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(54) METHOD AND APPARATUS FOR IMPROVED TWIN WIRE FORMING

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(56) References cited:
EP-A- 0 488 058
FR-A- 2 014 192
GB-A- 2 009 808
US-A- 3 224 928
US-A- 3 951 736

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention.

The present invention relates generally to paper machines and, more particularly, to twin wire forming for the production of a web.

2. Brief Description of the Prior Art.

A variety of what may be characterized as twin wire formers are known in the prior art. One such twin wire former is disclosed in U.S. Patent No. 4,209,360 to Stenberg, et al. Stenberg teaches an apparatus having a head box arranged to inject a jet of stock into a forming throat between inner and outer forming wires. The forming throat may be roughly as the area or gap between a forming roll and a breast roll and extending to include the area between such inner and outer wires supported thereon. This arrangement of a head box which injects stock into the gap between a forming roll and a breast roll is typical of many twin wire formers. Also typical of such twin wire formers is the fact that the breast roll is a solid or smooth roll whereas the forming roll may be an open roll allowing for drainage or a solid roll.

In the operation of such a twin wire former, care must be taken to avoid impinging a jet of stock on the surface of the breast roll. If the jet of stock touches the surface of the breast roll (impinges upon), the jet will be diverted around the breast roll giving rise to jet pumping. Impingement of the jet on a solid breast roll generally results in sheet disturbance and poor formation. This constraint of not impinging on a solid breast roll becomes a limiting factor on the minimum gap setting between the breast roll and the forming roll. The minimum operating gap is constrained by a situation known as jet "pumping" or vacuum pulse. Generally, if the gap is larger, then drainage is delayed to a later location on the outer fabric which adversely effects homogeneous sheet formation, uniformity and stability of basis weight and other web properties. Even more importantly, this delayed drainage can severely affect layer uniformity and purity of a stratified sheet. Further, impingement of the jet directly on the free span of the outer wire commonly results in distortion and corrugation of the outer wire which can significantly contribute to sheet non-uniformities.

FR-A-2041192 discloses a device for forming a fibrous web which includes a pair of porous forming webs which move longitudinally at the velocity of the pulp jet and pass over guides. One of the forming webs is supported on a rotating member.

EP-A-0488058 (prior art under Article 54(3) EPC) discloses a twin-wire former of a paper machine the twin-wire former comprises forming wires operating one against the other, which forming wires define a wedge-shaped narrowing forming gap between them. The forming-gap arrangement comprises two opposite support members, whose inner sides have been arranged as direct extensions of the inner sides of the lip walls of the headbox that define the discharge duct. The support members have been arranged to extend into the forming gap as parallel to one another so that the free ends of the support members are placed at direct proximity of, or in contact with, the forming wires.

US-A-3244928 discloses a papermaking machine including a first endless paper web forming fabric having interstices therethrough for draining paper stock deposited thereon, means for moving and supporting said fabric and including a member having a curved surface about which the fabric extends, a second endless fabric, said second fabric comprising a multitude of randomly oriented interlocked matted fibres so that said second fabric has no discernible interstices therethrough and is substantially compressible to absorb and release substantial amounts of water, means for moving and supporting said second fabric and including an element about which said second fabric moves having a curved surface approaching and in proximity to said first named curved surface, means for depositing paper stock on said first fabric and including a paper stock inlet arranged to direct the stock between said curved surfaces of said element and member and thereby between said two fabrics whereby the stock drains through said first fabric to form a web thereon which subsequently follows said second fabric.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an improved twin wire former which yields a web having improved uniformity.

It is a further object of the present invention to provide an open, substantially rigid support structure to allow for drainage through the outer wire of the twin wire former in the area of the forming throat.

Yet another object of the present invention is to provide an apparatus which allows for the narrowing of the gap between the breast roll and the forming roll in a twin wire former while still avoiding the occurrence of jet pumping.

According to the present invention there is provided a method of producing a web from a jet of stock injected into a forming throat between inner and outer tensioned forming wires run around a peripheral segment of a forming cylinder,

comprising:

(a) impinging the jet of stock substantially simultaneously on both the inner and outer forming wires in the forming throat;

(b) creating an initial drainage area by providing an open support structure for the outer forming wire over at least a portion of said forming throat, this open support structure comprising an open breast roll having a plurality of circumferential grooves thereabout, and initial impingement upon the outer forming wire occurring where the outer forming wire abuts and is supported by the open breast roll thereby allowing some immediate and rapid drainage through said supported outer wire.

Also according to the present invention there is provided an apparatus for forming a web, said apparatus comprising a rotatable forming cylinder, inner and outer endless forming wires, means for supporting said inner and outer endless forming wires so that they converge to form a forming throat and thereafter run together over a segment of the surface of the forming cylinder and headbox means for injecting a jet of stock into the forming throat between said wires, an open support structure being provided for the outer forming wire over at least a portion of said forming throat, said open support structure being in the form of an open breast roll having a plurality of circumferential grooves thereabout;

(b) a gap between said open breast roll and the forming cylinder, said gap being no greater than the thickness of said jet of stock such that said jet of stock impinges substantially simultaneously on said forming cylinder and said open breast roll, thereby creating an initial drainage area wherein drainage pressure is not dependent upon the tension of the outer forming wire and the radius of the path of the outer forming wire.

By use of this invention a grooved breast roll, which forms the open support structure, and the forming roll can be narrowed such that the jet of stock delivered from the head box is impinged upon both the forming roll and the open support structure. This arrangement allows for immediate drainage of the web through the outer wire of the twin wire former while avoiding the undesirable jet pumping. This results in an extended forming throat despite the fact that the gap between the forming roll and the breast roll is narrowed. Thus, an extended drainage area through the outer wire is achieved over that of the typical prior art twin wire former. In this extended area of drainage, the jet of stock is contained between the supported inner and outer wires. Further, because the outer wire is rigidly supported, the position radius and tension of the outer wire are held substantially constant and uniform. This situation results in the reduction of variation in the drainage process yielding greater sheet uniformity.

The invention will now be further described by way of example with reference to the accompanying drawings, in which:-

Figure 1 is a basic schematic of a typical prior art forming roll-breast roll arrangement for a twin wire former.

