July 3, 1945. E. A. POIRIER 2,379,746

STOCK REGULATOR FOR PAPER MACHINES

Filed June 11, 1942 2 Sheets-Sheet 1

Fig. 1.

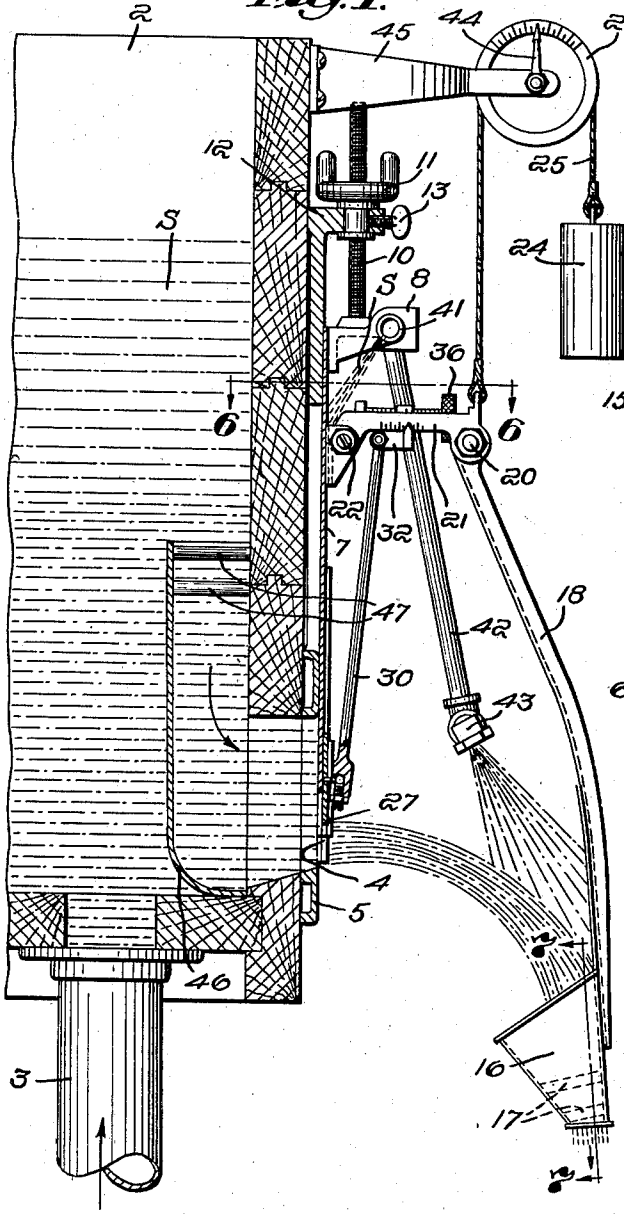
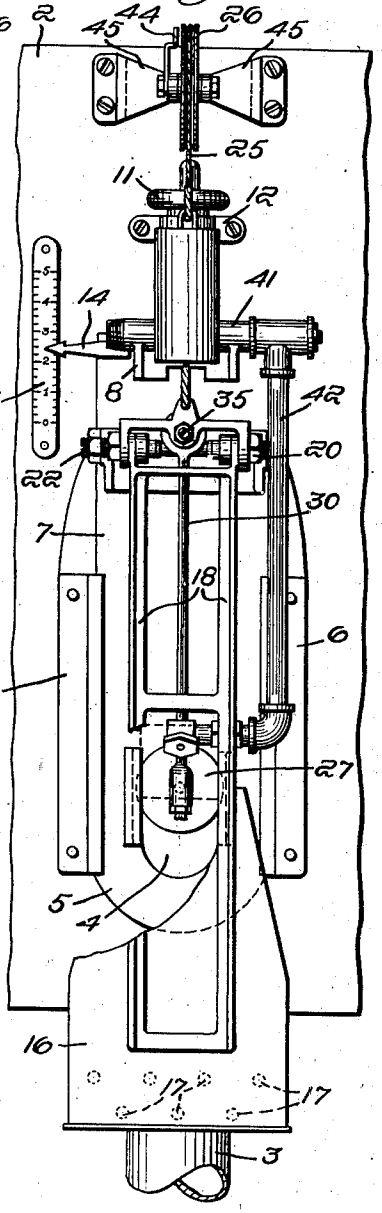


Fig. 2.



