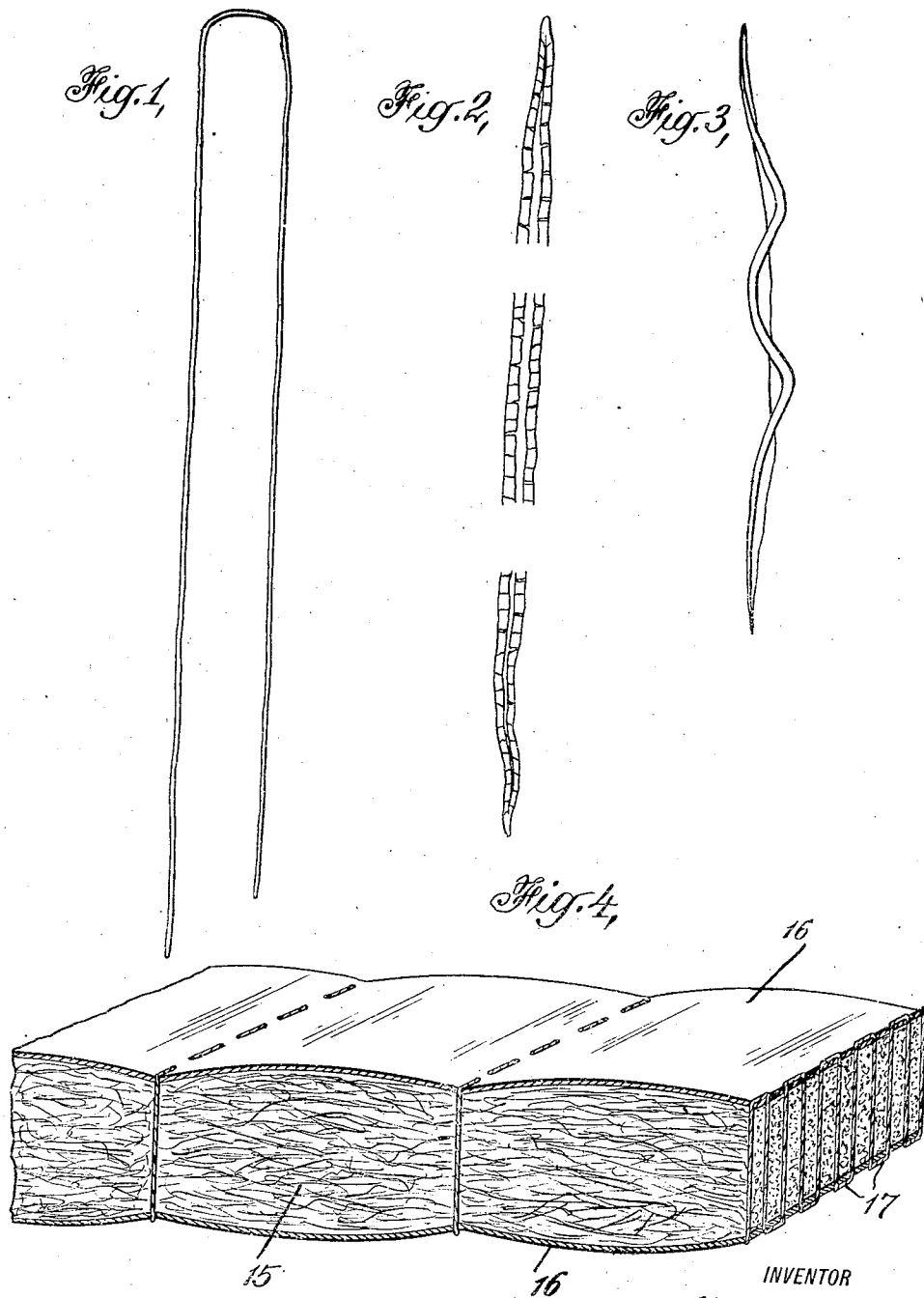


1,349,112.

H. F. WEISS.
FIBROUS PRODUCT.
APPLICATION FILED JULY 11, 1919.

Patented Aug. 10, 1920.
2 SHEETS—SHEET 1.