Figure 2 is a basic schematic of the forming roll/open breast roll arrangement of the present invention.

Figure 3 is a partial section of one open breast roll showing the contoured surface thereof.

Figure 4 is a partial section of another open breast roll showing an alternate pattern for the contouring of the surface thereof.

Figure 5 is a side view schematic showing the cross-sectional area of the forming throat of a typical, prior art, twin wire former.

Figure 6 is a side-view schematic showing the cross-sectional area of the forming throat achieved with the first above-stated embodiment of the present invention.

Turning first to Figure 1, there is shown a basic schematic of the relative location of the forming cylinder 10 and a solid breast roll 12 of a typical prior art twin wire former. The twin wire former includes head box 14, inner wire 16 and outer wire 18. Head box 14 delivers a jet of stock 20 having a set thickness T into the forming throat 22 between inner wire 16 and outer wire 18. Forming cylinder 10 may be a suction-type open roll or solid. The gap between forming cylinder 10 and solid breast roll 12 must be wide enough to assure that no part of the jet of stock 20 will impinge upon solid breast roll 12. Thus, where the jet of stock 20 strikes the outer wire 18, outer wire 18 is unsupported and jet of stock 20 strikes at a rather shallow angle.

The operation of the twin wire former depicted in Figure 1 is similar to the operation of the twin wire formers described in U.S. Patent Nos. 4,209,360; 4,100,018; 3,876,498; and 3,056,719 which are hereby incorporated by reference herein. Looking next at Figure 2 there is shown a basic schematic of the forming cylinder/breast roll arrangement of the present invention for use with an otherwise typical twin wire former. As with the prior art arrangement, the forming cylinder 30 may be a suction-type roll or a solid roll. The breast roll 32 is open or grilled such that there are a plurality of annular grooves 34 thereabout. The open breast roll 32 may or may not have a cover sleeve mesh depending upon the design of the outer wire and the particular product application. There is an inner wire 36 travelling about forming roll 30 and an outer wire 38 which travels first around open breast roll 32 and then about forming cylinder 30. Head box 40 delivers a jet of stock 42 having a thickness T into the forming throat 44 between the inner wire 36 and the outer wire 38.

It should be noticed that, even though Figure 1 and 2 are not to scale, the gap between the forming cylinder 30

and the open breast roll 32 is narrower than the gap shown in Figure 1. This is evidenced by the fact that the jet of stock 42 is depicted as impinging on both the forming roll 30 and the open breast roll 32. In such manner, the free span of the outer fabric 38 from the point where it leaves the grilled or open breast roll 32 to the point where it contacts or closely approaches the inner wire 36 on forming cylinder 30 is reduced relative to the free span depicted in Figure 1. Initial and early dewatering through the outer wire 38 is thus accomplished with greater support in the area of the forming throat 44 and with substantially rigid support at beginning area of the forming throat 44. The forming throat 44, from a two-dimensional perspective, is the area defined by the combination of arcs and segments interconnecting point A where the jet of stock 20, 42 impinges upon the inner forming wire 16, 36, the point B where the jet of stock 20 impinges upon the outer forming wire 18, 38, and the point C where the inner and outer forming wires converge. (See Figures 7 and 8). Thus, the shaded area in Figure 7 illustrates representative forming throat 22 of a typical prior art twin wire former while the shaded area in Figure 8 shows the forming throat 44 of the embodiment of the present invention depicted in Figure 2.

It has been shown that the amount of impingement of the jet of stock 42 upon open breast roll 32 can be significantly varied while still attaining improved uniformity. However, test results indicate that impingement upon breast roll 32 should preferably be approximately one-third (1/3) of the thickness T of the jet of stock 42.

It is well known to those skilled in the art of twin wire formers that uniformity in the sheet drainage and dewatering processes is of critical importance to the formation of the sheet. It is particularly important to have uniformity in the early, initial drainage because any early non-uniformities influence not only the initial drainage but will continue to be detrimental to later drainage. In the free span area of outer wire 18 in forming throat 44, the forces acting to cause drainage of the jet of stock 42 often can be simply and quantitatively described by the following relationship:

Drainage pressure equals the tension in the outer wire divided by the radius of the outer wire.

In the cross direction of the machine, the uniformity and time stability of the forces acting to drain the jet depend, to a large degree, on the uniformity on the outer wire tension and the outer wire radius at a given position across the machine width. In order to prevent unstable cross flows during the drainage process it is important to minimize variation of operation parameters, particularly, the outer wire tension and radius. It should also be recognized that uniformity of wire tension and radius may be equally important to both the inner and outer wires since, in some twin wire formers, both wires may be unsupported in the initial drainage stages nearest the head box, as is the case with alternative embodiment twin wire former depicted in Figure 6.

The present invention as depicted in Figure 2 hereof describes a method and apparatus to stabilize and reduce the cross direction variation and time variation in the drainage process thereby yielding significant improvements in the uniformity of the sheet. As depicted, the jet of stock 42 is directed so that it contacts or impinges on the outer fabric 38 when the outer fabric 38 is backed by an open, supporting surface 32. In this way, the free span of the outer fabric 44 does not bear the entire force of the jet of stock 42. It becomes imperative to allow for drainage through the outer wire 38 in those locations where the jet of stock 42 strikes the outer wire 38 supported on the stiff surface. This is accomplished by providing an open, stiff surface such as a breast roll 32 having annular grooves 34 thereabout. Grooves 34 may be V-shaped, squared, spiraled, etc. The operation of open breast roll 32 may benefit from a cover mesh (not shown) similar to the typical cover mesh sleeves used on open drainage rolls.

It should be recognized that a number of possible contour designs can be used for the outside surface of breast roll 32 to allow for drainage. Two of such designs are depicted in figures 3 and 4. It has been found that the depth of annular grooves 34 should preferably be in the range of 0.5" to 1.5", although the invention can be practiced with groove depths above and below such range depending upon the type of pulp, the amount of water being drained, the type of product being produced, machine speed, wire design, etc.

The width of peaks or tips 35 should generally be as small as possible to avoid sheet disturbances. In other words, the peak 35 structure which supports outer wire 18 should be as fine as is practical yielding a high percentage of open area at the outside surface of the breast roll thereby minimizing drainage marking and resistance. Thus, the width of tips 35 could be as small as 0.25mm. Typically, the width of tips 35 would be in the range of 0.75mm to 1.25mm but could range as high as 2.0mm.

