May 20, 1941. E. COWLES 2,242,419

METHOD AND APPARATUS FOR CONTROLLING THE CONSISTENCY OF PAPER STOCK

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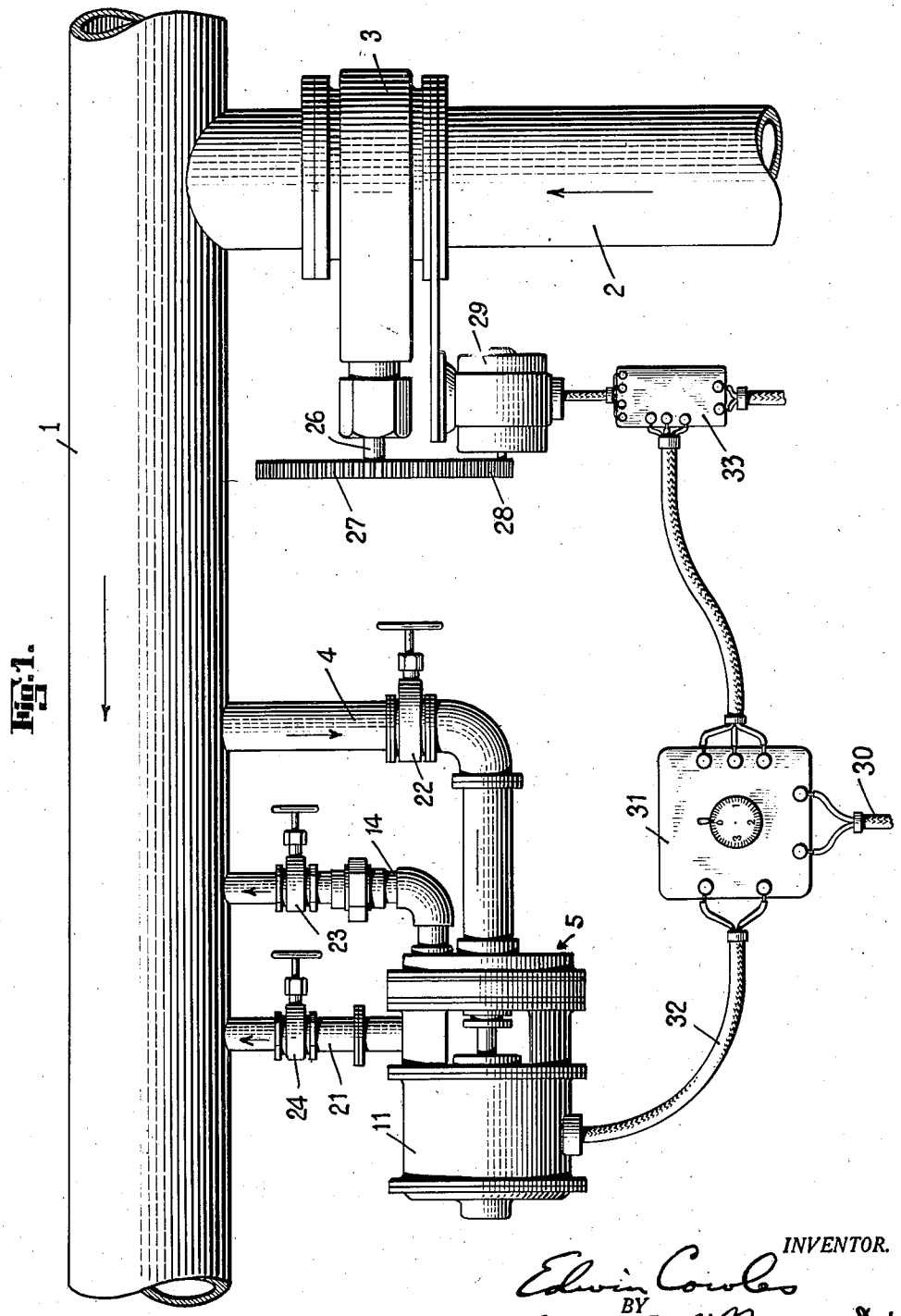


Fig. 1.

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Fig. 3.

