

Patented July 22, 1924.

1,501,925

UNITED STATES PATENT OFFICE.

JOHN K. SHAW, OF MINNEAPOLIS, MINNESOTA, ASSIGNOR TO C. F. DAHLBERG, OF ST. PAUL, MINNESOTA.

BAGASSE FIBER AND PROCESS OF PRODUCING THE SAME

No Drawing.

Application filed March 26, 1920. Serial No. 368,993.

To all whom it may concern:

Be it known that I, JOHN K. SHAW, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Bagasse Fiber and Processes of Producing the Same; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a process for treating bagasse fibers as well as to the fibers produced by such process, and has for its object to provide an article and a method which will be more efficient in action and less costly to employ than those heretofore proposed.

With these and other objects in view the invention consists in the novel steps and combinations of steps constituting the process, and in the novel fibers constituting the article, all as will be more fully hereinafter disclosed and particularly pointed out in the claims.

In order that the precise invention may be the more clearly understood, it is said:—

It is well known that not only bagasse fibers, but a large number of other fibers have been heretofore treated by boiling with caustic soda, but in so far as I am aware, all of such prior treatments have been more or less drastic in that they have used comparatively large quantities of sodium hydrate or other equivalent alkali compounds in the solution, and the boiling has been prolonged until the fibers were suitable for paper making purposes, or beyond the point at which the particular product of this invention could have been produced.

In addition to this, when employing bagasse fibers, the prior processes have invariably sought to make paper or the like, and have therefore either mechanically denuded said fibers of their pith, before the treatment with the alkali solution, or else the caustic soda treatment has been carried out for such a length of time as to have deprived said fibers of said pith. The result in either case has been that the prior finished fibers, unlike those produced by my process, have been substantially devoid of their natural pith.

In carrying out this invention, on the

other hand, I do not bring the fibers to a condition suitable for making paper at all, but take a surprisingly small quantity of caustic soda, say a weight equal to from 2% to 10% of the bone dry weight of the bagasse, make a solution of the same in water, and heat the bagasse fibers in this solution from say 1 to 3 hours at atmospheric pressure, or at a temperature of say from 150° F. to 212° F. By proceeding with this comparatively weak solution of alkali, without mechanically removing the pith from the fibers, as heretofore, and for this comparatively short time of boiling, I secure a weight of fiber from the bagasse equal to from 65% to 80% of the bone dry weight of the original material, a yield which is almost double that of any previous process of treatment with which I am acquainted, and the fibers are found to be only partially cooked, so that they are unfit for paper making purposes.

It should be said, however, that this relatively large yield of fibers is due, partially to the fact that substantially all the original pith of the bagasse fibers is found to remain therewith, as will presently appear. Not only does the employment of this weak solution of alkali in the manner stated produce the important results set forth, but in addition, I find that the fiber's original strength is not impaired in the least, which is in marked contrast to the effects produced by the prior processes using a weight of alkali equal to say from 30% to 40% of the fiber and so drastically cooking the same that the original strength is very materially lessened. This is evidenced by the fact that bagasse paper is not as strong as wood pulp paper in many cases.

In this process on the other hand, the resiliency and flexibility of the fibers is controlled by the strength of the alkali solution which when weak is heated to exhaustion. This control is opposed to the prior paper making procedures, wherein the resiliency and strength of the fibers depend upon the time of cooking and with the pressure employed. In such prior processes the fibers must be softened sufficiently to form a colloidal mass, and the strength of the alkali solution is not exhausted during the cooking for the alkali is usually recovered from the spent liquors.

As an example of my process, in case one

wishes to produce a maximum flexibility and a maximum strength in bagasse fibers, while leaving all the natural pith with the same, he may cook the fibers for say 2½ hours in a 10% caustic soda solution, or in the case of weaker solutions for a time sufficient to exhaust all the alkali present. If the cooking is stopped before the alkali is exhausted, all the encasing and binding substances associated with the fibers will not be dissolved out, and therefore, the fibers will not have their maximum flexibility. On the other hand, if he continues to cook after the alkali is exhausted, no harm is done, for the exhausted solution does not attack the fibers.

It should be noted that the natural bagasse fibers are encased with a hard substance which render them brittle, unless it is thoroughly removed. And it should be further noted that with the weak alkali solutions of this process, these casings will not be removed unless there is employed sufficient alkali to dissolve them and unless the cooking is continued until all or substantially all of the alkali is used up which generally takes from 1 to 3 hours. In other words, the alkali forms compounds with these encasing substances and with the binding material between the fibers which compounds are water soluble, and when said substances and material are thus removed from the fiber, the individual bundles of fibers are left in a very soft, pliable and resilient condition with its strength unimpaired, and with its original pith sticking to it in the form of small knots or protuberances.

Therefore, another advantage of this process resides in being able to produce these abnormally, strong, and pliable fibers with their original pith all as will appear more fully hereinafter.

These said bagasse fibers produced as above may be readily formed into heat insulating sheets, boards, etc., by the ordinary paper and board making machines, but I prefer to work them in the machine made the subject of my copending application, Serial Number 368,990, filed March 26, 1920, and entitled, Process of and apparatus for making fiber boards.

Stated in other language, these particular strong and resilient fibers resulting from this invention are produced with the special object in view of making heat insulating and other fiber boards used as a substitute for lumber and which are very different from paste board and paper articles in general. And as the pith accompanying said fibers is composed of closed air cells, surrounded by layers of cellulosic material, they constitute a most valuable heat insulating filling.

Further, the particles of pith being found to be attached quite firmly to the individual fibers, in the form of the small knots, or pro-

tuberances, above mentioned, the said fibers readily and truly felt together somewhat after the manner that wool fibers felt together, and quite different from the manner in which cotton fibers are sometimes said to felt. This felting action of these pith carrying fibers also makes an unusually strong board, as will presently appear.