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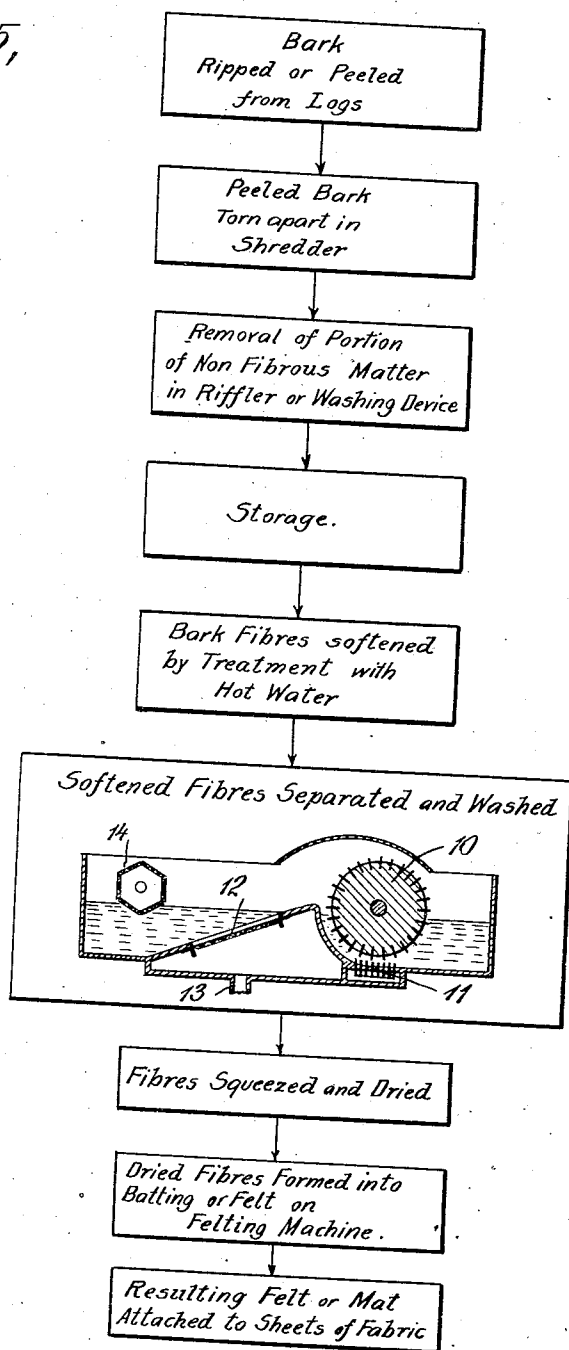
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2 SHEETS—SHEET 2.

Fig. 5,



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UNITED STATES PATENT OFFICE.

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FIBROUS PRODUCT.

1,349,112.

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To all whom it may concern:

Be it known that I, HOWARD F. WEISS, residing at Madison, in the county of Dane, State of Wisconsin, have invented certain new and useful Improvements in Fibrous Products; 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 fibrous felts or mats, and contemplates the production of an improved fibrous article of this character for use as an insulating, deadening, padding or packing material, as a covering for pipes and the like, and as a substitute for hair in such products as furniture upholstery, cushions, pads, mattresses, and the like.

I have discovered that the fibers of the bark of the so-called redwood tree possess certain peculiar characteristics which render them of particular advantage in the production of fibrous felts or mats. I have further discovered that by appropriate treatment such bark fibers may be separated without destroying these advantageous characteristics, and that the separated fibers may then be formed into a batting or felt on a suitable felting machine, thereby producing an improved fibrous felt or mat of exceptional utility for a wide variety of uses and purposes.

In carrying out the invention, the bark from the redwood tree, after appropriate mechanical treatment to reduce the part to particles or pieces of convenient size and form, is softened by treatment with hot water and is then subjected to a disintegrating or macerating operation for separating the individual fibers with as little cutting or breaking of the fibers as is practical. The separated fibers are then dried, and the dried fibers formed into a felt or mat of the desired dimensions. The fibrous mat so formed may be used without further treatment for a variety of purposes. In the manufacture of insulating and similar materials, the fibrous mat is usually inclosed between covering sheets of fabric, such as paper, cloth, or the like. These covering sheets may be attached to the fibrous mat by sewing, or may be attached thereto by a suitable adhesive, in which case the covering sheets are cemented to

the exposed surfaces of the mat. The covering sheets may moreover be water-proofed, fire-proofed, insect-proofed, etc., in accordance with well understood principles.

