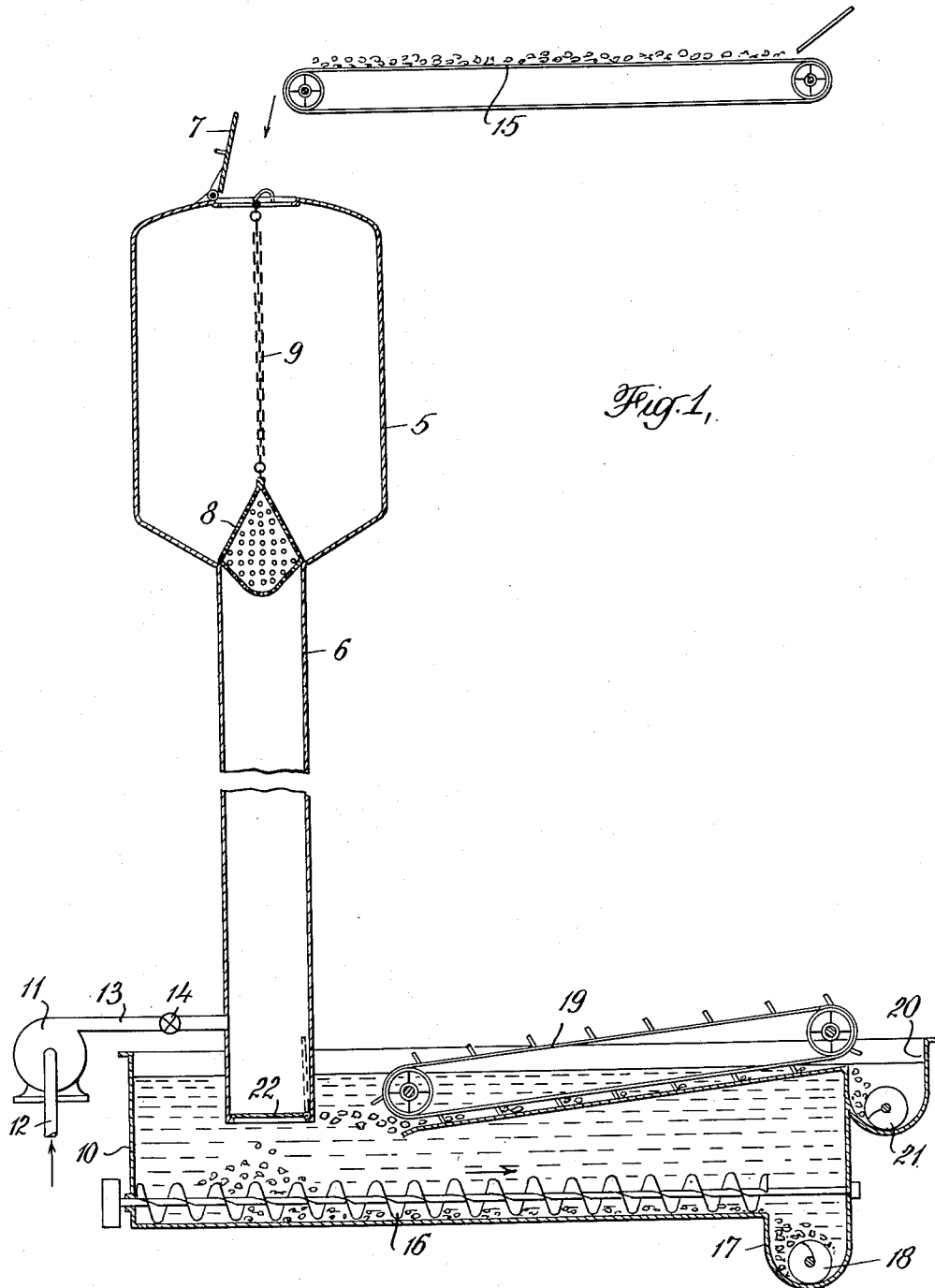


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WOOD CONSTITUENTS OF CONIFEROUS WOODS
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2 Sheets-Sheet 1



