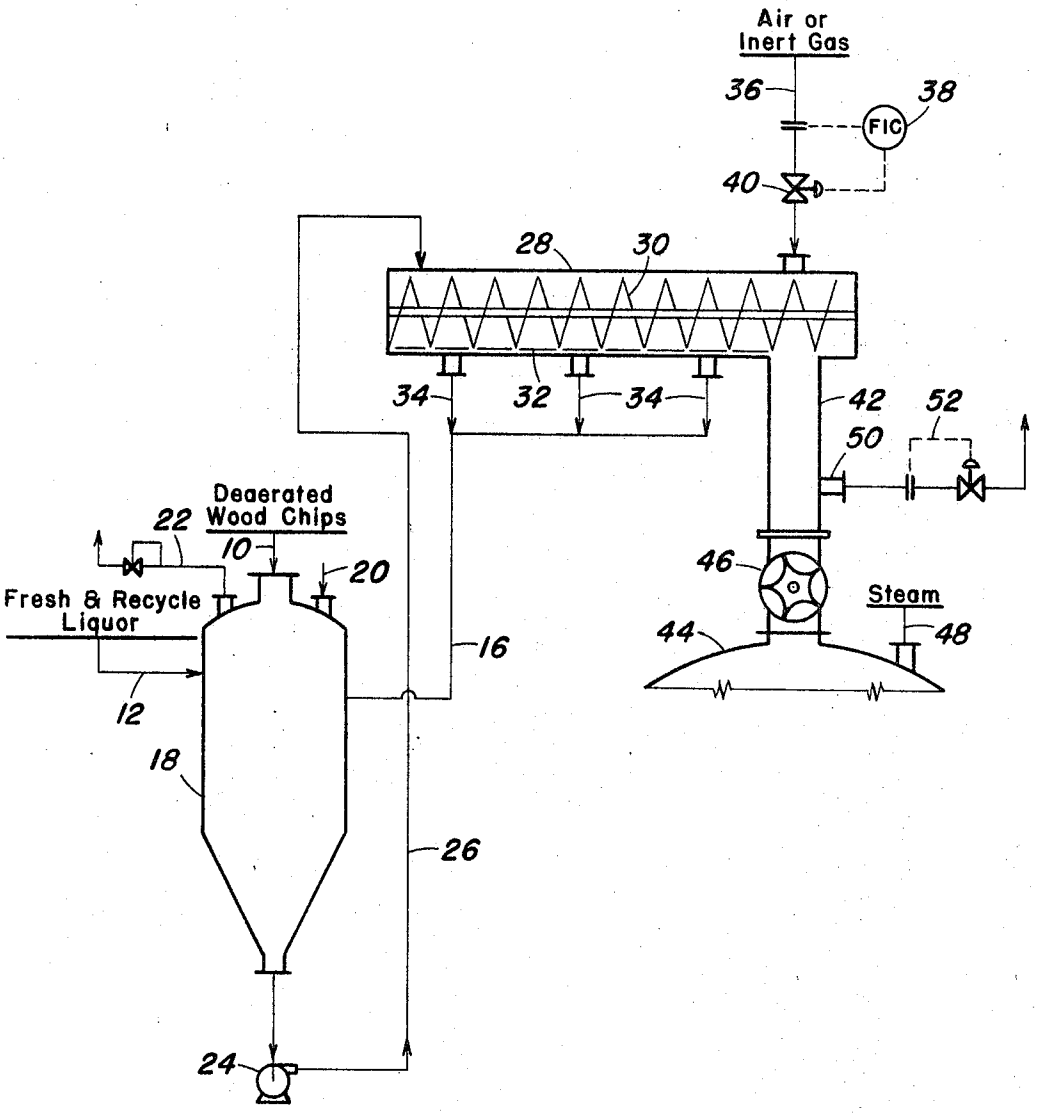
Aug. 25, 1970 A. W. GESSNER 3,525,665

METHOD OF TRANSFERRING IMPREGNATED WOOD CHIPS FROM AN IMPREGNATING VESSEL TO A DIGESTER

Filed Oct. 22, 1965




INVENTOR
Adolf W. Gessner

BY Marn & Jangarathis
ATTORNEYS

United States Patent Office 3,525,665
Patented Aug. 25, 1970



3,525,665

# METHOD OF TRANSFERRING IMPREGNATED WOOD CHIPS FROM AN IMPREGNATING VESSEL TO A DIGESTER

Adolf W. Gessner, Montclair, N.J., assignor to The Lummus Company, New York, N.Y., a corporation of Delaware