Reference will be made in the following discussion of the invention to the accompanying drawings for the purpose of more clearly explaining and illustrating certain aspects of the invention. In these drawings,—

Figure 1 is a view of a redwood bark fiber as it exists in nature in the bark of the redwood tree;

Fig. 2 is a greatly magnified sectional view of the bark fiber;

Fig. 3 is a perspective view of an individual bark fiber after the separating and drying operations contemplated by the invention and illustrates the flattened and twisted or wavy character of the fiber resulting from this treatment;

Fig. 4 is a perspective view of the improved fibrous mat of the invention embodied in an insulating material; and

Fig. 5 is a diagrammatic flow sheet representing the general operations involved in the production of the fibrous mat of the invention.

Throughout this specification and the appended claims I have employed the term "redwood" in a generic sense to cover the family of trees technically known as the *Sequoia*. The California redwood, or *Sequoia sempervirens*, is the best known and most available of this family. The *Sequoia gigantea*, or big tree, and the *Sequoia Washingtonia* are examples of other species of the genus *Sequoia*.

The redwood trees of mature growth are several centuries old and, of course, have resisted the weather for these long periods of time. The imperviousness of redwood to decay and its fire-resisting qualities are well known. These desirable properties of the wood are possessed by the bark to substantially the same extent. The tree is covered with a very thick layer of bark, often a foot or more in thickness, and has heretofore been practically regarded as a waste product, and, in fact, a detriment to sawmill operations. Redwood bark is therefore available in large quantities and is moreover a very cheap source of raw material.

Redwood bark fibers are of considerable length, very often attaining a length of

16 mm. or greater. Usually, however, the bark fibers will average approximately 12 mm. in length and about 0.05 mm. in diameter. In other words, these fibers are approximately 240 times as long as they are wide. The fibers of the wood are much shorter than those of the bark and average about 5 mm. in length and about 0.03 mm. in diameter. In other words, the wood fibers are only about 20 times as long as they are wide. It will, moreover, be observed that the bark fibers are approximately ten (10) times as long as the wood fibers. Fig. 1 of the drawings is intended to indicate the relatively great length of the redwood bark fiber with respect to its diameter, and shows the general appearance of the raw fiber as it exists in the bark of the redwood tree.

In Fig. 2 of the drawings I have shown a very high magnification of a raw fiber taken from the redwood bark. The ends of the fiber are closed, and the walls are about two-thirds the width of the fiber, thus providing a fine capillary cavity within the fiber. The walls of the fiber are marked with what are known as "pits." These are tiny openings, which generally become closed as the fiber advances in age.

Redwood bark fibers are quite smooth on the outside and do not possess bristles such as certain animal fibers possess. The fibers in the redwood bark are thicker walled than any other bark fibers I have studied. Furthermore redwood bark fibers average a greater length than those from the barks of any trees I have studied. The thick and heavy wall of the redwood bark fiber gives it greater strength than is possessed by bark fibers of other trees. I have furthermore found that many of the fibers in the redwood bark contain gums which probably add to the durability of the fiber and increase somewhat the tendency of the fibers to stick together when felted, probably in a manner similar to the effect of coating a nail with a small quantity of cement, which materially increases its resistance to withdrawal from the wood into which it is driven.

The redwood bark fibers contain no gums which attract insects and the like, or within which insects will thrive. The fibers are, moreover, extremely clean and sanitary and do not furnish a favorable medium for the development or propagation of bacteria and other unsanitary organisms. This property very sharply differentiates redwood bark fibers from animal fibers and makes it safe to use bark fiber products in places where food is stored.

The fiber in redwood bark is of such a nature that it does not require special chemical treatment in order to make it satisfactory for articles of the character herein contemplated.

The physical and chemical characteristics

of redwood bark fiber are such as to give it great durability, and the gums hereinbefore referred to undoubtedly contribute to this property. The bark fiber is thus especially characterized by its extreme durability and its resistance to the attack of decay and insects.

Furthermore, redwood bark fibers produce a remarkably "springy" felt. This property I attribute to their shape, physical and chemical composition, and more especially to their relatively thick or heavy walled structure. This "springy" characteristic of redwood bark mats gives lightness to the material and at the same time increases the number of dead air spaces within the mat, thereby adding to the thermal resistance of the product.

