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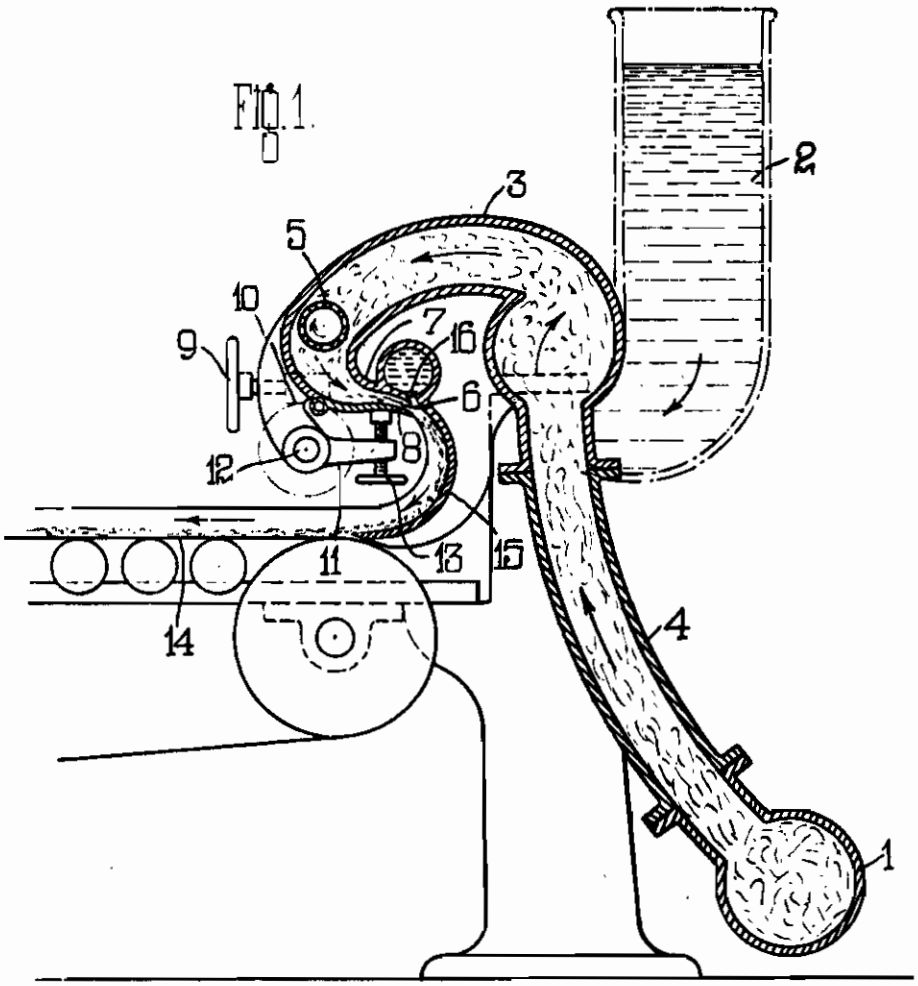
JUNE 1, 1943.
BY A. P. C.

K. A. THORSEN
DEVICE FOR DISTRIBUTION OF STOCK ON THE WIRE PART OF A PAPERMAKING MACHINE
Filed Jan. 8, 1940

Serial No.
312,989

5 Sheets-Sheet 1

FIG. 1.



Inventor
K. A. Thorsen
by
J. J. V. Armstrong
Attorney

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5 Sheets-Sheet 2

FIG. 3.

