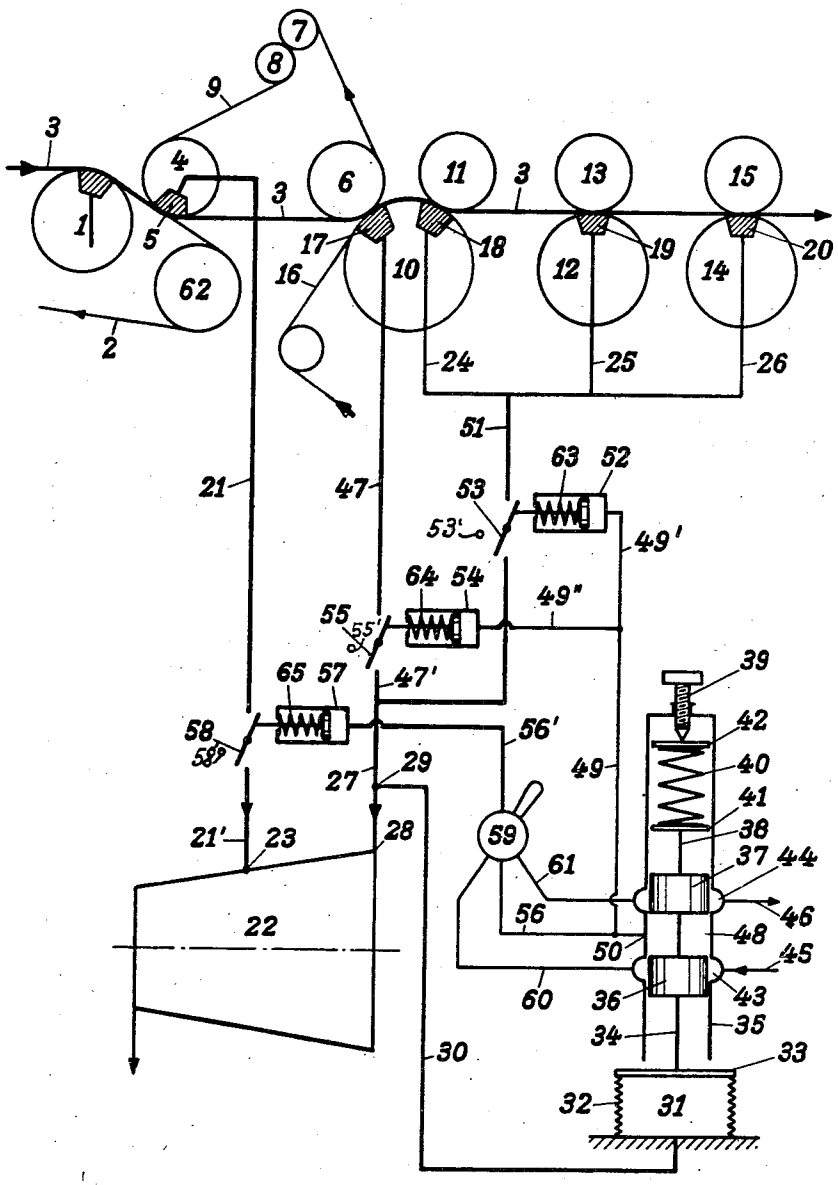
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MACHINE FOR MAKING LENGTHS OF PAPER OR CELLULOSE

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MACHINE FOR MAKING LENGTHS OF PAPER OR CELLULOSE

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The present invention relates to a machine for making lengths of paper or cellulose including a turbocompressor and devices for drawing liquid from the paper mat formed at the wet end of the machine on a wire and a felt ribbon whereby the paper mat is transferred from the wire to the felt ribbon by means of a transfer roll, the paper mat being normally drawn onto the roll by a suction effect.