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Fig. 3.

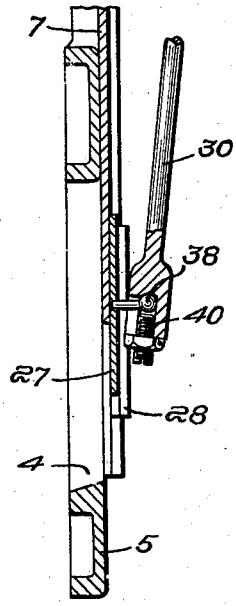


Fig. 4.

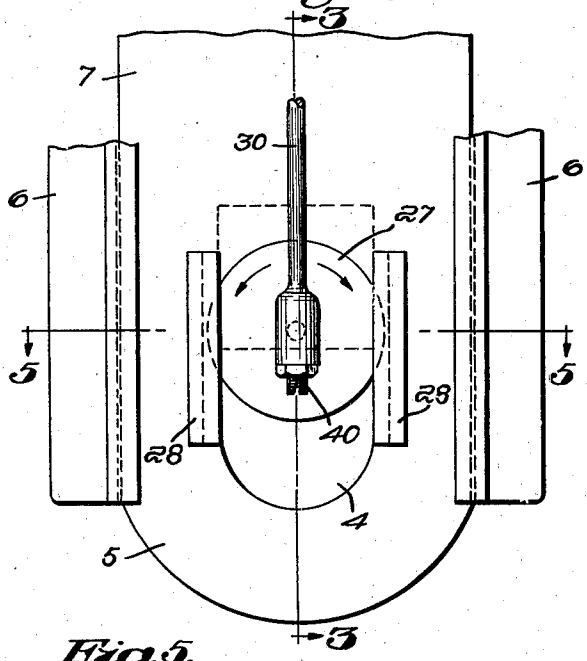


Fig. 5.

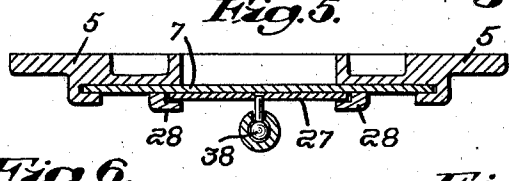


Fig. 6.

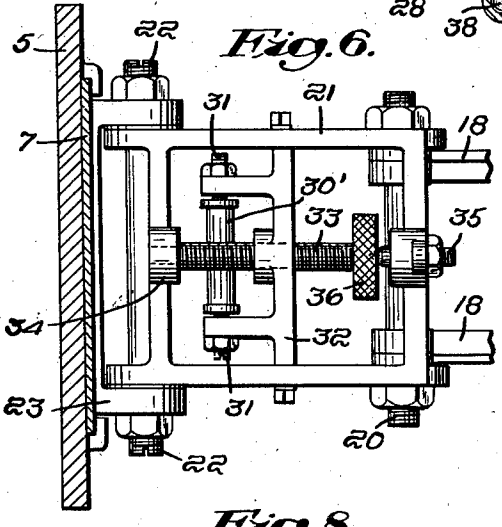


Fig. 7.