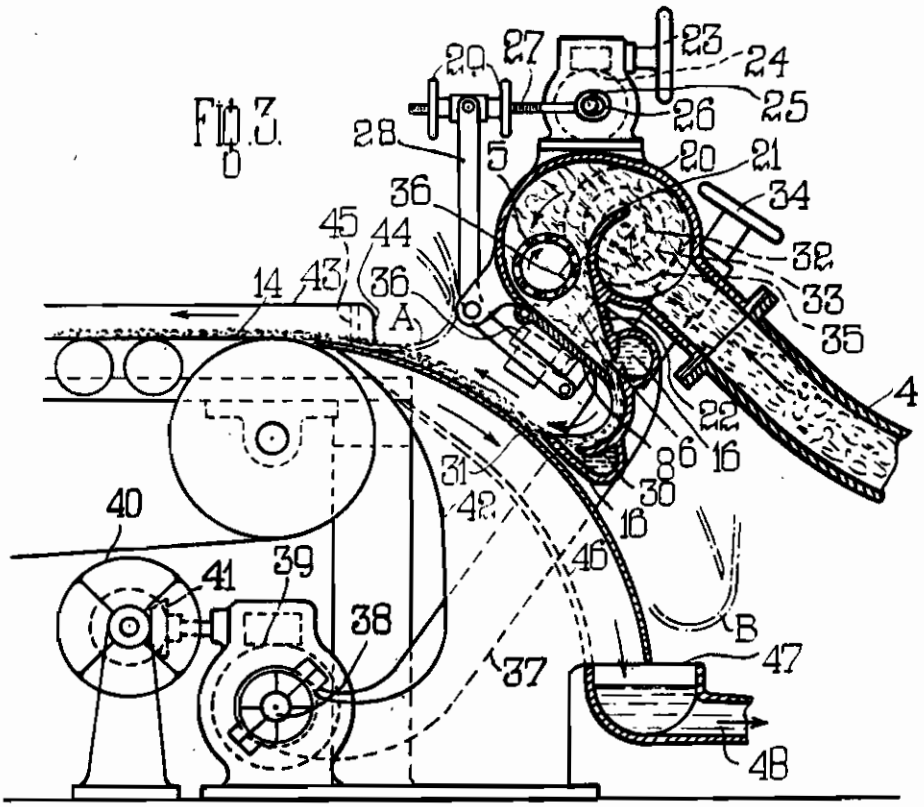


FIG. 2.

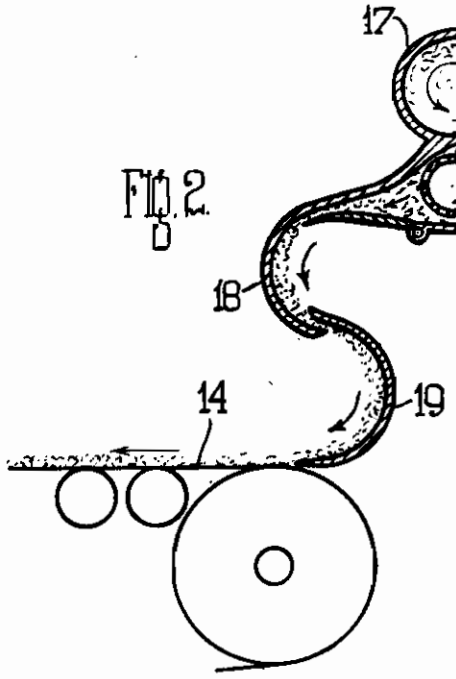
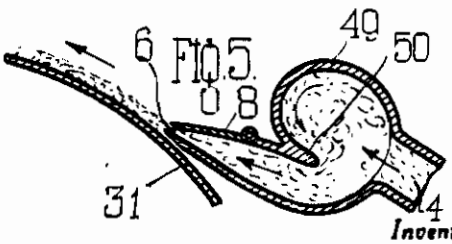


FIG. 5.