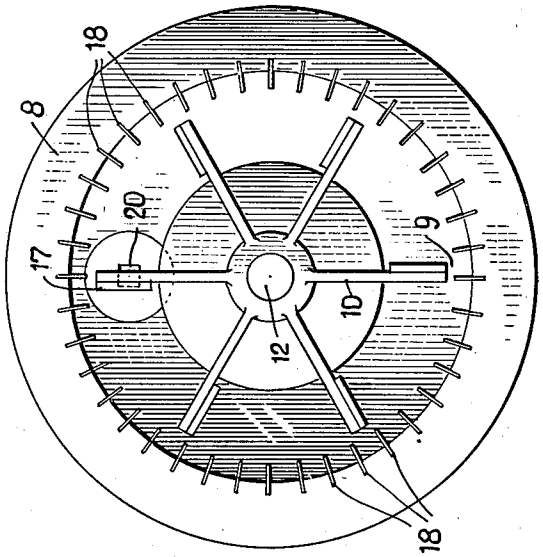


Fig. 2.

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METHOD AND APPARATUS FOR CONTROLLING THE CONSISTENCY OF PAPER STOCK

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5 Claims. (Cl. 137—78)

This invention relates to methods and apparatus for controlling the consistency of paper stock.

In the preparation of paper stock for use in paper making, and in the manufacture of paper from such stock, it is important to control the consistency of the stock within reasonably close limits. For the most part, however, the skill of the machine operators is relied upon to maintain this control; for while regulatory devices are available for controlling high consistency stock (2% and above) with reasonable accuracy, no such device has been available for controlling low consistency stock. It is an object of the present invention to provide a method and apparatus for controlling paper stock consistencies which shall be accurate and dependable for controlling both high and low consistencies, and even those extremely low consistencies (½% to ¼%) which are now frequently supplied to Fourdrinier or cylinder machines.

Other objects and advantages of the invention will appear hereinafter.

A preferred embodiment of the invention selected for purposes of illustration is shown in the accompanying drawings, in which,

Figure 1 is a plan view of the apparatus.

Figure 2 is a section through the control unit.

Figure 3 is a section on the line 3—3 of Figure 2.

According to the present invention, it is proposed to withdraw from the flowing stream of stock of which it is desired to control the consistency, a smaller continuously flowing stream. The withdrawn stock is agitated by an impeller, and it will be understood that the work required to agitate the stock will vary in proportion to the consistency of the stock. That is, if the consistency of the stock increases, the work required also increases, and if the consistency decreases, the work required also decreases. Preferably the withdrawn stock may be thickened as it is agitated thus magnifying the frictional effect.

Thus it will be apparent that if the quantity of water added to the flowing stream be controlled in accordance with the amount of work required, or any suitable indicator thereof, the consistency of the stock may be controlled. That is, if the work required tends to increase, the rate of adding water should be increased; if the work required tends to decrease, the rate of adding water should be decreased.

Referring to the drawings, the flowing stream of stock to be controlled may be carried in a conduit 1, to which is connected a water supply pipe 2, the rate of flow from pipe 2 to conduit 1 being controlled by valve 3.

Connected to the conduit 1 is a smaller conduit 4, forming the inlet conduit to the impeller unit 5. This unit comprises cover members 6 and 7, spaced apart by an annular ring 8 thus forming an impeller chamber 9 within which the impeller 10 rotates. The impeller is driven by motor 11, preferably of the constant speed type, through shaft 12.

Formed in the cover 7 is an annular chamber 13 which is connected to the conduit 1 by conduit 14. This chamber is separated from the impeller chamber 9 by a screen 15 having very fine perforations 16 therein. By very fine perforations I mean perforations of a size to substantially prevent the passage of fibers therethrough. Such perforations should be of the order of $\frac{1}{16}$'' or less in diameter.

The agitation of the contents of the impeller chamber by rotation of the impeller may be sufficient to prevent the screen perforations from clogging with fibers, but if desired the impeller vanes may be provided with scrapers 17 which engage the screen and positively clear the perforations of fibers.

It will be understood that the passage of water through the screen perforations has the effect of thickening the stock in the impeller chamber, thus magnifying the frictional effect of the agitation. The effect may also be increased by the provision of fins 18 projecting inwardly from the wall of the impeller chamber.