It is the object of the invention to provide a mechanism for selectively controlling the suction pressure on the transfer roll either manually or automatically in response to the vacuum in at least one suction box which is passed by the paper mat after it has left the transfer roll. The system according to the invention affords automatic control of the vacuum at the transfer roll during normal operation in the same manner as at any other vacuum box, particularly so that if the cellulose or paper is broken and air enters a box passed by the paper after the transfer roll the suction conduit to the suction box in the transfer roll is throttled and the latter can be lifted away from its normal position at the wire into an inactive position without taking the mat of paper along. The latter continues to move on the wire and is not transferred to the felt ribbon so that it can drop into a container. If the transfer roll is lowered to its normal operating position, after the severed rests of the paper mat have been removed, sufficient suction pressure can be applied by a manual adjustment to draw the mat of paper to the transfer roll away from the wire for transfer to the felt ribbon, before the subsequent vacuum boxes are covered by the paper, i. e. before full vacuum is restored in the subsequent boxes.

If desired, the throttle effect in the suction conduit of the transfer roll caused by a tearing of the paper may be so controlled that the mat of paper follows the wire and is dropped into a container instead of being transferred to the felt ribbon, although the transfer roll remains in its operating position, i. e. is not lifted. In this case the transfer roll must not be moved away from the wire in order to prevent flow of the paper onto the felt ribbon; throttling of the suction conduit leading to the suction box in the transfer roll produces the desired result and the rotation axis of the transfer roll can be stationary.

Paper making machines including a transfer roll of the type described supra have been built; these machines, however, used a plurality of individual water ring pumps, i. e. volumetric pumps, for producing vacuum in a plurality of suction boxes, instead of a turbocompressor for all suction boxes. There is no danger of overloading volumetric pumps as compared with turbocompressors so that no automatic vacuum control devices and no mechanism for selectively controlling the suction pressure automatically or by hand were provided in the conventional machines including a transfer roll.

In a preferred embodiment of the invention a hydraulically operating automatic suction control mechanism is provided for the vacuum boxes of the felt ribbon portion

of the machine whereby the suction pressure at the transfer roll is controlled in response to the suction pressure in at least one of the vacuum boxes of the felt ribbon portion of the machine. A fluid pressure operated actuator controls a valve in the suction conduit of the suction box within the transfer roll which actuator can be selectively connected with a control conduit for similar actuators for valves in the suction conduits of vacuum boxes which are passed by the paper after the transfer roll, or with a pressure fluid supply conduit, or with a pressure fluid relief conduit. The manual operation of the mechanism can produce two effects: The actuator for the throttle valve in the suction conduit of the suction box in the transfer roll can be manually connected with a fluid pressure supply conduit or with a fluid pressure relief conduit, i. e. the throttle valve can be moved by hand into open or into throttling position. If the paper breaks after passing all vacuum boxes of the machine, for example in the dry end of the machine, the control mechanism can be manually so adjusted that there is substantially no suction effect at the transfer roll and the flow of the paper mat from the wire to the felt ribbon is interrupted. The manual operation does not require increase of pressure at a vacuum box for closing the throttle valve in the suction conduit of the suction box in the transfer roll.

In an embodiment of the invention a three-way valve is interposed in the control conduit for the actuator of the throttle valve in the suction conduit of the suction box in the transfer roll for selectively connecting the actuator with the control conduits of the actuators for the throttle valves in the suction conduits of the other vacuum boxes or with the fluid pressure supply conduit or with the fluid pressure relief conduit.

In another embodiment of the invention a control cylinder containing a piston valve is provided, the piston valve being held by resilient means in an operating position and being adapted to be moved by the pressure in the suction conduit of a vacuum box which is passed by the paper after passing the transfer roll. A fluid pressure supply conduit, a fluid pressure relief conduit, and a control conduit for the actuators of the throttle valve in the suction conduits of the vacuum boxes are connected with the control cylinder, connection of the control conduit with the pressure fluid supply conduit, or with the relief conduit, or with neither of them being effected depending on the position of the piston valve. The latter is preferably held between two springs, the tension of at least one of the springs being adjustable.