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5 Sheets-Sheet 3

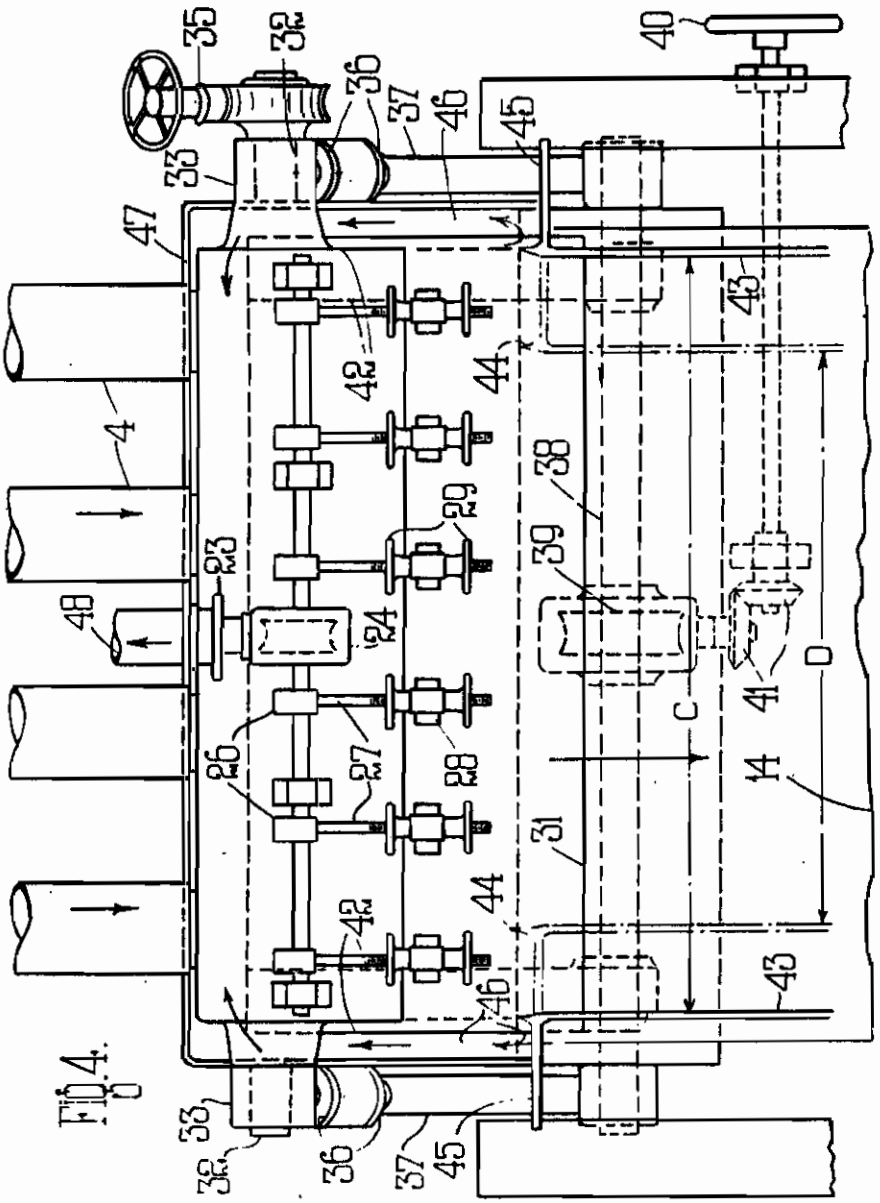

FIG. 4.

Inventor
K. A. Thorsen
by
J. J. V. Armstrong
Attorney

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FIG. 6.