The void volume of annular grooves 34 should be great enough to drain a substantial portion of the total jet thickness while leaving an unfilled air space at the bottom of each groove so as to prevent jet pumping. It is believed that further benefit might be achieved if the void volume is large enough to drain the entire jet of stock. It is also believed that if a cover mesh sleeve is used, it will be particularly beneficial to select a mesh with adequate cross-direction stiffness to span from peak 35 to peak 35 without deflecting under the force exerted by jet of stock 42.

It should be understood that the contour of the support structure 32 can be opened by means of a grill work, honeycomb, fabric mesh, drilled holes or the like. For purposes of this application, the term "open" shall be defined, when used in conjunction with "breast roll" or "support structure", as a contoured, channel forming surface or other similar or equivalent surface draining structure as mentioned above. "Solid breast roll" is intended to refer to a substantially cylindrical roll having no surface contour, channelling, grill work or openings.

A preferred method of construction of open breast roll 32 is to machine annular grooves 34 into a rubber covered

roll. It is believed that synthetic rubbers having a P & J hardness in the range of from about 5 to about 15 would be preferable. A P & J hardness of about 10 is believed to be the most preferable. Alternatively, grooves 34 may be machined into a thick walled, metal shell or the void structure may be created by other means well known by those skilled in the art.

An important difference between twin wire former operation using the outer wire open support structure 32 or 50 of the present invention as opposed to the standard solid or flat design breast roll is in the minimum gap setting between the forming roll 30 and the open support structure 32. This gap setting is a determining factor of forming throat geometry including the length of the free span of outerwire 38, the angle of impingement of the jet of stock 42 on inner and outer wire 36, 38 and the amount of impingement upon open support structure 32, and thus significantly affects the rate of drainage of the jet. Generally, if the gap is too large, drainage is delayed which adversely affects the formation of the homogeneous sheet and particularly the stratified sheet in terms of layer coverage and purity. As stated above, the minimum operating gap is constrained by the situation known as jet "pumping" or a vacuum pulse if the jet of stock touches the surface of a solid or flat breast roll. In such situation, the jet of stock 20 is diverted around the solid or flat breast roll. At the point where the jet of stock 20 reaches the free span of the outer wire, it is pushing that free span away from the forming roll 10 and toward the breast roll 12. This action leads to variations in tension of the outer wire 18 as well as variations in the radius of the outer wire 18.

As a general rule, the gap between the forming roll 10 and a solid or flat design breast roll 12 in a typical prior art twin wire former (See Figure 1) is limited to the relative thickness of the jet of stock 20 plus some margin to allow for an air gap clearance between the jet of stock 20 and breast roll 12. The gap may be even wider to accomodate possible jet expansion. The gap can be narrowed when forming roll 10 is an open roll such that some of the jet of stock 20 is drained through inner wire 16. The presence of the grooves 34 (See Figure 2) allows the minimum dimension of the gap to be reduced without incidents of jet pumping. In fact, tests show that uniformity of the sheet is greatly improved using a grooved breast roll 32 (Figure 2) when the gap dimension is significantly less than the thickness of the jet of stock 42. The impact of the bottom portion of the jet 42 on outer wire 33 is absorbed by the open or grilled breast roll surface and the reduced free span in the outer wire 18 makes the outer wire 38 more resistant to corrugations from jet impact. As mentioned above, drainage pressure can be expressed as the ratio of the tension of the outer wire divided by the radius of the outer wire. Increases in the uniformity of this ratio across the width of the machine promote a reduced basis weight profile for the web formed. Since fabric corrugation represents areas of non-uniform ratio, it is believed that reduction in corrugations is consistent with improved basis weight profile.

Additional enhancements in the operation of the present invention may be accomplished through a closer coupling of head box 40 such that the head box exit resides in closer proximity to forming throat 44. Such a modification results in drainage beginning earlier relative to the point when the jet of stock 42 exits head box 40.

A summary of the important basis weight profile testing results is contained in Table 1. It should be noted that in addition to the breast roll design condition mentioned in the configuration section of the Table 1, wet end settings which might affect the basis weight profile were held constant. These conditions included forming box vacuum level and location and jet impingement on the forming roll. Also, dry end settings, such as adhesive add-on, yankee pressure and line crepe were held constant. The tests were conducted with two layer forming fabrics (Asten 856A design manufactured by Asten Forming Fabrics Company) and 8" stratifying foils. The test were conducted on a high speed, pilot plant paper machine.

TABLE 1

TEST CDσ RUN (GSM)	BREAST ROLL CONFIGURATION	GAP	AVERAGE RANGE (GSM)	AVERAGE B.W. (GSM)	B.W. B.W. Pk-Pk
A SOLID	49mm	2.46	27.7	±4.4%	0.70
B GROOVED	32mm	1.35	27.4	±2.5%	0.43
C GROOVED	32mm	0.84	28.5	±1.5%	0.14
D GROOVED	45mm	1.62	29.0	±2.8%	0.52
E GROOVED	45mm	1.97	29.3	±3.4%	0.47
F SOLID	46mm	2.04	29.8	±3.4%	0.66
G GROOVED	32mm	0.62	28.8	±1.1%	0.14

The Average Range data presented in Table 1 represents the web high basis weight minus the web low basis weight for a particular run expressed in grams per square meter. Average B.W. shown in Table 1 is the average basis weight determined for each test run expressed in grams per square meter. B.W. Pk-Pk is the peak-to-peak variation of basis weight for each run expressed as a percentage. Thus, looking at test run A, the average range of 2.46 grams per square meter is approximately 8.8 percent of the average basis weight (27.7 GSM). Therefore, the basis weight

peak-to-peak variation is plus or minus 4.4%. The extreme right column of Table 1 (B.W. CDσ sigma) represents the standard deviation of basis weight in the cross direction of the machine.

The testing which resulted in the data presented in Table 1 was performed in accordance with a procedure similar to TAPPI procedure T 545 pm-86 entitled "Cross-machine grammage profile measurement (gramametric method)".