The novel features which are considered characteristic of the invention are set forth with particularity in the appended claims. The invention itself however and additional objects and advantages thereof will best be understood from the following description of embodiments thereof when read in conjunction with the accompanying drawing, the one figure of which diagrammatically illustrates a portion of a paper making machine to which the invention is applied.

The Fourdrinier wire 2 upon which the mat of paper 3 is formed travels over a couch roll 1 and a guide roll 62. The mat of paper is removed from the Fourdrinier wire 2 by means of a transfer roller 4 which is shown in operating (i. e. lower) position. Inside the roller 4 a suction box 5 is arranged for this purpose. The paper mat is transferred from the Fourdrinier wire to a felt ribbon 9 which extends around the roller 4 and is guided by additional rollers 6, 7, and 8. The ribbon 9 conducts the paper mat onto a second felt ribbon designated by numeral 16 and moving between pairs of pressure rolls 10—11, 12—13, and 14—15. The roll 10 contains suction boxes 17 and 18 and the rolls 12 and 14 contain suction boxes 19 and 20, respectively. The

part of the machine including the Fourdrinier wire 2 is called the wire screen portion, the part including the felt ribbons 9 and 16 is called the felt portion, the ribbon 16 and the press rollers 10 to 15 constituting the press portion of the paper making machine.

The suction box 5 in the paper mat transfer roller 4 is connected at 23 with an intermediate inlet socket of a turboblower 22 by means of a suction conduit 21, 21'. The suction box 17 of the roller 10 is connected by means of a suction conduit 47, 47', 27 at 28 with a suction socket of the blower 22. The suction boxes 18, 19, 20 of the rollers 10, 12, and 14, respectively, are connected by means of conduits 24, 25, 26, respectively, with a conduit 51 which terminates in the conduit 47'.

A conduit 30 is connected at 29 with the suction conduit portion 27 and leads to the inside 31 of a bellows 32 whose movable end 33 is connected by means of a rod 34 with a piston valve 36, 37 reciprocable in a cylinder 35. A coil spring 40 is interposed between the upper end of a rod 38 upwardly extending from the piston valve 36, 37 and an adjusting screw 39 screwed into the top cover of the cylinder 35, spring plates 41 and 42 being arranged at the ends of the spring 40. The piston valve 36, 37 is normally held in the illustrated position in which the spring 40 counterbalances the pressure in the bellows 32 and the spring tension of the latter. The piston valve portion 36 controls an annular recess 43 through which pressure oil may enter the cylinder 35 from a supply conduit 46. The valve portion 37 controls an annular recess 44 through which pressure oil may leave the cylinder 35 through a relief conduit 46.

The portion 48 of the cylinder 35 between the annular recesses 43 and 44 is connected at 50 with a control conduit system 49, 49', and 49", the conduits 49' and 49" being connected with fluid pressure responsive actuators 52 and 54, respectively, for operating throttle valve 53 and 55, respectively, in the suction conduits 51 and 47, respectively. A control conduit 56, 56' connects the control cylinder 35 with a pressure fluid operated actuator 57 for operating a throttle valve 58 in the suction conduit 21, 21' of the suction box 5 in the transfer roll 4. A three-way valve 59 is interposed in the conduit 56, 56' by means of which the conduit 56' can be connected either with the conduit 56 or by a conduit 60 with the annular recess 43 which is supplied with pressure fluid through the supply conduit 45 or by a conduit 61 with the annular recess 44 from which pressure fluid is relieved by the relief conduit 46.