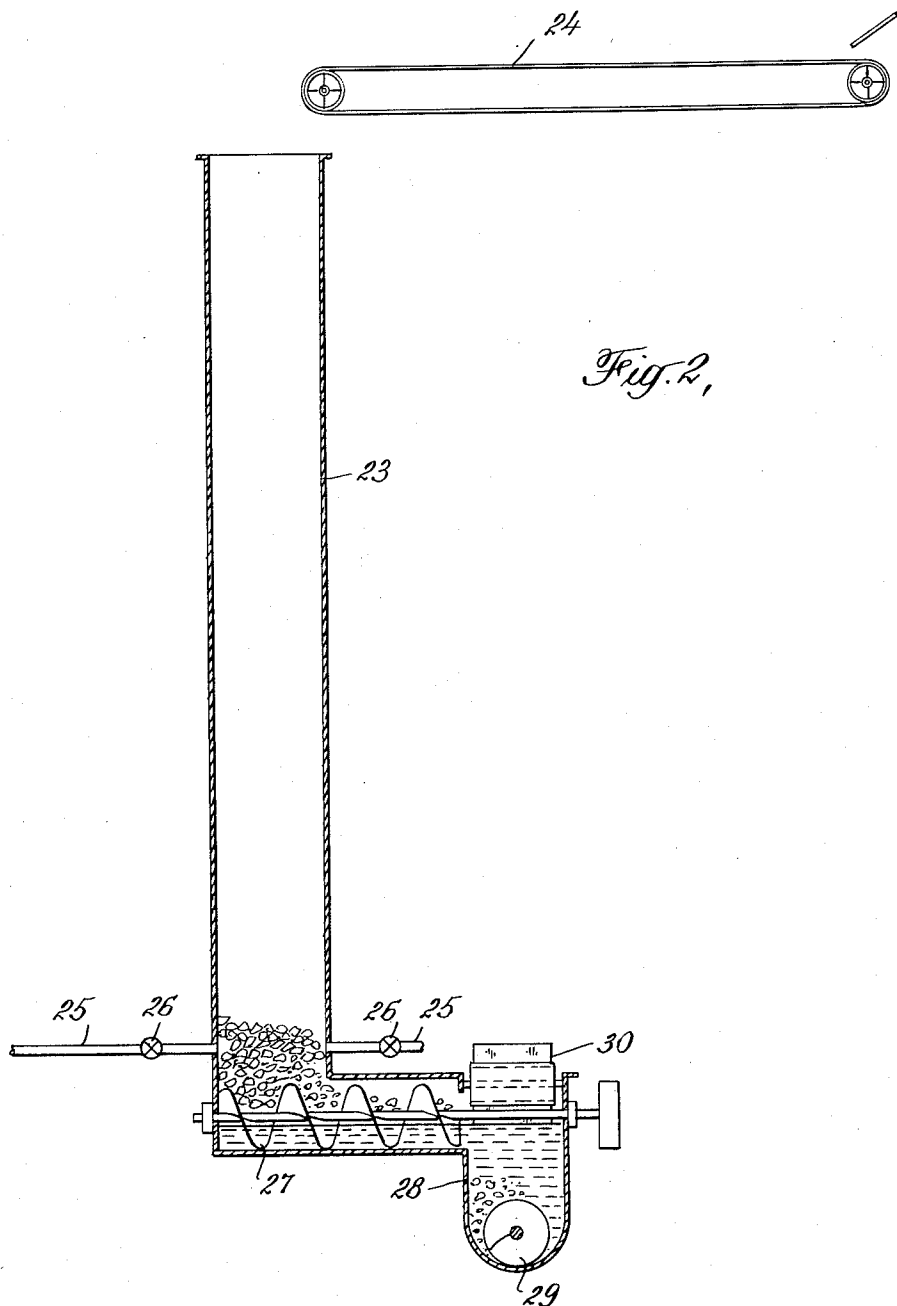
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UNITED STATES PATENT OFFICE

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METHOD OF SEPARATING THE HEART AND
SAP WOOD CONSTITUENTS OF CONIF-
EROUS WOODS

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8 Claims. (Cl. 209—173)

This invention relates to the separation of the heart and sap wood constituents of coniferous woods, and particularly to the preparation of such materials for pulping.

