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(54) IMPROVEMENTS IN DOUBLE-WIRE PAPER MACHINES

(71) We, ESCHER WYSS GMBH, a Company organised under the laws of Germany, of Ravensburg/Wurtt, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement: —

This invention relates to a separating system for separating two wires in a double-wire paper machine.

According to the present invention, a paper machine includes two wires arranged to run together with a web of paper between them to a main roll around which that one of the wires is trained on which the web of paper is intended to remain after separation of the wires, and an auxiliary roll around which the other wire is trained, the auxiliary roll being situated after the main roll as considered in the direction of movement of the wires, and being so disposed that the auxiliary wire trained over it separates from the main roll earlier than the main wire, the main roll being a smooth, imperforate roll and the distance between the surface of the auxiliary roll and the surface of the main roll being less than 0.25 times the diameter of the auxiliary roll, the machine including a separating wall between the main roll and the main wire on the entry side of the main roll and extending from adjacent the surface of the main roll to adjacent the main wire.

The use of a main roll with a smooth, imperforate surface results in an adhesive effect on the paper web, and this effect is known as the register roll effect. In the case of a wet paper web and a main wire whose apertures are filled with water, the paper web adheres to the wire with a certain force. In machines having high wire speeds, such as is frequently the case with double-wire machines, this force would not be sufficient to ensure satisfactory transfer of the paper web to the main wire. It has already been proposed to make the main roll as a suction roll to ensure that the web travels with the main wire but this is expensive both to provide and to operate. According to the invention, however, the auxiliary roll which must in any case be present is utilised for this purpose. By locating the auxiliary roll near the main roll, the flow of air entrained by the auxiliary roll is used to assist the lifting of the paper web away from the auxiliary wire, by developing in the wedge-shaped space between the auxiliary roll surface and the auxiliary wire running on to it a dynamic pressure.

Preferably, the distance between the surface of the auxiliary roll and the surface of the main roll is less than 10 mm so that the dynamic pressure formed by the auxiliary roll is developed to the maximum.

The separating wall between the main roll and the main wire on the entry side of the main roll and extending from adjacent the surface of the main roll to adjacent the wire closes off a wedge-shaped space between the main roll and the main wire. This reduces the development of a dynamic air pressure in the space between the surface of the main roll and the main wire such as might interfere with the separating process.

The edge of the separating wall adjacent the wire may be a sharp edge adapted to strip surplus water from the wire. Thus water which is suspended from the wire is removed before it can penetrate into the wedge space where it would be forced back into the wire and might interfere with the separating process.

The auxiliary roll preferably has a smaller diameter than the main roll.

The distance between the axis of the

auxiliary roll and the axis of the main roll in the direction of the portion of the auxiliary wire extending between the two rolls is preferably between 0.03 and 0.5 times the diameter of the auxiliary roll to obtain the best advantage from the dynamic pressure of the air entrained by the auxiliary roll.

Preferably, the angle of wrap of the auxiliary wire about the auxiliary roll is not greater than 90°. This leaves a considerable proportion of the auxiliary roll exposed and able to entrain air to develop the dynamic air pressure without obstruction by the auxiliary wire.

The auxiliary roll may have a smooth, imperforate surface. A construction of this kind, which is in most cases sufficient, is simple and cheap and uses less propulsion energy during operation. The surface of the auxiliary roll may alternatively be imperforate but roughened to increase the dynamic pressure by entrained air.

Alternatively, the auxiliary roll may have a surface provided with blind recesses. As a result of this, even if the main roll and auxiliary roll surfaces are closed together, air transport through the narrowest point between the rolls is possible, thus compensating somewhat for the pressure at and after the wire separating point. More air is also entrained by a roll surface construction of this kind than a smooth surface.

Finally, for maximum requirements, the auxiliary roll may have an apertured surface allowing air to flow from the interior of the roll outwardly. With a roll of this kind, a radial air flow forms under the influence of centrifugal force and not only facilitates the lifting of the auxiliary wire off the paper web, but in addition presses the paper web against the main wire after the separating point. This avoids the possible risk of the paper web lifting away from the main wire.