Test run A serves as a control run for the grooved breast roll evaluation. The standard solid breast roll was used with a gap of 49 millimeters between the solid breast roll and the forming roll. This was the nominal minimum gap without giving rise to occurrences of jet pumping. The average range for 12 scans of data collected in accordance with the above identified TAPPI procedure was 2.46 grams per square meter yielding a basis weight peak-to-peak variation of plus or minus 4.4%. Test run B utilized a grooved breast roll with a narrowed gap of 32 millimeters between the grooved breast roll and the forming roll. This configuration resulted in a basis weight average range variation of 1.35 GSM yielding a basis weight peak to peak variation of plus or minus 2.5%. The data clearly demonstrates that the grooved breast roll in combination with a reduced gap between the grooved breast roll and the forming roll results in improved basis weight profile including improved outer wire strata layer coverage and purity. Sheet uniformity has been significantly improved and the properties of the inner and outer strata layers become more balanced.

It has been found that the basis weight of paper made with a grooved breast roll design and a narrowed gap is more uniform, especially in the cross direction. The coefficient of variation (C.O.V.) of paper made with the grooved breast roll is significantly reduced compared to paper made with the typical solid breast roll. In one comparison, the C.O.V. for the grooved breast roll was 1.57% as opposed to a solid roll design which yielded a C.O.V. of 2.52%. These coefficients are based on a positional standard deviation of 0.43 GSM and an average basis weight of 27.35 GSM for the grooved breast roll (test run B). Corresponding data for the solid breast roll comparison test run (test run A) are 0.70 GSM and 27.74 GSM. In a subsequent comparison, the use of the grooved breast roll yielded a basis weight C. O.V. of 0.49% (based on a positional standard deviation of 0.14 GSM and an average basis weight of 28.47 GSM (test run G). The solid breast roll test (test run F) yielded a C.O.V. of 2.2% based on a positional standard deviation of 0.66 GSM and an average basis weight of 29.81 GSM.

The decrease in basis weight variation profile is also reflected in post dryer moisture scans recorded on the high speed pilot plant paper machine. The moisture scans corresponding to test runs D, F and G show that the decreased weight profile from run G also resulted in decreased post dryer moisture variation for run G when compared to runs D and F. It has been estimated, through extrapolation of mill data, that for a 29 GSM sheet made at 70% post through dryer dryness, a 1.0% reduction in weight profile will cause a reduction in the peak-to-peak dryness variation of 0.6%.

The grooved breast roll design of the present invention allows the gap between the breast roll and the forming roll to be reduced below that which is possible with a solid breast roll without fear of causing jet pumping. It is believed that the increased level of fabric support and the quicker overall drainage obtained with the grooved breast roll gives rise to the demonstrated improvement in weight profile and in strata coverage efficiency of the outer wire strata.

The data set forth in Table 1 demonstrates that as the gap was decreased from 49mm to 32mm, sheet uniformity was improved. It is believed that the gap can be narrowed to well less than 32mm so long as the void volume of breast roll 32 is great enough such that it can accommodate the water drained through outer wire 38 without becoming filled thereby eliminating any air gap between the water drained through the outer wire 38 and the bottom of the breast roll void volume.

From the foregoing, it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth together with other advantages which are apparent and which are inherent to the apparatus and method. It will be understood that certain features and subcombinations are of utility and may be employed with reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Claims

1. A method of producing a web from a jet of stock (42) injected into a forming throat (44) between inner and outer tensioned forming wires (36,38) run around a peripheral segment of a forming cylinder (30), comprising:

   (a) impinging the jet of stock (42) substantially simultaneously on both the inner and outer forming wires (36,38) in the forming throat (44);

   (b) creating an initial drainage area by providing an open support structure for the outer forming wire (38) over at least a portion of said forming throat (44), this open support structure comprising an open breast roll (32) having a plurality of circumferential grooves (34) thereabout, and initial impingement upon the outer forming wire (38) occurring where the outer forming wire (38) abuts and is supported by the open breast roll (32)

thereby allowing some immediate and rapid drainage through said supported outer wire (38).

2. A method as claimed in claim 1, further comprising:
positioning said open breast roll (32) such that there is a gap between said open breast roll (32) and the forming cylinder (30), said gap being no greater than the thickness (T) of the jet of stock.

3. A method as claimed in claim 2, wherein:
said gap is approximately two-thirds of the thickness (T) of said jet of stock.

4. A method as claimed in claim 2 or 3, wherein:
said open breast roll (32) is movable relative to the forming cylinder (30) such that the angle between the inner and outer forming wires (36,38) in the forming throat (44) and the dimension of said gap can be varied.

5. A method as claimed in any one of the preceding claims, wherein:
approximately one-third (1/3) of the thickness (T) of said jet of stock impinges on said open breast roll (32).

6. An apparatus for forming a web, said apparatus comprising a rotatable forming cylinder (30), inner and outer endless forming wires (36,38), means for supporting said inner and outer endless forming wires (36,38) so that they converge to form a forming throat (44) and thereafter run together over a segment of the surface of the forming cylinder (30) and headbox means (40) for injecting a jet (42) of stock into the forming throat (44) between said wires (36,38), an open support structure being provided for the outer forming wire (38) over at least a portion of said forming throat, said open support structure being in the form of an open breast roll (32) having a plurality of circumferential grooves (34) thereabout;
a gap between said open breast roll (32) and the forming cylinder (30), said gap being no greater than the thickness (T) of said jet of stock such that said jet of stock impinges substantially simultaneously on said forming cylinder (30) and said open breast roll (32), thereby creating an initial drainage area wherein drainage pressure is not dependent upon the tension of the outer forming wire (38) and the radius of the path of the outer forming wire (38).

7. An apparatus as claimed in claim 6, wherein:
approximately one-third (1/3) of the thickness of said jet of stock impinges on said open support structure.

8. An apparatus as claimed in claim 6 or 7, wherein:
said gap is approximately two-thirds of the thickness of said jet of stock.

9. An apparatus as claimed in any one of claims 6 to 8, wherein:
said open breast roll (32) is movable relative to the forming cylinder (30) such that the angle between the inner and outer forming wires (36,38) in the forming throat (44) and the dimension of said gap can be varied.

