United States Patent Office

3,490,361

Patented Jan. 20, 1970

3,490,361

HIGH CONSISTENCY THICKENER FOR PAPER PULP

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Filed Feb. 7, 1966, Ser. No. 525,772

Int. Cl. B30b 9/02, 9/20, 3/06

U.S. Cl. 100—37

10 Claims

This invention relates to a method and apparatus for dewatering pulp or pulp like material and more particularly to handling and removing liquid from pulp like material which is in the range of ten to fifteen percent solids or higher.

There are many known dewatering apparatus which have enjoyed varying degrees of success. One type employs a foraminous cylindrical core rotatably mounted on a generally horizontal axis. Material to be dewatered is caused to move longitudinally within the foraminous core and the excess liquid is permitted to drain through the perforations in the cylinder. Generally these machines rotate relatively slowly and consequently a relatively long core is required to handle commercially adequate quantities of material. Further, the consistency of the dewatered stock has been limited by gravity, i.e., gravity has generally been employed to separate the liquid from the material. Various means have been used to augment the separation such as by creating a suction on the outer periphery of the foraminous member, however the gain in consistency is still too limited.

Consistency of the material has been increased (more liquid has been removed) by using press rolls in the egress end of the core to squeeze out some liquid. This has been found to be very useful however the quantity of material handled has been limited by the rotation of the device.

In U.S. Patent 3,114,309 there is disclosed an apparatus, a centrifugal thickener, which is highly effective in removing excess liquid from material while using a minimal amount of space. This is accomplished by rotating a foraminous screen drum at a rate sufficient to create centrifugal forces which aid in separating the liquid from the material in conjunction with press and stripping rolls. This apparatus is especially useful for removing liquid from dilute paper stock from a low of one to two percent up to a consistency range from 10 to 15 percent and in some cases to twenty to thirty percent consistency range. Paper stock at such a low consistency range usually contains very fine fibre fragments and slimy or gelatinous material which tend to clog the small drain apertures used in conventional drums. This clogging has been avoided by use of the particular novel press and stripping rolls used in the rapidly rotating foraminous drum.

Once the consistency has been brought up to the range indicated in the above-referred-to patent it is sometimes desirable to increase the consistency even higher. Once the consistency has been increased as in the above-referred-to centrifugal thickener the stock does not have the same slimy or gelatinous characteristic and hence problems of processing the stock differ, e.g., the clogging problem is of a different nature due to the different physical characteristics referred to supra.

It is therefore an object of this invention to provide an apparatus and a method for removing liquid from pulp

like material such as paper stock which has a beginning consistency range in excess of approximately ten percent.

It is another object to provide an apparatus which can be used either separately or as an attachment to other stock thickening devices, in particular the centrifugal thickener disclosed in U.S. Patent 3,114,309.

Yet another object is the provision of an economical reliable stock thickening machine which is particularly useful in the higher stock consistency ranges.

Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, steps and sequence of steps, features of construction and manipulation, and arrangements of parts, all of which will be exemplified in the structures and methods hereinafter described, and the scope of the application of which will be indicated in the following claims.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

In the accompanying drawings, in which one of the various possible embodiments of the invention is illustrated:

FIG. 1 is a cross section of an exemplary embodiment of the present invention shown in operative relation to a centrifugal paper pulp thickener, partly broken away taken on line 1—1 of FIGURE 2;

FIG. 2 is an end view of the high consistency thickener of the instant invention;

FIG. 3 is a top view of the thickener, with the top portion removed and parts broken away for clarity; and

FIG. 4 is a perspective view of the spider member used in the apparatus of invention.

The thickener of the instant invention is indicated generally by numeral **10** and is shown attached to a centrifugal thickener **6** of the type disclosed in United States Patent No. 3,114,309 referred to supra. Only a portion of thickener **6** is shown, since it does not constitute the invention per se. Further details of construction can be gleaned from the above-referred-to patent. It will be understood that thickener **10** can be used either independently or with any other thickener, the only criteria is that the consistency of the stock is high enough to be devoid of slimy or gelatinous material, and usually in the range of ten to thirty percent consistency range.

In the illustrated embodiment thickener **10** is shown mounted on casing **8** of the centrifugal thickener **6** by any conventional fastening means.

