

June 21, 1927.

1,633,189

E. POIRIER
PAPER MAKING MACHINE
Filed Aug. 21, 1925

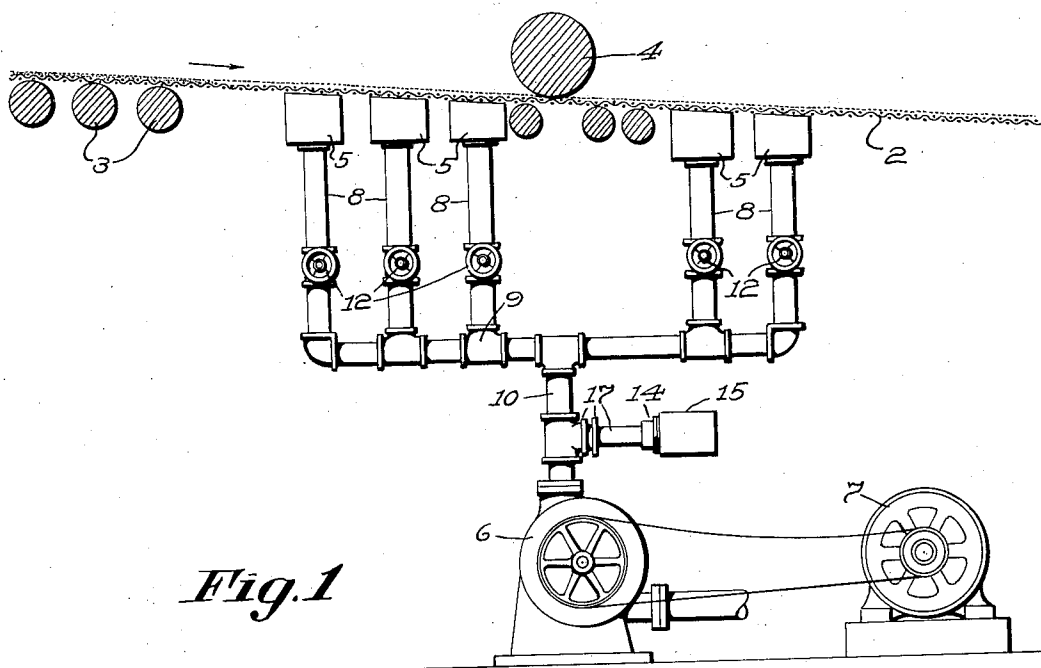


Fig. 1

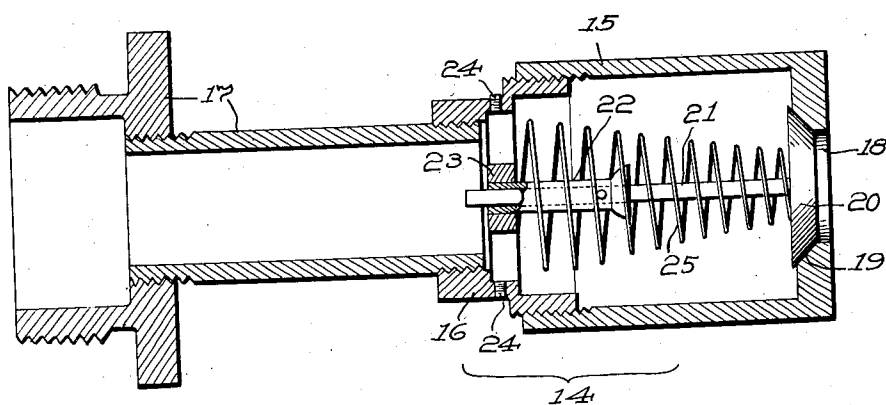


Fig. 2

INVENTOR:
Ernest Poirier,

BY *J. H. W. Crady*
his ATTORNEY

UNITED STATES PATENT OFFICE.

ERNEST POIRIER, OF WATERVILLE, MAINE, ASSIGNOR OF FORTY-NINE ONE-HUNDREDTHS TO JOHN W. STOBIE, OF WATERVILLE, MAINE.

PAPER-MAKING MACHINE.

Application filed August 21, 1925. Serial No. 51,702.

This invention relates to paper making and will be herein disclosed in connection with a machine of the well known Fourdrinier type, it being understood, however, that the invention is applicable to other types of paper making machines.