Patentansprüche

1. Verfahren zum Herstellen einer Bahn aus einem in eine Formkehle (44) zwischen innerem und äußerem gespanntem Formsieb (36, 38), die um ein peripheres Segment einer Siebwalze (30) herumlaufen, eingespritzten Papierstoffstrahl (42), umfassend: a) im wesentlichen gleichzeitiges Auftreffen des Papierstoffstrahls (42) auf dem inneren und dem äußeren Formsieb (36, 38) in der Formkehle (44); b) Schaffen eines Erstentwässerungsbereichs durch Vorsehen einer offenen Stützkonstruktion für das äußere Formsieb (38) über mindestens einen Teil der genannten Formkehle (44), wobei diese offene Stützkonstruktion eine offene Brustwalze (32) mit einer Mehrzahl von Umfangsrillen (34) daran umfaßt und wobei das anfängliche Auftreffen auf das äußere Formsieb (38) stattfindet, wo das äußere Formsieb (38) an der offenen Brustwalze (32) anliegt und von ihr gestützt wird, wodurch etwas unmittelbare und schnelle Entwässerung durch das genannte gestützte äußere Formsieb (38) ermöglicht wird.

2. Verfahren nach Anspruch 1, ferner umfassend: Positionierung der genannten offenen Brustwalze (32), so daß zwischen der genannten offenen Brustwalze (32) und der Siebwalze (30) ein Spalt besteht, wobei der genannte Spalt nicht größer als die Dicke (T) des Papierstoffstrahls ist.

3. Verfahren nach Anspruch 2, wobei der genannte Spalt etwa zwei Drittel so breit ist wie die Dicke (T) des genannten Papierstoffstrahls.

4. Verfahren nach Anspruch 2 oder 3, wobei die genannte offene Brustwalze (32) im Verhältnis zur Siebwalze (30) bewegbar ist, so daß der Winkel zwischen dem inneren und äußeren Formsieb (36, 38) in der Formkehle (44) und die Abmessung des genannten Spalts variiert werden können.

5. Verfahren nach einem der vorangehenden Ansprüche, wobei etwa ein Drittel (1/3) der Dicke (T) des genannten Papierstoffstrahls auf der genannten offenen Brustwalze (32) auftrifft.

6. Vorrichtung zum Formen einer Bahn, wobei genannte Vorrichtung eine drehbare Siebwalze (30), inneres und äußeres endloses Formsieb (36, 38), Einrichtungen zum Stützen des genannten inneren und äußeren endlosen Formsiebs (36, 38), so daß sie zusammenlaufen und eine Formkehle (44) bilden und danach zusammen über ein Segment der Oberfläche der Siebwalze (30) laufen, und Stoffauflaufeinrichtungen (40) zum Einspritzen eines Papierstoffstrahls (42) in die Formkehle (44) zwischen genannten Formsieben (36, 38), wobei eine offene Stützkonstruktion für das äußere Formsieb (38) über mindestens einen Teil von genannter Formkehle vorgesehen ist, wobei die offene Stützkonstruktion die Form einer offenen Brustwalze (32) mit einer Mehrzahl von Umfangsrillen (34) daran hat; einen Spalt zwischen der genannten offenen Brustwalze (32) und der Siebwalze (30) umfaßt, wobei der Spalt nicht größer ist als die Dicke (T) von genanntem Papierstoffstrahl, so daß genannter Papierstoffstrahl im wesentlichen gleichzeitig auf genannter Siebwalze (30) und genannter offener Brustwalze (32) auftrifft, wodurch ein Erstentwässerungsbereich geschaffen wird, in dem Entwässerungsdruck nicht von der Spannung des äußeren Formsiebs (38) und dem Radius des Wegs des äußeren Formsiebs (38) abhängt.

7. Vorrichtung nach Anspruch 6, wobei etwa ein Drittel (1/3) der Dicke des genannten Papierstoffstrahls auf der genannten offenen Stützkonstruktion auftrifft.

8. Vorrichtung nach Anspruch 6 oder 7, wobei der genannte Spalt etwa zwei Drittel so breit ist wie die Dicke des genannten Papierstoffstrahls.

9. Vorrichtung nach einem der Ansprüche 6 bis 8, wobei genannte offene Brustwalze (32) im Verhältnis zu der Siebwalze (30) bewegbar ist, so daß der Winkel zwischen dem inneren und äußeren Formsieb (36, 38) in der Formkehle (44) und die Abmessung des genannten Spalts variiert werden können.

Revendications

1. Procédé de production d'une bande à partir d'un jet de pâte à papier (42) injecté dans une gorge de formation (44) entre des toiles métalliques de formation tendues interne et externe (36,38) passées autour d'un segment périphérique d'un cylindre égoutteur (30), comprenant:

   (a) l'injection du jet de pâte à papier (42) sensiblement simultanément sur les deux toiles métalliques de formation interne et externe (36,38) dans la gorge de formation (44);
   (b) la création d'une zone de drainage initiale en fournissant une structure de support ouverte pour la toile métallique de formation externe (38) sur au moins une partie de ladite gorge de formation (44), cette structure de support ouverte comprenant un rouleau de tête ouvert (32) ayant une pluralité de rainures circonférentielles (34) autour de lui, et l'injection initiale sur la toile métallique de formation externe (38) se produisant là où la toile métallique de formation externe (38) butte contre et est supportée par le rouleau de tête ouvert (32) permettant ainsi un drainage immédiat et rapide à travers ladite toile métallique de formation externe supportée (38).

2. Procédé tel que revendiqué à la revendication 1, comprenant en outre:
   le positionnement dudit rouleau de tête ouvert (32) de telle sorte qu'il existe un écart entre ledit rouleau de tête ouvert (32) et le cylindre égoutteur (30), ledit écart n'étant pas supérieur à l'épaisseur (T) du jet de pâte à papier.

3. Procédé tel que revendiqué à la revendication 2, dans lequel:
   ledit écart est approximativement les deux-tiers de l'épaisseur (T) dudit jet de pâte à papier.

4. Procédé tel que revendiqué à la revendication 2 ou 3, dans lequel:
   ledit rouleau de tête ouvert (32) est mobile par rapport au cylindre égoutteur (30) de telle sorte que l'angle entre les toiles métalliques de formation interne et externe (36,38) dans la gorge de formation (44) et la dimension dudit écart peuvent être variés.

