Patented May 13, 1924. 1,493,535

# UNITED STATES PATENT OFFICE.

ANTON J. HAUG, OF NASHUA, NEW HAMPSHIRE, ASSIGNOR TO IMPROVED PAPER MACHINERY COMPANY, OF NASHUA, NEW HAMPSHIRE, A CORPORATION OF MAINE.

## METHOD OF AND APPARATUS FOR TREATING PAPER STOCK.

Application filed November 21, 1919. Serial No. 339,566.

*To all whom it may concern:*

Be it known that I, ANTON J. HAUG, a citizen of the United States, and a resident of Nashua, county of Hillsborough, and State of New Hampshire, have invented an Improvement in Methods of and Apparatus for Treating Paper Stock, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to methods of and apparatus for treating paper stock and more particularly to its treatment with reference to the removal of moisture from the stock and the refinement of paper stock broadly, in which the control of the moisture at some stage of the treatment becomes an important consideration.

The invention will be best understood by reference to the following description when taken in connection with the accompanying illustration of one specific embodiment thereof, while its scope will be more particularly pointed out in the appended claims.

In the drawings:

Figure 1 is a longitudinal elevation in partial section, taken through one form of apparatus which is adapted to carry out the invention as to one specific phase thereof;

Fig. 2 is an end elevation, partly in section, illustrating the apparatus of Fig. 1; and

Fig. 3 is a side elevation, partly in section, showing more or less diagrammatically and conventionally the employment of the apparatus illustrated in Fig. 1 to carry out one step in the process of pulp refinement.

Referring to the drawings and to the illustrated embodiment of the invention therein shown and particularly to Figs. 1 and 2, the paper stock, which may be in any stage of refinement—either screened stock or tailings—but which in the illustrated embodiment of the invention is assumed to be tailings and which is in such a stage of consistency as to make it desirable to remove more or less moisture therefrom, is fed by gravity or otherwise along the stock conduit 1 which is formed between the channel members 2 and the bottom plate 3 and at some appropriate point, such as the discharge opening 4, is discharged upon a suitable drainage surface 5, preferably by being allowed to drop thereon, the dropping of the stock upon such surface assisting in separating the surplus moisture therefrom.

While the drainage surface might be of some other suitable construction, herein it is perforated or foraminous and is presented in the form of a perforated plate or wire mesh of a size suitable to prevent the passage therethrough of the slivers or fibres being handled. While the drainage member might be of some cross section other than circular, herein it is in the form of a circular drum which is shown as encircling the stock conduit and adapted to receive the thin or relatively wet stock from the discharge opening 4 and deliver it through the open end of the drum over the edge 6 into any suitable underlying receptacle (not shown in Fig. 1), the water being discharged through the perforations in the drum into any suitable underlying receptacle (not shown in Fig. 1). Preferably the drum 5 is rotatable or such other means are provided as to cause relative movement between the stock and the draining surface.

While a cylindrical form of drum may be employed, herein the drum presents a slightly inclined drainage surface to the stock, being in the form of an oblique cylinder presenting a tapered or conical cross-section longitudinally, so that the stock is fed or worked from the inlet to the discharge end of the drum, although other auxiliary feeding means may be employed if desired.

While the natural agitation of the stock resulting from its being rolled over and over in traveling along the drum may be alone relied upon or other suitable agitating devices may be employed, herein the drying or thickening action is assisted by the action of an expressing device in the form of a roller 7 also preferably slightly tapered or conical in shape to conform to the interior surface of the drum, the roller being adapted to bear against and roll freely over the stock on the inner surface of the drum and preferably being held at or near the point where the accumulation of stock naturally forms—i. e., near the lower ascending side of the drum. The roller is herein shown so mounted that it is yieldably held toward the surface of the drum in such a

way that a free movement of the roller to and away from the drum is permitted. For this purpose it is journaled in a bearing 9 carried at the end of a bent or suitably shaped arm or bracket 11, the latter being fulcrumed at 13 on some suitable fixed support. The weight of the roll and the arm alone may be relied upon to give the necessary yielding pressure of the roll against the stock, but herein its weight is reinforced by other pressure-applying means, preferably adjustable in its nature, as for example the weight 15 which is suspended from the lower edge 17 of the bracket 11, the upper surface of the edge being notched and so arranged that the weight may be adjusted to different positions lengthwise the arm, thereby to adjust the pressure of the roller against the stock.

