United States Patent Office 3,214,375 Patented Oct. 26, 1965

3,214,375

LUBRICATED WICKING MATERIAL

Bernard Berkeley, Valley Stream, N.Y., assignor to Permawick Company, Detroit, Mich., a corporation of Michigan

No Drawing. Filed May 14, 1962, Ser. No. 194,679
19 Claims. (Cl. 252—14)

The present invention relates to lubricated wicking materials comprising a mixture of minute fibers and oil, and more particularly to a lubricated wicking material of this type having a controlled fiber content to provide predetermined oil release rates.

Patent No. 2,966,459, issued on December 27, 1960, discloses an extrudable wicking material made from a mixture of cellulose fibers and oil wherein the oil constitutes approximately 87% of the mixture by weight, and substantially all of the fibers are 3.5 mm. or less in length. A unique characteristic of this wicking material is that it can be pumped through small diameter tubing and extruded through small apertures without separation of the oil from the fibers. Because of its extrudibility, this material can be injected into bearing cavities of automatic injecting machinery to replace the old hand-assembled oil-impregnated felts that were previously used to lubricate the bearings.

It is an object of the present invention to increase the rate at which the lubricated wicking material of the aforementioned patent releases oil to a bearing surface.

It is another object of the present invention to vary the fiber content of the wicking material of the aforementioned patent to provide fiber blends having predetermined oil release rates.

It is a further object of the invention to mix fibers of different materials such as nylon and graphite with the cellulose fibers of the patented wicking materials to provide fiber blends having predeterimned oil release rates.

It is a still further object of the invention to coat the cellulose fibers of the patented wicking material with a predetermined amount of a material such as nylon or Zytel (a registered trademark of the E. I. du Pont Company), both well-known polyamide polymers, to provide fiber blends having predetermnied oil release rates.

It is a still further object of the invention to vary the oil release rate of the patented wicking material by employing oleophobic and hydrophobic material, either in the form of a coating on some or all of the cellulose fibers or as separate fibers mixed with the cellulose fibers.

Other objects and features of novelty of the invention will be specifically pointed out or will otherwise become apparent when referring, for a better understanding of the invention, to the following description.

To make a lubricated wicking material in accordance with the aforementioned patent, a paper stock consisting of 60% by weight ground wood fibers and 40% by weight sulphite fibers is mechanically rendered in a hammer mill, the original fiber size of the paper and the rendering being such that the bulk of the fibers produced are 3.5 mm. in length or less, with a substantial number of the fibers being less than 2.0 mm. in length. These cellulose fibers are mixed with a solvent refined petroleum oil similar to that disclosed in a copending application Serial No. 75,677, filed on December 14, 1960, and assigned to the assignee of the present invention. In a test conducted with this lubricated wicking material wherein the oil had a viscosity of 400 seconds at 100° F., it was found to release .226 gram of oil per gram of lubricated wicking material per hour (hereinafter referred to as the oil release factor). By way of comparison, a piece of felt impregnated with the same petroleum oil had an oil release factor of .468.

In accordance with the present invention, it was found that the oil release factor of the lubricated wicking material of the aforementioned patent can be increased to closely approach that of the felt, or provide any predetermined oil release factor, by mixing the bulk cellulose fibers with predetermined percentages of different types of fibers in bulk form such as rayon or nylon flock about 3.5 mm. in length or less, or by coating the cellulose fibers with a nylon resin such as Zytel or a polyvinyl alcohol such as Elvanol, or by blending the coated cellulose fibers with uncoated fibers.

The following are illustrative examples of the oil release factors of lubricated wicking materials made by mixing the aforementioned petroleum oil with different fiber blends, the oil constituting 87% by weight of the lubricated wicking material in each example and the fiber blend being set forth in terms of the percentage by weight of the different types of fiber with respect to the total weight of the fibers. In each of the following examples substantially all of the fibers are approximately 3.5 mm. or less in length.

Fiber blend:	Oil release factor
50% nylon flock and 50% cellulose fibers	.379
50% rayon flock and 50% cellulose fibers	.376
75% rayon flock and 25% cellulose fibers	.443
100% rayon flock	.636
100% nylon flock	.593
50% Zytel coated cellulose fibers and 50% uncoated cellulose fibers	.315
75% Zytel coated cellulose fibers and 25% uncoated cellulose fibers	.370
85% Zytel coated cellulose fibers and 15% uncoated cellulose fibers	.438
100% Zytel coated cellulose fibers	.552
50% Elvanol coated cellulose fibers and 50% uncoated cellulose fibers	.271
100% Elvanol coated cellulose fibers	.512

One suitable process for coating the cellulose fibers with Zytel and Elvanol, as mentioned in the above examples, is to dip coat the aforementioned paper stock as uniformly as possible, dry the coated paper, and then render it in the hammer mill to produce the desired fiber sizes. By way of example, Zytel resin obtained from the E. I. du Pont Company was applied to the paper stock from a 2.5% solids solution in SD 3A alcohol and water. The paper was then air dried and rendered in the hammer mill. The Zytel coated cellulose fibers in the blends of the above examples were made in this manner and the percentage of Zytel pickup was calculated as 30.6% based on the weight of the dry, uncoated paper. Of course, the thickness of this coating can be varied to vary the oil release factor of fiber blends containing the Zytel coated fibers.

