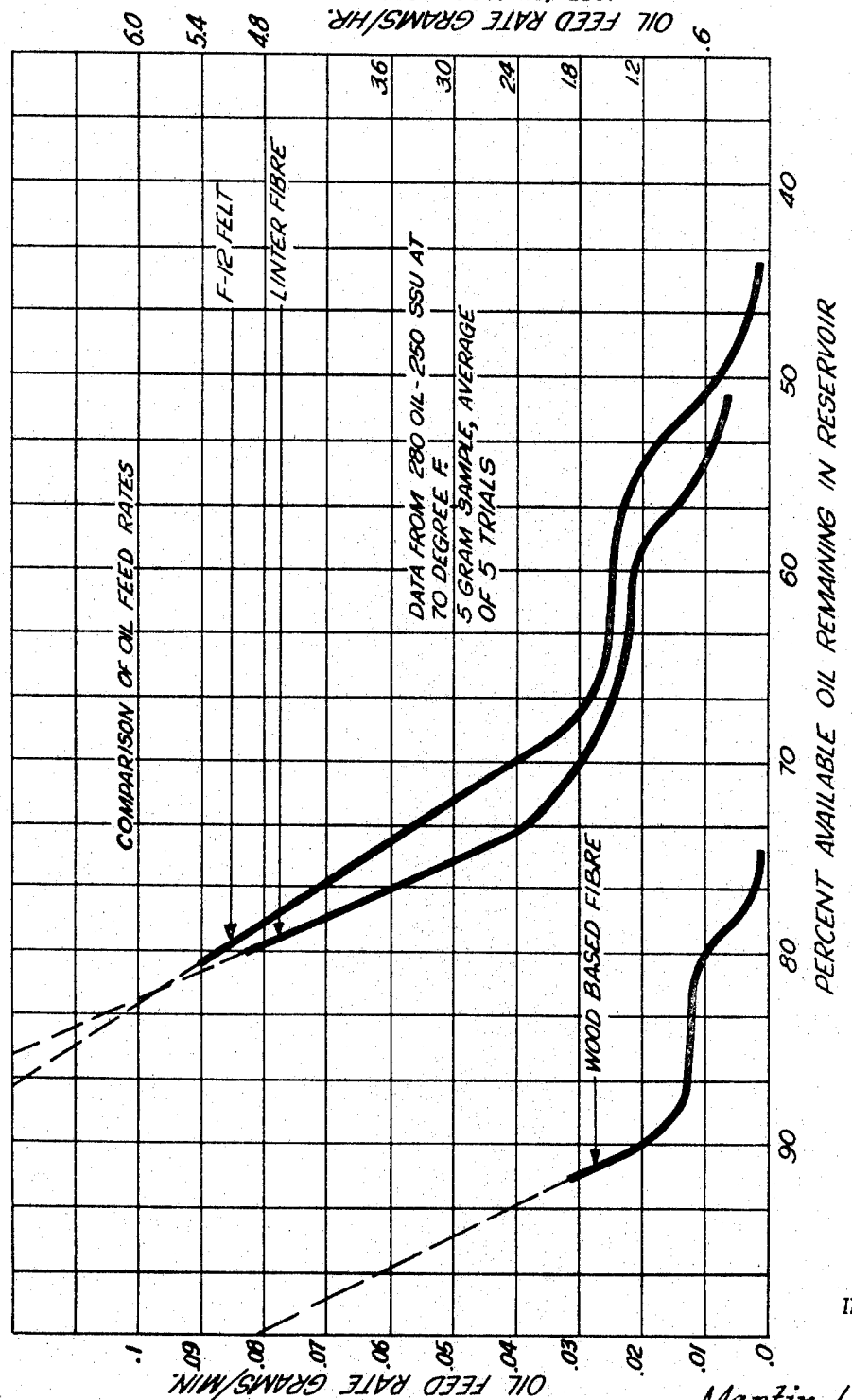
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OIL-IMPREGNATED WICKING MATERIAL

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OIL-IMPREGNATED WICKING MATERIAL

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ABSTRACT OF THE DISCLOSURE

An oil-impregnated wicking material comprising a mixture of a bearing lubricating oil and cotton linters fibers. The mixture is several parts oil by weight to one part fibers and can be injected under pressure into bearing wells without the oil separating from the fibers.

This invention relates to oil-impregnated wicking materials, and particularly to an oil-impregnated wicking material which can be injected under pressure into bearing reservoirs without separation between the lubricating oil and the wicking material.

