Sept. 22, 1959 N. H. SANDBERG 2,905,240

APPARATUS FOR IMPREGNATING WOOD CHIPS

Filed Dec. 10, 1954 3 Sheets-Sheet 1

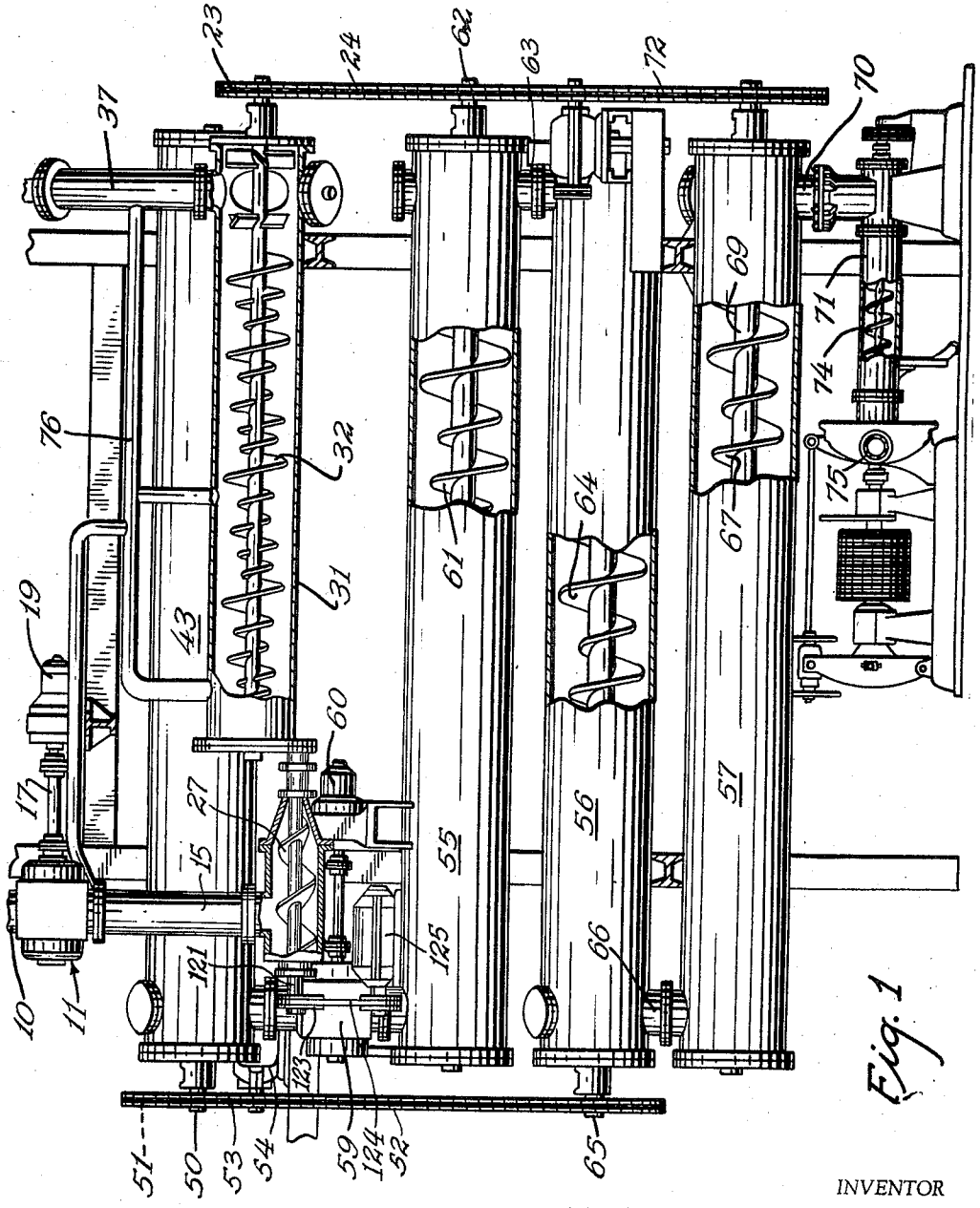


Fig. 1

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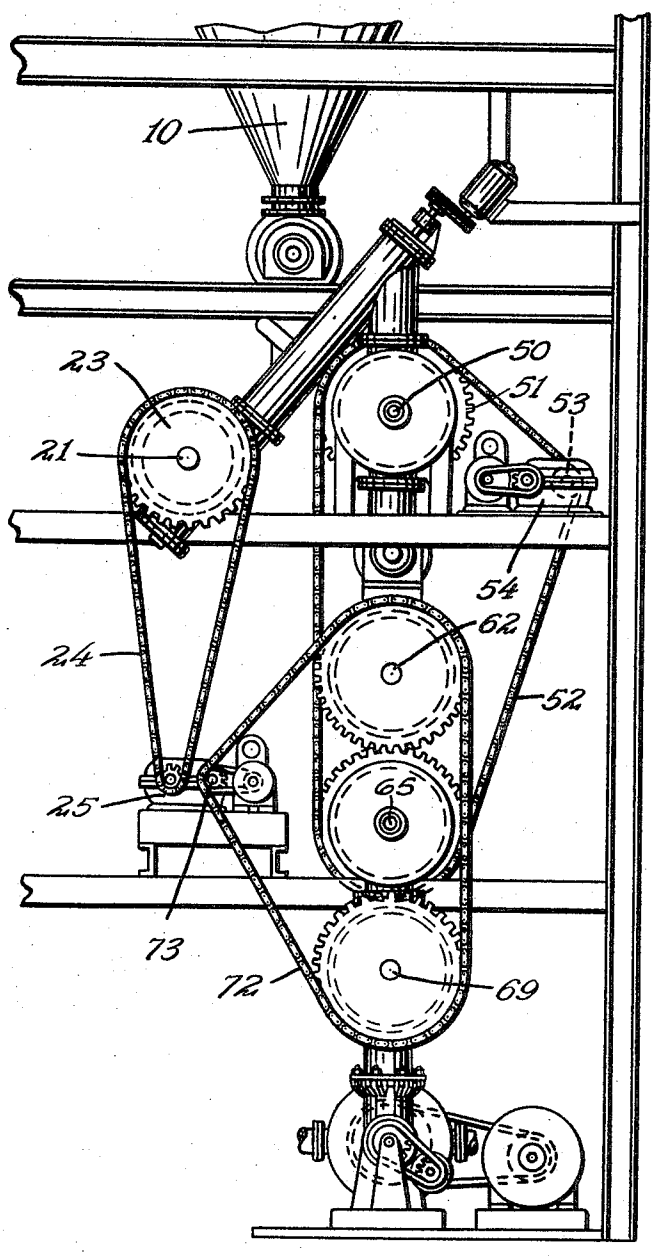


