

July 20, 1954

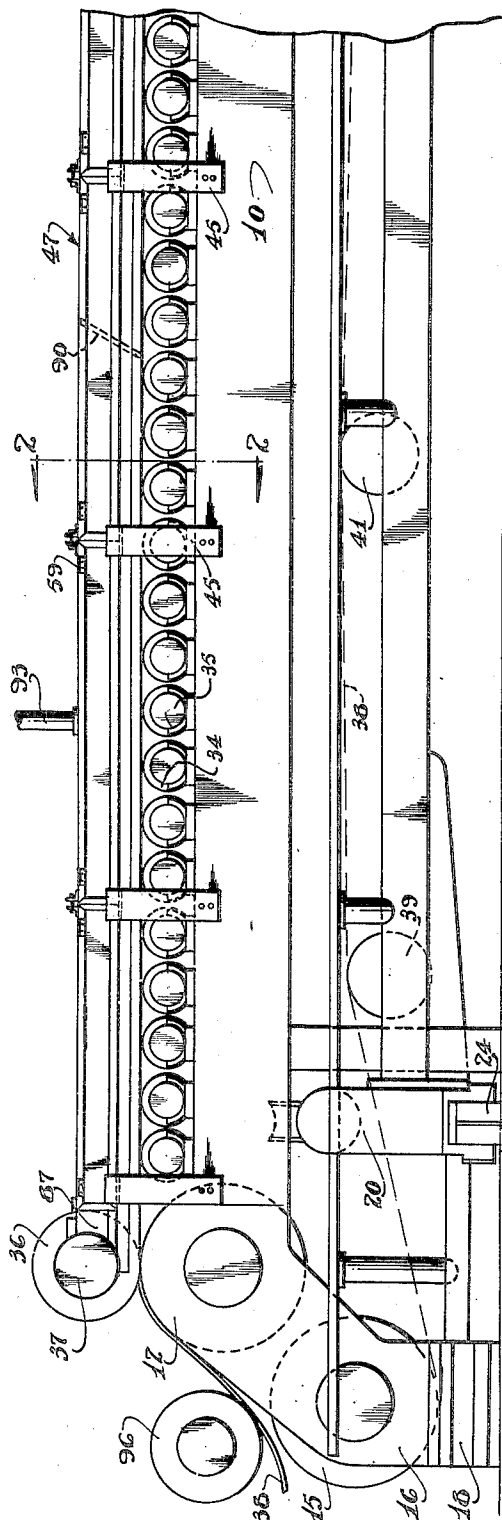
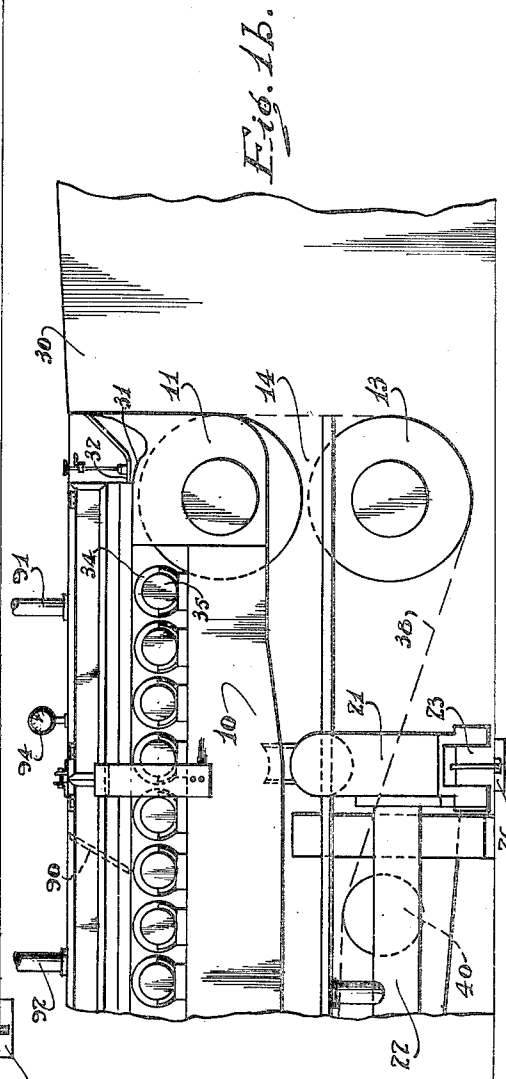
H. H. HART