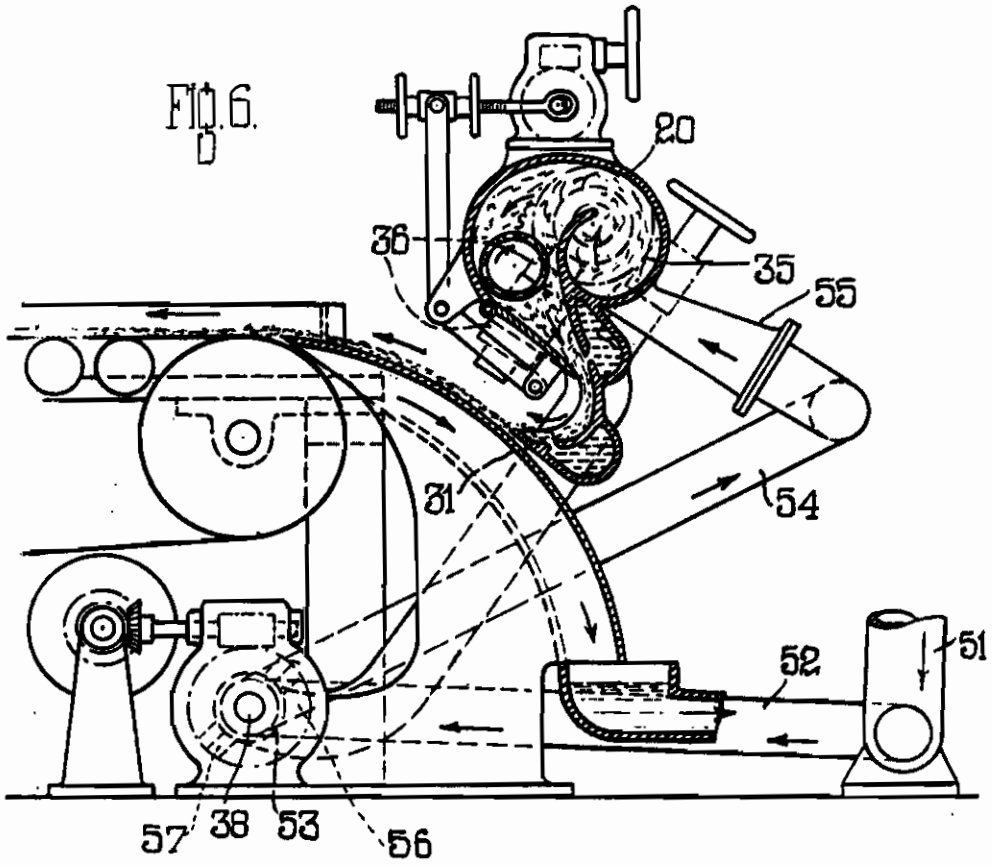

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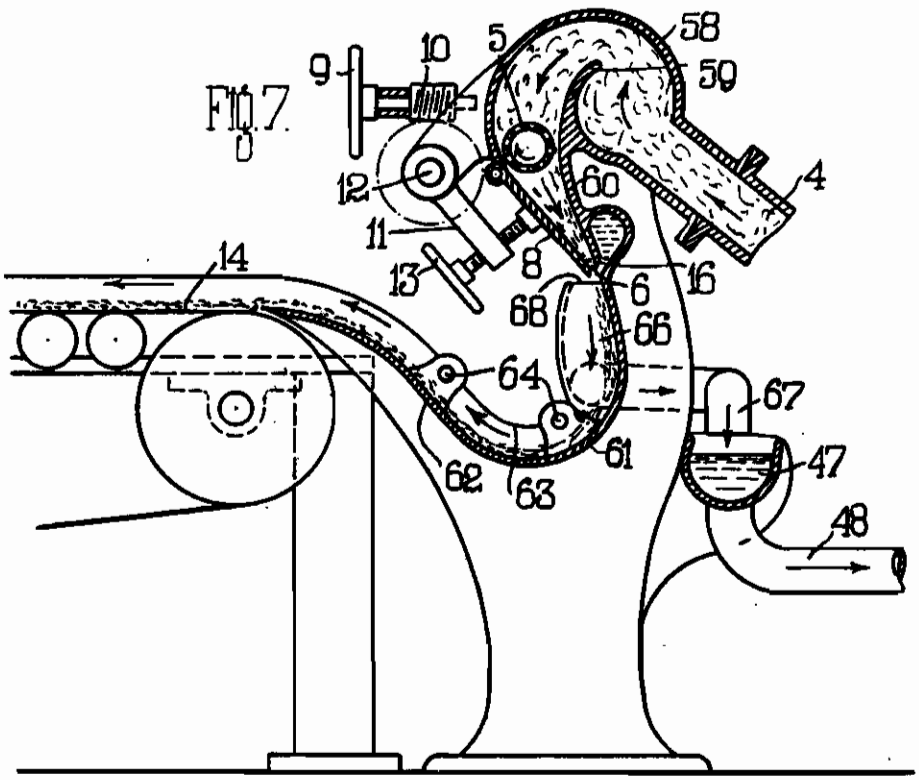
FIG. 7.



Inventor
K. A. Thorsen
by
J. J. V. Armstrong
Attorney

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ALIEN PROPERTY CUSTODIAN

DEVICE FOR THE DISTRIBUTION OF STOCK ON THE WIRE PART OF A PAPERMAKING MACHINE

Kristen Andreas Thorsen, Grenoble (Isere), France; vested in the Alien Property Custodian

Application filed January 8, 1940

The present invention relates to an improved method of and means for the manufacture of paper.

In paper making machines it has been usual to project a layer of stock or paper pulp upon one end of an endless moving band of wire gauze through an opening, sometimes termed a slice, which is adjustable in depth and which is disposed immediately above the travelling endless wire gauze belt; the speed of delivery of the pulp or stock has usually been adjusted to be substantially that of the linear speed of the travelling wire gauze conveyor.

The paper made in this manner has a much lower transverse resistance than its longitudinal resistance. This is due to the fact that under the effect of passing through the distributing slice, the majority of the fibres in the stock are set in the longitudinal direction.