Fig. 2

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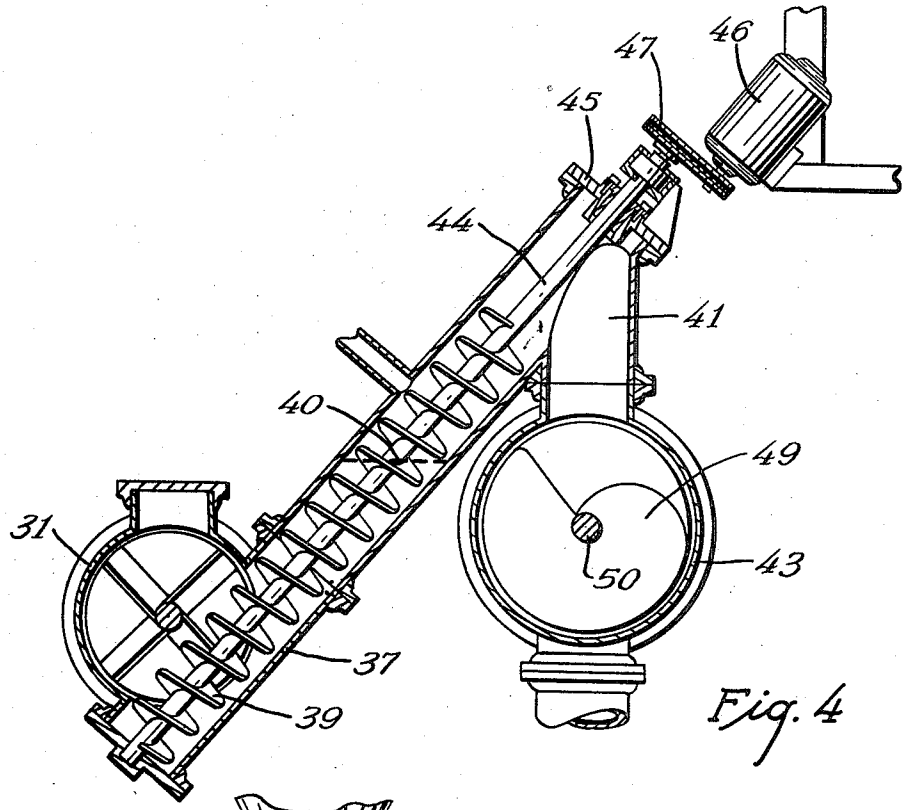


Fig. 4

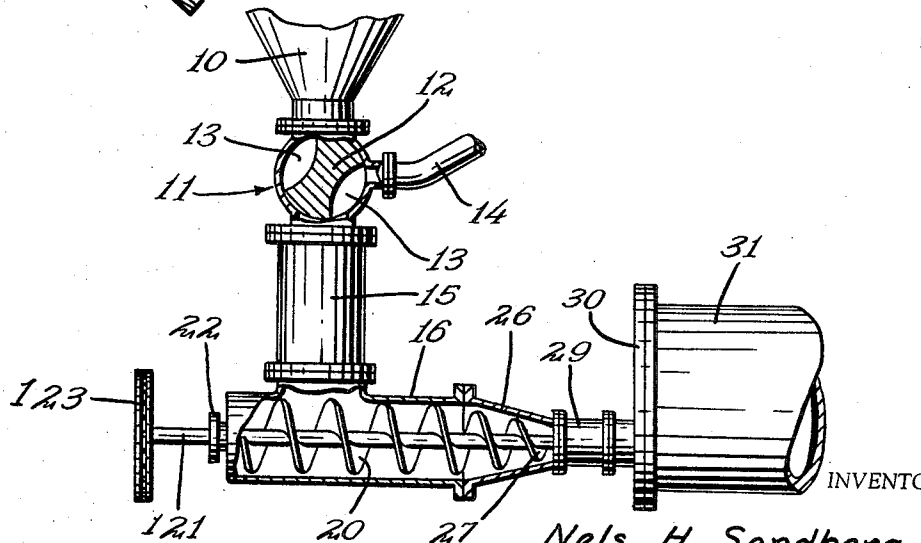


Fig. 3

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APPARATUS FOR IMPREGNATING WOOD CHIPS

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Application December 10, 1954, Serial No. 474,422

6 Claims. (Cl. 162—237)

This invention relates to an improvement in method of preparing paper pulp and deals particularly with a process of preparing wood chips and producing pulp from these chips.

In an application for patent recently filed, Serial No. 442,873, filed July 12, 1954, I disclosed a method of preparing wood chips which included the step of soaking the chips in liquor under hydrostatic pressure. By immersing the chips in a liquor and subjecting the chips to pressure, the liquor acts to heat the chips and the pressure tends to impregnate the liquor into the chips. At the same time however, the temperature of the chips in the liquor is lower than would be experienced if the chips were submitted to steam pressure and temperature.

