liquids and swells out of all proportion to its original volume. A gasket nevertheless should be pliable to the extent that it should resiliently yield to deforming forces, but it should have sufficient inherent elasticity to offer a continued resistance to such forces so as to maintain a satisfactory sealing or packing effect. Some gasket materials, heretofore available, eventually acquire a "permanent set" through deterioration of their elastic characteristics. Other such materials are soluble in hydrocarbon fuels or lubricants, or deteriorate when in contact therewith. Some gasket materials, while satisfactory with respect to their sealing and hydrocarbon resisting characteristics are adversely affected by atmospheric conditions, particularly humidity, whereby, for example, gasket stock or finished gaskets undergo dimensional changes or contour distortions while in storage, to such an extent that when taken from storage they cannot be fitted in their intended position. In many cases protective wrappings or treatments have been resorted to in an attempt to prevent climatic attack but of course such expedients, even if effective, add to the eventual cost.

An object of the present invention is to provide a novel packing material which is not appreciably affected by humidity or climatic conditions.

A further object of the invention is to provide a packing material which is adequately resistant to deterioration or volumetric changes when in contact with hydrocarbon fluids.

A further object of the invention is to provide a packing material which, while resistant to deterioration by contact with hydrocarbon and by weathering, is nevertheless volumetrically sensitive to contact with said hydrocarbons so as to actually improve its packing function, as will appear.

Further objects and advantages are in part obvious and will in part become apparent as the description proceeds.

One of the major and necessary constituents of my composition of matter is an oil resistant copolymer of butadiene with acrylonitrile. This is a commercially available rubberlike material, identifiable under such trade names as Hycar OR, Buna N, or Thiokol RD. It is highly resistant to solvent attack or deterioration when in contact with hydrocarbon fluids. It should be present in an amount between about 15% and 45% by weight of the total batch.

Another major and necessary constituent of my gasket material is wood flour. It is readily available commercially and should be finer than 40 mesh. Computed on the weight of the total batch, the wood flour should be present in amount between about 20 per cent and 40 per cent.

I use from about 10 per cent to 30 per cent by weight of one of the recognized plasticizing agents such as a petroleum base or coal tar base oil, or an organic compound of the character of octadecine nitrile, tricresyl phosphate, or a cumarone-indene compound.

It has been observed that such plasticizing agents progressively leach out of gasket material when in constant service contact with hydrocarbon fuels or lubricants. To counteract the resulting volumetric contraction, I incorporate in the material a swelling agent, such as a rubberlike material (by which terminology I mean to include natural rubber, either raw or reclaim), in an amount between about 5 per cent and 25 per cent of the weight of the butadiene copolymer, or, when computed on the weight of the total batch, the range would be between 0.7 per cent and 11.3 per cent. This latter range gives the minimum and maximum limits as calculated on the total batch, but for satisfactory results the actual amount of natural rubber should preferably be calculated as a proportion of the amount of butadiene copolymer present, as indicated by the earlier range in this paragraph. As previously indicated, natural cured rubber is affected by hydrocarbon fluids and swells when in contact therewith. The presence of cured rubber in amount as above indicated counteracts the shrinkage resulting from the loss of plasticizer and maintains a substantially constant volumetric relationship. However, constant volume is not essential and, if desired, enough cured rubber may be included to effect a slight increase in volume, so as to accentuate the packing effect.

I preferably also incorporate in the total batch a small proportion of one or more of the usual

curing agents, accelerators, and antioxidants. These reagents are appropriately proportioned to the "total hydrocarbon" content, said term being understood, by those skilled in the art, to comprehend both the synthetic rubber-like material and the crude or reclaim rubber. In the table given hereinbelow I list four common agents of this nature, defining for each the percentage by weight as calculated on the total hydrocarbon weight, and also on the total batch weight.

	Per cent total hydrocarbon	Per cent total batch
Benzothiazyl disulfide	0.5–2.5	0.08–1.4
Sulfur	0.5–2.5	0.08–1.4
Phenyl-beta-naphthylamine	0.5–1.5	0.08–0.8
Zinc oxide	3.0–6.0	0.5 –3.4

As in the case of the calculation for the preferred amount of natural rubber, the first percentage column in the above tabulation should be used for determining the preferred range of each curing agent with relation to the total hydrocarbon content, the last column, namely the per cent of the total batch, being included for convenience.

As a filler I may employ from about 15 per cent to 30 per cent of short fibered asbestos, calculated on the total weight of the batch.

The following formula is suggested as one suitable mix for a gasket material, the composition being tabulated both in parts by weight, and in approximate per cent by weight, calculated on the total weight of the mix.