A paper of this kind is suitable for newsprint since it has to withstand comparatively high longitudinal pulls in the rotative printing machine.

For all other applications however, this will be a drawback since such paper has not the nice aspect of a paper, the fibres of which are arranged along all possible directions, it will further not remain flat after slight absorption of humidity, and lastly, for an application necessitating a paper of given resistance, it will be necessary to choose a sheet having the desired resistance in the transverse direction, therefore of a greater thickness as would be necessary if the resistance were the same in all directions.

In the absence of precautionary measures, difficulties moreover would be present in the distribution of the stock to obtain a layer of pulp of uniform thickness from one side of the wire band conveyor to the other, and if the stock is being delivered at high speed there is a tendency for the stream to carry air bubbles with it, retarding the drainage of the paper stock on the wire band and resulting in a badly felted and cloudy sheet.

An endeavour has been made to remedy these drawbacks and to criss-cross the fibres by subjecting the wire to a rapid shaking motion in the transverse direction, the amplitude of the shake being 4 to 12 mm. and the number of shakes 150 to 400 per minute, but this results in a serious complication of the machine, while the desired effect is far from being attained since the transverse resistance of the paper will, even in this case, only amount to 50–60% of the longitudinal resistance.

An object of the present invention is to render a machine capable of manufacture of a greater variety of paper, whilst another object is to provide means whereby the distribution of fibre in the stock or pulp stream reaching the wire band conveyor can be under control; a further object is to provide means whereby air bubbles carried along with the pulp stream can be released.

According to the present invention paper pulp or stock under a dynamic or static head, that is to say fed by a pump or alternatively by gravity from a tank, passes from a slice or outlet onto a travelling woven wire band or conveyor. The direction of flow of the paper stock is altered between the point where it leaves the said slice and the place where it reaches the wire band conveyor.

It will be preferred that the direction of flow be altered smoothly and constantly.

In certain cases it may be desirable to deviate the direction of flow of the paper stock on leaving the slice in one direction, and then to turn it smoothly into the opposite direction prior to its arrival upon the wire band or the like conveyor.

The invention is more particularly described with reference to the accompanying drawings in which:

Figure 1 is a sectional elevation of one end of a paper making machine showing the outlet mouth or slice of the present invention.

Figure 2 shows an alternative form of outlet mouth or slice.

Figure 3 is a side elevation of a further form of construction, in which the position of the outlet mouth is adjustable.

Figure 4 is a corresponding plan view.

Figure 5 is a detail showing another form of construction.

Figures 6 and 7 show in side elevation further alternative forms of construction.

In the arrangement shown in Figures 1 and 2, the pulp coming from the screens is either fed to the collecting pipe 1 by a pump of constant delivery and pressure, or is fed to a reservoir 2 in which the head is adjustable, to give a static head of pulp, so as in each case to obtain an outlet speed of the pulp which approximates to the speed of travel of the wire band conveyor 14.

The pulp will therefore be fed by a dynamic or static head to a distributor 3 either through flexible pipe connections 4, or through a rectangular opening at the bottom of the reservoir 2. The pipes 4 may be replaced by a single rectangular conduit.

A perforated cylinder 5 of known type is placed close to the outlet opening of the distributor in order to even out the distribution and to prevent the possible accumulation of fibres in bundles.

The outlet spout or slice of the distributor 3 is formed by the fixed wall 7 and an adjustable lip 8. The adjustment of the lip 8 is controlled by a hand-wheel 9, operating worm gears 10, which adjust the angular position of the supporting arms 11 of the transverse shaft 12, these arms being positively connected to the lip 8 by a number of hand screws 13 by which the depth of opening at different points across the outlet can be adjusted to maintain the flow even across this width.

With the above mechanism, it is therefore possible to adjust the depth of the outlet spout the full width of the wire, which might be necessary due to an uneven arrival of the pulp stream on the wire band, and in order to obtain a regular depth of the pulp on the full width of the wire 14.

At the outlet spout 6, the pulp enters the downward directed and rapidly curved flow plate 15. In order to reduce friction between the fibres and the flow plate 15, a film of water is introduced through the narrow opening 16, between this flow plate and the layer of pulp, this opening extending over the whole length of the distributor 3.