The pulp material to be thickened is fed into thickener **10** by a conventional screw conveyor **12**. A spider **16** is attached to shaft **14** of conveyor **12** by conventional fastening means, such as the threaded fastener **15**. A foraminous or pervious drum **18** is attached to the outer periphery of spider **16**. Drum **18** is shown generally cylindrical however it is within the purview of the invention to employ a conical drum. A ring **20** is attached to the distal or free end of drum **18**. A casing member **22** encloses thickener **10** and is divided into a white water outlet **24** and a pulp outlet **26**.

Spider **16** supports drum **18** and additionally serves as an entrance for the pulp to be thickened. FIGURE 4 shows spider **16** which is formed of an axially extending hub **28**, drum seating ring **30** and ribs **32** joining hub **28** and ring **30** and which effectively divides the spider into a

stock inlet area and a stock directing area. Ribs **32** are shaped such that they permit pulp to enter within drum **18** without clogging and further permit employing stock directing means, plow **34**, which cooperates with flight **13** of conveyor **12** to keep the stock moving into the machine and prevent any build up of material. As seen best in FIGURES 1 and 4 flight **13** ends approximately half way between two ribs **32**. This has been found to result in optimum stock movement. Material which is pushed into spider **16** is forced against the inside periphery of ring **30** by gravity and centrifugal force. As spider **16** rotates in the direction of the darts shown in FIGURE 4 the material impinges against plow **34** and is directed into the drum cavity **19**. Retainer plate **17** fixed spider **16** on the end of shaft **14**. The material, as will be more fully described infra, is directed along the length of drum **18** toward stock outlet **26**. White water which is removed from the pulp goes through the perforations in the foraminous wall of drum **18** and thence through outlet **24**. A conventional seal is formed between ring **20** and rib **40** of casing **22**. Annular flanges **36, 38** form therebetween a groove **37** within which rib **40** extends thereby effectively segregating outlet **24** from outlet **26**.

The stock thickening members which cooperate with foraminous drum **18** to force effluent out of the pulp material comprise press roll **42**, scraper **52**, and conveyor **62**. Press roll **42** is arranged to be resiliently forced against the inner drum surface and may be provided with a suitable material such as a Micarta or hard rubber covering with small axial or helical grooves **43** formed therein. Roll **42** is rotatably mounted on shaft **44** and positioned by locating blocks **45, 46**. It will be noted that plow **34** is conveniently mounted by conventional means on block **46**. Shaft **44** is mounted in arm **47** which is pivotably mounted on plate **48** at **49**. A conventional mass **50** is placed on arm **51** fixed to pivot arm **47** to resiliently bias roll **42** against the inner periphery of drum **18**.

The rotation of drum **18** will cause roll **42** to rotate and squeeze the material into a mat which then passes therebetween. The effluent which is squeezed out of the material is forced by centrifugal force through the perforations in drum **18**. Since the material is already of a high enough consistency that it is not slimy or gelatinous the perforations do not tend to clog. Scraper bar **52** breaks up the mat of material and keeps the drum clean and is preferably mounted slightly askew in relation to the axis of revolution so that it will tend to move the loose material in the direction of the outlet end and thereby avoids random movement of the material which would interfere with optimum stock flow. Scraper **52** is mounted on bracket **54** which is adjustably mounted on casing **22** to permit both horizontal and vertical adjustment.

Positive axial control of the stock movement is obtained through use of conveyor **62**. Since space available for the conveyor is limited it is preferable to use a worm conveyor in which the flights serve as their own support. This can best be seen in FIGURE 3. Eliminating the central shaft support member such as shaft **14** of conveyor **12** mitigates the tendency for the material to plug up.

A sheave **64** is provided to drive conveyor **62**. The travel of the stock through drum **18** can be controlled by the speed of rotation of conveyor **62** so a vari-speed drive (not shown) can be used to advantage.

After the stock is thickened, it is urged out of drum **18** by the action of conveyor **62** and is forced into outlet **26** by one or more plows **21**. Outlet **26** is connected (not shown) as desired to the inlet of refining apparatus or to other stock flow means.

The consistency of the thickened stock will be dependent upon several factors such as type and freeness of the stock, rate of feed, beginning consistency, etc. Generally it is possible to achieve a consistency range up to 25 to 30 percent and in certain cases up to 40 percent.

A representative illustration is as follows. A thickener **10** was used as an attachment to the centrifugal thickener **6** referred to supra. Drum **18** had 9/16 inch round perforations and was rotated at approximately 380 r.p.m.; conveyor **62** was rotated at 570 r.p.m. and an effective weight of 19 pounds was exerted on roll **42**. Bleached kraft having a freeness of approximately 760 Canadian was brought up to a consistency of approximately 30 percent from a beginning consistency of approximately 3 percent bone dry.