	Parts by weight	Per cent by weight
Hycar OR	100	18.0
Reclaimed rubber	12	2.1
Benzothiazyl disulfide	2	0.4
Sulfur	2	0.4
Phenyl beta naphthylamine	1	0.2
Zinc oxide	4	0.8
Asbestos	160	29.0
Wood flour	200	36.0
Plasticizers	75	13.0
Total	556	99.9+

The degree of hardness desired in a gasket material is determined by the correlation of a number of factors, including the particular application or use for which the gasket is intended. This in turn determines the compressive force necessary, in conjunction with the area of the gasket available to receive the application of said force. The above specific mix gives a relatively hard gasket material since the per cent by weight of the rubber or rubberlike material and of the plasticizer is in the lower portion of the range as previously specified herein. In order to make a softer gasket material the amount of the said rubber, rubberlike material and plasticizer should be increased, and the amount of asbestos and wood flour should be reduced.

Butadiene also forms a rubberlike copolymer with styrene, the material being available under the trade names Hycar OS or Buna S. This styrene copolymer is another suitable rubberlike swelling agent. It is not sufficiently resistant to attack by hydrocarbon fluids to be used as the principal rubberlike synthetic material so as to replace, in whole or in part, the butadiene acrylonitrile copolymer, but its solvent response to hydrocarbon fluids makes it feasible to substitute said butadiene-styrene copolymer as a swelling agent instead of the natural rubber heretofore suggested, especially in view of the present supply problems arising from limitations on the use of natural rubber.

In compounding the materials the Hycar and reclaimed rubber are fed into a standard rubber mill and are rolled until smooth, which is generally achieved in between 10 and 30 minutes. The accelerator, antioxidant, and zinc oxide are then added, followed by dry powdered asbestos and wood flour. The plasticizing agent or agents may be added concurrently with the asbestos and wood flour since the oleaginous plasticizing material facilitates the incorporation of the dry ingredients in the mix. The sulfur is usually added last.

The mix is calendered in sheets of about the desired thickness and the gaskets are cut directly from this uncured stock. This permits the scrap trimmings to be recalendered in a succeeding batch. The gaskets are vulcanized in an oven at approximately 275° F. for from three to four hours, the air pressure within the vulcanizer being maintained at between 20 and 50 pounds per square inch.

Gaskets made from the novel composition of matter hereinabove disclosed have a high resistance to solvent attack by hydrocarbon fluids and to any deterioration resulting therefrom. Such gaskets are also unaffected by aging or weathering and require no special protective measures or means during storage prior to use.

What I claim is:

1. A composition of matter for use as a packing material, containing from 15 per cent to 45 per cent of an oil resistant butadiene-acrylonitrile copolymer of rubberlike characteristics, from 20 per cent to 40 per cent of wood flour, from 0.25 per cent to 11.25 per cent of natural rubber capable of increasing in volume when in contact with hydrocarbon fluids, and from 10 per cent to 30 per cent of a plasticizer for said composition of matter, said plasticizer being soluble in hydrocarbon fluids.

2. A composition of matter for use as a packing material containing from 15 per cent to 45 per cent of a butadiene-acrylonitrile copolymer of rubberlike characteristics, from 20 per cent to 40 per cent of wood flour, from 10 per cent to 30 per cent of a plasticizer for said composition of matter, said plasticizer being soluble in hydrocarbon fluids, and from 0.25 per cent to 11.25 per cent of a butadiene styrene copolymer of rubberlike characteristics, and capable of increasing in volume when in contact with hydrocarbon fluids.

3. A composition of matter for use as a packing material, containing from 15 per cent to 45 per cent of an oil resistant butadiene-acrylonitrile copolymer of rubberlike characteristics, from 20 per cent to 40 per cent of wood flour, from 0.25 per cent to 11.25 per cent of natural rubber capable of increasing in volume when in contact with hydrocarbon fluids, and from 10 per cent to 30 per cent of a plasticizer for said composition of matter, said plasticizer being soluble in hydrocarbon fluids, from 15 per cent to 30 per cent of asbestos fiber, and between about 0.75 per cent and 7 per cent of material comprising an antioxidant, a curing agent, and an acccelerating agent.

4. A composition of matter for use as a packing material containing about 18 per cent of a butadiene-acrylonitrile copolymer of rubberlike characteristics, about 36 per cent of wood flour, about 29 per cent of asbestos fiber, about 2 per cent of

natural rubber, about 2 per cent total of material comprising a curing reagent, an accelerating agent, and an antioxidant, and about 13 per cent of a plasticizer for said composition of matter, said plasticizer being soluble in hydrocarbon fluids.

5. A composition of matter for use as a packing material, containing from 15 per cent to 45 per cent of an oil resistant butadiene-acrylonitrile copolymer of rubberlike characteristics, from 20 per cent to 40 per cent of wood flour, from 10 per cent to 30 per cent of a plasticizer for said composition of matter, said plasticizer being soluble in hydrocarbon fluids, and from 0.25 per cent to 11.25 per cent of material insoluble in hydrocarbon fluids but capable of increasing in volume when in contact with hydrocarbon fluids, said material being selected from the group consisting of natural rubber, and a butadiene styrene copolymer of rubberlike characteristics.

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