Filed Oct. 22, 1965, Ser. No. 502,269
Int. Cl. D21c 3/26
U.S. Cl. 162—19 2 Claims

## ABSTRACT OF THE DISCLOSURE

In the treatment of cellulosic material wherein the material is treated in seriatim in an impregnator, liquor-drainer and digester, the digester and liquor-drainer are maintained at about the same pressure, a pressure higher than the impregnator, by introducing a compressed gas into the liquor drainer. In this manner, steam in the digester is prevented from entering the liquor drainer.

This invention relates generally to the treatment of cellulosic material and, more particularly, the invention relates to an improved method of transferring impregnated wood chips and the like from an impregnating vessel to a digseter, and apparatus therefor. The process results in closer thermal and chemical control of both the impregnation and digestion stages of the pulping process.

In pulping processes employing separate chip impregnation and cooking steps, as for example rapid alkaline pulping processes, it is essential that the temperature in each stage be controlled precisely. In such processes the chips or other cellulosic material are treated in seriatim in three stages. First, they are impregnated with white liquor and recycle liquor at a first temperature and pressure in an impregnation zone, the chips are then commonly drained of excess liquor in a chip drainer, and lastly they pass to the digestion zone. The chip drainer may also convey the chips to the digester. The liquor is recycled to the impregnating zone. The digester is operated at higher temperatures and pressures than the impregnating vessel. In continuous vapor-phase pulping close temperature control is extremely difficult, due to the escape of steam at digestion temperature and pressure from the digestion vessel into the chip drainer. The cooking steam, which is typically at a temperature in the range of about 170° to 185° C., comes into contact with the excess impregnation liquor draining from the chips. As long as there is any temperature difference between the cooking steam and the impregnation liquor, some cooking steam will condense into the liquor, causing its temperature to rise to a temperature approaching that of the steam, and at the same time diluting the impregnation liquor.

Heretofore, the above-described condensation has been considered essentially inescapable. The dilution problem has been overcome by flashing off steam from the hot, diluted impregnating liquor at a lower pressure prior to recycle. While this preserves the liquor at design concentration it does not prevent the loss of high pressure cooking steam. Moreover, it requires the use of an extra stainless steel flash drum, a level controller and a pressure controller.

Accordingly, it is an object of the present invention to provide an improved method and apparatus of transferring cellulosic material from an impregnation zone to a digestion zone which overcomes the deficiencies of prior art methods.

Another object of the present invention is to provide a method and apparatus for transferring impregnated wood chips to a digestion vessel without loss of cooking steam or dilution of the impregnating liquor.



Still another object of the invention is to provide a method and apparatus for transferring impregnated wood chips to a digestion vessel wherein temperature control of impregnation and digestion is improved.

Various other objects and advantages of the invention will become clear in the course of the following description of an embodiment thereof, and the novel features will be particularly pointed out in connection with the appended claims.

In accordance with the present invention, impregnated wood chips and excess liquor are fed from the impregnating vessel into a chip drainer, which may be of essentially conventional design. Commonly, this is a screw conveyor having a screen covering a trough in the bottom through which the excess liquor passes. A conduit or conduits and appropriate pumping means return the liquor to the impregnation vessel. The drained chips are dropped from the drainer through an opening and pass into a conduit leading into the digester. It is of course at this point, when the digester feeding valve opens, that cooking steam normally escapes and passes into cooler portions of the system. In the present invention, however, a small amount of high pressure air or inert gas is provided in the discharge end of the drainer. This gas serves to maintain the total pressure in the drainer at the same level as the pressure in the digester. However, the partial pressure of water vapor in the drainer may be much lower than that in the digester, and the impregnation liquor temperature may thus be at any temperature below the cooking temperature. The difference between the partial pressure of water in equilibrium with the impregnation liquor and the total pressure in the drainer is made up by the partial pressure of the added gas in the drainer.

The compressed gas passed into the drainer is vented as required through an opening in the conduit leading to the digester. Any steam which does leak upwardly against the air pressure will also be removed through this opening, so the liquor is never diluted.

A better understanding of the invention will be gained by referring to the accompanying drawing, which is a greatly simplified schematic illustration of the apparatus of the invention, and the following discussion of same.

