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METHOD AND APPARATUS FOR FEEDING SUBSTANTIALLY GAS-FREE PAPER PULP INTO A PAPER MAKING MACHINE

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The present invention relates to an apparatus for continuously feeding pulp into a paper making machine, and more particularly to an apparatus for continuously feeding substantially gas-free pulp at a constant rate.

One of the difficulties encountered in the production of high quality paper results from the fact that a certain amount of air is contained in the paper pulp. If such air bearing pulp is delivered onto the forming surface, of a paper making machine, paper of poor quality is produced.

It is one object of the present invention to overcome this shortcoming and to free the pulp of any gases before it is fed onto the paper forming surface of the machine.

It is a further object of the present invention to accomplish this result with relatively simple means so that the operation of the apparatus can be handled in an efficient manner.

It is an additional object of the present invention not only to free the pulp from any gas before it is fed onto the forming surface of a paper making machine but to keep at the same time the feeding rate of the pulp constant.

It is yet another object of the present invention to form an apparatus for accomplishing these results of relatively few and simple parts so that the apparatus can be produced at an economical price and will give long and trouble-free service.

With the above objects in view, the method for continuously feeding substantially gas-free pulp at a constant rate according to the present invention consists in the steps of feeding paper pulp at a rate higher than a given rate through an inlet located at the bottom of a chamber into the chamber to form a pulp bath in the chamber, guiding the flow of the pulp from the inlet in upward direction to the top level of the bath so that gases contained in the pulp may escape therefrom during the rise of the pulp in the bath, discharging the pulp from the chamber, in response to the pressure head of the pulp bath and the gas pressure acting on the bath, onto a supply conveyor of the paper making machine at a rate smaller than the given rate so that the level of the bath and the pressure head tend to increase, drawing off from the chamber excess pulp which tends to rise above a given level in the chamber in order to maintain the pulp constantly at the given level, and maintaining a constant gas pressure in the chamber above the bath, whereby the pulp will be discharged at a constant rate onto the conveyor.

The apparatus for carrying out the method comprises a closed container, inlet means communicating with the container through a bottom wall portion thereof for feeding paper pulp into the container, the inlet means located adjacent one of the end walls of the container, overflow means located at the end wall and spaced from the top wall of the container at a given distance, outlet means communicating with the container adjacent the bottom wall thereof and adjacent the end wall opposite the one

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end wall, and a guide wall in the container located between the inlet means and the outlet means and adjacent the inlet means, the guide wall connected to the bottom wall of the container and extending substantially normal to the bottom wall between opposite side walls thereof and having a top edge spaced from the top wall of the container a distance greater than the given distance, whereby when paper pulp is fed into the container the pulp is guided in an upward direction so that gases contained therein may escape therefrom during the rise of the pulp in the container before the pulp leaves the container through the outlet means.

Preferably, the apparatus comprises further a guiding roller in the container mounted and rotated in such a way that it will guide foam forming on top of the pulp in the container away from the outlet means and toward the overflow means.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a schematic, partly sectioned side view of the apparatus; and

Fig. 2 is a side view of a modification of an element shown in Fig. 1.

Fig. 1 of the drawings illustrates a gas-tight, closed container 1 supported above the floor by horizontal beams 24 and vertical columns 25. The container 1 is preferably made from steel plates and the inner surfaces of the container are preferably made from stainless or acid-proofed steel. The container is divided by an overflow partition 4, 5 into a chamber 26 and into a separate overflow compartment 7.

In the preferred embodiment shown in the drawing, the overflow partition has a lower stationary wall portion 4 fixedly connected to the bottom wall and to opposite side walls of the container 1, and an upper movable wall portion 5 extending between the side walls and adjustably connected at its lower end to the upper end of the stationary wall portion 4 for tilting movement about a horizontal pivot pin 51. The tilting movement of the upper wall portion 5 can be accomplished in any well known manner and by tilting the wall portion 5 the distance of the top edge 6 of this wall portion from the bottom wall of the container can be adjusted between a lower position in which the wall portion 5 is inclined to the stationary wall portion 4 and an upper position in which the former is in line with the latter. In any adjusted position the top edge 6 of the upper wall portion 5 will be spaced, as clearly shown in Fig. 1, from the top wall of the container so that the overflow partition 4, 5 will divide the container 1 in a chamber 26 and an overflow compartment 7 separated from each other and communicating with each other only through the space above the top edge 6 of the movable wall portion 5 of the overflow partition.