As the pulp approaches the outlet spout 6, its speed increases considerably and due to this the fibres will progressively be aligned in the direction of the pulp stream. The speed is still further increased by the gravity fall over the flow plate, so that the fibres, when the pulp reaches the wire 14, are mostly all arranged in the direction of travel of the wire. As a consequence of the speed and the rapid curve of the flow plate 15, the pulp will be subjected to centrifugal force.

As the pulp is very turbulent when leaving the outlet spout 6, it has a tendency to take up air, which is undesirable for the formation of the sheet, but by reason of the centrifugal action imposed on the pulp in passing over the flow plate 15, the air bubbles will burst and leave the pulp.

When arriving on the wire, the majority of the fibres will take up a longitudinal direction as a consequence of the increase in speed of the pulp in passing through the distributor 3 and in running down the flow plate 16 and the paper obtained will therefore show a much higher strength in the running direction than in the transverse direction of the wire 14; the paper obtained will be consequently particularly suitable for newsprint, as this paper has to withstand comparatively high longitudinal draws in passing through the rotary printing machines.

In order to increase the gravity fall effect, the slope 15 may be extended as shown on Figure 2, where the pulp leaving the distributor 17 is obliged to follow the flow plate 16, and then follow a second flow plate 19 before arriving on the wire 14.

The distributor 3 may be provided with means to adjust it angularly relatively to the centre of the roll supporting the wire, so that the amount of gravity fall of the pulp can be adjusted.

In Figures 3 and 4 the pulp is fed through the flexible pipe connections 4 and enters the distributor 20 where it is baffled by the partition 21, which causes the pulp to spread out transversely. The usual perforated cylinder 5 is provided to even out the distribution and to prevent bunching of the fibres.

The outlet spout 6 of the distributor 20 is formed by the fixed wall 22 and the adjustable lip 6. The adjustment of the lip 6 is controlled by a hand wheel 23, moving worm gears 24, which adjust the angular position of the transverse shaft 25. On this shaft is fixed a series of eccentrics 26 which, by the rotation of the shaft 25, will move forwards or backwards the connecting rods 27, which, with the help of the levers 28, will control the lip 8 and adjust the outlet spout 6. The hand wheels 29, of which a number are provided across the width of the outlet spout, serve to adjust the depth of this spout at various points across its width.

Leaving the outlet spout 6, the layer of pulp enters the curved flow plate 30, where it will even out in thickness on the whole transverse width under the influence of centrifugal force, which force will also tend to provoke the bursting of air bubbles which may become mixed with the pulp by the turbulent outflow from the outlet spout 6.

A film of water is introduced between the layer of pulp and the flow plates through the narrow opening 16, thus avoiding friction between the fibres and the flow plates.

Leaving the downward directed and curved flow plate 30, the pulp comes upon another flow plate 31, which is directed upwardly towards the wire 14. On this latter flow plate, the pulp stream will be slowed down, which effect results in a thorough mixing of the pulp and causes the fibres to be arranged in all directions.

The distributor 20 is provided with journals 32, resting in the supports 33. A hand wheel 34 controlling worm gears 35 enables the distributor to rotate around the axis of the journals 32 to a desired position, so that length of flow of pulp over the flow plate 31 can be adjusted as desired and thereby the degree of distribution of the fibres laterally of the direction of flow.

The distributor 20 may also be brought nearer to or farther away from the flow plate 31 by means of the adjusting nuts 36.

The lever arms 37 fixed on the shaft 38, which may be rotated by worm gears 38 by means of the handwheel 40 and the intermediate gears 41, will enable the distributor 20 to be placed in any position between the extreme positions A and B.

When the distributor 20 is placed in the position A, a paper with a maximum strength in the direction of travel of the wire will be obtained, and when it is placed in the position B, the paper obtained will have its maximum strength in a direction transverse to the direction of travel of the wire.

The flow plate 31 is fixed to two or several frames 42.

In order to simplify its construction, the form of the flow plate is shown cylindrical, but it may have other shapes, in which case the distributor 20 is displaceable in guides of the same contour as the flow plate.

By a suitable adjustment of the distributor 20, it is even possible for the pulp jet to arrive on the wire without passing over any part of the flow plate 31.

For slow speed machines the flow plate 30 may be eliminated and the distributor may be constructed as at 49, Figure 3. In this distributor, the partition 50 will compel the pulp to spread out in the transverse direction. A perforated cylinder 5 may or may not be used in the distributor 49.

