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METHOD OF AND APPARATUS FOR PRODUCING A HEAD IN RESPONSE TO THE CONSISTENCY OF PAPER MAKING STOCK

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Fig. 1.

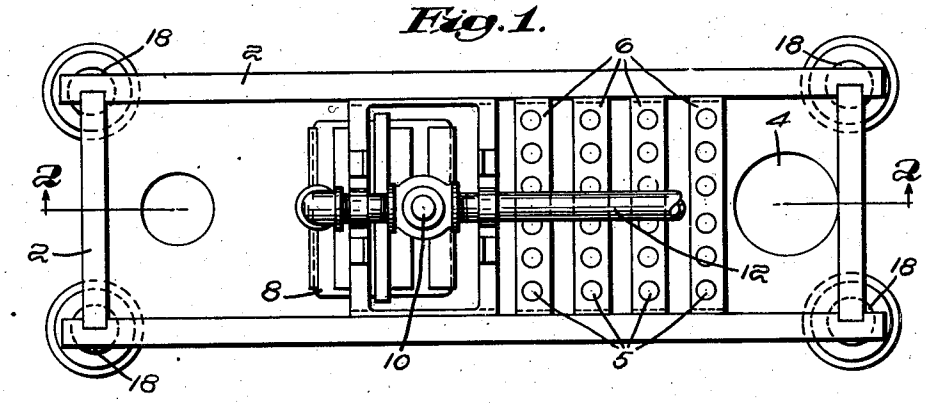
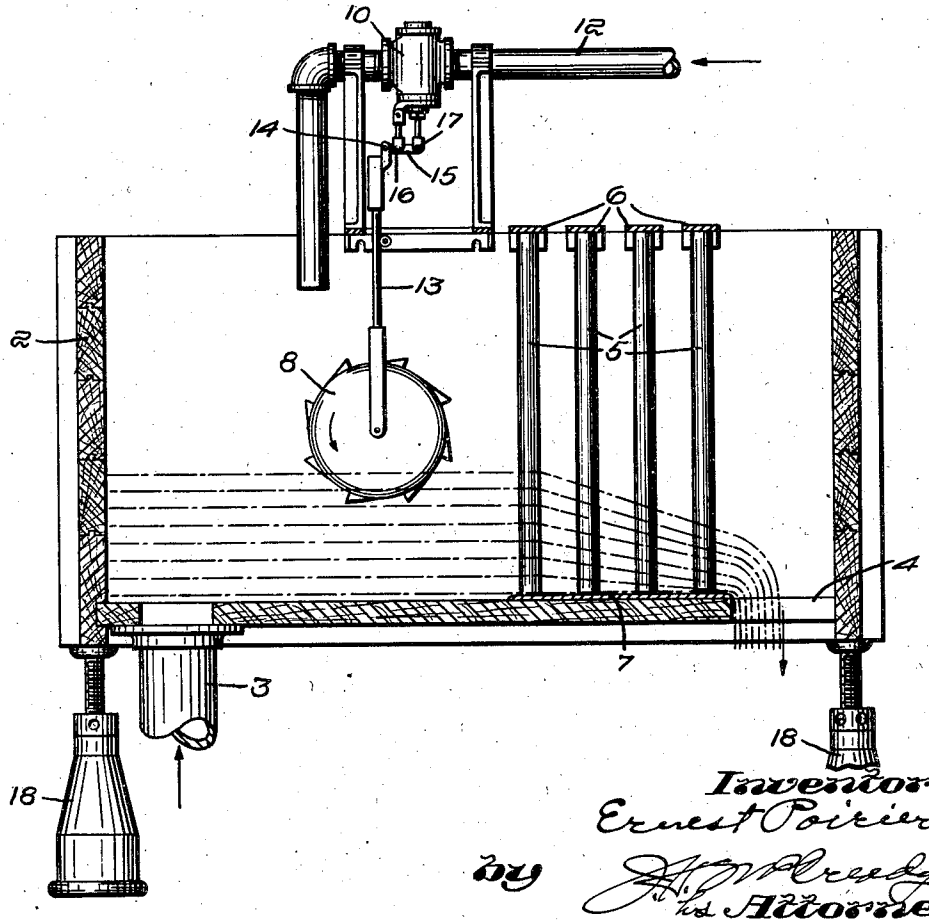


Fig. 2.