The chamber 26 is provided with an inlet opening 9 formed in a portion of the bottom wall of the chamber 26 adjacent the overflow partition 4, 5. Feeding means 3 are provided communicating with the chamber inlet 9 for feeding paper pulp into the chamber. The feeding means 3 are of known construction and they consist of an inlet box 8' divided by a partition wall 8'' into two separate box compartments, into which the paper pulp is fed by a pump, not shown in the drawing. Two perforated hollow rollers 27, driven about horizontal axes by any known drive means, are respectively arranged in the two box compartments. These rollers 27 serve

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to thoroughly mix the material fed into the inlet box 8' before it enters into the chamber 26. A similar roller 10 rotated about a horizontal axis by drive means, not shown in the drawing, is located inside the chamber 26 adjacent to the inlet opening 9. This roller 10 mainly serves to equalize the flow of the material through the inlet opening 3.

Located laterally from the inlet opening 9 and on the side opposite to the overflow partition 4, 5 is a guide wall 22 connected to the bottom wall 1'' of the container and extending substantially normal to the bottom wall between opposite side walls of the container. This guide wall 22 has a top edge 28 which is spaced in the preferred embodiment shown in the drawing substantially equal distances from the bottom wall 1'' of the container and the top edge 6 of the overflow partition 4, 5.

The guide wall 22 has a lower portion 22' curved in opposite directions toward the roller 10 and the lowest of three superimposed rollers 21 to provide streamlined surfaces between this lower portion 22' of the guide wall and the respective rollers.

For feeding the pulp onto a conveyor 16 the chamber 26 is further provided with discharge means 17 located at the bottom of the front wall 1' of the container. These discharge means 17 comprise two baffle plates 20 and 19 respectively hinged connected by hinges 19' and 20' to the front wall 1' and to the bottom wall 1'' of the container. The baffle plates 20, 19 project forwardly from these walls, extend in transverse direction over the full width of the conveyor 16 and form between themselves an elongated outlet nozzle communicating with the chamber 26. Regulating means are provided to adjust the position of the baffle plates 20 and 19. The regulating means for the preferred embodiment shown in the drawing consists in a plurality of eccentrics 29 supported for simultaneous turning movement on the container 1, and connecting rods 30 respectively connecting the eccentrics 29 with the upper baffle plate 20. Only one of the eccentrics 29 and one of the connecting rods 30 are shown in the drawing but it is understood that a whole series of such eccentrics and connecting rods are provided which are mounted spaced from each other along the front wall 1' of the container to support the elongated baffle plate 20 properly over its whole length. To make a fine-adjustment possible, each of the connecting rods is formed from two separate parts which are connected together by adjusting nuts 31 in a well known manner. By turning these nuts, which are threadedly connected to the adjacent ends of the two parts of the connecting rods 30, in one or the other direction, the overall length of the adjusting rod can be adjusted. The angular position of lower baffle plate 19 can be adjusted by means of adjusting screws 32 adjustably screwed in an arm fixed to the beam 24 and bearing with its upper end against the underside of the baffle plate 19.

By this arrangement, the opening of the outlet nozzle can be adjusted, as well as the position of the outlet nozzle in relation to the feed conveyor 16 located in front of the outlet nozzle. The feed conveyor 16, of known construction, consists of an endless belt 16' formed from a flexible wire mesh which is driven by a drive roll 33 and supported by a plurality of supporting rolls 34.

The overflow compartment 7 is provided with an outlet conduit 11 communicating with the compartment 7 near the bottom of the same. Float means are provided inside the overflow compartment 7 which consist of a protecting tube 12 open at both ends and fixedly mounted on the rear wall of the container 1 and an elongated float 13 located inside the protecting tube 12. A lever 35 is pivotally mounted on the rear wall of the container 1, whereby this mounting is sealed in any known manner to the rear wall so that neither gas nor liquid may escape through this mounting. The lever 35 reaches through a slot in the protecting tube 12 and is linked at one end to the upper end of the float 13. The other end of the lever 35

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is linked to a regulating device 14 which in turn is operatively connected in any well known manner to a valve 15 located in the outlet conduit 11. The regulating device 14 may be a pneumatic, hydraulic or electrical mechanism adapted to translate and to amplify the movements of the lever 35 into the proper adjustment of the valve 15. The outlet conduit 11 is, as schematically illustrated in the drawing, connected to the inlet means 8.

