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BACKUP MEMBER FOR ELASTIC ELEMENTS

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Fig. 1

Fig. 2

Fig. 3

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This invention relates to backups for resilient sealing members subjected to high pressures, such as pump piston rubbers.

The invention is particularly applicable to the field of high pressure pumps for drilling fluids and the like, as it provides a backup which will expand into contact with a worn liner without taking a permanent set. The disclosure will, therefore, be directed primarily to this field, but it will be understood that the invention may be applied to any situation in which a backup for a resilient member is desired.

Drilling fluid is highly abrasive, and therefore mud pumps conventionally employ pistons having a rubber cup-shaped member for slantly engaging the cylinder wall. It has been recognized for some time that it is necessary to back up the piston rubber to prevent its extruding under pressure and being chewed off between the pump liner and the metal parts of the piston.

Among other reinforcing materials, various fabrics such as cotton, Dacron and nylon have been tried. Until recently, these fabrics were all woven from multifilred threads of material. It has recently been determined that monofilament synthetic fibers are very superior to the multifilament threads. See my co-pending application Serial No. 718,350, filed February 28, 1958, for Nylon Backing for Elastic Elements. While the monofilament fiber as a backup member has been enthusiastically received by the drilling industry, its cost is much higher than conventional cotton duck material.

The primary difficulty with multifilament threads is their tendency to wick as there remains in the twists of the threads small voids. Thus, when the end of the thread is exposed due to abrasion of the backup with the pump liner, liquid will travel along the fiber due to wicking or capillary action. As pointed out in my above identified application, this wicking problem causes the fabric to break down and thus reduce the life of the piston rubber.

The use of monofilament threads eliminates the wicking problem. In searching for a cloth for use as a backup material, which would not be as expensive as one woven from monofilament fibers, but which would not be subject to the wicking action, it was found that cloth woven from multistrand threads could have its wicking tendency greatly overcome by coating each of the threads with a synthetic material, and this invention is characterized by the coating of multistrand threads of backup cloth with a synthetic material which coats each individual thread of the fabric and preferably incorporates each individual thread of the fabric to fill the voids in each thread and reduce capillary action. As pointed out in my above identified application, nylon, rayon and Dacron materials have superior characteristics for this type of service, and it is preferred that the threads of the backup cloth be coated by passing them through a bath of liquid nylon, rayon or Dacron. While Teflon might be used, it will not impregnate and bond to the same degree as nylon, rayon or Dacron.

It is an object of this invention to provide a backup reinforced with a fibrous material which is superior to cotton duck alone, and which is less expensive than monofilament fabric.

Another object is to provide a backup reinforced with a fibrous material in which the fibrous material is protected against wicking to prolong the life of the backup material.

Another object is to provide a backup reinforced with a fibrous material in which a better bond is obtained between the backup and frictioning material than has heretofore been possible with multistrand fibrous material such as cotton cloth.

Another object is to improve the permanent set characteristics of commonly used backup reinforcing materials such as cotton duck.

Another object is to improve the stiffness characteristics of commonly used backup reinforcing materials such as cotton duck to resist bending.

Other objects, features and advantages of this invention will be apparent from the drawings, the specification and claims.

In the drawing wherein there is shown an illustrative embodiment of this invention, and wherein like reference numerals indicate like parts:

FIGURE 1 is a view partly in section and partly in elevation of the liner and the working piston of a slush pump when the pump is not in operation and the piston rubbers are not subjected to a pumping force.

FIGURE 2 is a view on an enlarged scale of a fragment of a piston rubber and backup with a section of the backup cut away to illustrate the construction of the piston rubber back.

FIGURE 3 is a view on an enlarged scale of a fragment of one of the layers of cloth in the backup of FIGURE 2 and illustrating the manner in which the individual strands of the multistrand thread are encased and impregnated in accordance with this invention.

Referring now to the drawing, the liner 10 is conventional in form and provides the cylinder of a conventional slush pump such as widely used in the drilling industry to circulate drilling fluid. The pump piston indicated generally at 11 is provided with piston rubbers 12 which function in the pump in the conventional manner.

As best shown in FIGURE 2, the piston rubber 12 includes a section 13 of a resilient material which is conventionally rubber or synthetic rubber, and a section 14 which backs up the section 13. The backup section 14 is conventionally constructed of layers of fabric bonded together with frictioning material, as will be understood by those skilled in the art. The rubber section and backup section may be formed as separate members, or may be an integral structure as illustrated in FIGURE 2.

In accordance with this invention, each of the layers of backup cloth as shown at 15 through 18, inclusive, is coated in accordance with this invention to reduce the wicking tendencies of the cloth and to increase the bond between the cloth and frictioning material.