The system according to the invention operates as follows:

At normal operation the individual parts are in the position shown in the drawing. The three-way valve 59 is in the position for automatically controlling the pressure in the suction box 5 in which position the control conduits 56 and 56' are interconnected. The paper covers all suction boxes 5 and 17 to 20 so that a low or suction pressure prevails in the respective suction conduits 21, 21'; 47, 47'; 24, 25, 26, 51, 27. There is also the same vacuum in the chamber 31 as in the conduit 27. The fluid pressure in the actuators 52, 54, 57 is the same as in the space 48 of the cylinder 35 so that the throttle valves 53, 55, 58 are held open against the action of springs 63, 64, 65, respectively.

If the paper is broken, for example at the press portion of the machine, ahead of the vacuum box 19, the pressure in the conduits 24, 25, 26, 51, 47, 47', 27, and 30 and consequently also in the chamber 31 inside the bellows 32 rises to almost atmospheric pressure. This causes upward movement of the piston valve 36, 37 connecting the control conduits 49, 49', 49" and 56, 56' with the relief conduit 46. The springs 63 to 65 can now push the pressure fluid, for example oil, out of the actuators and close the valves 53, 55, and 58. Thereupon the pressure in the suction conduit portions between the throttle valves 53, 55, 58 and the turbocompressor 22 will be reduced and consequently also the pressure in the conduit 30 and in the chamber 31. This causes a downward movement of the piston valve 36, 37 into normal operating or neutral position in which the point 50 is no more connected with the annular recess 44. The transfer roll 4 may now be lifted into an upper or inactive position without taking the paper along. When the valve 58 is in throttling position, the suction effect of the suction box 5 is so little that the paper mat is not taken along by the transfer roll 4 if the latter is lifted from the Fourdrinier wire 2. When the roll 4 is lifted, the normal flow of the paper is interrupted. The paper mat 3 is not transferred to the felt ribbon 9 but remains on the Fourdrinier wire 2 until it reaches the roller 62 and drops into a container, not shown. The wet pulp is returned into the main reservoir, from which it is again brought onto the Fourdrinier wire 2.

If after removal of the rests of paper in the felt portion of the machine normal operation is to be resumed, i. e. if the paper mat is to be transferred from the Fourdrinier wire 2 to the felt ribbon 9, the three-way valve 59 is moved by hand into the position in which the pressure fluid control conduit 60 is connected with the control conduit 56' so that the actuator 57 receives pressure fluid from the supply conduit 45, and the valve 58 is opened against the action of the spring 65. The transfer roll 4 is now moved into the normal operating position which is the position shown in the drawing for picking up the paper mat 3, whereupon the pressure in the suction box 5 drops, causing the paper mat to be lifted from the Fourdrinier wire 2 and to be transferred onto the felt ribbon 9. When the paper mat has covered the vacuum boxes 17 to 20, the pressure in the suction conduits 47, 24 to 26, and 51 is reduced; simultaneously, the pressure in the conduits 47', 27, and 30, and also in the chamber 31 is lowered, causing the pistons 36, 37 to temporarily move downward from the position shown in the drawing, so that the control conduits 49, 49', and 49" are connected with the pressure fluid supply conduit 45. The actuators 52 and 54 receive pressure fluid from the supply conduit 45 and open the throttle valves 53 and 55. Thereupon, the normal operation suction pressure is restored in the conduits 47, 47', 24 to 26, 51, 27, and 30, and in the chamber 31. Since the normal operation suction pressure is higher than the pressure previously prevailing in the chamber 31, the pistons 36, 37 is moved back to its normal operating position which is shown in the drawing. The three-way valve 59 can now be turned back into the position for automatic control of the pressure in the suction box 5, i. e. into the position in which the conduits 56 and 56' are interconnected.

The throttle valves 53, 55, and 58 are preferably provided with abutments 53', 55', and 58', respectively, preventing complete closing of the valves, so that a minimum amount of air can pass through the throttle valves, even when they are in throttling position, for preventing pumping of the compressor 22.

During starting of the machine, the suction system according to the invention operates accordingly.