There are a number of species of coniferous woods which are not readily reduced to cellulose by the sulphite process. Attempts to treat such woods usually result in non-uniform pulp and a high percentage of screenings. Examination of the screenings discloses that they consist mostly of heart wood which is not readily amendable to treatment by the sulphite process. Examination of the pulp indicates that a portion of the wood has been over-cooked, whereas another portion is under-cooked, so that the pulp is of little value. It requires usually a very high proportion of chlorine to bleach it to a satisfactory whiteness, and the eventual product is unsatisfactory.

Some attempt has been made heretofore to avoid this difficulty by the selection of relatively immature trees in which the sap wood predominates. In certain southern states, southern pines under the age of twenty to twenty-five years, consist mostly of sap wood, and such material has been treated with some degree of success by the sulphite process. The northern trees, however, contain a larger proportion of heart wood, depending upon growth, soil and climatic conditions, and it is practically impossible to select trees for treatment on the basis of age, so as to avoid the difficulties hereinbefore mentioned.

It is the object of the present invention to afford a simple and satisfactory method of separating the heart from the sap wood after the material has been reduced to chips, thus permitting selection of the sap wood for treatment by the sulphite process. The separated heart wood can be treated satisfactorily by the kraft or sulphate process, to produce pulp of the desired quality, so that all the wood can be utilized successfully.

Other objects and advantages of the invention will be apparent as it is better understood by reference to the following specification, in which the preferred embodiments of the invention are described in connection with the drawings, in which

Fig. 1 is a diagrammatic view of an apparatus adapted for use in the practice of the invention; and

Fig. 2 is a similar view illustrating an alternative structure adapted to be similarly employed.

The sap wood, of all species of coniferous woods, is more open in its structure and is pro-

vided with continuous passages communicating from fiber to fiber, which are readily permeated by air and moisture. The heart wood, on the other hand, represents wood which is no longer growing, and the passages are either partially or wholly closed. I have discovered that if the wood is reduced to chips in the manner common in the art, the chips may be subjected to suitable treatment to remove air from the passages in the sap wood and to replace the air with water. The sap wood is thus readily permeated with water, whereas the heart wood treated in the same manner does not become filled with water and consequently has a lower specific gravity due to the entrapped air in the closed passages. This phenomenon affords a practical basis for separating the heart wood from the sap wood, since after treatment the heart wood floats on water, whereas the sap wood sinks.

The permeation of the sap wood with water may be accomplished in a variety of ways, two of the most practicable being hereinafter described. In one method, the chips are subjected in any suitable manner to a vacuum sufficient to withdraw air from the open passages in the sap wood. After the vacuum treatment, the chips are submerged in water which replaces the air withdrawn from the passages, causing the sap wood to become heavier. The heart wood is not affected appreciably by this treatment, and the chips which consist principally of heart wood float on the water, whereas the sap wood chips sink. Mechanical means of any suitable type may be employed then to separate the two constituents.

As an alternative procedure, the air in the sap wood chips may be driven off by heating the chips to a suitable temperature, for example about 212° F. Any suitable heating arrangement may be employed, but I prefer to introduce steam in quantity sufficient to raise the temperature of the chips to approximately the temperature indicated. As soon as the chips pass the heating zone, the temperature is reduced by quenching the chips in water, which fills the passages in the sap wood, whereas the heart wood is unaffected. The separation of the constituents is thereafter conducted mechanically as described.

In describing the operation in more detail, I shall refer to typical equipment illustrated in the accompanying drawings. It is to be understood, however, that numerous variations in the details of equipment are possible, and that the invention is not limited to any particular type of equipment or to details of procedure. The essential

features of the invention are the treatment of the mixed chips in such a manner as to replace air in the passages of the sap wood with water, so that the sap wood sinks in water whereas the heart wood floats, thereby permitting mechanical separation by any suitable devices.

Referring to Fig. 1 of the drawings, 5 indicates a suitable vessel, preferably cylindrical and constructed of steel or other suitable material to withstand a vacuum of about 28 inches of mercury. Connected to the bottom of the vessel 5 is a pipe 6 of large diameter and not less than 30 feet in length. The vessel 5 is provided with an opening at its top adapted to be sealed by a vacuum-tight closure 7. A valve, for example a perforated plug 8, is provided in the opening at the juncture of the vessel 5 and the pipe 6, to permit the passage of water, but retaining the chips in the vessel 5. The plug 8 may be connected by a chain 9 to the upper part of the receptacle 5 to facilitate manipulation.