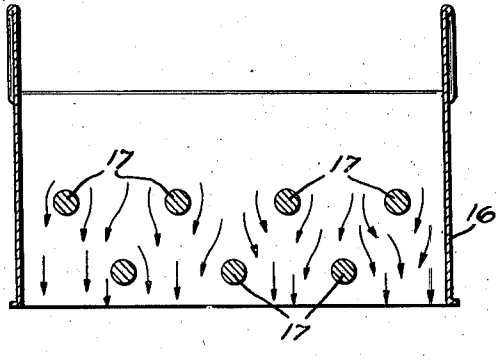
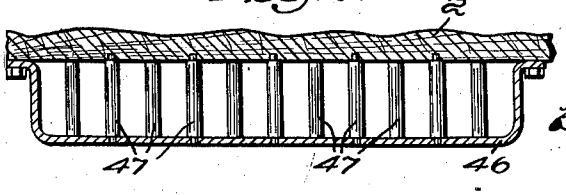


Fig. 8.



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Patented July 3, 1945 2,379,746

UNITED STATES PATENT OFFICE

2,379,746

STOCK REGULATOR FOR PAPER MACHINES

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Application June 11, 1942, Serial No. 446,567

5 Claims. (Cl. 137—68)

This invention relates to apparatus intended for use in controlling the flow of stock to the Fourdrinier wire or other paper making surface of a paper manufacturing machine. It is more especially concerned with apparatus of the type designed to respond automatically to changes in the consistency of the stock and to adjust or regulate its flow in such a manner that a substantially constant dry weight of paper making material will be delivered continuously notwithstanding variations in the consistency of successive portions of the stream of stock. Such apparatus is commonly referred to as a "weight regulator."

An exceedingly troublesome factor in apparatus of this general character is to make such an apparatus differentiate between variations in consistency and those in "freeness" or "slowness" of the stock. A slow stock is one in which the water line travels down the sheet further than normal toward the couch roll while producing a normal sheet. This action is commonly regarded as due to the fact that the fibrous portion of the stock is highly hydrated and tends to retain water in which it is suspended and to part with it reluctantly. A free stock, on the other hand, releases its water more readily than normal, with the result that the water line moves up the wire. A slow stock has a certain slimy characteristic which the free stock does not possess, and for this reason a slow stock of a given consistency does not exert the same frictional resistance on surfaces with which it is in contact as does a free stock carrying the same proportion of solids.

Another factor which also is extremely troublesome in using weight regulators is the fact that the gate which is continuously being adjusted to compensate for changes in consistency becomes loaded up with solid constituents of the stock which crowd in between the gate and the guiding surfaces for it and introduce so much resistance to the movements of the gate as to impede those movements and thus to interfere with the intended operation of the apparatus.

The present invention is especially concerned with these considerations and with other factors later to be mentioned which prevent that accuracy of control so much desired in a weight regulator and which is so difficult to realize in actual practice.

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

In the drawings,

Figure 1 is a view, partly in vertical section and partly in elevation, showing an apparatus embodying the present invention;

Fig. 2 is a front elevation, with some parts broken away, of the apparatus shown in Fig. 1;

Fig. 3 is a vertical, sectional view, on a somewhat larger scale, showing certain details of the connections through which the regulating gate is operated;

Fig. 4 is a front elevation of the parts shown in Fig. 3;

Fig. 5 is a horizontal, sectional view approximately on the line 5—5, Fig. 4;

Fig. 6 is a plan view of parts of the supporting mechanism for the vane;

Fig. 7 is a sectional view approximately on the line 7—7, Fig. 1; and

Fig. 8 is a plan view of the restrictor shown in Fig. 1.

The invention will be herein disclosed as embodied in an apparatus of the type shown in my prior Patent No. 1,893,678, although some of the features of the invention are equally applicable to other forms of apparatus for controlling the flow of paper stock.

Referring first to Figs. 1 and 2, the construction there shown comprises a head box 2 into which stock is pumped through the intake pipe 3, the box being equipped with a weir (not shown) over which the surplus flows and returns to the stuff chest. Thus an approximately constant level of stock is maintained in the intake chamber of the box. This is a common arrangement much used in the paper industry where it is desired to maintain a substantially constant head or level in a supply chamber from which stock is drawn for any purpose, and any other equivalent arrangement may be substituted for the particular construction shown.