The form of redwood bark fibers is such that they are not hollow tubes open at each end, as in the case with many vegetable fibers, such, for example, as straw and flax fibers, but on the contrary the redwood bark fiber is closed at each end and has somewhat the same form and shape as cow hair. The closed capillary cavity of the redwood bark fiber provides a very large number of sealed air spaces within the mat, thereby adding to the value of the latter as a heat insulator.

I have devised a special and novel mode of treating redwood bark whereby the fibers thereof are separated without being badly broken and are thereafter permitted to shrink in accordance with their natural tendencies toward deformation, the result being a crinkled or crimped and relatively flat fiber which can be readily felted and which entangles well with other fibers in the felt and preserves its resiliency for a long time. This mode of treating redwood bark and forming resilient mats or felts of the fibers thereof is diagrammatically represented by the flow sheet of Fig. 5 of the accompanying drawings, which is intended merely to indicate the principal steps of the process, and various types of apparatus suitable for the performance of these steps will occur to those skilled in the art from the following description of the general features and principles of the process.

In accordance with the present customary practice, the redwood logs are hauled to the mill pond where the bark is ripped or peeled off of them, usually by a mechanical device, although, of course, the bark may be removed by hand. In the practice of the invention I use all of the bark, whether alive or dead. The peeled bark is first mechanically broken up into pieces of convenient form for the subsequent operations. This can be done by passing the bark through a shredding engine in which the bark is torn apart or shredded. The shredded bark is then washed in a riffler or other appropri-

ate washing device to remove a portion of the dirt and non-fibrous matter. The washed and shredded bark is preferably dumped for storage from whence it is withdrawn as required.

The bark, prepared in the foregoing manner, is next softened by treatment with hot water. The hot water may be advantageously obtained from condensed and waste steam at the sawmill and felt plant. The temperature of this water will be in the neighborhood of the boiling temperature of water. The purpose of the preliminary hot water treatment is to soften the fibers and make them more pliable and amenable to the subsequent separating operation. The length of time necessary to accomplish this result will depend upon the size of the bark particles as well as upon the temperature of the water. I have found that shredded bark particles from an ordinary shredding engine can be satisfactorily softened by soaking in water at a temperature of approximately 200° F. for a period of one hour.

The softened bark particles are next fed into a beating engine provided with a washing drum, in which the fibers are, in the presence of water, subjected to a macerating or separating operation followed by a washing operation. The beating engine may be generally of the ordinary Hollander type, and in Fig. 5 of the drawings I have diagrammatically indicated the essential features of such an apparatus. The beater roll of this engine is raised from the bed plate 11, so that the space between the blades of the bed plate and the beater roll is relatively wide in order that the lumps and particles of bark may pass through this space without too great a cutting action. The action of the beating engine is that of separating rather than cutting the fibers, and this result is attained more by throwing and rubbing them together than by the cutting action between the blades of the beater roll and the bed plate. In the process of macerating and separating the fibers, a certain number of them are inevitably cut or broken, but I aim to break just as few as possible. By carrying out the macerating and separating operations in the manner described the bark particles readily separate into individual fibers with a minimum of breaking of the fibers, and at the same time the operations are attended with the expenditure of a relatively small amount of mechanical power.

The bark particles contain much dirt and other matter of no fiber making value. This is comparatively heavy and sinks in water. This non-fibrous material may be advantageously removed by providing a wiremesh or screen 12 in the "back-fall" of the beating engine, so that such material may pass through this screen and be thus automat-

ically separated from the pulp. The pocket in which this material collects can be flushed from time to time and the material discharged through the outlet 13. A washing drum 14 is provided for the purpose of removing much of the floating non-fibrous material, thereby enabling the formation of a practically clean pulp containing the separated fibers.

The washed fibrous pulp from the beating engine is squeezed and dried. The squeezing operation is merely a pressing or filtering operation to remove the surplus water and should not be such as to mat the fibers together. The drying of the fibers is preferably effected by artificial heat. The result aimed at in these operations is to obtain the separated fibers in a dry condition suitable for felting. The felting of the dry fibers may be effected in any appropriate manner, as, for example, on an ordinary felting machine.

Where the fibrous batting or felted mat is to be used as an insulating material, I have found it satisfactory to form the fibers into a felted mat approximately one-half inch in thickness. This mat may be sewed between sheets of paper, cloth or other suitable fabric, or in lieu of sewing the sheets of fabric may be attached to the mat by gluing, cementing, stapling, or by any other suitable instrumentality. In Fig. 4 of the drawings, I have shown an insulating material having a body portion 15, made up of redwood bark fibers felted into a mat as hereinbefore described, attached to sheets of fabric 16 by a stitched or sewed agent 17.