An injectable wicking material known to the art is disclosed in my U.S. Patent 2,966,459, granted Dec. 27, 1960. The fibers which form the oil-absorbing portion of the wicking material of this patent comprises substantially equal parts of comminuted wood-based paper stock having a maximum fiber length of about 4 millimeters with the majority of the fibers being from 0.5 to 2.0 millimeters in length. This material has gained widespread acceptance for use in fractional horsepower motor bearings and other sleeve bearings. As the material has been exposed to use in more highly loaded bearings operating at elevated temperatures, the rate at which this material gives up the absorbed oil in order to provide sufficient lubrication has become more critical. Similarly, the possibility of charring increases as the temperature of the environment of the wicking material rises, thereby resulting damage to the material.

It is accordingly one object of this invention to provide an improved wicking material which can be injected under pressure into bearing wells and will release a sufficient amount of oil to the bearing for adequate lubrication of the bearing surface.

It is another object of this invention to provide an oil-impregnated wicking material which is more stable at elevated temperatures.

It is a further object of this invention to provide a wicking material with improved window erosion characteristics so that the material is less likely to be drawn through the window of a sleeve bearing.

Other objects of the invention will become apparent to one skilled in the art when referred to the following description.

The wicking material which provides the basis for the present invention is derived from cotton linters. The long hairs on cotton seed are referred to in the art as lint fibers, or staple cotton. It is these fibers which are spun into textiles. In addition to the lint fibers, cotton seeds also contain short fibers which are not suitable for spinning because of their length; these short fibers are known as linters. In commercially available quantities, substantially all of these linters are 5 millimeters in length or less with a very small percentage (in the order of 5% or less) between 5–12 millimeters in length.

It is generally the practice of the cotton industry to gin the cotton seed to remove the staple cotton. The linters are thereafter removed from the seed prior to the extraction of cottonseed oil. The raw linters are then digested in a strong caustic solution; the digested linters thereafter undergo a series of bleaching steps, are washed and are finally formed into sheets in a paper machine or loose pulp in bundles. Such procedures for making sheets and bundles are well-known to the art; reference is made to "Hercules® Chemical Cotton," published in 1959 by the Hercules Powder Company, for a more detailed description of the linters refining process.

The fibers which form the oil-absorbing portion of the wicking material of the present invention are formed by comminuting these sheets to obtain, as intact as possible, the fibers from which the sheets were produced. The linters fibers thus restored from the sheets inherently have lengths generally less than 5 millimeters with a very small percentage between 5–10 millimeters. In the preferred embodiment, about 96% of the fibers have lengths of 5 millimeters or less.

The comminuted linters fibers have a great affinity for oils, not only for the purpose of holding it, but also for restraining flow of oil away from the fibers when subjected to extruding or injecting pressures. This tenacious retaining phenomenon of the bulk material is believed to be attributable to the surface adhesion of the oil to the minute linters fibers of the bulk material. The linters fibers will readily absorb 4 or more parts by weight of oil per one part of bulk material. The extrusion of this wicking material into bearing wells may be carried out by the same extrusion machinery methods now being used to extrude or inject the wicking material of my aforementioned patent, and the methods disclosed in my earlier U.S. Patents 3,226,801, granted Jan. 4, 1966, and 3,273,668, granted Sept. 20, 1966.

The oil to be used in the present invention can be selected from a wide variety of lubricating oils. The choice of a particular oil is governed not by any criteria of the wicking material, but by the needs of the particular device to be lubricated. In other words, any of the known liquid lubricating oils can be employed in conjunction with the wicking material. One such lubricating oil for bearings comprises 80–85% solvent refined, 90 V.I. min., petroleum oil having a viscosity of 120–130 SSU at 100° F. and 2.5 to 3.5% sulfurized sperm oil. If desired, anti-oxidants, anti-corrosion agents, anti-wear agents and other conventional additives may be included in the oil to improve its physical properties. Such additives form no part of the present invention.

It is surprising that the wicking material of the present invention has such increased effectiveness over the cellulose materials of my earlier U.S. Patent 2,966,459. FIGURE 1 of the drawing emphasizes this increased effectiveness by a comparison of the oil feed versus the time in use for the wood fiber mixture of my earlier Patent 2,466,459, the cotton linters of the present invention and the well-known oil impregnated wool felts (known as F–12 felt) which have to a great extent been replaced by the material of my earlier patent. The aforementioned materials were each tested by placing a sample of the oil-impregnated material to be tested in an oil release rate machine wicking tube situated above a rotating table. The tube was 0.006 inch above this table. A steel rod was inserted in the top of the tube to exert pressure on the oil-impregnated material, and the table rotated for

one hour at a speed equivalent to the surface speed of a ½" diameter shaft rotating at 1750 r.p.m. The remaining sample was thereafter removed and weighed to determine the weight of oil lost. Each sample contained the same bearing oil (280 oil with a viscosity of 250 SSU at 70° F.) mixed in the same ratio, namely about 85% oil and 15% fibers or wool felt in the case of the felt sample.