I have found that there are certain advantages in providing a different type of feed than was shown in my previous application. In the previous arrangement I disclosed the use of a rotary pocketed feed member which delivered the chips from atmospheric pressure to a zone of elevated pressure. The chips dropped by gravity from this rotary feed member into an inclined feed screw which fed the chips downwardly into the impregnate chamber. Here a horizontal feed screw conveyed the chips through the length of the impregnate impregnating chamber. An inclined outlet screw conveyed the chips upwardly to a point above the level of liquid in the impregnating chamber, allowing the chips to drop into a preheating chamber where the chips were heated at an elevated temperature.

It has been found that a somewhat more constant supply of chips may be provided through the use of a plug forming screw which forces the chips through a tapering passage and into the impregnating chamber. A feed of this type is somewhat more constant than that provided by a rotary valve which operates between chambers subjected to substantial variations in pressure. As a result the chips are more thoroughly and uniformly impregnated than would otherwise be possible.

In the chip impregnating process the chips are usually soaked or impregnated with a liquor such as sodium sulphite, sodium hydroxide and water, the amount of liquor being supplied being in certain proportion to the chips supplied. Where the amount of chips fed to the impregnation chamber varies, and where the liquor supply remains constant, it is virtually impossible to evenly impregnate the chips to produce a uniform pulp. Thus the particular type of feed arrangement employed is of importance to the results obtained.

An added feature of the present invention resides in the provision of a chip impregnating apparatus which includes a rotary feed valve which feeds the relatively dry chips into a small heating chamber which is normally subjected to relatively low steam pressure and temperature. With this arrangement, the rotary feed valve is not subjected to high pressure differentials, thus making the rotary feed easier to operate and to maintain,

and rendering it more effective. Furthermore, this rotary feed valve may be oversize if necessary so that the small heating chamber is at all times virtually filled. The heating chamber cannot readily be overfilled, as the rotary feed valve would then not dump its contents, but would merely rotate without emptying its pockets. A constant supply of chips for the plug forming screw is thus at all times maintained.

A further feature of the present invention lies in the provision of a pressure seal at the inlet end of a chip impregnating chamber which includes the combination of a plug forming screw and an auxiliary feed outwardly thereof. One of the major difficulties experienced in a plug forming screw type of seal lies in the fact that if the feed is not constant and if the stock is not of proper density the steam pressure inwardly of the plug forming screw will force the stock past the screw thus blowing the stock at high pressure through the chamber inlet. This not only creates a temporary delay in operation but also may have serious consequences due to the pressure with which the pulp is blown from the apparatus. With the present arrangement the danger of serious consequences due to the blowing out of the plug of chips is obviated by the rotary valve, as in the event the plug blows out, the chips are merely forced into the heating chamber adjoining the impregnating chamber.

A further feature of the present invention lies in the fact that the chips entering the impregnating chamber may be subjected for a short time to elevated temperature and pressure, which, however, is substantially less than the pressure encountered in the impregnating chamber. As a result the dry chips are given a relatively dry heating prior to immersion. This process has been found extremely beneficial to the results obtained.

These and other objects and novel features of my invention will be more clearly and fully set forth in the following specification and claims.

In the drawings forming a part of the specification:

Figure 1 is a side elevational view of a pulp forming apparatus partly broken away to show the interior construction.

Figure 2 is an end elevational view of the construction shown in Figure 1.

Figure 3 is a side elevational view, partly in section, showing the feed portion of the apparatus.

Figure 4 is a vertical sectional view through the outlet end of the impregnating chamber, the position of the section being indicated by the lines 4—4 of Figure 1.

The apparatus disclosed is quite similar in general to that disclosed in my previously filed application with the exception of the arrangement at feed end of the impregnating chamber. However, the entire system is shown somewhat diagrammatically so that the invention can be more readily understood.

The relatively dry chips which are to be made into pulp are fed in any suitable way to a hopper **10** which forms the inlet of the apparatus. At this point the chips are at atmospheric pressure and are usually at room temperature. By the term "relatively dry," I mean to imply that the chips contain their natural moisture content of about 10% to 40% moisture.

From the hopper **10** the chips are fed into a rotary valve **11** which includes a rotating element **12** having angularly spaced pockets **13** therein. The number of pockets **13** is not of importance, it being necessary that the pockets not overlap the inlet and outlet simultaneously.

