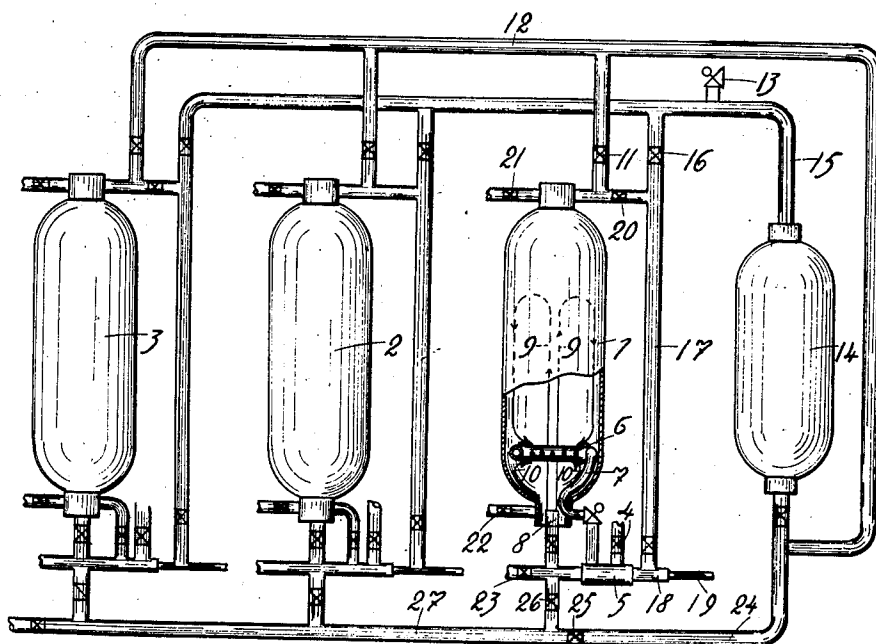


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J. H. WALLIN
PROCESS OF AND APPARATUS FOR TREATING FIBROUS
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Inventor
Johan H. Wallin
by *Harold Smith & Tennant.*
Attys.

UNITED STATES PATENT OFFICE

JOHAN HUGO WALLIN, OF BENGTSFORS, SWEDEN

PROCESS OF AND APPARATUS FOR TREATING FIBROUS MATERIALS FOR PULPING PURPOSES

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The manufacture of sulphite cellulose by digesting generally occurs by introducing steam directly into the digester, usually through steam-pipes opening into the bottom of the digester, or also by heating the digesting liquor indirectly through steam introduced through coils in the digester.

Especially in connection with direct digesting in standing digesters considerable inconveniences occur consisting first of all in an irregular distribution of the heat, imperfect liquor circulation in the digester, and a difficulty of maintaining the necessary percentage of sulphurous acid during the digesting. At a high packing degree of the fibrous material in the digester these inconveniences are especially conspicuous.

Even with other digesting processes employed hitherto the consumption of steam and chemicals is high, and the output generally less satisfactory and the quality of the mass manufactured irregular.

This invention refers to quite a new digesting process, by which the above-mentioned inconveniences are removed and a great many advantages won.

For digesting of sulphite cellulose it is very important that the digesting liquid should have a high percentage of free SO_2 especially during the saturation period when the fibrous material is saturated with digesting liquid before the process of decomposition begins at about 105°C . During the saturation period it is also advantageous to have a high pressure in the digester. It is, moreover, important that the composition of the digesting liquid should be as constant as possible all over the digester.

By this invention a high percentage of SO_2 may be maintained in the digester, and the pressure in the digester may be held high continuously from the beginning of the digesting.

Moreover, according to this invention, a composition and temperature of the digesting liquid as constant as possible may be maintained all over the digester, and a high starting temperature for the digesting may be obtained.

Referring to the accompanying drawing

an embodiment of the invention is described below as applied to the manufacture of sulphite cellulose. The invention is not, however, limited hereto, but may be applied to every kind of cellulose making by digestion, even to alkaline digesting. Nor is the invention limited to the process and apparatus described below, but modifications are in many respects possible within the scope of the invention, which carries with it a lot of advantages in comparison with the digesting processes known before and the apparatus necessary thereto. The process may be used with advantage even in combination with indirect heating by steam.

The embodiment of the invention given here as an example refers, as has been said, to the fabrication of cellulose by digesting with sulphite-acid. In the drawing a plant with many digesters combined in one system is shown schematically, and these digesters are to be regarded as being on different digesting stages.