The invention may be carried into practice in various ways but one paper machine embodying the invention and two modifications thereof will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a detail of a double-wire paper machine showing the separating system;

Figure 2 is a graph of the pressures in the region of the wire separating point;

Figure 3 is a detail of the barrel of an auxiliary roll formed with continuous bores; and

Figure 4 is a similar detail of Figure 3 showing the barrel of an auxiliary roll but with blind bores forming pockets to receive air.

Figure 1 shows the separating system of a double-wire paper machine, the system comprising a main roll 1 having a diameter D, an auxiliary roll 2 having a diameter d and a separating wall 3 for closing the wedge space 4 between the surface of the main roll 1 and a main wire 5. The separating wall 3 has side walls 6 intended to restrict the inflow of air from the sides. At its end facing the main wire 5, the separating wall is sharp edged to form a stripper edge 7. A baffle 8 is connected to the wall 3 in order to keep away from the surface of the main roll 1 water stripped off by the stripper edge 7.

An auxiliary wire 10 travels with the main wire 5 as far as the main roll 1 and then passes to the auxiliary roll 2. A web of paper 11 shown by a broken line is held between the wires 5 and 10. The two wires 5, 10 together with the web 11 come from a sheet forming zone which, for example, may be constructed in the manner described in U.S. Patent Specification 2 911 039.

As will be clear from the drawing, the surfaces of the main roll 1 and of the auxiliary roll 2 are at a distance A from one another. Also, the axis 0 of the auxiliary roll 2 as considered in the direction of that portion 10′ of the auxiliary wire 10 which connects it to the main roll 1, is at a distance E from the axis P of the main roll 1.

As it is trained around the auxiliary roll 2, the wire 10 forms an angle of wrap α. In the embodiment illustrated as an example, the diameter d of the auxiliary roll 2 is smaller than the diameter D of the main roll 1. The distance A between the surfaces of the rolls 1 and 2 is less than 0.25 times the diameter d of the auxiliary roll 2, but larger than the thickness T of the wires 5, 10 and of the paper web 11 together. The distance E is between 0.03 and O.5 times the diameter d of the auxiliary roll. The angle of wrap α of the auxiliary wire 10 should be less than 90° and in the embodiment shown in the drawing is approximately 45°.

During operation, the wires 5, 10 together with the web of paper 11 travel at a speed of at least 2000 metres per minute towards the two rolls 1 and 2. The stripper edge 7 strips any water escaping downwardly from the wire 5 and prevents it from penetrating into the wedge space 4. The separating wall 3 prevents a pressure from being built up by the air entrained by the surface of the main roll 1.

The two wires 5, 10 run on to the main roll 1 at a point X. The auxiliary wire 10 leaves the main roll at a point Y. The main wire 5 is lifted from the surface of the main roll 1 at a point Z which is beyond the point Y considered in the direc-

tion of travel of the wires.

In the embodiment illustrated, a dynamic pressure is developed in the wedge space 12 between the surface of the auxiliary roll 2 and the portion 10′ of the wire 10 by the air entrained by the surface of the auxiliary roll 2. The air movement required to form this dynamic pressure is assisted by the fact that the angle of wrap α of the auxiliary wire 10 is relatively small, so that the major proportion of the surface of the auxiliary roll 2 can move freely in the air space.

The register roll effect has an adhesive action during the movement of the main wire 5 between the points X and Z, and this adhesive effect retains the web of paper 11 on the main wire 5 and, with the latter, on the surface of the main roll 1. As the main wire lifts from the main roll together with the paper web, a vacuum forms beneath the wire so that the wire has to be lifted against atmospheric pressure. The air pressure acting in the wedge space 12 acts from above on the auxiliary wire 10 and assists separation of the paper web 11 from the auxiliary wire 10. Consequently, the paper web 11 is separated from the auxiliary wire 10 and advanced with the main wire 5 as required.