At the lower right-hand end of the box it is provided with an outlet 4 formed partly in the wall of the box and partly in a face plate 5 secured to the front side thereof. Mounted to slide in ways provided by the guides 6—6 associated with this face plate is a main gate 7 adapted to close the outlet 4 more or less, as desired. To the upper edge of the gate a small bracket 8 is secured into which the lower end of a screw 10 is fastened, this screw projecting through a wing nut 11 which is mounted to rotate in a stationary bracket 12. By revolving this nut the gate 7 will be raised or lowered, depend-

ing upon the direction of rotation of the nut. A thumb screw 13 serves to lock the nut when desired.

So far as the parts above described are concerned, the construction is very similar to those in common use. The gate 7 is often referred to as the "production gate" since it is adjusted to a position adapted to permit a flow of stock through the outlet 4 sufficient for the manufacture of the particular sheet in process. An arrow 14, Fig. 2, projecting laterally from the bracket 8 cooperates with a scale 15 to indicate the degree of opening of the gate.

As explained in my earlier patent above referred to, variations in the consistency of the stock produce changes in contour or curvature of the stream of stock discharged through the outlet 4, and the apparatus there shown utilizes such changes in controlling the rate of flow of the stock. That is, as the percentage of solids in the stock is reduced, the stream becomes longer and has a slower curve, while an increase in consistency shortens the stream and gives it a sharper curve; and the apparatus there shown includes a vane or scoop resting against the stream and held in contact with it by its own weight, the vane being so connected with the supplemental or auxiliary gate as to adjust that gate automatically in response to changes in position of the vane.

The present invention involves numerous improvements in the general organization of this earlier weight controlling apparatus designed to make it more sensitive, capable of handling a wider range of consistencies satisfactorily, easier to instal, adjust and repair, requiring less attention on the part of the operator, and having a substantially higher degree of reliability.

In order to accomplish certain of these results, an important feature of this invention consists in the provision of a vane which is moved both backward and forward by the action of the stock on it, instead of relying merely on gravity for moving it in one direction. As shown in Figs. 1, 2 and 7, the vane is made in the form of a laterally elongated, approximately rectangular funnel of relatively short height, and its discharge area is made sufficient to accommodate the maximum flow obtainable through the outlet 4. Preferably, also, several pins or studs 17 of substantial diameter are anchored in the opposite walls of the vane and extend transversely from front to rear across the channel provided through it. The right-hand plate of this vane is extended upwardly and is secured rigidly to an arm 18 which is adjustably fastened by a bolt 20 to the forward end of a bracket 21. The rearward end of this bracket is pivotally connected by cone pointed screws 22—22, Fig. 6, with a bracket 23 either formed integral with, or secured rigidly to, the main gate 7. Thus the vane can swing freely on the horizontal axis of the pivots 22 toward and from the front of the head box. Its weight is so disposed that it tends to hang to the left, Fig. 1, and in order to hold it normally in a predetermined neutral or zero position, a counter-balancing weight 24 is connected with the bracket 21 by a cord 25 running over a grooved pulley 26.

Since the movements of the vane are to be utilized in controlling automatically the rate of flow of stock through the outlet 4, a supplemental or auxiliary gate 27 is mounted on the main gate 7 with its edges running in guideways provided by the parts 28—28, Figs. 4 and 5. A link 30 connected at its lower end with the supplemental gate is pivoted at its upper end on screws 31—31, Fig. 6, to a slide 32 mounted on the bracket 21. The two screws have conical points positioned in correspondingly shaped sockets formed in the opposite ends of a T-shaped head 30', Fig. 6, rigid with the upper end of the link 30.