The container 1 is further provided with gas pressure regulating means communicating with the container 1 at an elevation higher than the elevation of the top edge 6 of the overflow partition 4, 5 in the uppermost position of this top edge. The gas pressure regulating means consist of an air pump 2 connected by a conduit with the interior of the container 1 and an air conduit 3 provided with a regulating air valve 3'.

Three mixing and guiding rollers 21 of similar construction as the rollers 27 are mounted superimposed to each other within the chamber 26 between the partition wall 22 and the outlet 17, and these rollers are rotated about horizontal axes preferably in the direction as indicated by the arrows. The rollers are adjacent to the partition wall 22 and the curved lower end portion 22' of the partition wall forms with the lowest of the three superimposed rollers 21 a stream-lined passage between this roller and the partition wall. The roller shafts 21' are supported in the side walls of the container 1 and are driven by any driven means not shown in the drawing. The rollers 21 serve to keep the pulp in the chamber 26 homogeneous and in continuous movement. The uppermost of the rollers 21 is spaced from the bottom wall 1'' of the container a distance farther than the top edge 28 of the guide wall 22.

An additional hollow guiding roller 23 having perforations 43 is provided in the chamber 26 adjacent its front wall 1'. Instead of the perforated hollow roller 23, as shown in Fig. 1, a paddle wheel 23', as shown in Fig. 2, may be provided. The roller 23 or the paddle wheel 23', respectively, is mounted for rotation about a horizontal axis which is nearer to the bottom wall 1'' of the container 1 than the top edge 6 of the overflow partition 4, 5 so that the uppermost portion of the roller or the paddle wheel will be slightly below or above the level of the pulp bath. The shaft 23'' of the roller 23 or the paddle wheel 23', respectively, is supported on the side walls of the container 1 and driven in the direction of the arrow by any known drive means.

A roller 18 similar to the rollers 21 is located within the chamber 23 adjacent the outlet 5. This roller is rotated in the direction as indicated and serves to equalize the flow of the material through the outlet. The speed with which the roller is rotated may be varied to adjust the feeding rate of the pulp.

The apparatus as described will operate as follows:

Paper pulp is fed through the feeding means 8 and the inlet opening 9 into the chamber 26 of the container 1. The feeding rate of the pump is adjusted in such a way that this rate is higher than the rate with which the pulp leaves the chamber 26 through the first outlet means 17. Therefore, a pulp bath is formed in the chamber 26 and when the pulp level will reach the top edge 6 of the overflow partition 4, 5, the excess pulp resulting from the difference in the feeding rate and the discharge rate will flow from the chamber 26 into the overflow compartment 7. The pulp level in chamber 26 with which the outlet 17 communicates will therefore be kept constant all the time.

The guide wall 22 forces thereby the pulp entering the chamber 26 to flow in upward direction against the top of pulp bath in the container 26 before the pulp can leave the container through the outlet means 17. The rollers 21 mix the pulp thoroughly and force the pulp again in upward direction along the other side of the guide wall 22. By this combined action of guide wall 22

and rollers 21 any gas contained in the pulp is freed therefrom and the pulp leaves the chamber 26 practically gas-free. The roller 23 or the paddle wheel 23', respectively, pushes the air foam forming on the top level of the pulp bath away from the outlet 17 toward the top edge 6 of the overflow partition wall 4, 5 so that this air foam will flow into the overflow compartment 7. Roller 23 or the paddle wheel 23' form therefore rotary guide means for guiding the top layer of the pulp bath and the air foam contained therein away from the outlet 17 toward the overflow portion 7.

The excess pulp located in the overflow compartment 7 will be drawn therefrom by means of the outlet conduit 11 and this excess pulp will then be fed back into the inlet box 8', and recycled into the chamber 26. The float 13 located in the overflow compartment 7 below the top edge 6 of the overflow partition 4, 5 serves thereby, in cooperation with the regulating mechanism 14 and the valve 15, to keep the pulp level in the overflow compartment always below the pulp level in the chamber 26. This assures that the excess pulp and air bearing foam forming on top of the pulp in chamber 26 is always free to flow over the top edge 6 from the chamber 26 into the overflow compartment 7 and prevents a build-up of the pulp level in the compartment 26 above the top edge 6 of the overflow partition.