From the valve **11**, the chips fall by gravity or are blown from the pockets by steam entering the heating chamber **15** through a steam line **14**. This heating chamber **15** is of sufficient diameter to hold the necessary

quantity of chips to compensate for variations in feed and so that the chamber may always supply the necessary amount to the lateral feed conveyor chamber **16** to maintain a feed plug.

As is shown in Figure 1 of the drawings the rotor **12** of the rotary valve **11** is operated by a shaft **17** driven by a suitable motor **19**, which rotates at the proper speed to effect the desired speed of rotation of the rotor **12**. The chamber **16** is equipped with a screw conveyor **20** driven by a shaft **121** extending through an end of the chamber and through a suitable seal **22**. A sprocket **123** is mounted on the shaft **21** and is connected by a chain **124** to the sprocket of a suitable drive motor **125**. The screw conveyor **20** directs the chips toward a tapered plug forming chamber **26**, and the end **27** of the conveyor **20** extending into the tapered chamber **26** is tapered.

The tapering conveyor screw thus forces the chips through the tapered chamber **26** compacting the chips into a solid plug and forcing them into the relatively small diameter orifice **29** leading to one end **30** of the impregnating chamber **31**. With this arrangement substantially greater steam pressure can be maintained within the impregnating chamber **31** than is experienced in the feed conveyor chamber **16**.

The impregnating chamber **31** is provided with a feed screw **32** extending therethrough. The outlet end of the conveyor is best illustrated in Figure 4. An inclined tubular member **37** supports a feed screw **39** and is upwardly inclined from the impregnating chamber **31** so that the impregnating chamber may be filled with liquor to a liquor line **40** (Figure 4) which is above the level of the chamber. The chips are conveyed upwardly by the conveyor **39** and dropped into a tubular passage **41** leading to a cooking chamber **43**. The shaft **44** of the conveyor **39** extends from the upper end **45** of the passage **37** and is driven by a suitable motor **46** connected by sprockets and by the chain **47** to the shaft **44**. An outboard bearing **48** near the upper end of the shaft assists in overcoming the end thrust of the conveyor.

The chips are conveyed through the cooking chamber **43** by a conveyor **49** mounted upon a shaft **50** which extends through an end of the cooking chamber. This shaft **50** supports a sprocket **51** which is connected by a chain **52** to a suitable sprocket **53** on a drive motor **54**.

In the cooking of the chips, the length of the cooking operation is dependent upon a number of features such as the liquor used, the chips used, and the type of pulp being made. In some systems a single elongated cooking chamber is sufficient to properly cook the chips. However, in other systems a longer cooking period is required. As the length of the cooking chambers are usually limited due to the necessity of continuously feeding the pulp through the chambers and due to space restrictions, in the present process I have disclosed additional cooking chambers **55**, **56** and **57** which are connected in series. Furthermore, as it is sometimes desirable to increase the temperature of the chips as they are cooked, one or more rotary transfer valves such as **59** may be provided between the various cooking chambers.

In the arrangement illustrated the cooking chamber **43** delivers chips through the transfer valve **59**, driven by the motor **60** into the cooking chamber **55**. A conveyor **61** on a conveyor shaft **62** conveys the chips from the inlet end to the outlet end of the chamber **55** delivering the chips to the passage **63** leading to the cooking chamber **56**. The chamber **56** is likewise provided with a conveyor **64** mounted upon a shaft **65** which forces the chips from the passage **63** to the passage **66**. The passage **66** delivers the chips to the cooking chamber **57** and the chips are conveyed by the conveyor **67** mounted upon the shaft **69** to a vertical passage **70** leading to the chamber **71**. The shafts **62** and **69** are driven by a chain **72** by a motor shaft **73** and the shafts **65** and **50** are driven by the chain **52** and motor **53**.