After the digester 1 has been filled with wood chips or any other raw material and digesting liquor, steam is let on through the valves 4 and 19, whereby the valve 16 is opened. The injectors 18 and 5 begin to operate. This results in sucking that digesting liquor from the digester through the sieve 6 and the pipe 7 into the injector 5, where it is heated by the steam and forced into the digester through the sieve 8. At the same time gas flows through the pipe 17 to the injector 18. Thus a circulation of the liquor in the digester is obtained along substantially the paths indicated by the arrows 9 and 10, and a circulation of gas through the contents of the digester is also obtained.

The heating of the contents of the digester results in a pressure above atmospheric. The valve 11 may then be opened and through this valve and the pipe 12 the digester 1 is connected to the boilers 2, 3 (or to one of them) which are under cooking at different stages, and also to the receptacle 14.

On account of the pressure above atmospheric in the digester 1 the liquor and gas

are forced through the pipe 12 into the bottom of the receptacle 14. The gas, which has become free in the receptacle, is led back through the pipe 15, the valve 16, the pipe 17 and the injector 18 to the injector 5 and further to the digester 1. The injector 18 works with high pressure steam supplied through the valve 19. From the gas in the receptacle 14 there is at the same time taken some gas to the digester (or the other digesters) in which the digestion occurs. As the need of a high percentage of sulphurous acid and the possibility of maintaining the same absorbed in the digesting liquor is the greatest before the temperature in the digester has risen too high, and as at the same time some gas has to be led away from the digester (or digesters) which has a higher temperature, a transmission of sulphurous acid takes place automatically through the receptacle 14 to the digester with the greatest absorbability. A heating of the contents may take place in the receptacle 14 if it is found suitable.

By regulation of the valves 4 and 19 the digesting may be driven in the way most suitable in order to obtain the desired cellulose quality. The valve 19 may for instance be held quite open during the whole digestion, and steam is introduced through the valve 4 to the extent to which a quicker rise of the temperature is wanted.

When there is too high a pressure in the whole system, gas leaves through the safety valve 13, which is placed on the pipe 15 to acid cisterns, or towers, or other devices for recovering the acid.

The digester 1 may, if desired after part of the digesting liquid has been taken out be shut off from the pipes 12 and 15 by closing the valves 11 and 16. If the valve 20 is opened, the gas circulation continues from the upper part of the digester through the pipe 17 and the injectors 18 and 5. When the digesting is finished, the valves are closed, after which the valve 21 is opened for drawing off gas and steam. After the liquor has been removed—if such removal takes place—for instance through sieve 8, the boiler is emptied through the valve 22.

At the charging of digesting liquor to the following digesting a suitable quantity of sulphite acid is introduced through the valve 23. Then or simultaneously herewith the liquor in the receptacle 14 is forced through the pipe 24 and the valves 25 and 26 into the digester. Finally, if desired, a larger or smaller quantity of digesting liquor is added through the pipe 27 and the valve 26 from one or more other digesters at a suitable digesting stage.

Should at any occasion a decrease of the quantity of the liquid be desired during the digesting, this may take place by shutting

off the steam supply and opening the valves 26 and 25, digesting liquid passing then over to the receptacle 14 through the pipe 24.

The outlet for liquid and gas at the top of the digester may be combined with a siphon-pipe. There may also be arranged various outlets on different heights of the digester.

The essential advantages of the invention are as follows:

An effective circulation of the digesting liquor in the digester is obtained. A very even heat distribution in the digester is obtained. The composition of the digesting liquor varying during the digesting is at every occasion as constant as possible in the whole digester. The highest possible percentage of the easily volatile ingredients of the digesting liquor may be maintained during the different periods of the digesting. Violent variations as to the composition of the digesting liquor during the run of the digesting may be avoided. The digesting takes place without disturbances and may be regulated in a simple and satisfactory way. During different digesting operations following upon each other an equalization of possible variations occurring on account of the qualifications for the digesting may be obtained. This equalization may take place automatically.

The cooking may take place quicker than before without disadvantage. An increased pulp output of even and high quality is obtained. A considerable saving of steam and chemicals is obtained. A higher filling degree with accompanying advantages may be had without difficulty. The emptying of the digesters is facilitated. At the application of the system to the cases when regular violent changes of the digesting pressure are wanted this may easily be effected. The risk of getting too high a pressure of the digesters drops out thereby that a valve may be used. The circulation pipes for the digesting liquor are very short. The risk of encrustation is a minimum. Air may easily be effectively separated from the digesters.