2,684,019

PAPERMAKING MACHINE

Filed Nov. 14, 1950

4 Sheets-Sheet 1



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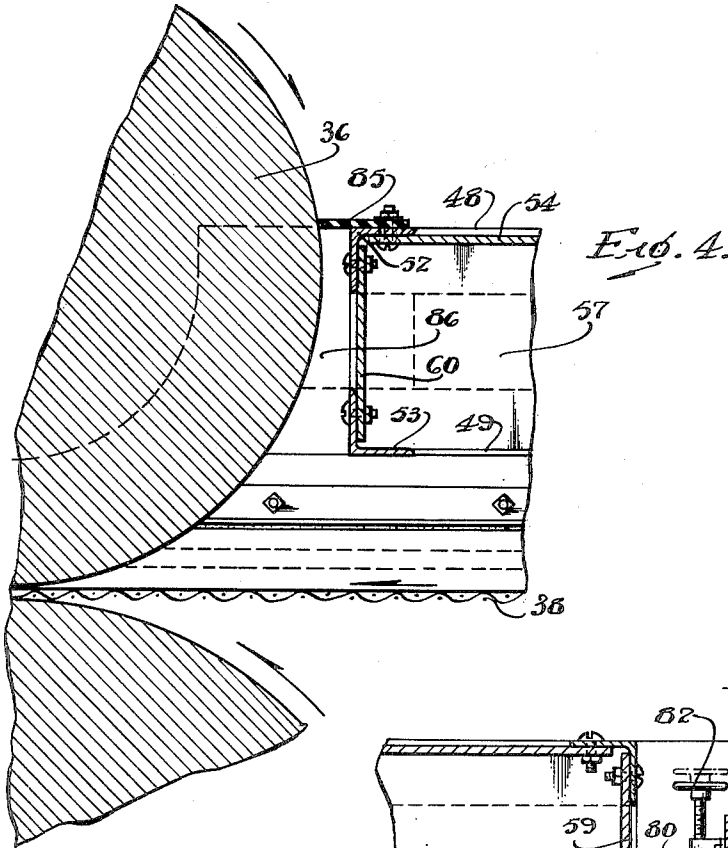
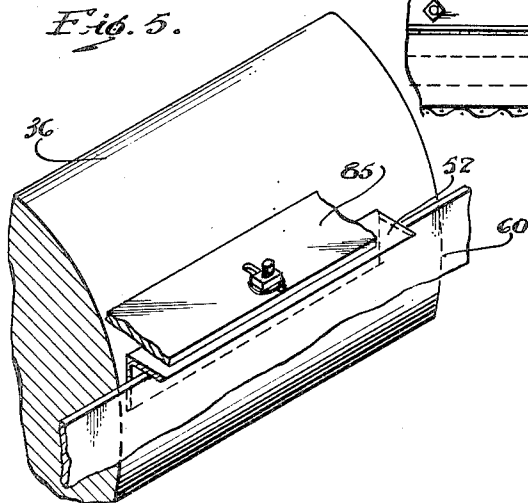
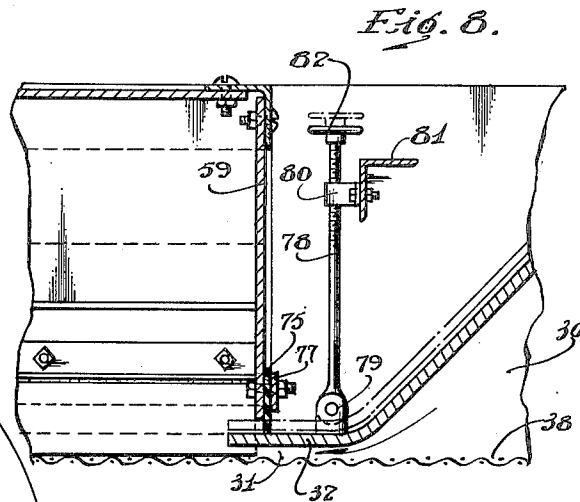
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4 Sheets-Sheet 3