Figure 2 is a graph of the dynamic air pressure acting on the paper web 11 from above, and the lifting force applied to the paper web at the lift-off point.

In Figure 2 the dynamic air pressure acts from point X to a point beyond point Z on the upper surface of the web (curve *a*). A lifting force between the web and the auxiliary wire occurs from point Y to a point just beyond point Z as the two are separated as shown by curve *d*. When this lifting force exceeds the dynamic air pressure force an overall lifting force would result on the web but for the increse of the capillary attraction between the main roll and the lower surface of the web, known as the Register Roll effect, acting from point X to point Z, and this action on the web is shown by curve *b*.

The lift off force, shown by curve *c*, results from a vacuum being formed beneath the web from point Z when the main wire leaves the main roll. The resultant of these forces is a force acting downwards on the paper web from point X to a point beyond point Z.

As already stated, the aerodynamic pressure as shown by curve *a* in Figure 2 may be influenced by the nature of the surface of the auxiliary roll 2.

The auxiliary roll of the machine shown in Figure 1 has a smooth imperforate surface.

Figure 3 is a partial section of the barrel 20 of an auxiliary roll 2 which may be substituted in the machine shown in Figure 1 and which is formed with continuous bores 21. These enable air to flow radially from the interior of the roll 2 outwardly under the influence of centrifugal force. In this way, the roll 2 becomes a simple form of blow roll, the roll acting on the paper web 11 with an air pressure from above. Of course this air pressure can be much higher than the dynamic pressure forming in the case of a roll with a smooth surface.

To save propulsive power, in a roll having a barrel 20 as shown in Figure 3, that part of the roll periphery not required for the blowing process can be covered by a cover (not shown).

Figure 4 is a detail of the roll barrel 30 of another auxiliary roll 2 which may be substituted in the machine shown in Figure 1 and which is formed with blind bores 31. These are intended to receive air at super-atmospheric pressure in the dynamic pressure zone 12, and they transport this air through the narrowest point between the rolls 1 and 2. This arrangement is suitable particularly when the space A between the rolls 1 and 2 is at a minimum and is only slightly in excess of the thickness T of the wires 5 and 10 with the web of paper 11. They prevent the formation of a vacuum after the narrowest point between the rolls 1 and 2 such as might in some cases result in the web of paper 11 lifting away from the wire 5.

WHAT WE CLAIM IS: —

1. A paper machine which includes two wires arranged to run together with a web of paper between them to a main roll around which that one of the wires is trained on which the web of paper is intended to remain after separation of the wires, and an auxiliary roll around which the other wire is trained, the auxiliary roll being situated after the main roll as considered in the direction of movement of the wires and being so disposed that the auxiliary wire trained over it separates from the main roll earlier than the main wire, the main roll being a smooth, imperforate roll and the distance between the surface of the auxiliary roll and the surface of the main roll being less than 0.25 times the diameter of the auxiliary roll, the machine including a separating wall between the main roll and the main wire on the entry side of the main roll and extending from adjacent the surface of the main roll to adjacent the main wire.

2. A machine as claimed in Claim 1 in which the distance between the surface of the auxiliary roll and the surface of the main roll is less than 10 mm.

3. A machine as claimed in Claim 1 or Claim 2 in which the edge of the separat-

ing wall adjacent the wire is a sharp edge adapted to strip surplus water from the wire.

4. A machine as claimed in any of the preceding claims in which the auxiliary roll has a smaller diameter than the main roll.

5. A machine as claimed in any of the preceding Claims in which the distance between the axis of the auxiliary roll and the axis of the main roll in the direction of the portion of the said other wire extending between the two rolls is between 0.03 and 0.5 times the diameter of the auxiliary roll.

6. A machine as claimed in any of the preceding Claims in which the said other wire has an angle of wrap about the auxiliary roll which is not greater than 90°.

7. A machine as claimed in any of the preceding Claims in which the auxiliary roll has a smooth, imperforate surface.

8. A machine as claimed in any of Claims 1 to 6 in which the auxiliary roll has a surface provided with blind recesses.

9. A machine as claimed in any of Claims 1 to 6 in which the auxiliary roll has a surface formed with apertures arranged to allow air to flow outwardly from the interior of the roll.