The moist stock, as it is delivered to the drum, tends to be carried up the side thereof and as the side of the drum becomes steeper tends to roll or work back upon itself, this action tending both to agitate the stock and permit the water to drain therefrom as well as to work the stock gradually toward the discharge end of the drum. At the same time the roller is yieldably pressed against the accumulations of stock which travel up with the drum and particularly those from which the moisture has been partly removed by agitation along the lower portion of the drum. In the course of operation the fibres engaged by the roll tend to roll over and around the roll itself, which action assists in drying them out to the desired degree.

The thickening or drying of stock by some such method or apparatus as has been herein described is frequently desirable in the refinement of paper stock, as for example in the handling of tailings from some prior screening operation when it is required to further refine or reduce the tailings for subsequent screening operations in order to make use of the good fibres contained in the tailings. Such refining action commonly takes the form of reducing the slivers contained in the tailings by a crushing or similar action and converting them into fine fibres which on further screening may be utilized in the refined product. Where such refining action is carried out, the degree of reduction, or the fibre length of the refined pulp which is turned out by the refiner, may be varied not only by increasing the intensity or duration of the refining action but by varying the consistency of the supply. A thin supply, that is—containing a large amount of water, frequently tends to produce a long fibre, whereas a thick supply for the refiner, that is—one having a heavy consistency, with a lesser amount of water, may produce a short fibre. It therefore often becomes desirable to thicken the consistency of the tailings supplied to a refiner and also to exercise some measure of control over the consistency.

In Fig. 3 I have shown a drying device of the type illustrated in Figs. 1 and 2 applied to a screening apparatus 20 adapted to receive the tailings therefrom; and, after removing the required amount of moisture therefrom, deliver the latter to a refiner 21. The screening apparatus 20 may be of any suitable type but is herein of the general type shown in my prior Patent No. 1,284,668, dated Nov. 12, 1918, and specifically of the construction shown in my copending application Ser. No. 339,562, filed November 21, 1919. Such screening apparatus has the inlet 22 through which paper stock is fed to the apparatus, which stock may be, for example, the tailings from a prior screening operation by some suitable centrifugal screen. The tailings screener 21 is provided with a rotatable screen drum 23, driven by the driving pulley 24, and with suitable stock-feeding passages contained in the feeding device 25. By means of this apparatus the stock is agitated, lifted and dropped against the screening surface of the drum, being thinned and diluted between successive screenings by the shower pipe 26 which delivers shower water to the screen drum 23 but not to the draining drum 5. The finally screened residue is delivered to the discharge conduit 1 and thereby to the drying drum 5, as already described, the screened stock passing through the fine-stock outlet 27. The drying drum is herein secured to a rotatable part 28 of the tailings screen drum 23 so as to turn therewith; and a suitable underlying casing 29 is provided to drain away the water removed from the tailings.

The tailings from the screening apparatus 20, thus thickened by the action of the drying drum 5 and the roller 7, are delivered to the inlet 30 of the refiner 21. While the refiner may be of any suitable type, it preferably acts to operate upon the rejections from the tailings screener by a series of rolling or crushing actions, the number and pressure of which are predetermined, the stock being crushed by a series of rolls 31 and 32 which are supported in rotatable supports or spiders 33 and caused to move through an orbital path over the stock within the casing. Between each crushing action and the next, the stock is agitated and advanced by a screw-conveyor device 34.

As delivered from the discharge end 35 of the refiner, the product has been uniformly advanced and uniformly crushed, and consists of rejections which are uniformly reduced in size and of suitable consistency. The refiner 21 is only conventionally shown in Fig. 3, a type of such refiner

being illustrated in detail in my prior Patent No. 1,302,469, dated April 29, 1919. By drying and suitably thickening the supply to this refiner, the fineness of the fibres turned out at its discharge end may be materially increased and the product may be maintained of a uniform quality.