5. Procédé tel que revendiqué dans l'une quelconque des revendications précédentes, dans lequel:
approximativement un tiers (1/3) de l'épaisseur (T) dudit jet de pâte à papier est injecté sur ledit rouleau de tête ouvert (32).

6. Appareil pour former une bande, ledit appareil comprenant un cylindre égoutteur rotatif (30), des toiles métalliques de formation continues interne et externe (36,38), un moyen pour supporter lesdites toiles métalliques de formation continues interne et externe (36,38) de telle sorte qu'elles convergent pour former une gorge de formation (44) puis passent après ensemble sur un segment de la surface du cylindre égoutteur (30) et un moyen de caisse de tête (40) pour injecter un jet (42) de pâte à papier dans la gorge de formation (44) entre lesdites toiles métalliques (36,38), une structure de support ouverte étant foumie pour la toile métallique de formation externe (38) par dessus au moins une partie de ladite gorge de formation, ladite structure de support ouverte ayant la forme d'un rouleau de tête ouvert (32) ayant une pluralité de rainures circonférentielles (34) autour de lui;
un écart entre ledit rouleau de tête ouvert (32) et le cylindre égoutteur (30), ledit écart n'étant pas supérieur à l'épaisseur (T) dudit jet de pâte à papier de telle sorte que ledit jet de pâte à papier est injecté sensiblement simultanément sur ledit cylindre égoutteur (30) et ledit rouleau de tête ouvert (32), créant ainsi une zone de drainage initiale dans laquelle la pression de drainage ne dépend pas de la tension de la toile métallique de formation externe (38) et du rayon du trajet de la toile métallique de formation externe (38).

7. Appareil tel que revendiqué à la revendication 6, dans lequel:
approximativement un tiers (1/3) de l'épaisseur dudit jet de pâte à papier est injecté sur ladite structure de support ouverte.

8. Appareil tel que revendiqué à la revendication 6 ou 7, dans lequel:
ledit écart est approximativement les deux-tiers de l'épaisseur dudit jet de pâte à papier.

9. Procédé tel que revendiqué dans l'une quelconque des revendications 6 à 8, dans lequel:
ledit rouleau de tête ouvert (32) est mobile par rapport au cylindre égoutteur (30) de telle sorte que l'angle entre les toiles métalliques de formation interne et externe (36,38) dans la gorge de formation (44) et la dimension dudit écart peuvent être variés.

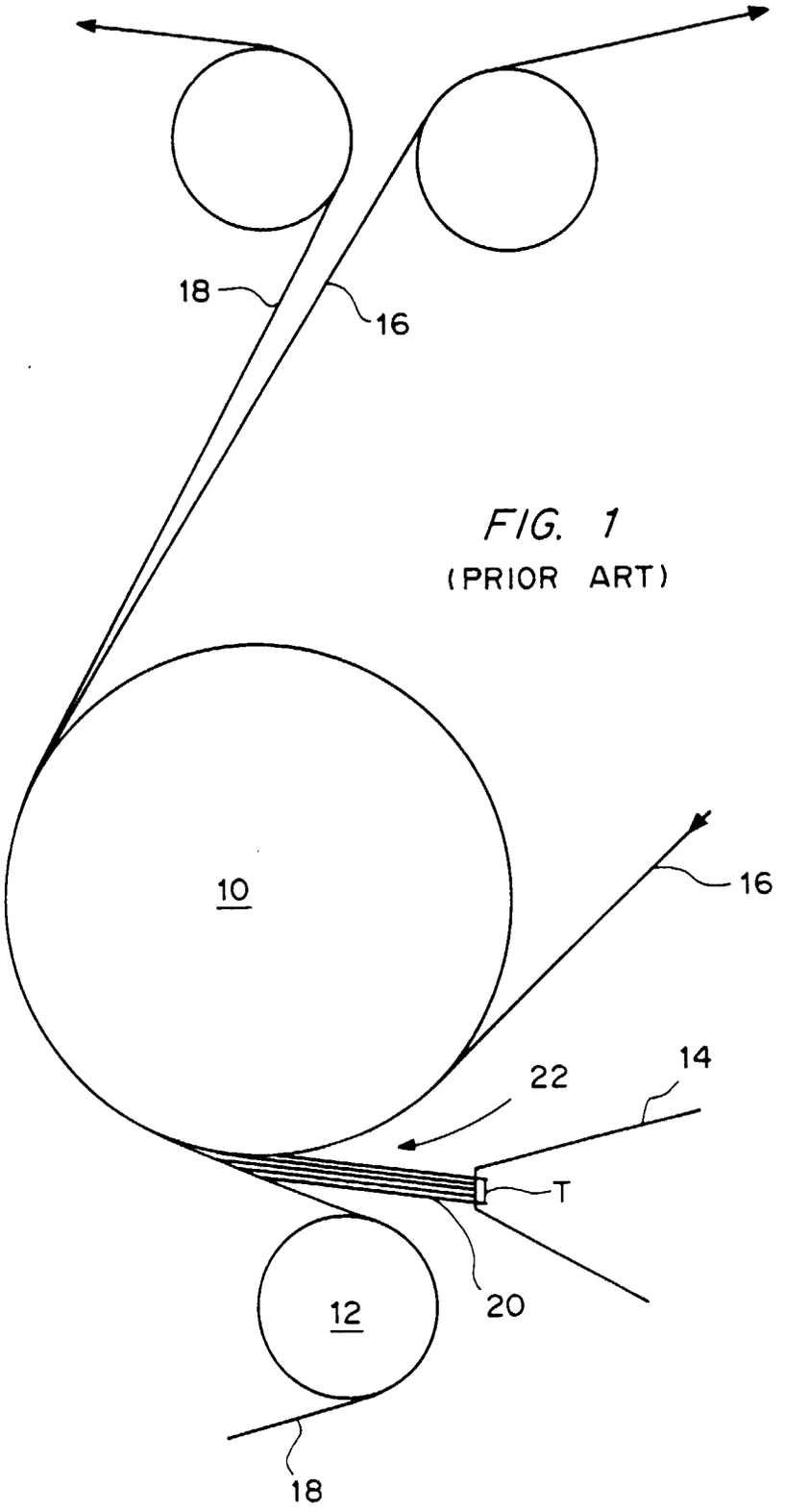


FIG. 1
(PRIOR ART)