The macerating treatment of the bark particles in the beating engine not only separates the fibers but removes from them a certain amount of foreign matter which has no fibrous structure. In addition to separating the fibers the beating engine treatment tends to flatten and twist them. In Fig. 3 of the drawings I have indicated the general appearance of a single fiber (dried) after it has passed through the beating engine. As will be seen from this figure the fiber is materially flattened and has a pronounced wavy or crinkled configuration. This crinkled configuration gives the fibers added felting properties. The wavy or crinkled configuration of the separated and dried fibers appears to be due to a shrinking and warping of the individual fibers as the result of a certain release of stress caused by separating and subsequently drying the fibers. Thus, in sawing lumber from logs, certain stresses in the wood are relieved, which cause the boards to twist on drying, unless they are held flat. I believe that a similar action occurs in the case of the individual redwood bark fibers, that is to say, unequal drying and shrinkage in the fiber walls causes the twisting action. I believe

that the closed ends of the bark fiber effect the twisting and that the fiber or cell walls are proportionately thicker at the ends of the cells than at the middle.

5 Redwood bark fibers produced in the manner herein before described may be termed mechanically disintegrated or pulped fibers. The fibrous felts or mats of the invention
10 cally disintegrated bark fibers, or such fibers may be admixed with a certain proportion of other fibrous materials. Thus, for example, flax straw, wheat straw, mineral wool, asbestos, etc., may be mixed with the red-
15 wood bark fibers. This mixture can be made after the redwood bark fibers are dried, or the admixed fibrous materials may be dumped into the beating engine and subjected to the same subsequent treatment as
20 the redwood bark fibers.

I claim:

1. The process of treating redwood bark which comprises softening the bark by treatment with hot water, beating the softened
25 bark in water to disintegrate the same and separate the fibers thereof with a minimum of breaking or cutting, washing the separated fibers to remove non-fibrous matter, and drying the washed and separated bark
30 fibers; substantially as described.

2. The process of treating redwood bark which comprises mechanically reducing the bark to particles of appropriate size for subsequent treatment, softening the bark particles by treatment with hot water, disintegrating the softened bark to separate the
35 fibers thereof with a minimum of breaking and cutting, washing the separated fibers to remove non-fibrous matter, and drying the washed and separated bark fibers; substantially as described.

3. The process of treating redwood bark fibers which comprises softening the bark by treatment with hot water, disintegrating
45 the softened bark in water to separate the fibers thereof, eliminating the water from the resulting pulp containing the separated bark fibers, and drying the fibers; substantially as described.

4. The process of producing fibrous mats 50 of redwood bark fibers which comprises softening the bark by treatment with hot water, disintegrating the softened bark in water to separate the fibers thereof, eliminating the water from the resulting pulp containing the
55 separated bark fibers, drying the fibers, and forming the dried fibers into a felted mat; substantially as described.

5. The process of producing fibrous mats of redwood bark fibers which comprises mechanically reducing the bark to particles of
60 appropriate size for subsequent treatment, softening the bark particles by treatment with hot water, beating the softened bark particles in water to disintegrate the same
65 and separate the fibers thereof with a minimum of breaking or cutting, washing the separated fibers to remove non-fibrous matter, drying the washed and separated bark fibers, and forming the dried fibers into a
70 felted mat; substantially as described.

6. As a new article of manufacture, a fibrous mat consisting essentially of flattened and entangled fibers of the bark of the redwood tree, the greater part of said fibers
75 being of full length.

7. As a new article of manufacture, a fibrous mat containing separated redwood bark fibers of twisted form felted together.

8. As a new article of manufacture, a 80 fibrous mat consisting essentially of mechanically disintegrated fibers of the bark of the redwood tree.

9. As a new article of manufacture, an insulating material comprising a fibrous mat
85 of redwood bark fibers having a covering agent attached to one or more of the surfaces thereof.

10. As a new article of manufacture, a mass of entangled fibers of the bark of the
90 redwood tree, said fibers being for the greater part of full length and of a flattened and twisted form.

11. As a new article of manufacture, a resilient, springy mat of redwood bark fibers. 95

In testimony whereof I affix my signature.

HOWARD F. WEISS.