Means are also provided for withdrawing thickened stock from the impeller chamber in order that there may be a continuous flow of both water and fibers therethrough, said means comprising the orifice 20 communicating with conduit 21 connected to conduit 1.

The conduits 4, 14 and 21 are provided with valves 22, 23 and 24 respectively through which the flow through the respective conduits may be adjusted in order to provide the desired conditions in the impeller chamber. It will be understood, however, that these valves are set at the beginning of the operation and are not changed during the operation, unless it is desired to alter the operating conditions. Primary control is effected through valve 23, however, which controls the flow of water through the screen and thus controls the consistency of the stock being agitated.

Automatic means are provided for controlling the valve 3 in accordance with variations in the work required to agitate the contents of the

impeller chamber, and such means are preferably electrical. The valve shaft 26 is provided with a gear 27 which meshes with gear 28 operated by reversible motor 29. When the motor is caused to operate in one direction the valve tends to open and when the motor is caused to operate in the reverse direction the valve tends to close.

Current for the motor 11 is supplied through leads 30 connected to a contacting wattmeter 31 and thence through leads 32 to the motor. The operation of motor 29 is controlled by the wattmeter 31 in accordance with practice well known in the art. Thus the contactor of the wattmeter has a normal non-contacting position when the motor 11 is running at normal load. If the load increases the contactor makes a contact which starts the motor 29 in a direction to open valve 3. This increases the flow of water to conduit 1 which gradually reduces the load on motor 11. When it becomes normal the contact is broken and motor 29 is stopped. If the load decreases a different contact is made to drive the motor in the opposite direction to close the valve 3. Such contacting wattmeters are standard equipment and will not be described in detail herein.

If desired, a magnetic switch 33 of standard construction may be included between the wattmeter 31 and the motor 29 in the manner illustrated, in which case the movement of the wattmeter contactor in one direction or another causes movement of the switch in one direction or another to control the operation of the motor 29.

It will be understood that the invention may be variously modified and embodied within the scope of the subjoined claims.

I claim as my invention:

1. Method of controlling the consistency of a flowing stream of paper stock which comprises withdrawing stock from said stream, thickening said stock to a degree proportionate to the thickness of the flowing stock, agitating said thickened stock, and adding more or less water to said flowing stream in accordance with the increase or decrease of work required to agitate said thickened stock.

2. Method of controlling the consistency of a flowing stream of paper stock which comprises continuously withdrawing stock from said stream, continuously withdrawing water at a constant rate from said stock to thicken the same to a degree proportionate to the thickness of the flowing stock, continuously agitating said thickened stock, continuously adding water to said flowing stream, and controlling the rate at which said water is added in accordance with the increase or decrease of work required to agitate said thickened stock.

3. Apparatus for controlling the consistency of a flowing stream of paper stock which comprises means for withdrawing a portion of said stream, means for agitating said withdrawn stock, means for thickening said withdrawn stock to a degree proportionate to the thickness of the flowing stock, means for registering variations in the power required to agitate said thickened stock, and means controlled by said last named means for increasing or decreasing the flow of water to said flowing stream in accordance with the increase or decrease in said power requirement.

4. Apparatus for controlling the consistency of a flowing stream of paper stock which comprises means for withdrawing continuously from said flowing stream a smaller stream of stock, means for withdrawing water continuously from said withdrawn stock to thicken the same to a degree proportionate to the thickness of the flowing stock, means for agitating continuously said thickened stock, means for registering variations in the power required to agitate said thickened stock, and means controlled by said last named means for increasing or decreasing the flow of water to said flowing stream in accordance with the increase or decrease in said power requirement.

5. Apparatus for controlling the consistency of a flowing stream of paper stock which comprises means for withdrawing continuously from said flowing stream a smaller stream of stock, means for agitating continuously said withdrawn stream, means for thickening said withdrawn stock to a degree proportionate to the thickness of the flowing stock, means for registering variations in the power required to agitate said thickened stock, and means controlled by said last named means for increasing or decreasing the flow of water to said flowing stream in accordance with the increase or decrease in said power requirement.

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