10. A paper making machine which includes two wires arranged to run together with a web of paper between them and rolls around which the wires are respectively trained at their point of separation, the wires and rolls being constructed and arranged substantially as described herein with reference to Figures 1 and 2 or to Figures 1 and 2 as modified with reference to Figure 3 or Figure 4 of the accompanying drawings.

KILBURN & STRODE,
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3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

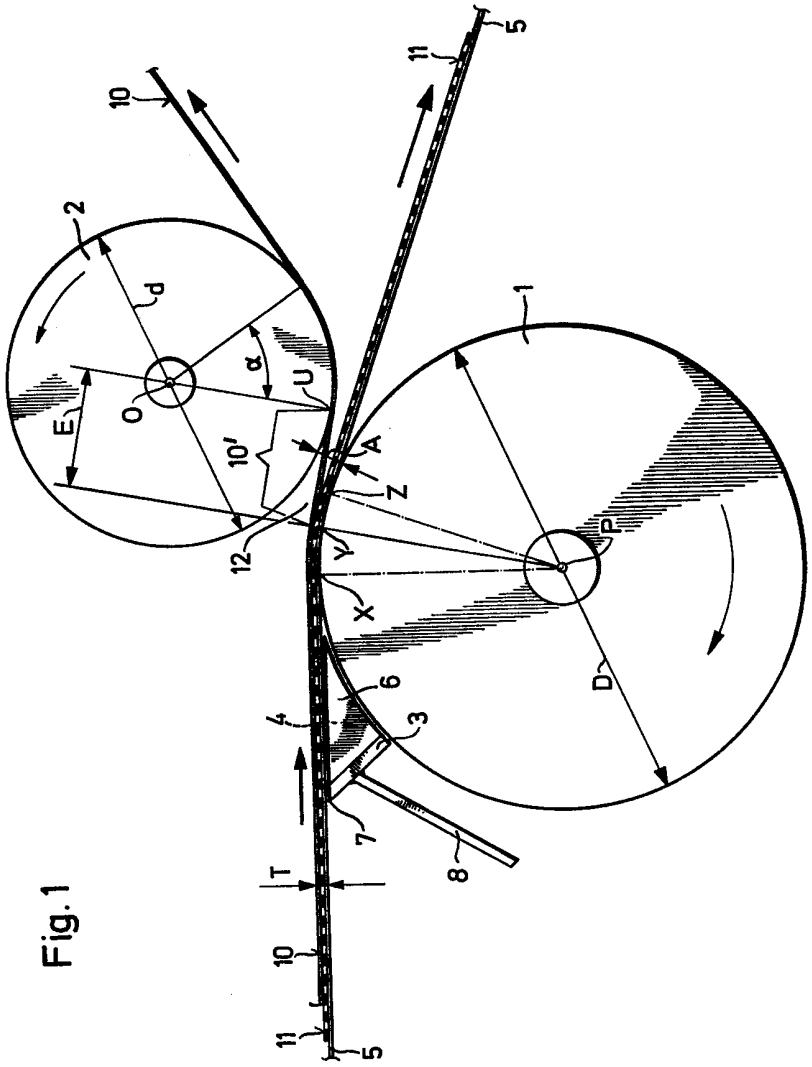


Fig. 1

Fig. 3

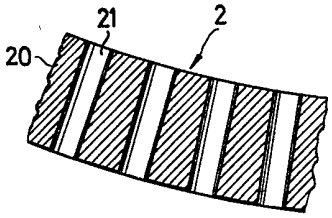
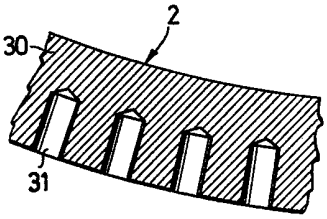


Fig. 4



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Sheet 3

Fig. 2