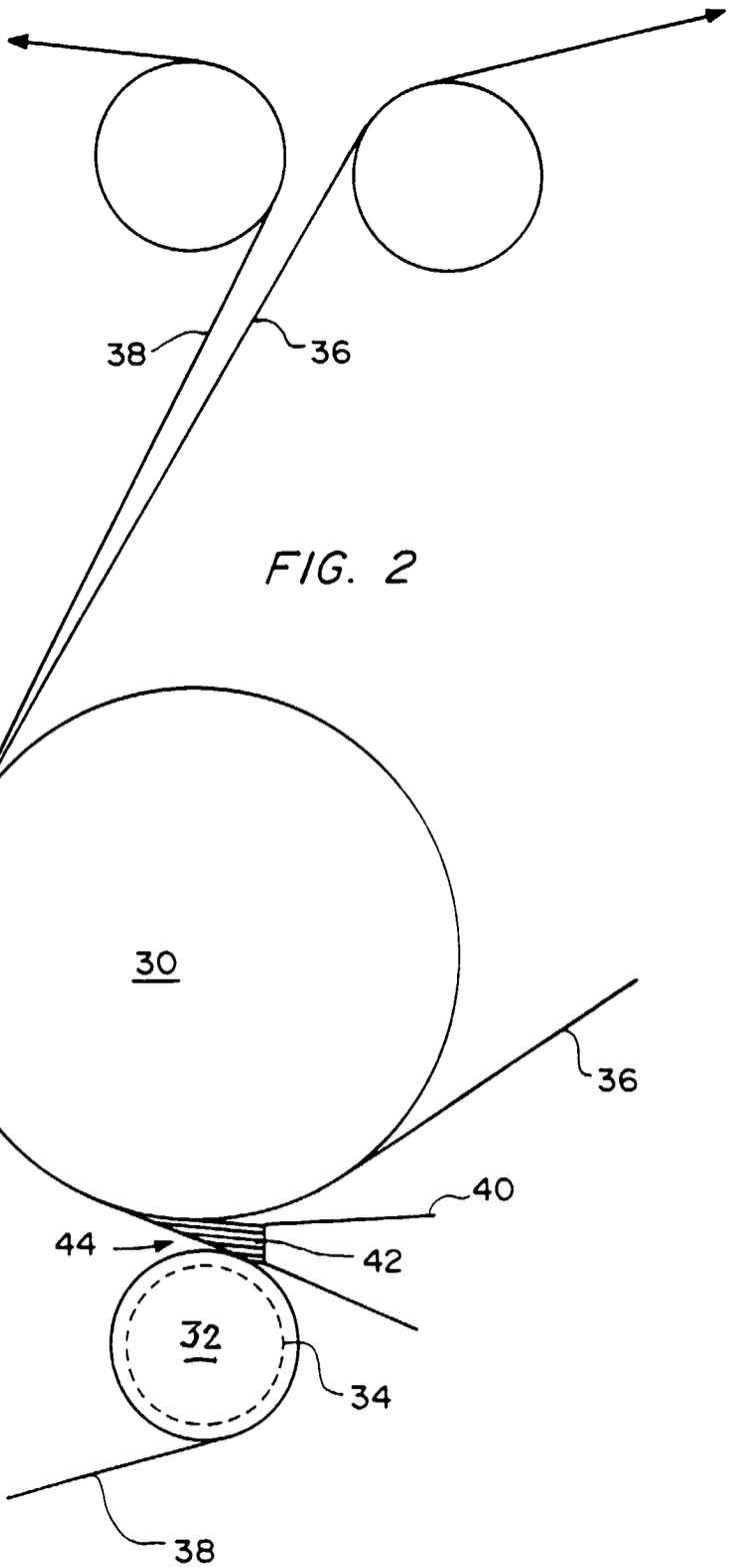


FIG. 2

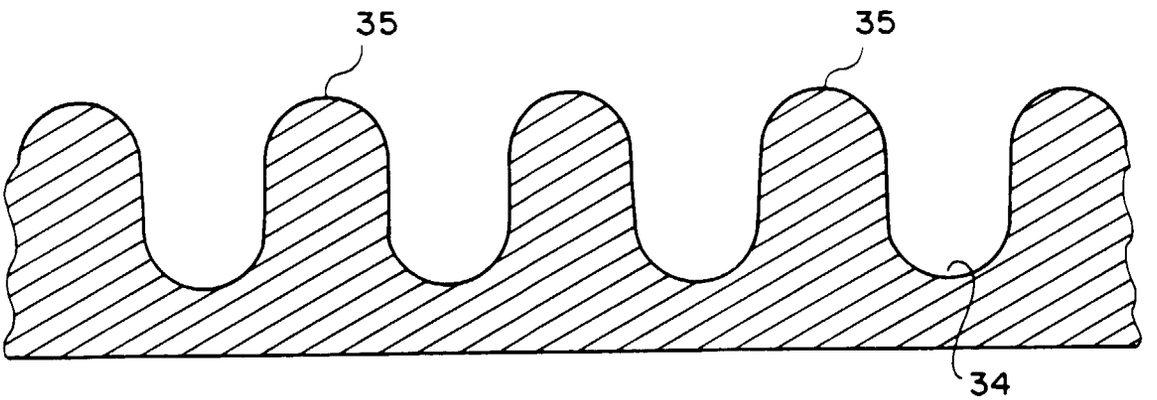


FIG. 3

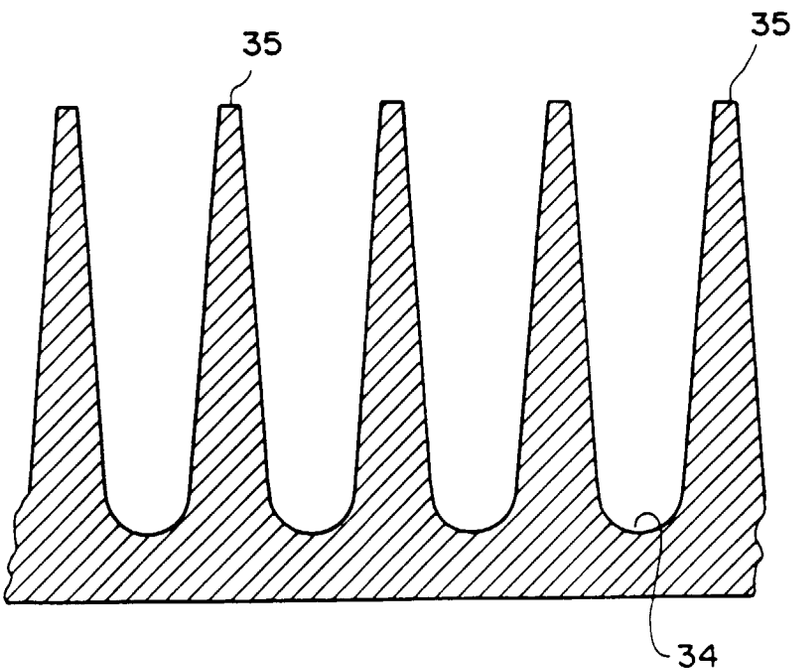