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METHOD OF AND APPARATUS FOR PRODUCING A HEAD IN RESPONSE TO THE CONSISTENCY OF PAPERMAKING STOCK

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11 Claims. (Cl. 137—78)

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In connection with the preparation and handling of paper-making stock there are many situations in which it is desirable to be able to compensate for the variations in its consistency, to smooth out these variations, and to deliver a product which is relatively uniform in this respect. It is well known that a stock, when originally produced, does vary widely in the proportion of solid content carried by the water in which it is dispersed, and that these variations are responsible for many of the troubles experienced in connection with the production of a uniform sheet. While consistency regulators have been devised, and are used quite generally, it is commonly recognized that the range of consistency which any individual piece of apparatus can handle is very limited. For example, none of the prior art forms of apparatus of this type, so far as I have been able to learn, are of any substantial value at consistencies below 2.5%, or above 5%.

The present invention is especially concerned with these considerations, and it aims to improve both the methods of producing a variable head which is responsive to variations in consistency and also the apparatus for performing these functions, with a view to handling a much wider range of consistency successfully than has been possible heretofore.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawing, and the novel features will be particularly pointed out in the appended claims.

In the drawing,

Figure 1 is a plan view of an apparatus constructed in accordance with this invention; and

Fig. 2 is a sectional view, approximately on the line 2—2, of Fig. 1.

Most of the prior art consistency regulators in common use depend for their operation on the fractional resistance created by the flow of a stream of stock in contact with the walls of a conduit of some type. Such resistance, in turn, naturally depends upon the rate of flow or velocity of the stock in contact with said walls. The higher the rate of flow, the greater the friction. I have found, however, that a far more effective way of compensating for changes in consistency of successive portions of a stream of stock is to utilize the internal friction which can be created in the stock itself. The frictional resistance to flow thus set up can be made to produce effects of far greater intensity than that created merely by the confining wall surface; they can be made to operate at low velocities, and they make possible a greater degree of control, especially at low consistencies, than has been possible by any prior art method which has come to my attention.

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Accordingly, the present invention proceeds on the principle of creating a high degree of internal resistance in a slowly flowing stream of stock at some localized section of that stream and substantially throughout the entire cross-sectional dimensions of that section; utilizing the resistance so set up to the flow of the stock to create variations in the hydrostatic head in the stream behind the resistance point in response to changes in consistency, and causing these changes in hydrostatic head to control the rate of delivery of diluting water to the stock so that the product discharged will be of relatively uniform consistency.

An apparatus designed to operate in accordance with this method is disclosed in the drawing. It comprises a conduit or trough 2 into which a stream of stock is delivered by a pipe 3 and from which it is discharged through an outlet 4. The conduit is of rectangular cross-sectional form, of uniform width, and it is provided in a portion adjacent to the outlet with a resistance device comprising a series of pins, rods or dowels, indicated at 5. These elements, as shown, are supported at their upper ends in bars 6 extending across the top of the trough and at their lower ends in a foot plate 7 secured to the bottom of the trough. They are arranged in rows and preferably are uniformly spaced apart both cross-wise and length-wise of the trough. While they may be made of various dimensions and in various arrangements, a typical construction includes doweling an inch and a half in diameter with a pin spacing of four to five inches apart on centers in each row, and the rows being spaced apart by the same distance.

The velocity of the stock should be low, say for example, from one foot in three seconds to about a foot per second. For the lower consistencies, such as 1%, the lower velocity will produce better results, while for higher consistencies the velocity also can be higher. For example, for consistencies running up to 5% or 6% the rate of flow can be made somewhat higher than a foot a second, although a lower velocity than that will produce even better results.

Mounted in the trough behind, or up stream from, the resistance device, is a float 8, preferably of the revolving type so that it will keep itself clean, and this float is utilized to operate a valve 10 in a pipe line 12 which conducts diluting water into the stock. Preferably the valve is

of the balanced type, and the float may be connected with it in any suitable way to adjust it or control it so that the quantity of water which it delivers will vary with the variations in consistency, a greater volume of water being introduced into a stock of high consistency than into one of a lower consistency, and none at all being delivered into a very thin stock of what may be regarded as a predetermined base value, say half of one percent. In the particular arrangement shown, the float revolves in the lower end of a forked plunger 13 which is guided for vertical movement and is pivotally connected at 14 with the power end of a lever 15, fulcrumed at 16, and pivoted at 17 to the valve plunger.