As is well understood by those skilled in this art, the paper making wire or screen of a Fourdrinier machine runs over and in contact with one or more vacuum boxes which extract a large percentage of the water in which the fibre is suspended during the formation of the sheet. Several of these boxes are located closely adjacent to each other, and they are all joined to a header which is connected to the intake end of a vacuum pump. The vacuum on the individual boxes is regulated by an air inlet valve at each box, each valve being manually adjustable, so that more or less air can be admitted to the air pipe as desired and the degree of vacuum consequently adjusted. A high degree of skill is required in regulating the vacuum at the boxes. In order to produce uniform paper the air valves must be adjusted not only for different grades of paper but the adjustment must be changed frequently in making any one grade of paper in order to suit changing conditions, particularly changes in the consistency of the stock delivered to the wire. For example, if the air valves are set for a given condition and the stock then becomes drier for a time, the paper will take on a mottled or uneven appearance (often referred to as "wild"), and it may even mat into the wire so hard that the wire will "lock" to the boxes and break, or at least be given a jerky motion. To compensate for this condition it is necessary to reduce the vacuum, which is done by admitting more air through the air valves. On the other hand, if the stock becomes wetter, the fibres cannot "felt" properly, the sheet will take on a "crushed" appearance, the water running down the wire farther at some points than others, and resulting in forming a sheet that is uneven. The vacuum must be increased in order to compensate for this condition. These variations also introduce difficulties in the subsequent operations. For example, the dandy roll effect will not be uniform, drying will be uneven, the calender finish will not be as uniform and the winding of

the web into a solid roll will be more difficult.

The present invention aims to improve the machines for making paper with a view especially to producing more uniform results, avoiding much of the skill and attention now required on the part of the operator, increasing the life of the wire, and reducing the number of interruptions in the operation of the machine.

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 accompanying drawings,

Figure 1 is a diagrammatical view of part of a paper making machine constructed in accordance with this invention; and

Fig. 2 is a cross sectional view of the vacuum regulating valve which forms a part of the apparatus shown in Fig. 1.

Referring first to Fig. 1, the Fourdrinier wire is indicated at 2, certain of the table rolls which support this wire are shown at 3, the dandy roll at 4, and the vacuum boxes over which the wire runs are indicated at 5. The vacuum boxes are connected through suitable pipes with the intake end of the vacuum pump 6, which is driven by an electric motor 7. The pipe connections include individual pipes 8 running from the respective boxes 5 to a header 9 which is connected through a pipe 10 to the pump 6, a valve 12 being included in each of the pipes 8 to permit the cutting out of any of the boxes when desired.

The arrangement so far described is like that of the ordinary Fourdrinier machine except that the air inlet valves are omitted from the pipes 8, substantially air tight connections being provided between the boxes 5 and the pipe 10.

Connected to the pipe 10 is an automatic air inlet valve, indicated in general at 14, Fig. 1, and shown in detail in Fig. 2. Referring to the latter figure it will be seen that this valve construction, as shown, comprises a casing 15 screw threaded on a base 16, which is connected through pipe fittings 17 to the pipe 10. A relatively large air inlet port 18 is formed through the end of the casing 15 opposite the base 16 and this

port opens into a valve seat 19 which is arranged to receive a valve 20 of the poppet type. This valve includes a stem 21 mounted to slide through a valve guide 22 which is supported in a spider 23, this spider being secured in the base 16 by screws 24. A coiled spring 25 encircles the stem 21 and tends to hold the valve 20 against its seat 19. The tension of this spring can be adjusted by turning the valve casing 15 on its base 16 and thus shortening or lengthening the spring more or less, as desired.

In using this apparatus the machine tender adjusts the spring 25 by turning the valve casing 15 to the right or left and watching the wire as he makes this adjustment until the desired results are obtained. Usually he makes this adjustment such that the water remains in the stock until it reaches or has passed the first vacuum box 5. The results produced after such an adjustment has been made are very surprising since the air inlet valve automatically adjusts itself thereafter to take care of any ordinary changes in conditions. Usually, in actual operation, the valve 20 normally remains slightly open or unseated. If the stock begins to run quick or free the valve opens wider, while if the stock becomes slower the valve closes somewhat, or entirely.

If the weight of the paper being made is changed the adjustment of the valve spring must also be changed, but when this adjustment has once been made properly for a given weight of paper it is usually unnecessary to touch the valve again until the weight of the paper is changed. This not only relieves the operator of the duties of adjusting the air as conditions change, which heretofore must be made manually and at very frequent intervals, but it results in the production of a much more uniform quality of paper. The valve can be readily adjusted so that the water will remain on the wire until the sheet is properly formed, this point varying with different grades of paper. The water will then disappear uniformly from the sheet, and the point on the wire at which it disappears will remain practically fixed instead of moving backward and forward along the wire as heretofore. This gives the full benefit of the wet end shake of the machine and allows the fibres to felt properly and evenly from one deckle to the other. This also results in producing a more uniform dandy roll effect since the sheet is of a uniform thickness and also because the point at which the water leaves the sheet is controlled more accurately and remains practically fixed. For the same reason the sheet dries more uniformly, a better finish is produced in the calender rolls, and the winding of the web into a solid even roll is facilitated. The

formation of a more uniform sheet also tends to reduce breakage between the couch roll and the calender rolls. The starting and stopping of the machine is also facilitated, especially starting on a heavy sheet, as will be readily appreciated by those skilled in this art.