The passage **71** includes a driven screw conveyor **74** leading to the defibrator **75** which is of the Asplund type. This defibrator passes the pulp while still under elevated temperature and pressure between a pair of relatively rotating attrition discs before the pulp is exhausted through a relatively small orifice to atmospheric pressure.

A steam manifold **76** extends into the impregnating chamber **31** and communicates with the outlet passage **37** at a point above the liquid level so as to maintain pressure within the soaking chamber. However, as the impregnating chamber contains liquor, the temperature within this chamber is not as high as would be the case if the chips were subjected to the temperature corresponding to saturated steam pressure of perhaps one hundred fifty pounds. For example, the liquid within the chamber may be only approximately 240° F. within the chamber **31** although the temperature of saturated steam at one hundred twenty-five pounds pressure is approximately 344° F. Thus the chips are soaked under hydrostatic steam pressure within the liquid and the chips are thoroughly impregnated without becoming cooked or without danger of being overheated at the outside raw and uncooked at the center.

The heating chamber **15** may be maintained at any desired steam pressure at or lower than that found in the impregnating chamber. However, it is usually desirable to maintain the chips at a temperature somewhat below that in the cooking chambers if the heating chamber is large enough so that the chips remain therein for any substantial period of time.

It will be seen that with this system the feed through the impregnating chamber will remain substantially constant as the type of apparatus employed produces a substantially constant feed. As long as the rotary valve **11** provides an adequate supply of chips in the heating chamber **15**, no difficulty will be involved in the event the rotary valve does not feed the same amount during each rotation. The steam supply in the heating chamber **15** may be through the rotary valve element **12** to assist in emptying the pockets thereof or may be directly into the chamber **15** as desired.

The system described may use the types of liquors described in my previous application and may produce the pulps described therein. The main difference in the present invention resides in the particular form of feed for supplying the impregnating chamber with chips.

In accordance with the patent statutes, I have described the principles of construction and operation of my method of preparing paper pulp, and while I have endeavored to set forth the best embodiment thereof, I desire to have it understood that obvious changes may be made within the scope of the following claims without departing from the spirit of my invention.

I claim:

1. A feed mechanism for wood chips and the like comprising a rotary transfer valve, a sealed heating chamber connected to the transfer valve to receive chips therefrom, a tubular passage into which chips pass from said heating chamber, a tapered end on said passage, a screw conveyor within said tubular passage, and a tapered end on said screw conveyor, and a chip immersion chamber into which said tubular passage extends.

2. The construction described in claim 1 and in which the heating chamber is positioned above the tubular passage so that chips may drop by gravity into said passage.

3. The structure described in claim 1 and in which the heating chamber is generally vertical and the tubular passage is generally horizontal and below said heating chamber.

4. A wood chip impregnating apparatus including an elongated liquid containing immersion chamber, an out-

let at one end of said chamber extending upwardly therefrom, a tubular passage tapering toward the other end of said chamber and communicating therewith, a spiral conveyor in said tubular passage having a tapered end in said tubular passage, a heating chamber above said passage and a rotary valve connected to said heating chamber and arranged to deliver chip thereto.

5. The structure described in claim 4 and including means for maintaining hydrostatic pressure upon the liquor within the impregnating chamber.

6. A wood chip impregnating apparatus including an impregnating chamber, an inlet extending downwardly into said chamber, said inlet including a feed valve through which the wood chips are fed, a preheating chamber beneath the level of said feed valve, a second feed means extending from said preheating chamber to said impregnating chamber through which the chips pass while maintaining a pressure differential between said impregnating chamber and said preheating chamber, conveyor means for conveying the chips longitudinally of said impregnating chamber, an outlet at the end of said impregnating chamber remote from the second feed means, said outlet extending upwardly from said impregnating chamber, and steam supply means for subjecting the liquid within said impregnating chamber to steam pressure, the impregnating liquor within said impregnating chamber being maintained thereby at a temperature substantially below the corresponding temperature of saturated steam at the steam pressure upon the liquid, whereby the chips passing through the impregnating chamber may be soaked

at a temperature below steam temperature and at a pressure substantially above atmospheric pressure.

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