A screw 33 holds said slide snugly against the lower edge faces of the side members of the bracket 21 and also serves to adjust the slide toward and from the fulcrum of the bracket. For this purpose the screw is threaded through a part of the bracket, as clearly shown in Fig. 6, its rearward end is mounted for rotation in a boss 34 formed in said bracket, and its forward end rotates on the conical end of a screw 35 equipped with a check nut by means of which it may be locked in its adjusted position. These parts 34 and 35 form bearings for the screw 33, supporting it for rotation but preventing it from moving axially. Also, the screw is provided with a knurled head 36 so that it may be revolved conveniently, and such rotative movement adjusts the slide 32 toward or from the fulcrum 22 of the bracket. The slide carries upright pointers at opposite ends thereof cooperating with graduations formed on the opposite lateral surfaces of the bracket to facilitate the matter of making records of adjustment for different stocks and reproducing the settings for such stocks.

It will be seen from the foregoing that when the apparatus is in operation the scoop or vane 17 will be acted upon by the stream of stock in such a manner as to hold the vane substantially centered on, or in any event in a predetermined positional relationship to, the main body of the stream. This is true because the stream flows between the tapering front and rear walls of the scoop and engages both of them. Consequently, as the contour of the stream changes or as the part of the stream engaged by the vane shifts toward or from the head box, due to variations in its consistency, the scoop will be compelled to move with it. Such movements rock it and the bracket 21 on the fulcrum 22 and a component of this movement is transmitted through the link 30 to the auxiliary gate 27, thus adjusting it to change the size of the outlet 4 in a manner depending upon the direction of such adjusting movements. If the consistency of the stream increases, the gate will be closed somewhat, while a decrease in consistency will produce an opening movement of the gate. And the extent or amplitude of these adjusting movements can be so related to the changes in consistency that the volume of stock delivered will be varied inversely with changes in its consistency. Thus an approximately uniform rate of delivery of solids will be maintained nothwithstanding such variations.

Ample and convenient adjustments of the parts are provided by the construction above described, the connection of the vane arm 18 with the bracket at 20 affording an angular positional adjustment of the vane while the leverage utilized in operating the auxiliary valve 27 can be adjusted by turning the knurled screw head 36.

It should be particularly noted that in this apparatus the vane 16 is moved both forward and backward by the action of the stream on it and that such action is produced partly by the impact of the stream on the tapered walls of the vane and partly by the weight of stock acting on certain of the surfaces of the vane and es-

pecially on the pins 17. Thus there is ample force available in this construction to produce substantially positive adjusting movements of the auxiliary valve 27.

An important feature of the invention also resides in the construction and mounting of this auxiliary valve. As best shown in Figs. 3, 4 and 5, it consists of a circular disk lying against the face of the main gate 7 with its lateral edges under the flanges of the guides 28—28. The link 30 is connected to this disk by means of a ball and socket joint consisting of a ball ended pin 38 and a socket in which it fits, this socket being adjustable by means of the screw 40. As the link is moved up and down in unison with the changes in position of the vane, the disk 27 is free to oscillate or to revolve in either direction. Consequently, if its movement is retarded by solids which have collected in one or the other of the guides, it will rock about its own center as it moves up or down but will not stick. The direction in which it rocks will depend upon which side is under the greater resistance. The very act of rotating, however, tends to clear out the obstruction and thus to make the gate free itself. This matter of maintaining the auxiliary gate continuously in a freely operable condition is an extremely important factor in the satisfactory operation of an apparatus of this kind.

As a further means for maintaining the parts free from such accumulations of fiber, washing sprays may be directed against the apparatus at suitable points. For this purpose the bracket 8 carries a pipe 41 for wash water and this pipe is apertured to produce the spray S, Fig. 1, against the face of the front gate above the pivot 22 where it assists in keeping this pivot clear. Also, this water runs down the face of the gate and tends to wash away any accumulations of fiber on it or the gate 27 or under the guides 28. Another pipe 42 extends downwardly from the pipe 41 and carries a spray nozzle 43 which may be set at any suitable angle to wash the lower parts of the apparatus. As shown, the spray is directed against the rearward upper surface of the vane but it does not have sufficient force to affect the operation of the vane.