With this arrangement, and assuming that a stock of average consistency is flowing through the trough, the pins 5 break up the stream throughout substantially its entire cross-sectional dimensions and for a length which may be determined in accordance with the requirements of individual installations, so that a high degree of internal resistance is created in this section of the stream. This resistance is caused almost exclusively by the rubbing against each other of the solid particles dispersed in the stream of water. This action, in turn, is produced by the fact that the stock flows around the pins or rods, the continuity of the stream is broken up into small turbulent sections, and the friction so created prevents a rate of flow or velocity that otherwise would naturally occur.

The result is that the rate of flow through this section of the stream varies inversely with changes in the consistency of the stock, the greater the consistency the slower the flow, and vice versa. Consequently, with an increase in consistency the stock is backed up in the float chamber, and a higher head or level and, consequently, a higher hydrostatic pressure, is created in this part of the apparatus. Either a float or a pressure-responsive control may be actuated by the change in conditions here produced. And because those conditions vary with the variations in solid content of the stock, they afford a convenient means for controlling the rate of delivery of diluting water into the stock which also is proportional to the variations in consistency of the stock.

It has been found in actual practice that this apparatus will operate successfully on an exceptionally large range of consistencies and will reduce wide variations in consistencies of successive portions of a continuous stream to suprisingly narrow limits.

A further advantage of this construction is that coarse materials, such as splinters, chips, and the like, give practically no trouble, but that they find their way through the resistance device and are discharged.

The velocity of flow can be controlled by devices external to the apparatus, or it can also be regulated by changing the inclination of the trough. For example, the corners at one or both ends can be supported in any convenient manner, as, for example, on jack screws 18, so that the slant of the stream may be adjusted, as desired.

While I have herein shown and described a typical embodiment of my invention, it will be evident that the invention may be embodied in other forms and that the method may be practiced with the aid of other forms of apparatus than the specific form illustrated. Also that resistance units of the type here disclosed may be used in other relationships than that here illustrated.

Having thus described my invention, what I desire to claim as new is:

1. That improvement in methods of producing a variable head in a stream of paper-making stock in response to changes in the consistency of said stock, comprising the steps of creating a flowing stream of said stock, confining a portion of the stream so produced, and creating a high degree of internal friction in said stream substantially throughout the cross-sectional area of a portion of the length of the confined portion of the stream and thereby causing the rate of flow of the stock through said area to vary inversely with said changes in consistency of the stock.

2. That improvement in methods of producing a head which varies in response to changes in the consistency of a stream of paper making stock, comprising the steps of creating a flow of said stock, confining a portion of the stream so produced, imposing internal resistance to such flow at spaced points distributed substantially throughout the cross-sectional area of a portion of the confined section of the stream and thereby creating a head of stock behind said resistance, which head varies with changes in consistency of the stock.

3. A method according to preceding claim 2, including the step of making the velocity of said stock through said confined portion of the stream very slow for thin stocks and faster for stocks of higher solid content.

4. A method according to preceding claim 2, including the step of so adjusting the velocity of said stock through the resistance as to accentuate the effects of the resistance in producing said variations in head created thereby.

5. A method according to preceding claim 2, including the step of adjusting the velocity of said stock through the resistance to less than one foot per second.

6. A consistency responsive device for paper-making stocks, comprising a conduit for a stream of said stock, resistance means in said conduit for breaking up the stream in such a manner as to create internal frictional impedance substantially throughout the cross-sectional area of the stream to the flow of stock through said conduit, whereby a hydrostatic pressure is created in the conduit behind said resistance, and said pressure varies with changes in the consistency of the stock.

7. A consistency responsive device for paper-making stocks, comprising a conduit for a stream of said stock, a resistance unit extending substantially across said stream and having parts distributed substantially throughout the cross-sectional area of the stream constructed and arranged to create a high degree of turbulence in practically all sections of the stream for a short length thereof, whereby the rate of flow of the stock through that portion of the conduit in which said unit is located will vary inversely in response to changes in the consistency of the stock.

8. A consistency responsive device according to preceding claim 7, in which said unit comprises a series of stationary pins or rods spaced apart by approximately uniform distances and breaking up the entire stream for a short portion of its length into relatively small sections, said pins or rods being so spaced that the stock can flow freely around and between them but they offer considerable frictional resistance to the flow of internal sections of the stream.

9. A consistency responsive device according to preceding claim 7, in which said unit comprises

a series of pins or rods arranged in rows extending across the stream with the rows spaced apart so that they serve to divide the entire cross-sectional area of the stream into small turbulent sections.

10. A consistency responsive device according to preceding claim 6, including means for adjusting said conduit into different angles of inclination.

11. A consistency responsive device according to preceding claim 7, including means for varying the velocity of the flow through said resistance unit.

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