Considering first the cloth, it is preferably woven from conventional cotton duck material. However, the cloth may be provided by any multistrand thread material useable as a backup cloth, such as cotton, flax, nylon, Dacron, etc. To be useful as a backup material, the threads from which the cloth is woven should be chemically resistant to conventional drill fluids, should be fairly stiff but not brittle, should have at least the recovery characteristics of cotton, should be abrasive resistant, and capable of withstanding the temperatures employed in bonding the backup fabric with the frictioning material.

Conventionally, molding temperatures for molding piston rubbers are about 300 degrees Fahrenheit, and the cloth employed should be able to withstand this temperature during the molding operation.

The individual threads of the woven cloth, or, if preferred, the cloth after it is woven, are coated with a material which is capable of encasing each thread and of bonding to the frictioning material. Preferably, the ma-
terial is one which will also impregnate each thread to give maximum protection against wicking action. If desired, the coating operation may be carried out under pressure to obtain maximum impregnation of each thread. It is preferred that the threads be woven into a cloth and the cloth then passed through a liquid bath of the coating material. Excess coating material is preferably squeezed off of the cloth by passing the cloth through squeeze rollers or the like. Preferably, the surface of each piece of fabric or cloth is not completely coated to provide an impervious surface, but instead the individual threads of fabric or strands are individually coated and spaces are left therebetween. It has been found that an impervious sheet does not give as good a result as merely coating the individual threads.

The coating material may be provided by any material which can be liquified for the coating operation and then will set to provide a flexible, non-brilliate coating having in general the characteristics enumerated above for the cloth. Of course, the coating material should have the desired characteristic of expanding and recovering with the cloth so as not to destroy the bond between the cloth and the coating material.

The coating material is preferably nylon, rayon or Dacron. While Teflon might be used, it is not characterized by good impregnation of each thread, and will only encase the threads. Nylon is preferred as the coating material, and it is preferred to coat cotton duck cloth with nylon material.

Referring to FIGURE 3, the individual threads indicated generally at 19 and 20 are each made up of a number of strands, a section of which is indicated at 21. Each thread is coated and impregnated with a synthetic material in accordance with this invention. This coating provides an outer sheath 22, and it will be noted that the coating material has penetrated to the interior of each thread, as shown at 23 and elsewhere, to fill up the spaces or voids between adjacent strands which would induce capillary action along each thread. By preventing this capillary action, swelling and wicking of the individual threads are prevented.

After the individual pieces of cloth have been coated, they are bonded together by frictioning material 24 which is placed between each layer of cloth. The frictioning material is bonded to each layer in a conventional bonding operation. It has been found that a superior bond between the frictioning material and the fabric is provided when the fabric has its threads encased in the manner provided by this invention. While the reason for this superior bond is not understood, actual tests have shown that cotton duck fiber coated with liquid nylon and then bonded to frictioning material results in a bond superior to that obtained with mere cotton duck bonded to frictioning material.

It has been found further that the permanent set characteristics of cotton duck are slightly improved by coating with liquid nylon. The weave is somewhat stiffer and therefore resists bending.

From the above it will be seen that all of the objects of this invention have been attained. By coating any commonly used backup fabric with a synthetic which both encases and impregnates the individual threads of the fabric, wicking action is prevented, the stiffness characteristics of the material are improved, and the permanent set characteristics of the material are slightly improved.

While the resulting backup is not as good as the use of monofilament threads, the results are superior to the use of the multistrand threads alone. As cloth woven from monofilament fibers is much more expensive than cotton duck, for instance, the product of this invention is less expensive than a backup provided with monofilament fibers, and it results in a better backup than the use of uncoated multistrand fibers alone.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction, may be made without departing from the spirit of the invention.

What is claimed is:

1. A piston rubber comprising, a molded rubber member having imbedded at one end thereof layers of reinforcing fabric woven from multifilament nylon threads and coated and impregnated with nylon material.

2. An article of manufacture comprising, a molded rubber member having imbedded at one end thereof layers of reinforcing fabric woven from stiff, non-brilliate multistrand threads which will withstand molding temperatures, said layers of fabric coated and impregnated with a material selected from the group of nylon, rayon and Dacron.

3. An article of manufacture comprising, a molded rubber member having imbedded at one end thereof layers of reinforcing fabric woven from multifilament threads selected from the group of cotton, flax, nylon, rayon or Dacron; said fabric coated and impregnated with a material selected from the group of nylon, rayon and Dacron.

References Cited in the file of this patent

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