In the case of the Elvanol coated fibers, the aforementioned paper stock was dip coated in water containing a copolymer of 70% by weight polyvinyl alcohol and 30% by weight polyvinyl acetate. The coated paper is then mechanically rendered in the hammer mill to produce the fibers of the desired size. If desired, the Elvanol coated paper can be exposed to formaldehyde vapors before rendering to make it moisture resistant.

In working with fiber blends comprising a mixture of coated and uncoated cellulose fibers, and other blends comprising 100% cellulose fibers, an entirely unexpected phenomenon was encountered. It was discovered that fiber blends of 100% coated cellulose fibers had a significantly higher oil release factor than fiber blends containing the same total amount of coating material but consisting of mixtures of coated and uncoated fibers. This can be seen from the following examples wherein three different fiber blends were prepared from cellulose fibers with

each of the blends having nylon coated on all of the fibers in different amounts. The amount of the nylon in the first blend was 2.2% by weight, in the second blend 3.6% by weight, and in the third blend 30.6% by weight. The three fiber blends were mixed with the petroleum oil as previously described, and the oil release factor of the first blend was .284, the oil release factor of the second blend .312 and the oil release factor of the third blend .552. In contrast with this, two blends were prepared with a mixture of uncoated cellulose fibers and cellulose fibers coated with nylon with the amount of the nylon in the first blend being 7.4% by weight and the amount of nylon in the second blend being 15% by weight. In this case the first blend, after being mixed with the petroleum oil as previously described, had an oil release factor of .270 and the second blend had an oil release factor of .310.

Because of this unexpected phenomenon, fiber blends made from 100% coated cellulose fibers can be made to provide desired oil release factors with a significant saving in the amount of coating material needed as compared with blends having a mixture of coated and uncoated fibers. It is also noted at this time that the coated fibers provide higher oil release factors than blends of uncoated fibers and fibers of the coating material. For example, a blend of 30% nylon fibers by weight and 70% cellulose fibers by weight would have a much lower oil release rate than a blend of 100% cellulose fibers all coated with nylon wherein the nylon coating is 30% by weight of the fiber blend and the cellulose fibers are 70% by weight.

The nylon, rayon, Zytel and Elvanol were employed in each of the foregoing examples because they are oleophobic materials which release oil more rapidly than the oleophilic cellulose fibers. It is to be understood that these oleophobic materials have been given by way of example only, and that other oleophobic materials may be used in a similar manner to provide oil and fiber blends having predetermined oil release rates. It is also noted that each of the aforementioned materials is hydrophobic as well as oleophobic so as to be water or moisture-resistant, with the exception of Elvanol which is not moisture-resistant unless exposed to the formaldehyde vapors as mentioned above. Moisture-resistance is of course a very desirable property of lubricated wicking materials, and therefore in selecting other oleophobic materials to be used, those which are more hydrophobic than hydrophilic would naturally be preferred.

From the foregoing, it is apparent that the present invention provides a new concept for lubricated wicking materials. The user can now specify the oil release factor desired, and the manufacturer can simply select from prepared charts, or the like, the appropriate fiber blend to be used in preparing the lubricated wicking material to provide the specified oil release factor. Whenever the term bulk mixture or bulk fibers is used herein or in the following claims, it is to be understood that the term designates a loose mass of fibers which can be mixed with oil to provide a fluent material which can assume a variety of shapes as contrasted to fibers which are twisted into elongated wicks having a definite configuration.

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. A lubricated wicking material comprising a fiber blend mixed with a bearing oil at a ratio greater than about four parts oil to one part fiber blend by weight, said fiber blend comprising a bulk mixture of cellulose fibers and fibers which are oleophobic relative to the cellulose fibers, the proportion of said last-mentioned fibers relative to said cellulose fibers being sufficient to significantly raise the oil release factor of said lubricated wicking material above the oil release factor of a lubricated wicking material having oil mixed at the same ratio with a fiber blend consisting solely of said cellulose fibers.

2. A lubricated wicking material comprising a fiber blend mixed with a bearing oil at a ratio greater than about four parts oil to one part fiber blend by weight, said fiber blend comprising a bulk mixture of cellulose fibers and cellulose fibers coated with a material which is oleophobic relative to the cellulose fibers, the proportion of said coated cellulose fibers relative to said cellulose fibers being sufficient to significantly raise the oil release factor of said lubricated wicking material above the oil release factor of a lubricated wicking material having oil mixed at the same ratio with a fiber blend consisting solely of said cellulose fibers.

