United States Patent Office 3,119,708 Patented Jan. 28, 1964

3,119,708

METHOD OF BURNING OFF PROTRUDING PAPER FIBERS AND COATING THE RESULTING ARTICLE

Ellsworth G. Munck, Cleveland, Ohio, assignor to Union Carbide Corporation, a corporation of New York

No Drawing. Filed Mar. 23, 1960, Ser. No. 16,953
12 Claims. (Cl. 117—46)

This invention relates to fibrous material having a thin, relatively impervious coating thereon. It more particularly refers to a method of making such material which is superior to that known to the art.

It is important in many fields to have a relatively inexpensive material which is thin, light weight, chemically resistant, and relatively fluid impervious. Such materials find use for example in bag construction, waterproof paper, shipping tubes, and tubes used to house cylindrical batteries. It has been the practice in the art to form a sheet of material, such as paper, into just less than the desired thickness; pass it through heated rolls; and then laminate or apply a suitable coating onto the material to make an article of the proper thickness. This has been practiced for a long time and is quite adequate where the coating is relatively thick.

A problem has been encountered where it is necessary to apply a very thin coating on the fibrous material since fibres from the material often protrude from the plane of the surface of the material. These protruding fibres extend into the coating, sometimes penetrating all the way through it, but more often penetrating only part way through the coating. Therefore there is a thinner coating over these partially penetrating fibres than the already thin coating on the remainder of the fibrous material. A wick effect may thus be caused resulting in leakage through the coating. This generally defeats the very purpose of the coating. Even if there is no immediate wick effect, the thinness of the coating on these fibres weakens the coating and renders them subject to abrasive damage.

This problem is particularly prevalent in the case of paper tube jackets for batteries. In this situation a paper tube is coated with a plastic film to enable it to retain any exudate which may leak through the anode-container of the battery. This exudate is very corrosive and may damage equipment which the battery is intended to power. It is therefore imperative that this tubing be as leak-proof as possible.

It is therefore an important object of this invention to provide a coated fibrous material which does not suffer from the disadvantages of those of the prior art.

It is another object of this invention to provide a method of making such improved material.

In accord with and fulfilling these objects, this invention includes a fibrous material having a thin, relatively impervious coating adhered to at least one surface thereof, wherein no fibres protrude from the material into the coating. Fibrous materials as used herein include paper, synthetic and natural textiles, mineral fibres, and metallic cloths. The coating will vary with the particular use intended but in general, resins and polymers which may be applied either from a hot melt or from a solution in a volatile solvent are of interest. The particular materials which make up the coating and the base fibrous materials are best selected by those skilled in the art in order to suit the particular needs at hand. The invention lies in the physical coaction and interrelation of the coating and the fibrous material rather than in the particular chemical composition of either.

The above noted objects of this invention are also fulfilled by the method of making an article as described above which includes the use of heat to burn off any protruding fibres from the fibrous material, thereby leaving

a relatively uniform surface onto which the desired coating is applied. This heating may be accomplished by an open gas flame or by an infra-red radiating source. It is preferred that the heating source and the fibrous material move relative to each other during the time that the protruding fibres are being burned off. It may be seen that if there is not relative movement, the basic fabric of material may be scorched or even burned due to prolonged exposure to the heat. This does not apply to such heat resistant fabrics as asbestos. Therefore it is seen that this invention is available for use only where the protruding fibres are affected by heat, either by burning, softening or melting. If the fibres are so affected, the heat application will either remove them or cause them to melt into the main body of fabric.

It is desirable to install a safety feature in the method described above to prevent burning or scorching of the main body of fibrous material. In this respect, a device for stopping the heat-producing device when the speed of the fibrous material relative to the heating device falls below a predetermined point which is considered safe is useful. This may be accomplished by providing a solenoid control on the drive mechanism which is keyed to shut off the heating device when the predetermined speed is reached.

As a specific example of the practice of this invention, a length of kraft paper, 6,500 feet long by 0.007 inch thick by 15 inches wide, was treated with a gas flame at a speed of 350 linear feet per minute relative to the flame. A coating of polyethylene from a hot melt was applied to the surface which had been heat treated, the coating thickness being about 0.001 inch. The coating was found to adhere with approximately the same tenacity to the heat treated paper as it did to similar kraft paper which had not been treated to remove any protruding fibres.