The air pressure within the container 1 above the pulp level is regulated and kept constant by means of the pump 2 and the valve regulated air conduit 3. Depending on the air pressure desired above the pulp level, the pump 2 is driven either as a suction pump or compression pump whereby pressure higher or lower than atmospheric pressure can be built up above the pulp in the container. During the operation of the machine pump 2 and the valve 3' are regulated in such a way that the air pressure above the pulp level is kept constant. Proper indicating instruments, not shown in the drawing, are provided to observe and/or to regulate the air pressure in the container.

Since the horizontal cross-sectional area of the overflow compartment 7 is only a fraction of the horizontal cross-section area of the chamber 26, small variations in the pulp level in the overflow compartment 7 will have no disturbing influence on the constant air pressure maintained above the pulp level.

The discharge rate of the pulp depends on the pressure head of the pulp bath and the gas pressure acting on the bath. Since the pulp level is kept automatically constant by means of the described overflow arrangement, only the air pressure above the pulp level has to be kept also constant to arrive at a practically constant preselected discharge rate, so important in the production of uniform paper.

To regulate the discharge rate for the production of a different grade of paper, the pulp level may be raised or lowered by adjusting the upper wall portion 5 of the overflow partition, by adjusting the air pressure above the pulp level through proper adjustment of the air pump 2 and the regulating valve 3', or by adjusting the position of the baffle plates 19 and 20. These adjustments may be made separately or in combination, as desired. A small adjustment of the flow rate may also be made by adjusting the rotational speed of the roller 18.

By the provision of the guide wall 22 in combination with the mixing rollers 21 the paper pulp fed into the chamber 26 is guided through this chamber in such a way that any gases contained in the pulp will be freed therefrom before the pulp is fed onto the forming surface of the paper making machine. The roller 23 or the paddle wheel 23', respectively, supports this action by driving gas-bearing foam away from the outlet of the chamber 26 into the overflow compartment 7. The pulp leaves the chamber 26 therefore practically completely gas-free so that the quality of the paper produced is greatly improved.

The automatic maintenance of a constant pulp level height within the container further greatly simplifies the operation of the machine and contributes also to the improved quality of the paper produced.

A similar method and apparatus is described in co-pending application No. 544,522.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of methods and apparatus for continuously feeding pulp into a paper making machine differing from the types described above.

While the invention has been illustrated and described as embodied in an apparatus for continuously feeding substantially gas-free pulp at a constant rate, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. Pulp handling apparatus for a paper making machine comprising, in combination, a container; an overflow partition in said container connected to the bottom wall and extending between opposite side walls of said container, said overflow partition being spaced from one of the end walls of said container considerably farther than from the other of said end walls, said overflow partition dividing said container into a chamber for a pulp bath and an overflow compartment, said chamber having an inlet in said bottom wall and adjacent said overflow partition, said overflow partition having a top edge; feeding means communicating with said chamber inlet for feeding paper pulp into said chamber; first discharge means communicating with said chamber for discharging pulp therefrom, said discharge means being located adjacent the bottom of said container and adjacent said one end wall; a guide wall in said chamber connected to the bottom wall thereof and extending between opposite side walls of said chamber, said guide wall being located adjacent said inlet and being spaced from said overflow partition farther than said inlet and having a top edge nearer to the bottom wall of said container than said top edge of said overflow partition; second discharge means communicating with said compartment; and a perforated hollow guiding roller mounted for rotation about a horizontal axis adjacent said one end wall at an elevation substantially equal to the elevation of said top edge of said overflow partition, said perforated hollow guiding roller adapted to rotate in a direction so that the upper portion of said roller moves away from said one end wall.

2. Pulp handling apparatus for a paper making machine comprising, in combination, a container; an overflow partition in said container connected to the bottom wall and extending between opposite side walls of said container, said overflow partition being spaced from one of the end walls of said container considerably farther than from the other of said end walls, said overflow partition dividing said container into a chamber for a pulp bath and an overflow compartment, said chamber having an inlet in said bottom wall and adjacent said overflow partition, said overflow partition having a top edge; feeding means communicating with said chamber inlet for feeding paper pulp into said chamber; first discharge means communicating with said chamber for discharging pulp therefrom, said discharge means being

located adjacent the bottom of said container and adjacent said one end wall; a guide wall in said chamber connected to the bottom wall thereof and extending between opposite side walls of said chamber, said guide wall being located adjacent said inlet and being spaced from said overflow partition farther than said inlet and having a top edge nearer to the bottom wall of said container than said top edge of said overflow partition; second discharge means communicating with said compartment; and a paddle wheel mounted for rotation about a horizontal axis adjacent said one end wall at an elevation substantially equal to the elevation of said top edge of said overflow partition, said paddle wheel adapted to rotate in a direction so that the upper portion of said paddle wheel moves away from said one end wall.