In view of the above it will be seen that the several objects of the invention are achieved and other advantageous results attained.

I claim:

1. A high consistency pulp thickener comprising:
(a) a support;
(b) a generally cylindrical foraminous drum having ingress and egress ends rotatably mounted along its longitudinal axis on the support;
(c) press roll means located within the drum and biased thereagainst;
(d) stock breaker means comprising a scraper bar located within the drum in juxtaposition to the inside periphery of the drum;
(e) axial stock directing means located within the drum in juxtaposition to the inside periphery of the drum; and
(f) means to rotate the drum about its longitudinal axis.

2. A thickener according to claim **1** in which the stock breaker means is positioned angularly in front of the press roll means in the direction of rotation of the drum and the axial stock directing means is positioned angularly in front of the stock breaker means in said direction.

3. A thickener according to claim **1** in which the press roll means includes a press roll mounting arm pivotably connected at an end thereof to the support and mounting a press roll at another end and a weight arm is connected to the said arm intermediate the said ends so that a force applied to the weight arm will be transmitted to the press roll.

4. A thickener according to claim **3** in which the press roll is provided with a plurality of generally axially extending grooves in the outer periphery of the roll.

5. A thickener according to claim **1** further including:
(g) spider means on which is mounted the ingress end of the drum, said spider comprises:
(I) a cylindrical drum seating member,
(II) a hub portion, and
(III) a plurality of curved ribs connecting the seating member and the hub portion and effecting a division of the spider into a stock inlet area and a stock directing area thereby permitting stock to enter between the ribs from the stock inlet area to the stock directing area; and
(h) plow means adapted to fit into the stock directing area so that stock fed into the thickener impinges on the plow upon rotation of the spider and drum and is thereby directed into the drum interior.

6. A thickener according to claim **5** in which the plow is mounted on the press roll means.

7. A thickener according to claim **5** in which the spider is mounted on a feed conveyor shaft, such that the end of a conveyor flight mounted on the conveyor shaft extends into the stock inlet area of the spider intermediate two ribs thereof.

8. A thickener according to claim **1** in which the axial stock directing means includes a worm conveyor and the stock breaker means includes a scraper mounted such that its longitudinal axis is inclined relative to the axial direction of the drum.

9. The method of removing white water from paper stock devoid of slimy, gelatinous character, having a consistency in excess of approximately ten per cent comprising the steps of:
(a) rotating a foraminous member;
(b) directing stock so that it impinges against the member;

(c) squeezing the stock into a mat against the member;
(d) breaking up the mat and separating the stock from the member;
(e) moving the stock along the member while in contact with the member; and
(f) repeating the squeezing, breaking and moving steps for a sufficient number of times to effect a desired consistency range.

10. The method of claim **9** in which the squeezing step is accomplished with a surface having a plurality of grooves resiliently biased against the member with an adjustable force.

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U.S. Cl. X.R.