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4 Sheets-Sheet 4

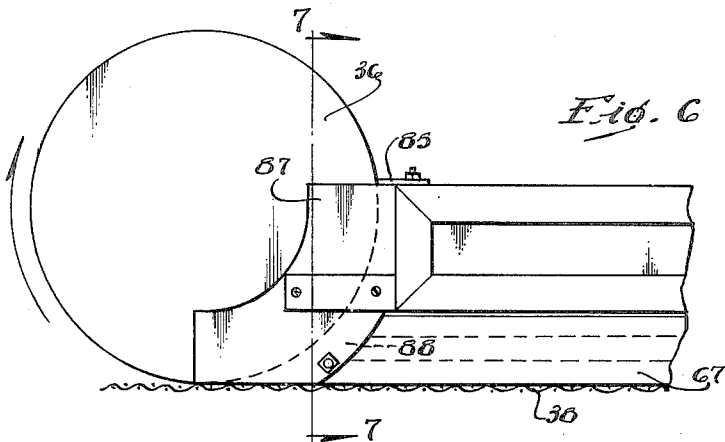


Fig. 6

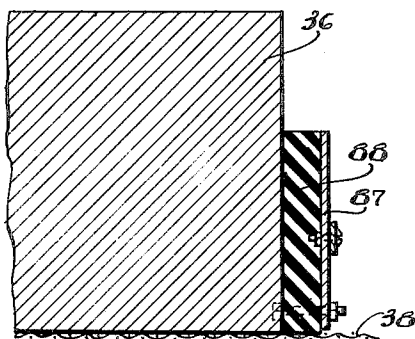


Fig. 7.

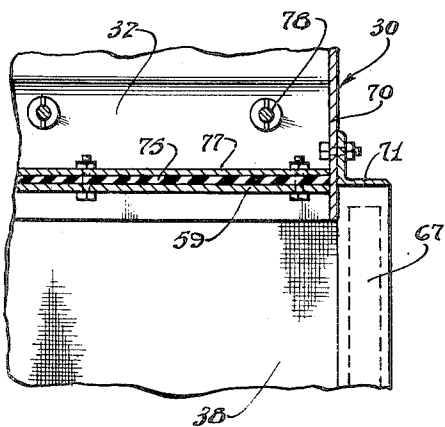


Fig. 9.

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2,684,019

PAPERMAKING MACHINE

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Application November 14, 1950, Serial No. 195,645

4 Claims. (Cl. 92-44)

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The present invention relates to improvements in Fourdrinier paper-making machines. The primary object of the invention is to provide means for increasing the rate and volume of the flow of white water from the paper-making stock on the Fourdrinier wire. This and other objects of the invention are accomplished by subjecting the paper-making stock on the Fourdrinier machine to superatmospheric pressure throughout substantially its entire travel with the wire.

A further object of the invention is to provide a Fourdrinier machine in which a higher percentage of the water is removed from the paper-making stock, before the web of paper leaves the wet part of the machine and goes to the presses and driers.

Another object of the invention is to provide improved means making it possible to decrease the length of the Fourdrinier part of a paper-making machine and to reduce the length of the Fourdrinier wire correspondingly.

Another object of the invention is to provide a machine which will produce a better grade of paper, through the use of a finer mesh wire screen, made possible by the use of the improved means for forcing the water through the screen.