If the paper breaks after the felt portion of the machine, for example at the dry end thereof, the three-way valve 59 is moved into the position in which the pressure relief conduit 61 is connected with the control conduit 56'. This causes closing of the valve 58 due to the action of the spring 65, the pressure fluid flowing out of the actuator 54 and through the relief conduit 46. Closing of the valve 58 effects an increase of the pressure in the suction box 5, whereupon the normal flow of the paper mat is interrupted. The subsequent operation is the same as described supra.

The pressure in the suction box 5 can be so controlled by the throttle valve 58 that the paper mat remains on the Fourdrinier wire 2 until it reaches the roller 62 immediately after movement of the valve 58 into throttling position and before the transfer roll is lifted

away from the Fourdrinier wire 2. If it is desired to again transfer the paper mat from the Fourdrinier wire 2 to the felt ribbon 9, the three-way valve 59 must be turned into the position in which the conduit 60 is connected with the control conduit 56'. This causes opening of the valve 58, effecting a vacuum in the suction box 5 which vacuum pulls the paper mat from the Fourdrinier wire onto the felt ribbon 9. It is therefore not necessary that provisions be made affording lifting of the roll 4. The latter may be arranged to rotate on a stationary axis.

While specific embodiments of the invention have been shown and described, it will be apparent to those skilled in the art that various changes, modifications, substitutions, additions and omissions may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. A paper making machine comprising a wire at the wet end of the machine, a felt ribbon for taking over the paper mat from the wire, a roll over which said felt ribbon is laid, a suction box placed inside of said roll for normally drawing the paper mat from said wire to said felt ribbon, a plurality of rolls guiding the moving paper mat after it has been taken over by said felt ribbon, vacuum boxes individually connected with said last mentioned rolls for removing moisture from the paper mat, a turbocompressor, a conduit connecting said turbocompressor with said suction box and conduit means connecting said turbocompressor with said vacuum boxes for producing a vacuum in said boxes, a control mechanism responsive to the pressure in at least one of said vacuum boxes, a valve in the conduit connecting said turbocompressor with said suction box, and a manually operable device including means for selectively manually operating said valve and for connecting said control mechanism with said valve when said valve is not manually operated for automatic actuation of said valve by said control mechanism according to the pressure in at least one of said vacuum boxes.

2. A paper making machine as defined in claim 1, including a pressure fluid operated actuator for said valve, said control mechanism including a pressure fluid supply conduit, a pressure fluid relief conduit, a control conduit connected with said actuator, a control valve adapted to

be actuated by the pressure in at least one of said vacuum boxes and interposed between said control conduit and said pressure fluid supply and relief conduits for supplying pressure fluid into or relieving pressure fluid from said control conduit and for disconnecting the latter from said supply and relief conduits, valves in said conduit means, actuators for said last-mentioned valves, and conduit means connecting said last-mentioned actuators with said control conduit, said manually operable device being interposed in said control conduit between said first-mentioned actuator and the point where said last-mentioned conduit means is connected with said control conduit, said manually operable device being adapted to either afford free flow of pressure fluid through said control conduit or to connect said first-mentioned actuator for pressure fluid flow either with said pressure fluid supply conduit or with said pressure fluid relief conduit.

3. A paper making machine according to claim 2, in which said manually operable device is a three-way valve.

4. A paper making machine according to claim 2, in which said control valve includes a cylinder, said pressure fluid supply and relief conduits as well as said control conduit being individually connected for pressure fluid flow with said cylinder, a piston valve reciprocable in said cylinder for connecting either said pressure fluid supply conduit or said pressure fluid relief conduit with said control conduit or for disconnecting the latter from both said supply and relief conduits, means for moving said piston in response to the pressure in at least one of said vacuum boxes, and spring means tending to hold said piston valve in neutral position, in which it disconnects said control conduit from said supply and relief conduits, at normal operating conditions.

5. A paper making machine according to claim 4, in which said spring means include a spring at either end of said piston, and including means for manually adjusting the tension of at least one of said springs.

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