In addition to these advantages the "locking" of the wire to the vacuum boxes, with the consequent liability of breaking the wire, is prevented. The tendency of the wire to lock which does not actually result in locking but does start a jerking motion of the wire is also eliminated. The maintenance of a substantially uniform vacuum increases the life of the wire and reduces the variations in power required to drive both the machine and also the vacuum pump.

I am aware that it has been proposed heretofore to use a vacuum relief valve which would prevent locking of the wire to the vacuum boxes, but such valves have been so constructed that they could operate only in an emergency, and have not been capable of regulating the vacuum in the manner above described. In fact, no attempt has been made to use such prior valves for this purpose, so far as I am aware, and they have been so constructed that they could not be used for this purpose. My invention not only protects the wire but it also maintains a substantially constant vacuum during normal operation, which I believe to be a new result.

In this connection it may also be pointed out that the mounting of the valve so that a relatively large area is subjected to atmospheric pressure and the provision of free communication between the valve casing 15 and the pipe 10, seem to aid materially in eliminating the effect of inertia of the valve and enabling it to respond instantly to changes in the vacuum in the header 9 or pipe 10. The valve 20 seems to float between the air pressure on one side and the pressure of the spring on the other, the two pressures being substantially balanced, and the valve opening or closing more or less as required to regulate the vacuum. This instantaneous adjustment, taking place automatically, is exceedingly important in the production of a uniform web of paper.

While I have herein shown and described the best embodiment of my invention which I have so far devised, it will be understood that the invention may be embodied in other forms without departing from the spirit or scope thereof. It will also be understood that the air valve may be connected into the piping at other points than that shown, or individual valves like the valve 14 may be connected directly to the boxes 5, the results produced being essentially the same. The invention is also applicable to other types of paper making machines, particularly the so-

called "wet machines", in which a felt carries the web of paper and corresponds to the wire fabric which forms the carrier in a Fourdrinier machine.

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

1. In a paper making machine, the combination of a travelling carrier on which the paper stock is deposited, a suction box in contact with said carrier, a vacuum pump, 10 pipe connections leading from said box to said pump, a valve of slight inertia for automatically controlling the vacuum at said box, and means for operatively supporting 15 said valve to partially overcome the inertia effect thereof whereby to cause it to maintain a substantially constant vacuum in said box.

2. In a paper making machine, the combination of a travelling carrier on which the paper stock is deposited, a suction box in contact with said carrier, a vacuum pump, 20 pipe connections leading from said box to said pump, a valve of slight inertia for automatically admitting air to said connections, and means for operatively supporting said 25 valve to partially overcome the inertia effect thereof whereby to permit automatic regulation thereby of the vacuum maintained in said box by said pump.

3. In a paper making machine, the combination of a travelling carrier on which the paper stock is deposited, a suction box in contact with said carrier, a vacuum pump, 30 pipe connections leading from said box to said pump, a valve of slight inertia for automatically admitting air to said connections, and means for operatively supporting said 35 valve to partially overcome the inertia effect thereof, said means being connected directly with said pipe connections adjacent to said box whereby said valve acts automatically to admit air to said connections 40 immediately upon a rise in the degree of vacuum therein above a predetermined point but is operative to shut off said air again as soon as the vacuum falls below a predetermined 45 value.

4. In a paper making machine, the combination of a travelling carrier on which the paper stock is deposited, a suction box in contact with said carrier, a vacuum pump, 50 pipe connections leading from said box to said pump, a valve casing in free, non-restricted communication with said connections adjacent to said box and having a 55 valve seat therein, a valve in said casing movable toward and from said seat and arranged to be opened by atmospheric pressure to admit air freely to said connections, and 60 a spring for resisting said opening movement of the valve and adjustable to hold the valve substantially balanced against atmospheric pressure.

5. In a paper making machine, the combination of a suction box, a vacuum pump, 65 pipe connections leading from said box to said pump, a valve casing in free communication with said connections adjacent to said box and having a valve seat therein, an inwardly opening valve of slight inertia in 70 said casing mounted to partially overcome the inertia effect thereof and cooperating with said seat, and adjustable means for yieldingly holding said valve against its seat 75 but permitting it to open upon a rise in vacuum above a predetermined point.

6. In a paper making machine, the combination of a suction box, a vacuum pump, 80 pipe connections leading from said box to said pump, a valve casing in free, non-restricted communication with said connections adjacent to said box and having a valve seat in one end thereof, a valve mounted in 85 said casing for reciprocating movement toward and from said seat, a coiled spring tending to hold said valve against its seat, and a base on which said casing is mounted 90 for screw threaded adjustment, whereby the tension of said spring may be adjusted, said casing having a relatively large port open to the atmosphere but arranged to be closed by said valve, whereby a free flow of air into said pipe connections is permitted by the opening of said valve.

ERNEST POIRIER