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ANTI-FRICTION DEVICE

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The heretofore known synthetic resin molding materials for anti-friction bearings contain as fillers fibrous materials, such as asbestos, paper, cotton, linen, etc. in random arrangement or also principally disposed in a direction to obtain from the molded bearing parts the highest possible mechanical strength.

Such bearings have initially uneven surfaces which do not give a low friction coefficient. The bearings in operation produce a relatively high frictional heat and accordingly are adapted only for small loads and low speeds. The surfaces of such bearings under the generated heat become more uneven, since the materials incorporated therein differ greatly in expansion. Furthermore the bearing surfaces made from the hereto known synthetic resin molding materials are for the most part porous and for that reason useless for heavy pressure bearings, since a durable continuous lubricating film cannot form as is the case with bearings having dense surfaces. Moreover, it follows from the porosity that the bearings, becoming compressed particularly under heavy variable loads, are soon after a short running period given an intolerably great play. Finally the porous bearing surfaces cause the sliding machine elements to become adherent to the bearing surfaces and therefore require a high starting effort.

Because of these experiences there has arisen the problem of providing molding materials that do not have the objections mentioned. The difficulty lies in fulfilling simultaneously five requirements placed upon bearings when in use, namely, a small friction coefficient, minimum porosity, great mechanical strength, high resistance to heat and a minimum deformation of a bearing under varying pressures. Further, in the selection of the ingredients for the molding materials care must be taken that neither the molds nor the sliding metal parts are attacked.

The hitherto known synthetic resin molding materials which, as has been stated before, contain fibrous fillers in random or orderly arrangement, fail in at least one of the described requirements. Likewise it is not possible to satisfy the demands placed on high quality bearings by using either mineral or organic materials in powder form as fillers.

It has now been found that it is possible to obtain synthetic resin molding materials by means of mixtures of pulverized inorganic and organic materials as fillers from which can be prepared bearings or molded bearing parts of high quality and fulfilling all the prescribed requirements.

As inorganic ingredients found suitable are those of inferior or medium hardness, such as finely ground silicates exemplified by feldspar, soapstone, carbonates exemplified by marble and calcite besides oxides as bauxite, sulfates as heavy spar, fluorides as fluorite, and cryolite. Asbestos in fibrous or spun form can also be used. Precipitated inorganic materials do not meet the requirement of high mechanical strength, but it is the minerals in finely powdered or ground condition to which restriction is made by this requirement. As suitable organic ingredients are cotton flock, wood flour and preferably hardwood flour, and other finely ground cellulose materials.

A small addition, not over fifteen per cent by weight, of graphite to the molding mixture improves the properties of the bearings.

In the preparation of molding materials according to this invention with relation to the properties of the herein described bearings, it is found particularly advantageous to maintain certain quantity proportions between the inorganic and organic ingredients of the filler. These quantity proportions are such that in the filler mixture there are present from 35 to 85% of finely ground inorganic substances—as asbestos in fibrous or prespun form—and 15 to 65% of finely ground organic substances. The ratio of the organic to the inorganic ingredients can be modified within the limits set, depending upon whether the desired bearings are to possess greater resistance to heat or greater resistance to load.

Example 1

	Kilos
Marble dust	330
Woodflour	270
Phenol-novolak	300
Hexamethylenetetramine	50
Coloring and other usual additions	50
	1000

Example 2

	Kilos
Asbestos	420
Cotton flock	180
Phenol-novolak	300
Hexamethylenetetramine	50
Coloring material and other usual additions	50
	1000

Example 3

	Kilos
Heavy spar	360
Cellulose	150
Graphite	90
Phenol-novolak	300
Hexamethylenetetramine	50
Coloring material and other usual additions	50
	1000

Molding materials are prepared from the mixtures in the usual manner by working on mixing roll or kneading machines.

The heat of friction developed with a synthetic resin bearing made from molding materials as herein prepared approximates only about one-eighth of that generated with metal bearings.

Measurements that have been made show that bearings prepared from the described molding materials support under the same conditions of test from two to three times the load that white metal bearings will endure. At a surface speed of 8 meters per second without oil-reflux cooling, bearings of white metal under test had a maximum load capacity of 60 kilos per square centimeter whereas bearings of the molding materials here described showed no fatigue under a load of 150 kilos per square centimeter. Such results have not heretofore been attained with synthetic resin molding materials under like conditions; their load capacities have amounted to only about one-third of that of the new molding materials.

As the resinous bonding agent, the examples specify the novolak or non-heat-hardening type of phenol resin with which is included hexamethylenetetramine as a hardening agent. The use of a novolak type is specified as it permits an intimate mixing and fluxing of the binding agent with the filler without setting up the resin. Resins which are heat-hardening per se without added hardening agent can be substituted in whole or in part. Moreover it is possible to use other heat-hardening types of resins, such as the urea-formaldehyde type of resin. With such heat-hardening resins care should be observed in the mixing operation that the temperature is below that at which substantial advancement of the resin takes place so as to interfere with the molding of the mixture.

The ground or powdered inorganic filler included in the mixture is preferably of a substantially water-insoluble nature characterized by inferior hardness as stated and illustrated above. In general these are included in major proportion in the filler, as the examples bring out.

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