With present types of paper making machine when it is desired to adjust the width of the sheet, it is either necessary to stop the machine, resulting in a loss of output, or to trim-off a strip on either side of the sheet at the couch roll in order to obtain the desired width of finished paper web. At the couch roll, however, the pulp is dewatered and consequently the trimmed-off

strip requires treatment by independent equipment to render it a density suitable for it to again mix with the pulp stream.

The arrangement of Figures 3 and 5 show a means by which the sheet width can be adjusted whilst the wire is running and the eliminated pulp strips, whilst still in a liquid state, can be returned directly to the pulp coming along through the flexible pipe connections **4**. To arrive at this result, two side frames **43** are provided to limit the width of the sheet, one on each side of the wire. Those side frames may be adjusted in the transverse direction by any desired means. The maximum width of the sheet is indicated by C and the minimum width by D.

The edges **44** of the side frames **43** will divide the layer of pulp into three parts, the central part of which follows the wire. The two side portions will contact with the plates **45**, which compel the pulp to follow the channels **46** to arrive finally into the gutter **47**. From this, the pulp will travel through the pipe **48** to arrive in a reservoir, where it is mixed with the pulp fed to the distributor **20**.

Figure 6 shows the same arrangement as Figures 3 and 5, with the difference that the flexible pipe connections **4** are replaced by fixed pipe connections.

The pulp is fed by a constant dellvery and pressure pump or from a reservoir with a constant head, through the pipe **51**, from which it is distributed to the pipes **52**, which terminate in the swivel joints **53**. The pulp then enters into two other pipes **54**, through which it arrives at the distributor **20**, passing through the two tapered mouthpieces **55**. The lower extremities **56** of the pipes **54** are fixed to the extremities of the shaft **38**, by couplings **57**, the shaft **38** adjusting the position of the distributor **20** along the flow plate **31**, being jointed to the pipes **54** which feed the pulp to the distributor, and connected to the pipes **52**, in fixed position, by the swivel joints **53**.

The pipes **54**, being slightly flexible metal, will permit of a small degree of adjustment of the distributor **20**, by means of the nuts **36** and the worm gears **35**.

Figure 7 shows an arrangement of pulp distribution with downward and upward directed flow plates in a fixed position.

The pulp is fed to the distributor **58** through the flexible pipe connections **4** or through a single inlet extending over the whole width of the distributor. In passing into the distributor, the pulp will be baffled against the partition **59**, which will force it to spread out transversely in the distributor **58**. A perforated cylinder **5** evens out the distribution and prevents the bunching of the fibres.

The outlet spout or slice **6** is formed by the fixed wall **60** and an adjustable lip **8**.

The adjustment of the lip **8** is controlled by the handwheel **9** through worm gear **10**, which adjusts the angular position of the supporting arms **11** of the transverse shaft **12**, these arms being firmly connected to the lip **8** by a number of individually adjustable hand screws, by which the depth of opening of the outlet spout **6** at any point from one edge to the other across the width of the spout can be adjusted.

Leaving the outlet spout **6** the pulp is downwardly directed on to the rapidly curved flow plate **61**.

In order to avoid friction between the fibres and the flow plate, a film of water is introduced between this flow plate and the layer of pulp through the narrow opening **16**, which extends over the whole width of the distributor **58**.

As a consequence of the increased speed of flow due to gravity and to the rapid curving of the flow plate **61**, the pulp will be subjected to strong centrifugal action and will even out, so that the thickness of the layer of pulp will be the same on the whole width of the flow plate permitting a sheet of regular thickness to be obtained on the wire, and air bubbles will burst and leave the pulp.

After having gone over the downward directed flow plate **61**, the pulp flows on to the upwardly directed flow plate **62**. On this flow plate, the pulp stream will slow down, which results in a thorough mixing of the pulp, the fibres being arranged in all directions. As a result, a paper will be obtained of a transverse strength about equal to its strength in the direction of flow of the pulp stream.

The width of the sheet on the wire may be adjusted whilst the machine is running, with the help of the side frames **63**, which may be moved in the transverse direction by the screwed rods **64**. Each one of the side frames **63** is provided on the outside and immediately against the outlet spout **6** with a gutter **66**, provided with an outlet pipe **67**, which communicates with a recipient **47**, from which the pulp flows by the pipe **48**.

KRISTEN ANDREAS THORSEN.