Another object is to produce a Fourdrinier machine which delivers a dryer and stronger web of paper to the presses and driers, with the result that the presses and driers may be reduced in size, since less moisture remains to be removed from the web.

Another important advantage of the invention is to provide a machine in which the life of the Fourdrinier wire is increased very materially, by the elimination of the frictional wear normally produced by contact of the wire with the suction box covers. The accomplishment of this objective effects important economies in the operation of a paper mill, as less frequent wire changing results in fewer mill shut-downs.

Another object is to reduce the power required for driving the Fourdrinier machine, by eliminating the making board, the suction boxes, the suction couch roll, the lowering and raising mechanism, and the shake mechanisms, all made possible by the improved means for increasing the rate of white water drainage through the Fourdrinier screen.

Another object is to eliminate entirely the suction boxes normally employed in Fourdrinier machines, thereby dispensing with their initial cost, as well as their cost of maintenance, such as grinding the suction box covers and removing and replacing the same.

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Another object is to provide a machine in which time losses due to paper breakage are eliminated, by producing, at the delivery end of the wet part of the machine, a paper web which is dryer and stronger than heretofore.

Another object of the invention is to provide improved mechanisms for accomplishing the foregoing objectives, which can be applied to existing Fourdrinier machines, without major modifications.

Other and further objects and advantages of the present invention will be apparent from a consideration of the following description of a specific embodiment, shown for purposes of illustration in the accompanying drawings in which:

Figure 1a is a side elevation of the central section and the foot end of a machine embodying the invention;

Figure 1b is a continuation of the right-hand or head end of the machine of Figure 1a, these two figures constituting in combination, a side elevation of the apparatus as a whole;

Figure 2 is a fragmentary transverse section, on an enlarged scale, taken on line 2-2 of Figure 1a;

Figure 3 is a longitudinal section through the hood of the present invention, showing the connection between two sections;

Figure 4 is a longitudinal section of a preferred form of seal, between the hood and a lump breaker roll;

Figure 5 is a fragmentary isometric view of the seal of Figure 4;

Figure 6 is a side elevation, showing the seal between one side wall of the hood and the end face of the lump breaker roll;

Figure 7 is a vertical section on line 7-7 of Figure 6;

Figure 8 is a longitudinal section, showing a seal between the hood and the vertically adjustable upper lip of the slice, and

Figure 9 is a horizontal section on line 9-9 of Figure 8.

In the accompanying drawings, the Fourdrinier machine is shown diagrammatically and only those parts are illustrated which are required to show the cooperative relation of the instrumentalities of the present invention with the machine.

A Fourdrinier frame including side members 10 supports a breast roll 11 adjacent the head of the frame and an upper couch roll 12 at the foot end. A stretch roll 13 is pivotally suspended from the frame, below the breast roll, by heavy arms

14, so that it may be swung upwardly to the dotted-line position, for a wire changing operation. A lower couch roll 15 is journaled in a downwardly extending portion 16 of the side frame 10, and said extension may constitute the main support for the foot end of the frame, by the interposition of a plurality of removable blocks 18, below its lower end. During a wire changing operation, the near side frame is supported by other instrumentalities, such as the transversely movable carriage indicated generally at 20, 21, and 22, having rollers 23 and 24, mounted on tracks 25 and 26 extending transversely below the machine, into the tending aisle, as is shown and described in the prior patent to Hart No. 2,299,746, October 27, 1942.

Adjacent the head end of the machine is a stock head box of any appropriate type, indicated generally at 30, having a slice 31, defined by side plates and a vertically adjustable, upper slice lip 32, described below.

A longitudinally extending series of transversely arranged table rolls 34 have journals supported in bearings 35 carried by the side frame members in a known manner, except that, in accordance with the present invention, the rolls extend the full length of the frame, from the breast roll to the couch roll, and the ones near the foot end of the machine replace the suction boxes conventionally employed.