Tests have been run on coated fibrous material wherein the material has been heat treated. The results of these tests are compared with results of identical tests run on identically coated material which has not been treated according to this invention. These tests consist of applying a similar coating on heat treated and untreated fibrous material; rolling the coated materials into tubes; adhering one end of the tube to a glass sheet with wax and filling the tube with a material which the coated tube is intended to retain. A measure of the retention power and adequacy of the coated material is the length of time this tube retains the material placed therein with no leakage. In the particular test results reported below, the filling material is a 50 percent aqueous solution of zinc chloride.

Table I

Material:	Time to leakage (hrs.)
Three layers of 0.006 inch kraft paper sandwiched around two layers of 0.001 inch polyethylene (untreated)	72
One layer of 0.006 inch kraft paper with 0.001 inch polyethylene coating (untreated)	48
Three layers of 0.006 inch kraft paper (heat treated) sandwiched around two layers of 0.001 inch polyethylene	900
Two layers of 0.006 inch kraft paper (heat treated) sandwiched around one layer of 0.001 inch polyethylene	246

These data show an improvement greater than fourfold in retentivity for heat treated kraft paper over untreated kraft paper having the same coating of polyethylene thereon. Since the materials are identical in every respect except the heat treatment, this great improvement may be attributed solely to the heat treament. Additionally, it is now practical with the use of heat treating according

to this invention to eliminate the use of heated rolls prior to laminating thereby simplifying production.

It is to be understood that the dimensions of the fibrous material being subjected to the heat treatment disclosed herein are in no way a limiting factor on this invention since the heat only affects the surface of the material. It is also important to note that both sides of the fibrous material may be so treated. The fibrous material need not be in sheet form but may be a length of rope or the like if such is desired. It is also within the contemplation of this invention that more than one heating device may be used and that the heating device may be of any configuration suited to the particular application involved.

What is claimed is:

1. In a method of applying a thin, relatively impervious coating onto a paper sheeting having fibers protruding from the surface to be coated, the improvement comprising burning off the protruding fibers from said surface to be coated and applying said coating to the treated surface whereby the presence of fibers extending into the coating and attendant wicking effect is eliminated.

2. The improved method according to claim 1 wherein said coating is a polyethylene.

3. The improved method according to claim 1 wherein said paper is a continuous strip and wherein such strip is fed past a heat producing means at such rate as not to burn the bulk of said paper.

4. The improved method according to claim 1, wherein said coating is applied from a hot melt.

5. The improved method according to claim 1 wherein said coating is applied from a volatile solvent.

6. In a method of applying a thin, relatively impervious coating onto a paper sheeting having fibers protruding from the surface to be coated, the improvement comprising applying heating means contiguous to said sheeting, burning off the protruding fibers from said surface to be coated while moving said sheeting relative to said heating means at a predetermined speed sufficient to preclude burning of said sheeting and thereafter applying said coating to the treated surface whereby the presence of fibers extending into said coating and attendant wicking effect is eliminated.

7. The improved method according to claim 6 wherein said sheeting is kraft paper having a thickness of about .007 inch.

8. The improved method according to claim 7 wherein said sheeting is moved relative to said heating means at a speed of approximately 350 linear feet per minute.

9. A fibrous paper sheeting having a thin, relatively impervious coating adhered to at least one surface thereof having the protruding fibers removed therefrom by heat prior to the application of said coating.

10. A fibrous paper sheeting as described in claim 9 wherein said coating is polyethylene.

11. A leak-proof paper tube for use in batteries comprising a fibrous paper sheeting having a thin, relatively impervious coating adhered to at least one surface thereof having the protruding fibers removed therefrom by heat prior to the application of said coating.

12. The leak-proof paper tube according to claim 11 wherein said coating is polyethylene.

References Cited in the file of this patent

UNITED STATES PATENTS

1,425,307	Wilson	Aug. 8, 1922
1,835,741	Allen	Dec. 8, 1931
1,877,344	Mathey et al.	Sept. 13, 1932
2,739,058	O'Flynn et al.	Mar. 20, 1956
2,894,853	Anderson	July 14, 1959
2,924,538	Nadelman	Feb. 9, 1960
2,998,401	Reavis	Aug. 29, 1961

OTHER REFERENCES

Kresser: Polyethylene, Reinhold Publishing Co., N.Y., 1957, pages 21, 22, 128, 129 and 130.