FIG. 4

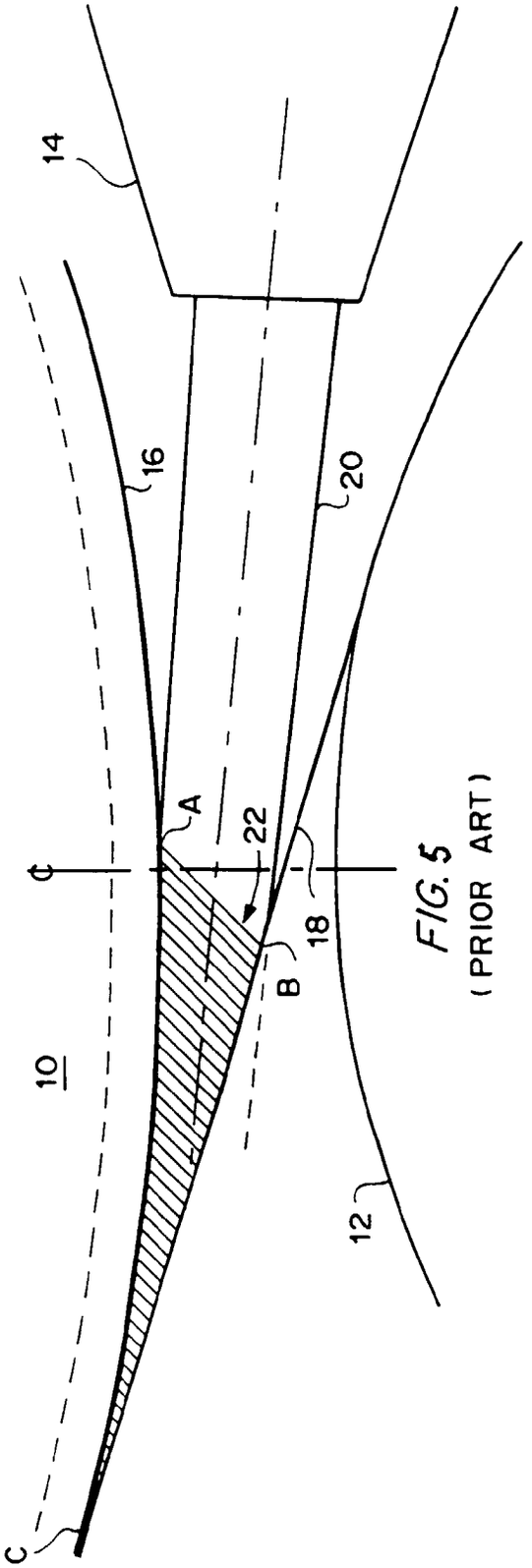


FIG. 5
(PRIOR ART)

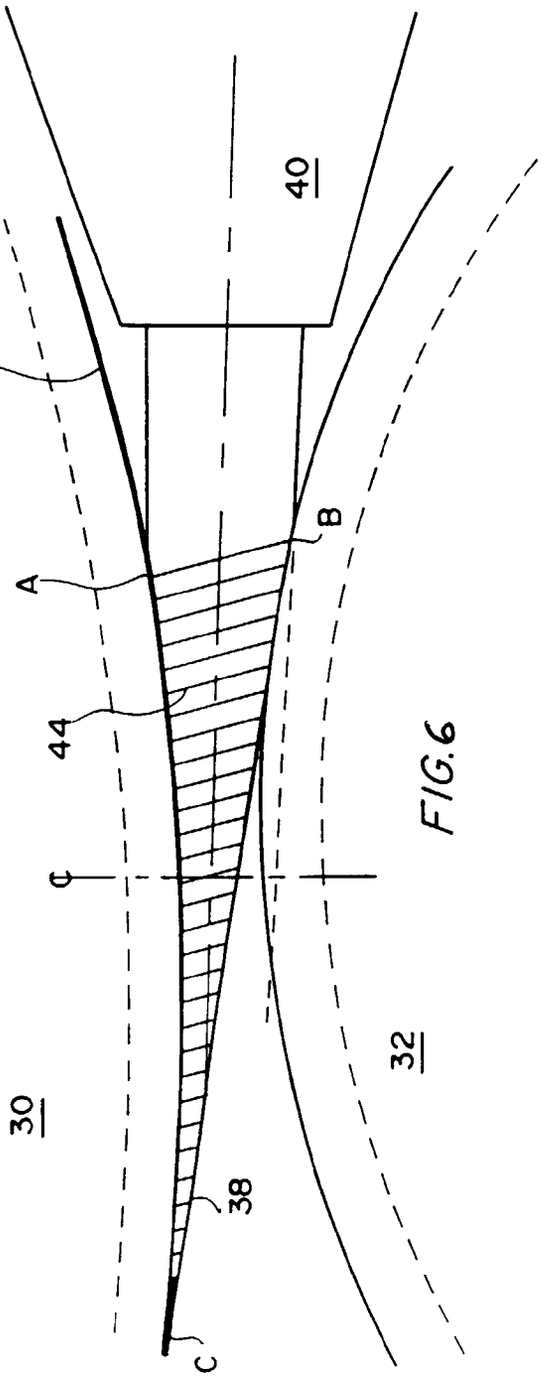


FIG. 6