Above the couch roll 12 is a lump breaker roll 36, mounted in bearings 37, supported by suitable framework not shown.

A continuous Fourdrinier wire 38 is trained about the stretch roll, the breast roll, above the table rolls, below the lump breaker roll and about the couch rolls 12 and 15. A plurality of return rolls 39, 40 and 41 may be provided, below the lower run of the wire.

Projecting upwardly from the side frames 10 of the Fourdrinier machine are a plurality of brackets 45, having laterally projecting flanges 46, serving as supporting means for a compressed air hood, represented generally at 47.

The hood may be made up in a plurality of sections, each comprising upper and lower longitudinally extending, angle members 48 and 49 along both sides, transverse upper and lower angle members 50 and 51 at their forward ends and 52 and 53 at their rear ends, and a cover plate 54, secured to the upper angle members by any appropriate means. The several hood sections may be laterally braced and the cover plate transversely supported by a plurality of angularly disposed, sheet metal truss plates 55 and 56, appropriately secured to the angle members and also to the side plates 57, by suitable means, such as continuous welds.

The several sections may be bolted together in end to end relation, with appropriate sealing strips 58 interposed between the end plates 59 and 60. The sections may also have laterally projecting angle brackets 61, secured to their sides, adjacent their opposite ends, and having apertures therein, for the reception of lifting hooks 62, so that the hood as a whole may be raised above the frame and the wire, during a wire changing operation.

Means are provided for making a substantially airtight seal between the hood and the wire, along the side margins of the latter, and adjacent the head end and the foot end of the machine. The longitudinally extending seal along the side edges of the wire is best shown in Figure 2. It may comprise a downwardly extending angle strip 65,

carrying, for vertical adjustment, a second angle member 66, to the lower surface of which is secured a normally stationary elongated, flexible sealing strip 67, having its lower surface in running, sealing contact with the upper surface of the wire 38. The sealing strip may be secured to angle member 66 by adhesive 68 or by any other suitable means. The strip 67 may have a longitudinally extending internal chamber or bore 69, into which air under pressure may be delivered, to cause the lower surface of the strip to be pressed downwardly into firm running contact with the wire and to follow the slight undulations between the table rolls 38, where the wire tends to sag slightly. Air under pressure may be delivered to the hollow interior of the sealing strips from any suitable source, not shown.

At the head end, the strip makes a sealing contact with the side wall 70 of the head box 30, and its end face is in sealing contact with a bracket 71 projecting outwardly therefrom.

The head end seal between the hood and the wire is best shown in Figures 8 and 9 and may comprise a flexible, rubber strip 75, secured in airtight relation to the head end plate 59 by a clamping plate 77 and making contact with the upper surface of the lip 32. Of course, the strip may be fixedly secured to the lip and may have a slidable or compressible engagement with the hood, so long as the lip may be adjusted vertically and the seal perform its sealing function in all positions of adjustment. Thus, the seal is provided by the sealing strip 75, the upper lip 32, the side walls 70 of the head box and the body of paper-making stock flowing through and filling the slice.

Vertical adjustments of the lip may be accomplished in any conventional manner, as by a plurality of laterally spaced screws 79 each having its lower end rotatably mounted in a socket 79, and its threaded shank disposed in a nut 80 carried by a fixed cross-bar 81, and each having a hand wheel 82 at its upper end.

The seal at the foot end of the hood may be substantially as shown in Figures 4, 5, 6 and 7 may comprise a flexible strip 85, adjustably secured to the upper surface of the hood and having its free edge 86 disposed in sealing contact with the periphery of the lump breaker roll 36. The end wall of the last hood section carries rearwardly projecting, adjustable sealing plates 87, having their rear edges curved to fit quite closely the lump breaker roll journals. Correspondingly shaped, arcuate rubber blocks 88, interposed between these plates and the end faces of the roll provide a seal therebetween. These blocks have their forwardly facing, lower surfaces in engagement with arcuate ends of the side strips 67 and constitute sealing extensions thereof. Thus, the seal is provided by the lump breaker roll 36, disposed in contact with the web of stock on the upper surface of the wire, the flexible strip 85 carried by the hood and disposed in running contact with the periphery of the roll and the rubber blocks 88 disposed between the side walls of the hood and the end faces of the roll.