The invention may be applied at plants comprising one or more boilers. By introducing the steam necessary for the digesting through at least two injectors, and by connecting one of them to a liquor circulation pipe, which is so arranged as to obtain the best possible circulation of the liquid in the digester, and the other to a pipe for supply of steam and gas, the contents of the digester may be heated as even as possible during maintenance of necessary circulation and uniform composition of the digesting liquor and the highest possible concentration of the easily volatile ingredients form-

ing parts of the digesting liquor during the whole digesting operation.

It has been found very well adapted to combine the two injectors, so that the outlet pipe of the gas-injector opens into the steam pipe of the injector for the circulation of the digesting liquor. Thus a simplified arrangement is obtained, a decreased risk of encrustation ensuing from over-heating of the digesting liquor, as well as a further improvement of the circulation.

It is in many cases suitable to use steam only having a pressure a little above the digester pressure for the liquor injector, whereas steam of a substantially higher pressure is supplied to the injector for gas and steam.

When advantageous, the steam which is led to the liquor injector may be of a lower pressure than the digester pressure, in which case the pressure in the outlet pipe from the injector for steam and gas, which pipe in such a case must be connected to the steam pipe in the liquor circulation injector in a suitable way, must have such a high pressure, that the mixture of steam and gas which in the liquor circulation injector comes into contact with the digesting liquid obtains a higher pressure than that of the digester. During these special working conditions it is suitable to use a regulating device constructed according to any known principle, and which according to what has just been said, limits the supply of steam with a lower pressure than the digester pressure.

Several injectors on one and the same boiler may also be used within the scope of the invention. These are then preferably constructed in form of double-injectors of the kind described above.

The cooking liquid which is supplied to the liquor circulation injector is exhausted from the digester by means of one or more sieves, which are placed in any suitable manner according to the form of the digester and the employed digesting method. The inventor has found it preferable in standing cellulose digesters to place one or two annular sieve surfaces peripherically at the top of the lower conic part of the digester.

The digesting liquid, which is circulated, is preferably introduced into the digester through one or more sieves, which are so arranged that an effective circulation is obtained. The inventor has found it preferable at a standing cellulose boiler to introduce the digesting liquid at the bottom of the digester and to distribute it so through the sieve surface, that either part of the liquid circulates in the lower part of the digester, and part of it flows upwards and circulates in the upper part of the digester, or that all the introduced liquid first

circulates in the lower part of the digester and then flows upwards and circulates in the other parts of the digester.

The invention is not limited to the placing of the sieve surfaces as mentioned as an example above. Within the scope of the invention the sieve surfaces may with regard to the form of the digester and the digesting procedure applied be arranged in such a way as is most preferable in the case in question.

As an essential part of the invention should be noticed the possibility of maintaining the highest possible percentage of the easily volatile ingredients of the digesting liquid automatically in the liquid in all parts of the digester and during the whole digesting operation. This is obtained by arranging it so at the circulation procedure described above that the easily volatile ingredients in the digesting liquid may be accumulated in a receptacle communicating with the digester. The advantages of the system stand out at a still higher degree when several digesters are connected to one and the same receptacle. In such a case a permanent transmission and equalization takes place between the conditions in the different digesters, and the most ideal regulation possibilities exist.

On account of the fact that the pipe running from the top of the above-mentioned receptacle to the circulation system contains a mixture of gas and steam quite exempt from digesting liquid and cellulose, one or more safety valves may be applied on the same. Effective safety valves have not at all been able to be provided for sulphite cellulose digesters hitherto. Thus a completely automatical regulation of the maximum pressure of all digesters may be obtained, which means considerable progress against all sulphite digesting systems existing hitherto.

If valves for blowing off gas and steam constructed as safety valves are provided on one or more digesters the outlet from one or more of these valves are connected to one or more receptacles containing digesting liquor and standing under a pressure no less than a certain minimum pressure, and which receptacles even through a pipe, possibly provided with an automatically operating valve device, are connected with the receptacle serving as separator. In such a way gas may be stored under pressure in order to be conducted to the system in case of need when a low pressure arises.

In a plant comprising several digesters combined with each other and with one or several receptacles adapted for application of this invention any digester may be disconnected from the system when desired and be driven with a higher or lower pressure than that of the other digesters. Thus the

liquor and gas circulation may continue and liquor be let off or supplied. By changing the pressure and temperature and by opening valves gas may be let off, or supplied to the digester, and even liquid from the receptacle may be introduced into the digester if desired.

It has been found suitable when using separately coupled digesters to provide these with valves constructed as safety valves. If these valves are easily adjustable, an appropriate automatical maximum pressure regulation may be obtained.