The utilization of the drying apparatus in connection with the described form of tailings screener and refiner merely illustrates one adaptation or application thereof. It will be understood that the drying apparatus herein described, and widely varied in form and construction, may be utilized in various connections or combinations. The drying apparatus may be constructed as a separate machine or as an attachment to various forms of paper machines. The drying process described may be carried out as a separate step of pulp refinement or in conjunction with other steps constituting part of the complete process. It will be further understood that extensive deviations may be made from the mechanical construction herein described and from the form and relative arrangement of parts, all without departing from the spirit of the invention.

Claims.

1. An apparatus for thickening paper stock comprising a rotary, perforated drum with means for dropping moist stock on the inner surface of the drum and a roller yieldably pressed against said drum near the lower, inner, ascending side thereof.

2. An apparatus for thickening paper stock comprising a rotary, cone-shaped drum having a foraminous draining surface, means for delivering stock to the interior of the drum near the smaller end thereof, said stock adapted to be discharged from the larger end of the drum, a roller adapted to turn freely over the stock on the inner surface of the drum, said roller being yieldably pressed thereagainst.

3. An apparatus for thickening paper stock comprising a draining drum adapted to receive the stock and a pressure roller working on the inside of the drum and having a fulcrumed support at a point outside the drum to permit a yieldable movement to and from the stock.

4. An apparatus for thickening paper stock comprising a stock-receiving draining drum arranged for a continuous feed of stock thereto, means for dropping moist stock thereon, a roller adapted to turn freely over the stock on the interior surface of the drum, said roller being yieldably pressed thereagainst and a stock discharge for said drainage surface.

5. An apparatus for thickening paper stock comprising a rotary perforated drum arranged for a continuous feed of stock thereto with means for dropping moist stock on the inner surface of the drum and means engaging the stock to express the water therefrom.

6. An apparatus for thickening paper stock comprising a foraminous drum adapted to receive moist stock on its inner surface and arranged for a continuous feed of stock thereto, yieldable expressing means adapted to engage the stock thereon and a stock discharge for said drum.

7. An apparatus for thickening paper stock comprising a foraminous draining drum adapted to receive stock on its inner surface and arranged for a continuous feed of stock thereto, and means to force the stock against the drum and express water therefrom.

8. An apparatus for thickening paper stock comprising a rotatable, foraminous, draining drum having a circular cross-section longitudinally tapered, with means for delivering stock to the interior of the drum, and means to engage the stock to press it free from water, the drained stock being discharged from the end of the drum.

9. An apparatus for thickening paper stock comprising a rotatable, foraminous drum having a circular cross-section and longitudinally tapered, means for dropping stock on the interior of the drum and a roller engaging the stock to drain the water therefrom while the stock is advanced toward the delivery end of the drum.

10. An apparatus for thickening paper stock comprising a rotatable draining drum arranged for a continuous feed of stock thereto, means for delivering moist stock to the interior of the drum and means including a roller acting on the stock to agitate and drain the latter.

11. An apparatus for thickening paper stock comprising a rotatable draining drum arranged for a continuous feed of stock thereto, means for delivering stock to the interior of the drum and means to assist in expressing water therefrom and engaging the stock on the ascending side of the drum.

12. An apparatus for thickening paper stock comprising a rotatable draining drum arranged for a continuous feed of stock thereto, means to deliver stock to the interior thereof and means movable relatively to the drum for engaging the stock therein to assist in removing the moisture therefrom.

13. The process of thickening moist paper stock which consists in dropping the stock on a foraminous surface and expressing moisture therefrom by a roller agency while advancing the stock along the surface in the direction of thel ength of the roller.

14. The process of thickening moist paper stock which consists in delivering the stock to a foraminous surface, causing such relative movement between the stock and the surface as to turn the stock over thereon while progressively advancing it along the

surface and at the same time pressing the stock to expel moisture therefrom.

15. The combination with a screen having a tailings outlet of a drying device comprising a rotary draining drum adapted to receive said tailings on its inner surface and drain the water therefrom, said drum having separate discharge passages for the water and the thickened tailings and having also means to express the water from the tailings.

16. The combination with a screen having means for screening paper stock and for diluting and rescreening the unscreened residue of a drying device comprising a rotary draining drum adapted to receive the tailings on its inner surface and drain the water therefrom and having separate discharge passages for the water and the thickened tailings and a roller to express the water from the tailings.