The space within the hood may be divided into a plurality of compartments, by downwardly extending partition plates 90, having their lower edges in close proximity to the upper surface of the stock on the wire. The partition plates may be carried by, or may constitute continuations of, certain of the angularly disposed truss plates 55 and 56.

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Air under pressure may be delivered to the interior of the hood at a plurality of points along its length, by pipes 91, 92, and 93. The pressure in each compartment, defined by the partitions 90, may be independently regulated, by conventional pressure regulating valves in the air lines, so that different pressures are applied to the stock on the wire at different areas in its travel with the wire.

Conventional pressure gauges, such as the one indicated at 94 in Figure 1b may be mounted upon the hood at one or more points throughout its length, so that the pressure within the hood may be accurately determined.

The web of paper formed on the wire 38 may be picked off directly from the upper couch roll 12, but, preferably, is separated from the wire at a point between the upper couch roll and the lower couch roll 15, by a take-off roll 96, as indicated in Figure 1a, from which point it may be carried to the felts of the press part of the machine, in accordance with conventional practice.

In the operation of the apparatus of the present invention, paper-making stock, consisting of fibers and the like in an aqueous suspension, is discharged through the slice 31 in a uniform, rapidly moving stream, extending entirely across the wire. The stock moves with the wire into the first compartment below the hood and is there subjected to superatmospheric pressure, with the result that the water in the stock, commonly termed "white water," flows through the screen at a higher rate than is conventionally the case, where the water is subjected to the force of gravity alone. As the wire travels longitudinally under the hood, it is subjected to air pressure in the next compartment, which may be greater or less than the air pressure in the first compartment. Additional moisture is drained through the wire under the influence of this pressure as the wire and the stock travel along. A certain amount of water is withdrawn by capillary attraction between the wire and the table rolls 35, and this removal of water is more effective with the apparatus in accordance with the present invention, because of the increased pressure contact between the wire and the table rolls, resulting from the air pressure in the hood, so that the capillary attraction between the rolls and the wire is increased.

The wire with the stock thereon next passes over the table rolls adjacent the foot end of the machine, in the area normally occupied by the suction boxes, and additional moisture is removed by the superatmospheric pressure existing under this portion of the hood. The web passes below the lump breaker roll and emerges to the atmosphere on the wire, where it is picked off by the take-off roll 96, for further treatment, as is well understood in the art.

In view of the extremely large area of the paper making stock on the wire which is effectively subjected to superatmospheric pressure below the hood, relatively low degrees of pressure, above atmosphere, may be provided, to effect the desired results of increasing the rate of the drainage of water through the wire. In the use of suction boxes, in accordance with the prior art, high degrees of vacuum in the boxes have necessarily been employed, in view of the extremely small effective area of the suction on the wire, which is limited to the sum of the cross-sectional areas of the small openings in the suction box covers. This area amounts to only a minute fraction of the area subjected to pressure in

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accordance with the present invention. Accordingly, pressures ranging from one ounce per square inch to a few ounces above atmosphere may be employed in the present invention, with superior results to the use of as much as 7 pounds' negative pressure in the suction boxes of the prior art. However, it must be understood that the present invention is not limited to the use of superatmospheric pressures in the above suggested range, as under certain conditions and with particular types of stock a much higher pressure may be found desirable.

It must be understood that the invention is not limited to the details of construction shown in the accompanying drawings and described above, but includes all modifications coming within the scope of the appended claims and their equivalents.