As is evident from the graph, the oil feed rate of the cotton linters is significantly higher than that of the mixture of fibers of my earlier patent. This difference in oil feed rate is most significant in the case of more highly loaded sleeve bearings which require more oil to maintain a hydrodynamic film. It is similarly evident from the graph that the cotton linters of the present invention closely approximate the oil feed rate of wool felt, with the oil delivery rate being somewhat slower and more uniform. This difference similarly represents a significant advance in the art since, as is readily appreciated by those skilled in the art, felt has a tendency to deliver oil too rapidly for some bearing applications. It is therefore apparent that the cotton linters of the present invention deliver the optimum amount of oil to the device to be lubricated. Just why the cotton linters of the present invention are so successful as compared to the prior art cellulose wicking materials is not clearly understood at this time.

EXAMPLE I

A sheet derived from cotton linters as described in the aforementioned Hercules Powder Company publication was comminuted, and the resultant fibers were separated into eight length categories. The number of fibers within each category were counted under a microscope. (It was assumed that the average length of the fibers in each category fell half way between the upper and lower limits of the individual categories.) This procedure revealed the following distribution:

Length category (mm.)	Average length of category (assumed)	Number of fibers counted	Percent by number
1	0.5	12	6.0
1-2	1.5	77	38.5
2-3	2.5	59	29.5
3-4	3.5	30	15.0
4-5	4.5	14	7.0
5-6	5.5	3	1.5
6-7	6.5	3	1.5
8-9	8.5	2	1.0
		200	

It is thus seen from the above table that 96% of the linters have lengths less than or equal to 5 millimeters with the majority of the fibers being 2.5 millimeters or less.

The linters were mixed with a bearing lubricating oil. The resultant wicking material showed excellent results when used to lubricate bearings, including significantly higher oil release rates, improved window erosion characteristics, and the capability of withstanding significantly higher temperatures as compared to the material of my earlier Patent 2,966,459.

EXAMPLE II

In this example, the source of cotton linters was the loose pulp as described in the aforementioned Hercules publication. The pulp gave the following distribution:

Length category (mm.)	Average length of category (assumed)	Number of fibers counted	Percent by number
1	0.5	21	10.5
1-2	1.5	82	41.0
2-3	2.5	59	29.5
3-4	3.5	28	14.0
4-5	4.5	5	2.5
5-6	5.5	2	1.0
6-7	6.5	1	0.5
7-8	7.5	1	0.5
11-12	11.5	1	0.5
		200	

In this example, 97.5% of the linters have lengths less than or equal to 5 millimeters. The linters were utilized in the same manner as that employed in Example I, yielding comparable results.

While it will be apparent that the embodiment of the invention herein disclosed is well calculated to fulfill the objects of the invention, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. An injectable oil-impregnated wicking material comprising a lubricating oil and a loose mass of cotton linters fibers, said fibers and said oil being thoroughly admixed so that the oil is retained by the fibers in a fluent mixture.

2. The oil impregnated wicking material as defined in claim 1 wherein about 96% of said fibers have lengths less than or equal to 5 millimeters.

3. The oil impregnated wicking material of claim 1 wherein the majority of said fibers is about 2.5 millimeters in length or less.

4. The oil impregnated wicking material of claim 3 wherein said oil is a bearing oil and said material comprises at least four parts by weight of said oil to one part by weight of said fibers.

5. The oil impregnated wicking material of claim 4 wherein about 96% of said fibers have lengths less than or equal to 5 millimeters.

6. The oil impregnated wicking material of claim 5 wherein the remaining 4% of said fibers range in length from over 5 millimeters to 12 millimeters.

7. The oil-impregnated wicking material of claim 2 wherein about 89.5% of said fibers having lengths equal to or more than 1 millimeter.

8. The oil-impregnated wicking material of claim 1 wherein the majority of said fibers are 1 to 3 millimeters in length.

9. The oil-impregnated wicking material of claim 1 wherein about 84.5% of said fibers are 1 to 4 millimeters in length.

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