In some cases it is desirable to mount a pointer 44, Fig. 1, on the bracket 45 which supports the pulley 46 where it will cooperate with graduations on the rim of the pulley to indicate the angular position of the vane in its path of swinging movement.

A further feature of this invention resides in a novel form of restrictor 46, Figs. 1 and 8, through which the stock flows in passing from the inlet chamber of the head box to the outlet 4. As shown, this device comprises a curved pressed metal member, somewhat trough-shaped but open at its upper end so as to form a channel for the flow of stock downwardly into and through the outlet 4. At the upper end of this restrictor there are two rows of pins or rods 47, positioned one above the other, with the pins in one row staggered with reference to those in the other. Thus these elements provide a uniformly distributed resistance to the flow of stock from the chamber to the outlet. If the front of the head box 2 were a partition separating the chamber 2 from another chamber from which the stock were discharged, it would be found that under suitable conditions of flow the stock would maintain a certain level in the latter chamber so long as its consistency remained constant, but that if the consistency increased, the head of stock in the latter chamber would rise, while if it decreases, the head would be lowered. In other words, the restrictor 46 operates to vary the rate of flow from the chamber 2 in response to variations in the consistency of the stock. This fact is useful in connection with the operation of the weight regulator since it cooperates with the vane and the flow controlling elements operated by it to produce the ultimate desired result of so varying the rate of delivery of stock to the paper making wire that a substantially constant weight of solids will be delivered continuously.

The apparatus herein shown and described has been found in actual operation to produce exceptionally satisfactory results. It is extremely reliable, will handle an extraordinary range of consistencies satisfactorily, and is relatively free from the disturbing effects formerly produced by variations in slowness or freeness of the stock. As above indicated, an important factor in the operation of this apparatus is the downward thrust exerted by the stream on parts of the scoop and the impeding action of the pins or rods 17, and I believe that these factors, and the manner in which they react on stocks varying in freeness and slowness, is an important fact in producing the favorable results obtained with this invention. Apparently what happens is that the slow stock and the free stock react on the surfaces of the scoop in such a manner that the peculiar qualities which go with freeness and slowness do not materially affect the operation of the apparatus but its response is controlled almost entirely by variations in consistency. However, regardless of what may be the explanation, it has been found in actual practice that the apparatus will handle extraordinary ranges of consistency very satisfactorily.

While a preferred embodiment of the invention is herein illustrated, it will be evident that the invention may be embodied in other forms without departing from the spirit or scope thereof, and that some features of the invention are useful in other forms of apparatus, and particularly in consistency regulators.

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

1. In an apparatus of the character described, the combination with a head box having an outlet for a stream of stock, of a main gate adjustable to vary the area of said outlet, a vane for engaging the stream of stock flowing through said outlet, means supporting said vane on said main gate for swinging movement about a horizontal axis, said vane having parts to be engaged by the forward and rearward portions of said stream, whereby it will be moved toward and from said gate by changes in contour of the stream, means for adjusting said main gate, a supplemental gate mounted on but adjustable independently of said main gate to change the area of said outlet, and connections between said vane and said supplemental gate for causing changes in the position of the vane to adjust said supplemental gate.

2. In an apparatus according to preceding claim 1, a construction in which said vane has the form of a laterally elongated funnel.

3. In an apparatus according to preceding claim 1, a construction in which said vane has the form of a laterally elongated funnel with a series of pins extending transversely across said funnel from front to rear.

4. In an apparatus of the character described, the combination with a head box having an outlet for a stream of stock, of a gate for controlling

the area of said outlet, guides for engaging the opposite edges of said gate, said gate being of circular outline, and adjusting means for said gate having a ball and socket connection with the central portion of the gate so that the latter may have a rotative movement in either direction about its own center.

5. In an apparatus of the character described, the combination with a head box having an outlet for a stream of stock, of a gate adjustable to control the area of said outlet, guides for engaging the opposite edges of said gate, said gate being of circular outline, and means supporting said gate for rocking movement around substantially its own center.

ERNEST A. POIRIER.