3. The wicking material as defined in claim **2** wherein said oleophobic material is polyamide polymer.

4. A lubricated wicking material comprising a fiber blend mixed with a bearing oil at a ratio greater than about four parts oil to one part fiber blend by weight, said fiber blend comprising bulk cellulose fibers coated with a material which is oleophobic relative to the cellulose fibers, the proportion of said material relative to said cellulose fibers being sufficient to significantly raise the oil release factor of said lubricated wicking material above the oil release factor of a lubricated wicking material having oil mixed at the same ratio with a fiber blend consisting solely of said cellulose fibers.

5. The wicking material as defined in claim **4**, wherein said oleophobic material is a polyamide polymer.

6. A lubricated wicking material comprising a fiber blend mixed with a bearing oil at a ratio greater than about four parts oil to one part fiber blend by weight, said fiber blend comprising a bulk mixture of cellulose fibers and fibers of a material which is oleophobic relative to the cellulose fibers, the proportion of said last-mentioned fibers relative to said cellulose fibers being sufficient to significantly raise the oil release factor of said lubricated wicking material above the oil release factor of a lubricated wicking material having oil mixed at the same ratio with a fiber blend consisting solely of said cellulose fibers.

7. The wicking material as defined in claim **6** wherein said oleophobic material is nylon flock.

8. The wicking material as defined in claim **6**, wherein said oleophobic material is rayon flock.

9. A lubricated wicking material comprising a fiber blend mixed with a bearing oil at a ratio greater than about four parts oil to one part fiber blends by weight, said fiber blend comprising a bulk mixture of cellulose fibers and fibers of a material which is oleophobic relative to the cellulose fibers, said fibers of oleophobic material comprising more than approximately 50% by weight of the fiber blend, the proportion of said last-mentioned fibers relative to said cellulose fibers being sufficient to significantly raise the oil release factor of said lubricated wicking material above the oil release factor of a lubricated wicking material having oil mixed at the same ratio with a fiber blend consisting solely of said cellulose fibers.

10. A lubricated wicking material comprising a fiber blend mixed with a bearing oil at a ratio greater than about four parts oil to one part fiber blend by weight, said fiber blend comprising a bulk mixture of two different types of fiber, one of said types of fibers being oleophobic and the other of said types of fibers being oleophilic relative to said oleophobic fibers, the proportion of said oleophobic fibers relative to said oleophilic fibers being sufficient to significantly raise the oil release factor of said lubricated wicking material above the oil release factor of a lubricated wicking material having oil mixed at the same ratio with a fiber blend consisting solely of said oleophilic fibers.

11. The wicking material as defined in claim **10** wherein most of said fibers are less than about 3.5 millimeters in length.

12. A lubricated wicking material comprising a fiber blend mixed with a bearing oil at a ratio greater than

about four parts oil to one part fiber blend by weight, said fiber blend comprising a bulk mixture of oil-retaining fibers, some of said fibers being coated with a material which is oleophobic relative to the material of the fiber itself, the proportion of said material relative to said fibers being sufficient to signicantly raise the oil release factor of said lubricated wicking material above the oil release factor of a lubricated wicking material having oil mixed at the same ratio with a fiber blend consisting solely of said fibers.

13. The wicking material as defined in claim **12** wherein most of said fibers are less than about 3.5 millimeters in length.

14. The wicking material as defined in claim **1** wherein said cellulose fibers are wood fibers.

15. The wicking material as defined in claim **2** wherein said cellulose fibers are wood fibers.

16. The wicking material as defined in claim **4** wherein said cellulose fibers are wood fibers.

17. The wicking material as defined in claim **6** wherein said cellulose fibers are wood fibers.

18. A lubricated wicking material comprising a fiber blend mixed with a bearing oil at a ratio greater than about four parts oil to one part fiber blend by weight, said fiber blend comprising a bulk mixture of cellulose fibers and other fibers which are oleophobic relative to the cellulose fibers, said cellulose fibers comprising a major portion of said fiber blend and said other fibers comprising a minor portion sufficient to significantly raise the oil release factor of said lubricated wicking material above the oil release factor of a lubricating wicking material having oil mixed at the same ratio with a fiber blend consisting solely of said cellulose fibers.

19. The wicking material as defined in claim **9** wherein said oleophobic material is a polyamide polymer.

References Cited by the Examiner

UNITED STATES PATENTS

1,570,666	1/26	Geppert	117—121.2
2,966,459	12/60	Abel	252—14
2,991,134	7/61	Harkenrider	308—243
3,022,542,	2/62	Davis	308—243

FOREIGN PATENTS

572,947	10/45	Great Britain.

DANIEL E. WYMAN, *Primary Examiner.*

JULIUS GREENWALD, *Examiner.*