17. The combination with a screen having a tailings outlet of a rotary drainage drum to the inner surface of which said tailings may be delivered and a roller engaging the tailings on the inner surface of the drum.

18. The combination with a screen having a tailings outlet of a rotary drainage drum to the inner surface of which said tailings may be delivered and a roller yieldably pressed against the tailings on the inner surface of the drum.

19. The combination with a screen having a tailings outlet of a drying device comprising a rotatable draining drum adapted to receive the tailings on its inner surface and means to express water therefrom.

20. The combination with a screen having a tailings outlet of a rotary draining drum with the interior of which said tailings outlet communicates, means movable relatively to the drum for engaging the tailings therein and separate discharge passages for the thickened tailings and the water withdrawn therefrom.

21. The combination with a screen having a tailings outlet of a drainage surface upon which said tailings are discharged and expressing means for expressing water from the tailings on said surface.

22. The combination with a screen having a tailings outlet of a drainage surface to receive the tailings and a roller adapted to pass over the tailings thereon and remove moisture therefrom.

23. The process of working paper stock which consists in first screening the stock and separating the fine fibre from the tailings, withdrawing the tailings and feeding them to a rotary draining surface and removing moisture from the tailings by expressing the moisture therefrom.

24. The process of working paper stock which consists in screening the stock, diluting and rescreening the residue, withdrawing the final tailings dropping the latter on a foraminous surface and thickening them by withdrawing the moisture therefrom by combined expressing and drainage.

25. The process of working paper stock which consists in screening the stock, diluting and rescreening the residue, withdrawing the tailings dropping the latter on a foraminous surface and expressing water from the tailings by a rolling agency to thicken the same.

26. The process of working paper stock which consists in screening the stock, diluting and rescreening the residue, dropping the final tailings on a foraminous surface and expressing water therefrom by a rolling agency applied while the tailings are in contact with said surface.

27. In an apparatus for working paper stock, the combination with a drum screen of means attached thereto and operated with the drum thereof for drying or thickening the tailings from said screen and means for reducing the thickened tailings while thickened to finer fibres for rescreening.

28. In an apparatus for working paper stock, the combination with a screen having means to screen the stock and dilute and rescreen the unscreened residue of a drying device connected to said screen for extracting moisture from the tailings and a refiner having crushing means adapted to reduce the thickened tailings.

29. In an apparatus for working paper stock, the combination with a screen of a foraminous draining surface adapted to receive the tailings from the screen, said surface being relatively movable with reference to the tailings and a refining device for subjecting the thickened tailings to a rolling action predetermined in amount.

30. In an apparatus for screening paper stock, the combination with a screen having means for screening the stock and diluting and rescreening the unscreened residue of a rotary draining drum to receive the tailings, a roller working within the drum and against the tailings contained therein and a refiner adapted to refine the tailings by a series of rolling actions.

31. The process of working paper stock which consists in screening the stock, thickening the tailings to remove moisture therefrom continuously feeding the tailings to a crushing agency and crushing the thickened tailings.

32. The process of refining stock which consists in screening the stock, diluting and rescreening the unscreened residue one or more times, extracting moisture from the tailings, thickening the same continuously feeding the tailings to a rolling agency and

repeatedly rolling the thickened tailings to refine the same.

33. The process of working paper stock which consists in screening the stock, drying the tailings by a rolling agency, acting in conjunction with a draining surface continuously feeding the tailings to a second rolling agency and refining the thickened tailings by said second rolling agency.

In testimony whereof, I have signed my name to this specification.

ANTON J. HAUG.

May 13 , 1924. 1,493,535

A. J. HAUG

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Fig. 2.