With reference to the drawing, deaerated wood chips, in line **10**, fresh cooking liquor and spent liquor recycled from the digester in line **12**, and recycle impregnation liquor in line **16**, are all passed to the impregnating vessel **18** in the conventional manner. Compressed air or an inert gas in line **20** may be employed to control pressure in impregnator **18**, line **22**, with a back pressure control valve, being provided for exhaust.

A suitable pump **24** below impregnating vessel **18** feeds impregnated chips and liquor via line **26** into chip drainer **28**. The chips are conveyed along the length of drainer **28** by screw conveyor **30**, which is equipped with a screen in the bottom thereof, indicated generally by dotted line **32**, through which the liquor passes. A plurality of conduits **34** collect the liquor and return it to liquor recycle line **16**.

Compressed gas is supplied to drainer **28**, from line **36**, which may include a flow indicating controller **38** which opens or closes flow control valve **40** as required. Chips reaching the end of drainer **28**, fall into conduit **42** located directly above digester **44**, shown only partially. A rotary feed valve **46** may be placed in the top of the digester to pass the chips into the digester, but the invention will work without such a valve. Cooking steam is supplied to digested **44** through line **48**. An air vent **50** is located in conduit **42** or in the casing of rotary feed valve **46**, these locations assuring that any steam coming from digester

44 will be drawn off before it reaches the cooler chip drainer. Vent **50** is provided with a suitable back pressure controller and valve **52**.

In operation, drainer **28** is maintained at approximately the same temperature as the impregnator and the same pressure as the digester. Thus, the chip slurry entering the drainer via line **26**, which is 1–5% solids by weight, may be at about 120° to 140° C. Impregnating vessel **18** is maintained at only 0.8 to 2.4 atm. gage, however, and immediately on entry into the drainer the chips are subjected to the digester pressure of 5–11 atm. gage, maintained by compressed gas from line **36**. The pressure differential between the drainer and the impregnator reduces the amount of work necessary to recycle the liquor.

As noted above, the compressed gas in line **36** can be air or an inert gas; it is to be noted, however, that air should not be used when the presence of oxygen will adversely affect the pulp brightness and strength. In such an instance, a gas generated by burning a fuel in air to consume the oxygen may be employed. To completely consume the oxygen, there should be a stoichiometric excess of fuel. When the cooking liquor is alkaline, $CO_2$ should be scrubbed from the combustion gases before injection in line **36** to avoid decreasing the effective alkalinity of the liquor by absorption of $CO_2$ and formation of sodium carbonate. Of course, other inert gases can be employed when use of air is restricted. For instance, natural gas (predominently methane) or town gas (predominantly $H_2$ and CO) or nitrogen are all satisfactory. Since only moderate quantities of gas are required, the cost is not a significant economic burden. By virtue of the foregoing, it will be understood that the expression "air or an inert gas" is not truly alternative, the choice being dictated by these considerations. Naturally, air will be used whenever possible.

By virtue of the foregoing, steam from the digester is effectively prevented from entering the drainer, temperature control of the impregnating and digester vessel is made easier because the recycle liquor is not heated in the drainer and steam losses from the digester are minimized and, lastly, there is no dilution of the recycle liquor.



It is to be understood that various changes in the details, steps, materials, arrangements of parts, and design of parts, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention as defined in the appended claims.

What is claimed is:

**1.** In a process for treating cellulosic material in seriatim in an impregnating zone, a liquor-draining zone and a digestion zone, and wherein said impregnating zone is maintained at a first temperature and pressure and said digestion zone is maintained at a second, higher temperature and higher pressure, the improvement comprising maintaining the temperature of the liquor draining zone at about the same temperature as the impregnating zone and maintaining said liquor-draining zone at about the same pressure as said digestion zone by introducing compressed air into said liquor-draining zone.

**2.** The process as claimed in claim **1** wherein the impregnating zone is maintained at a pressure between about 0.8 and about 2.4 atm. gage and the liquor-draining zone and digestion zone are maintained at a pressure between about 5 and about 11 atm. gage.


**References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 2,996,422 | 8/1961 | Durant et al. | 162—237 X |
| 3,446,698 | 5/1969 | Shick | 162—19 |
| 3,259,538 | 7/1966 | Schnyder | 162—19 |

FOREIGN PATENTS

| | | |
|---|---|---|
| 463,363 | 2/1950 | Canada. |



HOWARD R. CAINE, Primary Examiner

U.S. Cl. X.R.

162—65