I claim:

1. A Fourdrinier machine comprising a frame having a head end and a foot end, a breast roll adjacent the head end of the frame, a couch roll at the foot end of the frame, a plurality of table rolls extending transversely of the frame, a wire trained over said breast roll and over said table rolls and couch roll, a lump breaker roll positioned above the wire adjacent the couch roll, a head box having a slice above the breast roll adapted to deliver a continuous stream of paper making stock to the upper surface of the wire, a hood above said frame, substantially co-extensive in area therewith, sealing means between one end of the hood and the head box, sealing means between the other end of the hood and the lump breaker roll, longitudinally extending, flexible, normally stationary seals carried by the hood and making running contact with substantial pressure with opposite marginal portions of the wire, and means for delivering air under pressure to the interior of the hood.

2. A Fourdrinier machine comprising a frame having a head end and a foot end, a breast roll adjacent the head end of the frame, a couch roll at the foot end of the frame, a plurality of table rolls extending transversely of the frame, a wire trained over said breast roll, said table rolls, and said couch roll, a stock head box having a slice above the breast roll adapted to deliver a continuous stream of paper making stock to the wire, a lump breaker roll positioned above the couch roll in closely spaced sealing relation to the stock on the upper surface of the wire, a hood above said frame substantially coextensive in area therewith, means providing an air-tight seal between one end of the hood and the head box, means at the other end of the hood disposed in running contact with the lump breaker roll and providing an air-tight seal therebetween, flexible, normally stationary, sealing strips carried by the sides of the hood disposed in running contact under substantial pressure with the upper surface of the wire and providing a continuous air-tight seal therebetween, and means for delivering air under pressure to the space below the hood.

3. A Fourdrinier machine comprising a frame having a head end and a foot end, a plurality of rolls extending transversely of the frame in a continuous series substantially from one end thereof to the other and including a breast roll at the head end and a couch roll at the foot end, a wire having an upper run trained over said rolls, a lump breaker roll above the couch roll, a head box having a vertically adjustable upper lip defining an adjustable slice extending trans-

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verseley of the wire adapted to control the thickness of the stream of paper making stock delivered to the upper run of the wire above the breast roll, a hood above said frame substantially coextensive in area therewith and extending from the breast roll to the couch roll, vertically adjustable sealing means at the head end of the hood and disposed in physical contact with said lip, a transversely extending sealing strip carried by the other end of the hood and disposed in running contact with the periphery of the lump breaker roll, longitudinally extending, normally stationary, flexible sealing strips carried by the sides of the hood, disposed in running contact under substantial pressure with the side edges of the upper run of the wire and providing substantially airtight side seals between the hood and the wire, said strips having their head ends connected in airtight sealing relation to the sides of the head box and their foot ends extended into face to face, airtight sealing contact with the end faces of the lump breaker roll, and means for delivering air under pressure to the interior of the hood.

4. A Fourdrinier machine comprising a frame having a head end and a foot end, a plurality of rolls extending transversely of the frame in a continuous series substantially from one end thereof to the other and including a breast roll at the head end, a couch roll at the foot end, and intermediate table rolls, a wire having an upper run trained over said rolls, a head box having a vertically adjustable upper lip defining an adjustable slice extending transversely of the wire above the breast roll to control the thickness of the stream of paper making stock delivered to the upper run of the wire, a hood above said frame substantially coextensive in area therewith and extending from the breast roll to the

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couch roll, a vertically adjustable sealing strip at the head end of the hood disposed in airtight sealing relation with said lip and said hood, transversely extending sealing means at the foot end of the hood disposed in airtight relation to the hood end in substantially airtight relation to the stock on the wire, longitudinally extending, normally stationary, flexible sealing strips carried by the sides of the hood, disposed in running contact under substantial pressure with the upper surface of the side edges of the upper run of the wire and providing substantially airtight side seals between the hood and the wire, said strips having their head ends connected in airtight sealing relation to the sides of the head box and their foot ends connected in airtight sealing relation to said transversely extending foot end sealing means, and means for delivering air under pressure to the interior of the hood.

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