Gas or steam and gas may be conducted to the digester from several receptacles and several conduits may be with or without injector devices connected to the digester. It is not necessary that the top of the digester is connected to the bottom of the receptacle during the digesting process but the gas may be led away to any other device for recovering. It has been found suitable to introduce the steam and gas into the digester in such a way that the digesting liquor is entrained and thus brought in circulation within the digester. This circulation is facilitated, if the digesting liquor through one or more sieves is separated from the fibrous material and then is led to a device, for instance one or more injectors, where it is affected by the steam and gas.

The contents in the receptacle, from which the gas is led to the digester may be directly or indirectly heated. In certain cases it may be suitable to cool the contents in the receptacle in order to give the liquor increased power of absorption.

One or several gas injectors, common to several digesters, may be used and these may be so arranged, that the gas is pressed into the digesters.

The total amount of steam may pass the gas injectors used.

Gas from any other source than digesters may be introduced into the digester or into the receptacle. The gas or gas mixture to be introduced into the digester may before its introduction into the circulation organs be extra compressed. The circulation device for gas may also consist of a compressor.

The circulation may also be driven in such a way that the liquor is taken out at the bottom of the digester, an even flow thus occurring upwards in the horizontal section of the whole digester.

In certain cases it may be advantageous that the circulation is allowed to take place in such a way that the liquor passes the fibrous material from the top to the bottom, and the steam and the gas from the bottom to the top. This is especially favourable when the fibrous material is not totally covered by cooking liquor. Especially at high working pressures there may, by application of the invention, advantageously be

worked with a small quantity of liquor in the digester, at which thus the fibrous material only is saturated with digesting liquor, and liquor incessantly is flushed from the top over the fibrous material while gas flows from the bottom to the top. Thus steam may be conducted either separately, with the gas, with the valve, or in many of these ways at the same time. In this case is it advantageous to construct the digesters with large height and relatively small diameter cylindrical or a little conical, wider at the bottom. In order to facilitate the emptying, it may be advantageous to construct the whole bottom of the digester as a removable lid.

It may be preferable to allow a large quantity of digesting liquor to be present at the beginning of the digesting in the digester in such cases when the digesting at least partly occurs in the presence of only a relatively small quantity of digesting liquor in the digester.

The invention, especially constructed as described immediately above, may be advantageously applied to digesting processes, at which at different stages the fibrous material is subjected to a treatment with different chemicals.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. The process of treating fibrous materials in a digestion for pulping purposes by digestion, consisting in injecting the digesting liquor into the digester by means of a mixture of steam and gas produced by the digestion operation, and effecting circulation of said digesting liquor through the fibrous material in said digester.

2. Process of treating fibrous materials for pulping purposes by digestion, consisting in effecting circulation of the digesting liquor through said fibrous material thereby, that the digesting liquor and the steam and gas produced by digestion are made to circulate simultaneously by means of injector action effected by steam, the steam introduced for injecting the steam and gas being of a higher pressure than that for injecting the digesting liquor.

3. In a process according to claim 1 further compressing the steam and gas before introducing in the digesting liquor.

4. In a process of treating fibrous materials for pulping purposes by digesting in several digesters being at different digestion stages, leading the steam and gas from one or several digesters through a receptacle serving as separator, in which the accompanying liquor is separated from the steam and gas, to one or more digesters, in which there is a greater absorbability for the gas on account of the conditions existing therein, and pressing in digesting liquor from

the bottom of a digester into the liquor separated in the separator.

5 5. An apparatus of the class described including a digester and at least two injector devices, connected to the digester and so arranged, that the injector device for the steam and gas injects the steam and gas in the injector device for the digesting liquor.

10 6. An apparatus of the class described, including several digesters, at least two injector devices connected to each digester, one of which is adapted for injecting the digesting liquor in the digester and the other for injecting the steam and gas at the bottom of the digester, and a closed receptacle serving as a separator, each digester being connected to the bottom of the separator by means of a pipe having valves and the top of the receptacle being connected to the steam and gas injector device of each digester by means of an other pipe having valves.

15 7. An apparatus as claimed in claim 6, characterized thereby, that a safety valve is mounted on a pipe running from the top of said receptacle for conducting the gas to devices for recovering of the acid.

20 8. An apparatus as claimed in claim 6, characterized thereby, that the digesters are provided with valves constructed as safety valves.

25 9. An apparatus as claimed in claim 6, characterized thereby, that the valves and pipes are so arranged, that each digester may be separately disconnected in order to obtain circulation in a separate digester.

In witness whereof I have hereunto signed my name this 5th day of June, 1929.

JOHAN HUGO WALLIN.

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