3. Pulp handling apparatus for a paper making machine comprising, in combination, a container; an overflow partition in said container connected to the bottom wall and extending between opposite side walls of said container, said overflow partition being spaced from one of the end walls of said container considerably farther than from the other of said end walls, said overflow partition dividing said container into a chamber for a pulp bath and an overflow compartment, said chamber having an inlet adjacent said overflow partition, and said overflow partition having a top edge feeding means communicating with said chamber inlet for feeding paper pulp into said chamber; first discharge means located adjacent the bottom wall of said container and adjacent said one end wall thereof and communicating with said chamber for discharging pulp therefrom; a guide wall in said chamber connected to the bottom wall thereof and extending substantially normal to said bottom between opposite side walls of the chamber and being located adjacent said inlet and being spaced from said overflow partition farther than said inlet, said guide wall having a top edge nearer to said bottom wall of said container than the top edge of said overflow partition; second discharge means communicating with said compartment; and rotary guide means adjacent said one end wall at an elevation substantially equal to the elevation of said top edge of said overflow partition for guiding foam forming in the top layer of said pulp bath away from said one end wall toward said overflow compartment.

4. Pulp handling apparatus for a paper making machine, comprising in combination, a container; an overflow partition in said container connected to the bottom wall and extending between opposite walls of said container, said overflow partition being spaced from one of the end walls of the container considerably farther than from the other of said end walls and dividing said container into a chamber for a pulp bath and an overflow compartment, said chamber having an inlet in said bottom wall thereof and adjacent said overflow partition, said overflow partition having a top edge; feeding means communicating with said chamber inlet for feeding paper pulp into said chamber; first discharge means communicating with said chamber for discharging pulp therefrom, said first discharge means being located adjacent to the bottom of said container and being spaced from said inlet; a plurality of superimposed rollers mounted for rotation about horizontal axes in said chamber between said inlet and said first discharge means and below said top edge of said overflow partition; a guide wall in said chamber connected to the bottom wall thereof, extending between opposite side walls of said chamber and being located between said inlet and said plurality of superimposed rollers, said guide wall having on a bottom portion thereof a curved face blending into said bottom wall, slightly spaced from and substantially concentric with the outer

surface of the lowermost of said superimposed rollers and having a top edge nearer to the bottom wall of said container than said top edge of said overflow partition; second discharge means communicating with said compartment; and a guiding roller mounted for rotation about a horizontal axis adjacent said one end wall at an elevation substantially equal to the elevation of said top edge of said overflow partition and being adapted to rotate in a direction so that the upper portion of said roller moves away from said one end wall.

5. Pulp handling apparatus for a paper making machine, comprising in combination, a gas-tight, closed container; an overflow partition in said container connected to the bottom wall and extending between opposite walls of said container, said overflow partition being spaced from one of the end walls of the container considerably farther than from the other of said end walls and dividing said container into a chamber for a pulp bath and an overflow compartment, said chamber having an inlet in said bottom wall thereof and adjacent said overflow partition, said overflow partition having a top edge spaced from the top wall of said container; feeding means communicating with said chamber inlet for feeding paper pulp into said chamber; first discharge means communicating with said chamber for discharging pulp therefrom, said first discharge means being located adjacent to the bottom of said container and being spaced from said inlet; a plurality of superimposed rollers mounted for rotation about horizontal axes in said chamber between said inlet and said first discharge means and below said top edge of said overflow partition; a guide wall in said chamber connected to the bottom wall thereof, extending between opposite side walls of said chamber and being located between said inlet and said plurality of superimposed rollers, said guide wall having on a bottom portion thereof a curved face blending into said bottom wall, slightly spaced from and substantially concentric with the outer surface of the lowermost of said superimposed rollers and having a top edge nearer to the bottom wall of said container than said top edge of said overflow partition; second discharge means communicating with said compartment; a guiding roller mounted for rotation about a horizontal axis adjacent said one end wall at an elevation substantially equal to the elevation of said top edge of said overflow partition and being adapted to rotate in a direction so that the upper portion of said roller moves away from said one end wall; and gas pressure regulating means communicating with said container and at an elevation higher than said top edge of said overflow partition.

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