The end of the pipe 6 extends into a tank 10 and the valve 22, adapted to be swung from the full line position to that shown in dotted lines by any suitable mechanical means, is provided at the bottom of the pipe 6 to close or open the outlet to the tank 10 during the operation. A suitable pump 11 connected by a pipe 12 to a source of water supply is provided with a discharge outlet 13 having a valve 14, so that water may be delivered as desired into the pipe 6.

A suitable conveyor 15 permits delivery of the chips to the opening at the top of the vessel 5. In the bottom of the tank 10 a conveyor 16 is adapted to deliver the chips which sink to the bottom of the tank to a sump 17, from which the chips are removed by a conveyor 18. A conveyor 19 is adapted to withdraw chips from the surface of the water in the tank 10 and to deliver them to a trough 20 from which they are withdrawn by a conveyor 21. It is to be understood that the several conveyors are actuated by suitable mechanical devices, not shown since they are well known in the art.

In the operation of the method, in apparatus such as that described, the vessel 5 is first filled with chips consisting of heart and sap wood. The chips are prevented from falling into the pipe 6 by the plug 8. The valve 22 is closed and the valve 14 is opened, and the pump 11 is then actuated to supply water to the pipe 6. The water eventually rises until all of the chips are submerged and the vessel 5 is filled. The closure 7 is then secured, the valve 14 is closed, and the valve 22 is opened. The column of water falls to a point where it is supported by atmospheric pressure and induces a vacuum in the receptacle 5 of from 26 to 28 inches of mercury. The vacuum need be maintained only for a period of approximately 2 to 5 minutes in order to withdraw the air from the chips of sap wood. The valve 22 is then closed, the valve 14 is opened, and the pump is started to force the water again to rise in the vessel 5 until the vessel is full. The closure 7 is then opened and the plug 8 is raised, permitting the chips to descend into the pipe 6. The valve 22 is then opened, permitting the mass of water and chips to flow into the tank 10. Here the chips of sap wood which have become saturated with water sink to the bottom of the tank, whereas the heart wood chips float. The chips of sap wood and heart wood are withdrawn respectively by the conveyors 16 and 19 and discharged from the apparatus. The sap wood chips may be de-

livered to suitable storage for manufacture into sulphite pulp. The heart wood chips are conveyed to suitable storage for pulping by an alkaline process such as the kraft or sulphate process.

In Fig. 2 of the drawings, I have illustrated a type of apparatus adapted for the application of the invention by utilizing steam to heat the chips sufficiently so that air is separated from the passages of the sap wood and replaced by water. In this apparatus, a column 23 of suitable height is provided to receive chips supplied continuously by conveyor 24. The operation is continuous, the chips moving gradually down the column 23, in which they are subjected to the effect of steam supplied through a plurality of pipes 25 having valves 26. As the chips descend, they are heated to approximately 212° F., and air trapped in the open passages of the sap wood is driven off. The chips eventually descend to the bottom of the column and are picked up by a conveyor 27 which delivers the chips to a tank 28 filled with water. The water immediately fills the passages in the sap wood from which air has been driven off. It cannot, however, enter the closed passages of the heart wood, and consequently the heart wood floats, whereas the sap wood sinks. The sap wood is withdrawn from the bottom of the tank 28 by a conveyor 29 which delivers it to storage for treatment by the sulphite process. The heart wood is taken off by a conveyor 30 from the surface of the water in the tank 28, and delivered to storage for treatment by an alkaline pulping process.

The method as conducted in the apparatus shown in Fig. 1 is intermittent, whereas in the apparatus shown in Fig. 2 it is continuous. The adoption and use of one or the other of these procedures will depend upon existing economic conditions. Where an adequate quantity of exhaust steam is available and inexpensive, it will be found most economical to operate in the apparatus shown in Fig. 2. Where the cost of steam is high, the vacuum system as illustrated in Fig. 1 is more economical. Either procedure results in the efficient separation of sap wood from heart wood and permits the manufacture of high grade sulphite pulp from species of coniferous woods which ordinarily cannot be treated successfully by the sulphite process. Since the constituents of the wood after separation are each available for separate treatment by processes to which they are suited, it is possible to recover all of the available material in the form of satisfactory pulp.