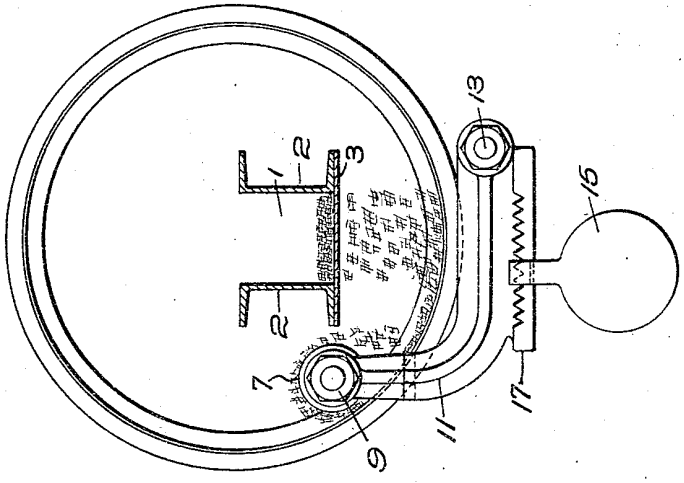
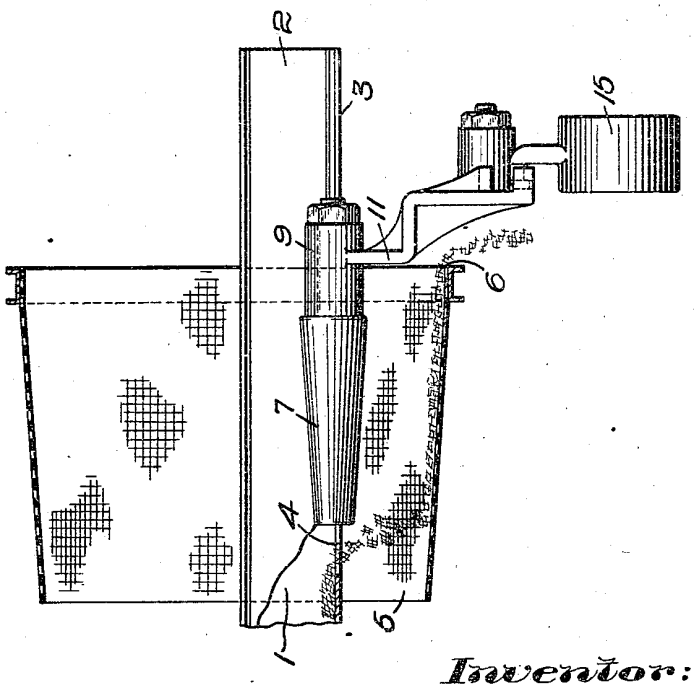



Fig. 1.




Inventor:
Anton J. Haug,
by Emery Booth Janney & Varney
Attys.

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A. J. HAUG

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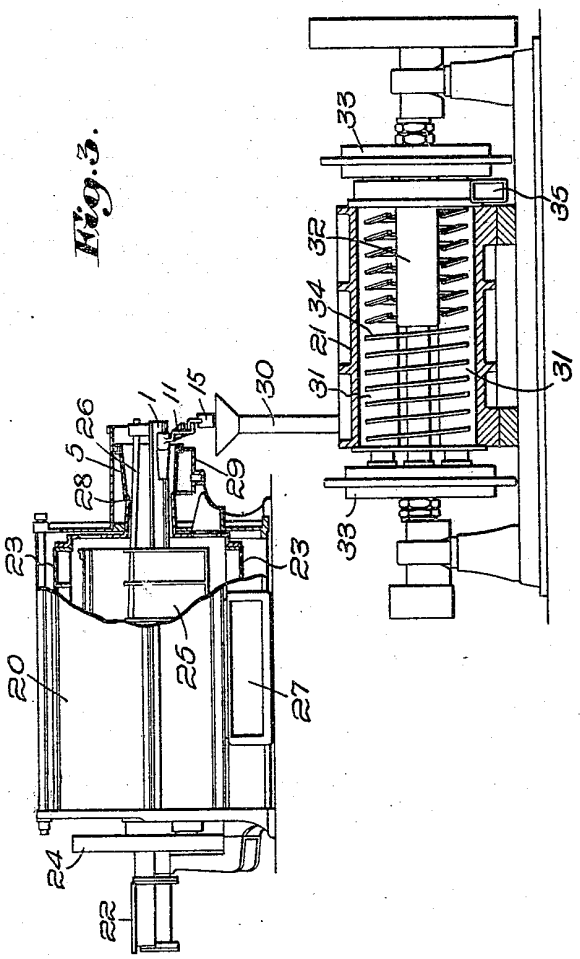
Fig. 3.




Inventor:
Aston J. Haug.
by Emery Booth Janney & Varney
Attys.