The color of the bagasse fiber is generally dark, or of a light straw color. But in the making of my fiber boards, this is not objectionable, in that I readily coat said boards with fibers of lighter, or any other color, all in accordance with the disclosure in said prior copending application.

Bagasse heat insulating fiber boards produced from these fibers are found to dry as readily as do wood pulp boards, and they may be sawed and handled in the same manner. The strength, however, of these said bagasse boards is found to greatly exceed the strength of the wood pulp boards. For example, when using the same weight of pulp and same density and dimensions of board, say 1 foot wide and ½ inch thick, I have found that the bagasse boards when compressed to the same degree as the wood pulp boards will show a tensile strength of say 1500 pounds, whereas the wood pulp boards will show a tensile strength of only 1100 pounds. Flax boards similarly made are no better than the wood pulp boards, and in fact have been found to be somewhat inferior.

On the other hand, when the bagasse fiber boards are compressed quite hard, in the making, or to a pressure of say 400 pounds per square inch, I find that it gives the remarkable tensile strength of over 17000 pounds. And I further find this hard product may be whittled, planed or handled in every way as is lumber.

Tests that I have made as to transverse breaking strength give similar relatively very high results when compared with other fiber boards. For example, when the bagasse is compressed even in the manner first stated, I find that a piece 1 foot wide and ½ inch thick, when supported on supports 4 inches apart, gives a breaking strength of 285 pounds thus showing that it makes an admirable material for trunks, valises, etc., as well as for lumber. Corresponding wood fiber boards, of the same weight give a transverse strength of only 113 pounds, and some of them much less than that. These remarkable results are unquestionably due in part to the fact that, the bagasse fibers retain the little pith particles, which causes them to felt together. This prevents a free sliding over each other and causes the straining of the fibers longitudinally. Said fibers, under the microscope, show small prongs somewhat resembling a barbed wire.

A further advantage possessed by bagasse

fibers over wood fibers resides in the fact that the ultimate bagasse fiber is smaller in diameter than the wood fiber, which it is possible to secure in commerce; and that with the same degree of pressure it will give a much more compact board than will wood fiber. That is to say, by increasing this pressure the bagasse fibers will yield a board having a density which it is impossible to get with wood fiber without using with said wood fiber some binding material, such as boiled linseed oil, rosin, etc. This property is made use of to produce with a bagasse fiber alone, and without any binding material, a board that will be suitable for making fiber water buckets, suit cases, trunks, etc.

These articles are now produced from wood fibers but in every case, in so far as I am aware the wood fiber is ground very fine and mixed with a binding material which will harden on exposure to the air or to heat. In fact, it is this binding material which gives the property of hardness, waterproofness, etc., to the product, and the wood fiber in reality only acts as a filler. In my board, on the other hand, made of bagasse fibers, without any binding material, the fibers themselves impart the property of strength, hardness, etc., and by precipitating thereon, the original encasing compounds which were dissolved off by the alkali, I impart waterproofing qualities to my fibers. This precipitation is readily accomplished by treating the spent alkali solution with aluminum sulphate.

It will now be clear that this process involves—

(a) The employment of a limited quantity of alkali and exhausting the strength of the same in dissolving the binding material and substances encasing the fibers, thus enabling cheap labor to carry out the process without observing instruments;

(b) The retention by the fibers of the original pith with which they are associated;

(c) The production of strong, resilient and pliable fibers; and

(d) The precipitation of the original binding and encasing material from their alkali combinations, onto the individual fibers to render the same water repellant.

It is obvious that the foregoing procedure may be varied without departing from the spirit of the invention, and therefore, I do not wish to be limited to the above disclosure except as may be required by the claims.

What is claimed is:—

1. The process of producing flexible and strong bagasse fibers provided with pith like protuberances which consists in cooking the same while associated with their natural pith for a time and at a tempera-

ture insufficient for paper making purposes, and in a solution containing a weight of alkali not exceeding 20% of the bone dry weight of the fibers until the strength of said alkali is practically exhausted; and recovering the fibers thus treated, substantially as described.

2. The process of producing flexible and strong bagasse fibers provided with pith like protuberances which consists in preparing a solution containing a weight of alkali not exceeding 15% of the bone dry weight of the fibers to be treated; cooking said fibers for a time and at a temperature insufficient for paper making purposes and in said solution until the strength of the alkali is exhausted; and recovering the fibers thus produced, substantially as described.

3. The process of producing flexible and strong bagasse fibers provided with pith like protuberances which consists in preparing a solution containing a weight of alkali not exceeding 10% of the bone dry weight of the fibers to be treated; cooking said fibers for a time and at a temperature insufficient for paper making purposes and in said solution until the strength of the alkali is exhausted; and recovering the fibers thus produced, substantially as described.

4. The process of producing flexible and strong bagasse fibers provided with pith like protuberances which consists in preparing a solution containing a weight of alkali less than 10% of the bone dry weight of the fibers to be treated; cooking said fibers for a time and at a temperature insufficient for paper making purposes and in said solution until the strength of the alkali is exhausted; and recovering the fibers thus produced, substantially as described.

5. The process of producing flexible and strong bagasse pith carrying fibers which consists in cooking said fibers with their natural pith in a solution containing a weight of alkali other than lime not exceeding 5% of the bone dry weight of the fibers, and until said alkali is exhausted and the hard brittle substances enclosing said fibers are dissolved; and subsequently precipitating said dissolved substances on said fibers, substantially as described.

6. The herein described new article of manufacture the same consisting of a partially cooked flexible bagasse fiber unsuited for paper making purposes and associated with its natural pith and having its natural strength unimpaired, substantially as described.

In testimony whereof I affix my signature.

JOHN K. SHAW.