100—121, 157; 162—232

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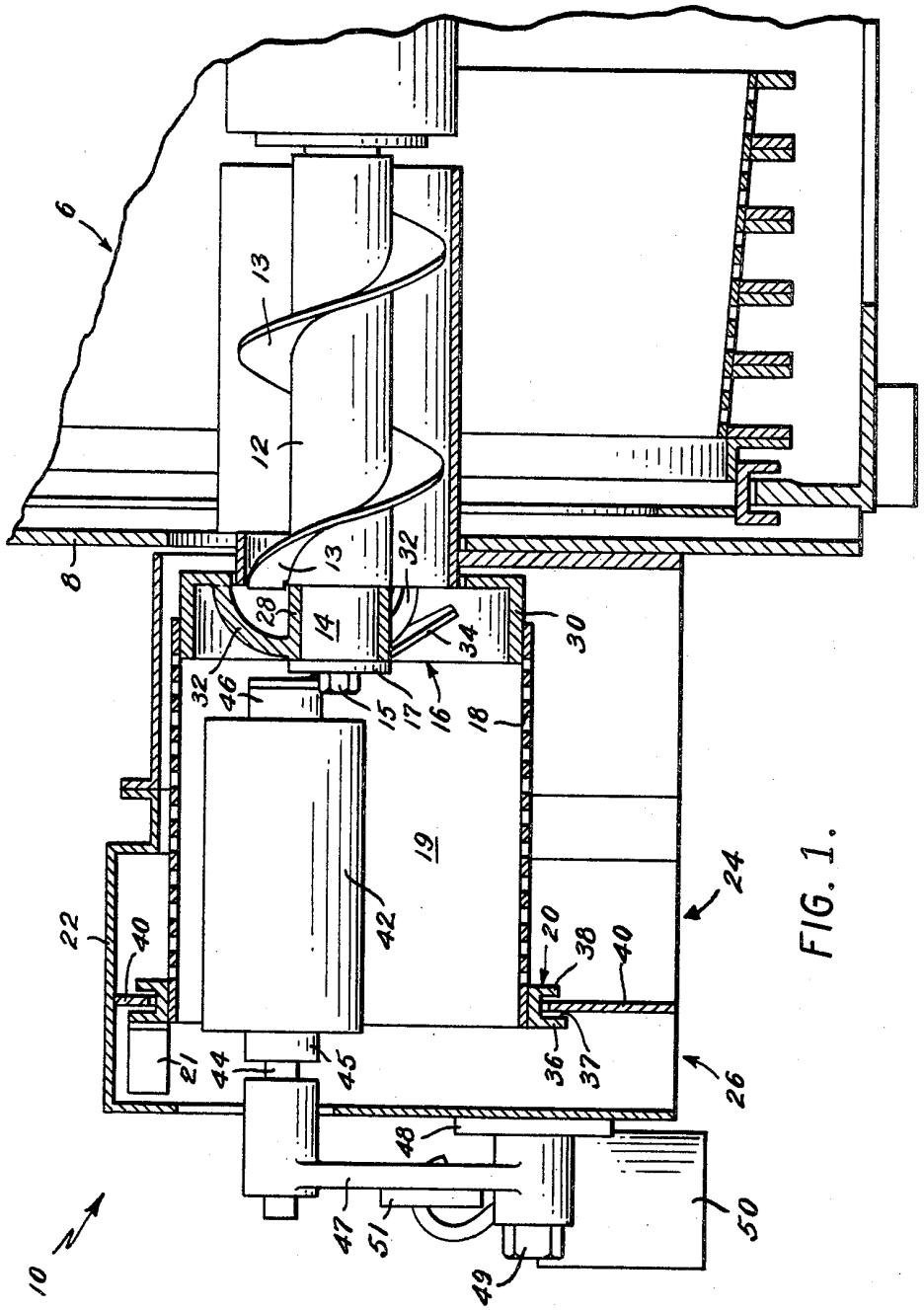

FIG. 1.

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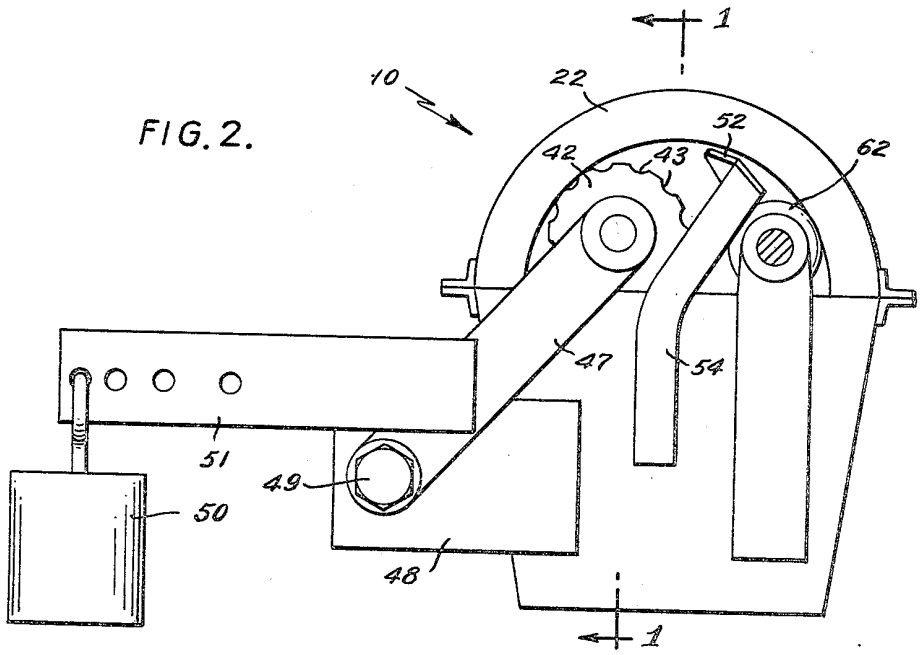
FIG. 2.