Various changes may be made in the procedure and in the apparatus employed without departing from the invention or sacrificing any of its advantages.

I claim:

1. In the method of preparing coniferous woods for pulping, the improvement which comprises reducing both the heart wood and the sap wood of a piece of coniferous wood to chips, treating a mixed mass of the heart wood and sap wood chips to increase the apparent specific gravity of the sap wood chips relative to the apparent specific gravity of the heart wood chips, and effecting separation of the heart wood and sap wood chips by the difference in their apparent specific gravities.

2. In the method of preparing coniferous woods for pulping, the improvement which comprises reducing both the heart wood and the sap wood of a piece of coniferous wood to chips, removing air from the cells of the sap wood chips

and replacing it with water to thereby increase their apparent specific gravity relative to the apparent specific gravity of the heart wood chips, and effecting separation of the heart wood and sap wood chips by the difference in their specific gravities.

3. In the method of preparing coniferous woods for pulping, the improvement which comprises reducing both the heart wood and the sap wood of a piece of coniferous wood to chips, removing air from the cells of the sap wood chips and replacing it with water to thereby increase their apparent specific gravity relative to the apparent specific gravity of the heart wood chips, and effecting separation of the heart wood chips from the sap wood chips by floating the heart wood chips in an aqueous medium in which the sap wood chips sink.

4. In the method of preparing coniferous woods for pulping, the improvement which comprises reducing both the heart wood and the sap wood of a piece of coniferous wood to chips, subjecting a mixed mass of the heart wood and sap wood chips to a partial vacuum for a length of time sufficient to extract air from the cells of the sap wood chips, thereafter maintaining the mass of chips in a body of water for a length of time sufficient for water to permeate the evacuated cells of the sap wood chips and hereby increase their apparent specific gravity relative to the apparent specific gravity of the heart wood chips, and effecting separation of the heart wood and sap wood chips by the difference in their apparent specific gravities.

5. In the method of preparing coniferous woods for pulping, the improvement which comprises reducing both the heart wood and the sap wood of a piece of coniferous wood to chips, subjecting a mixed mass of the heart wood and sap wood chips in a closed chamber to a partial vacuum induced by the weight of a column of water for a length of time sufficient to extract air from the cells of the sap wood chips, thereafter immediately flooding the chips with water until the water fills the evacuated cells in the sap wood chips and

increases their apparent specific gravity relative to the apparent specific gravity of the heart wood chips, and effecting separation of the heart and sap wood chips by the difference in their apparent specific gravities.

6. In the method of preparing coniferous woods for pulping, the improvement which comprises reducing both the heart wood and the sap wood of a piece of coniferous wood to chips, heating a mixed mass of the heart wood and sap wood chips for a length of time sufficient to expel air from the sap wood chips, and thereafter immediately quenching the mass of chips in water, whereby the sap wood chips absorb excess water and have their apparent specific gravity increased relative to the apparent specific gravity of the heart wood chips and sink while the heart wood chips float.

7. In the method of preparing coniferous woods for pulping, the improvement which comprises reducing both the heart wood and the sap wood of a piece of coniferous wood to chips, heating a mixed mass of the heart wood and sap wood chips with steam for a length of time sufficient to expel air from the sap wood chips, and thereafter immediately quenching the mass of chips in water, whereby the sap wood chips absorb excess water and have their apparent specific gravity increased relative to the apparent specific gravity of the heart wood chips and sink while the heart wood chips float.

8. In the method of preparing coniferous woods for pulping, the improvement which comprises reducing both the heart wood and the sap wood of a piece of coniferous wood to chips, heating a mixed mass of the heart wood and sap wood chips with steam at approximately 212° F. for a length of time sufficient to expel air from the sap wood chips, and thereafter immediately quenching the mass of chips in water, whereby the sap wood chips absorb excess water and have their apparent specific gravity increased relative to the apparent specific gravity of the heart wood chips and sink while the heart wood chips float.

GEORGE V. PALMROSE.