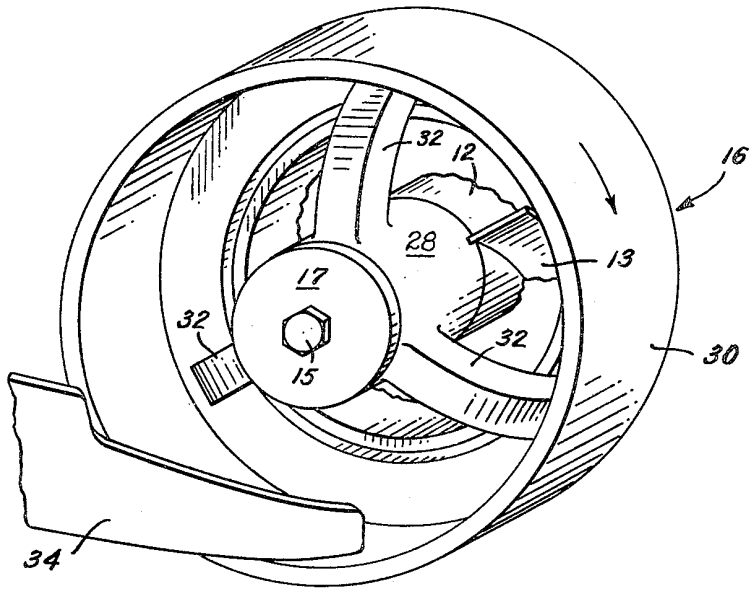


FIG. 4.

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Filed Feb. 7, 1966 3 Sheets-Sheet 3

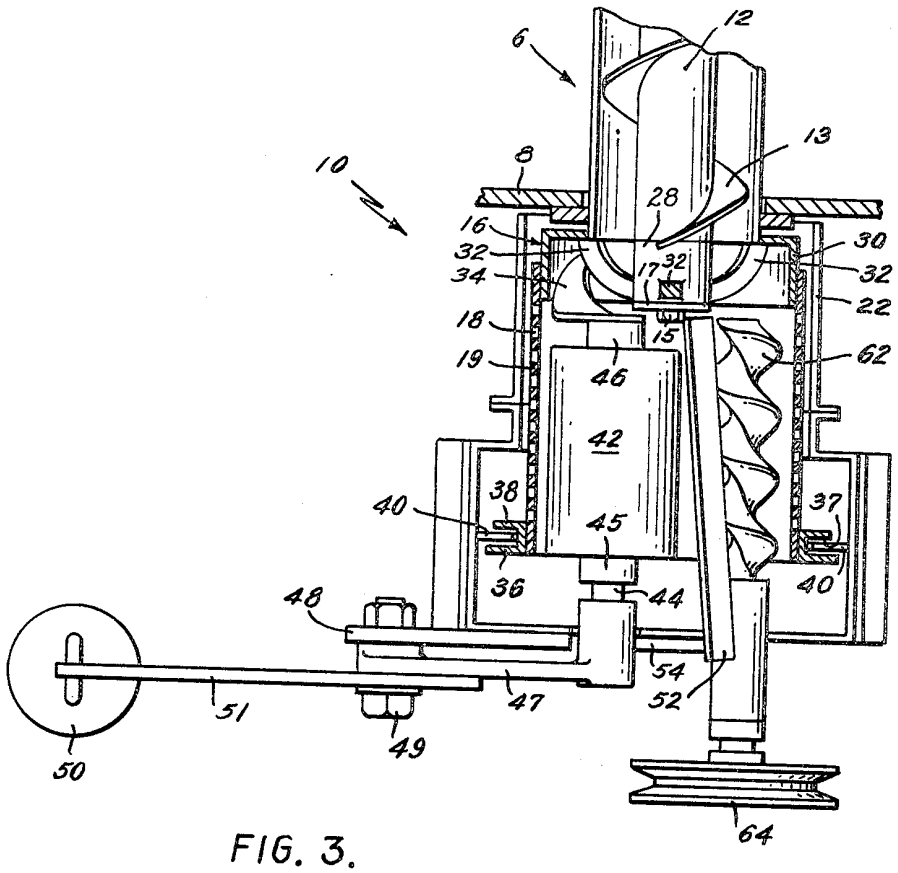

FIG. 3.

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