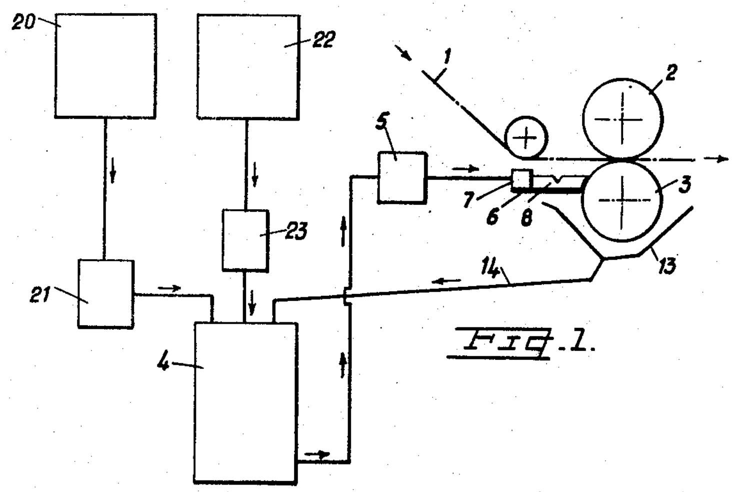
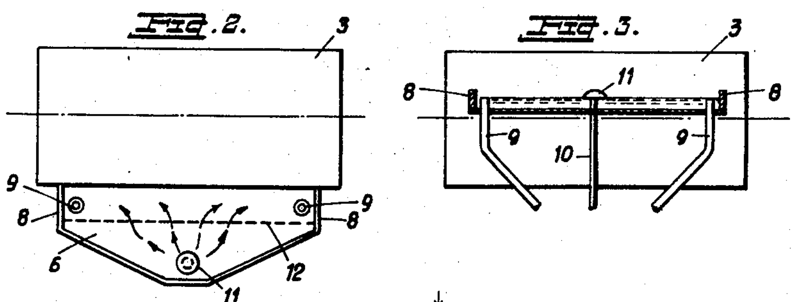
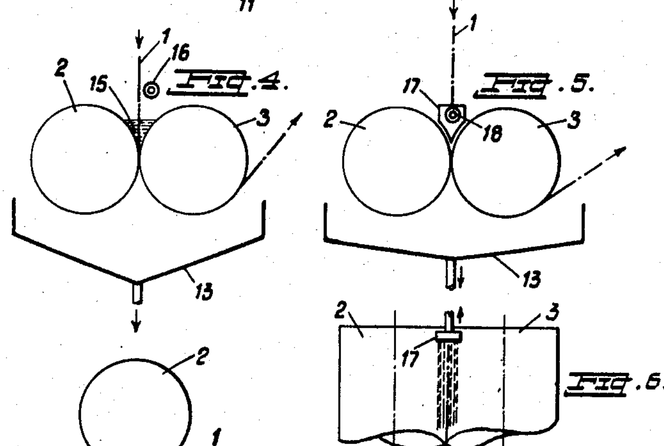
TREATMENT OF YARNS AND THE LIKE WITH LIQUIDS

Original Filed Dec. 8, 1953

3 Sheets-Sheet 1







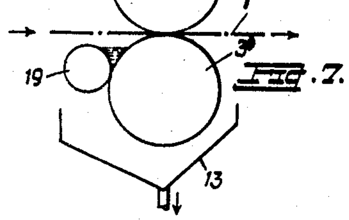


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FIG. 8.

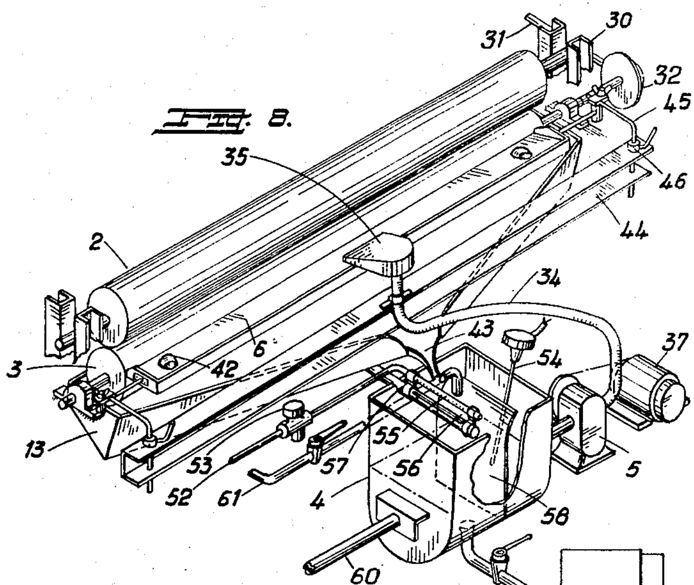

FIG. 9.

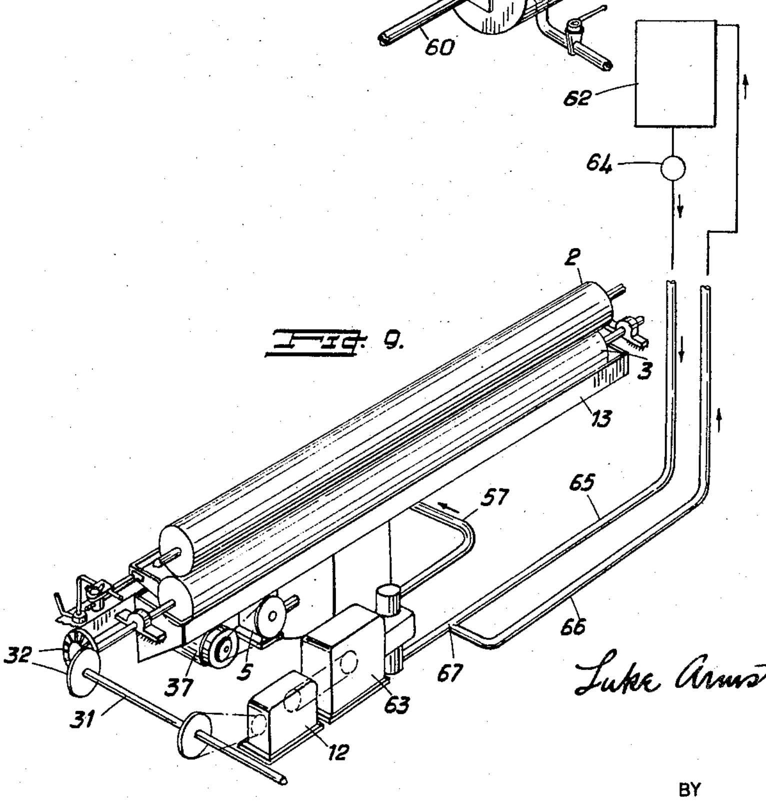

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FIG. 10.

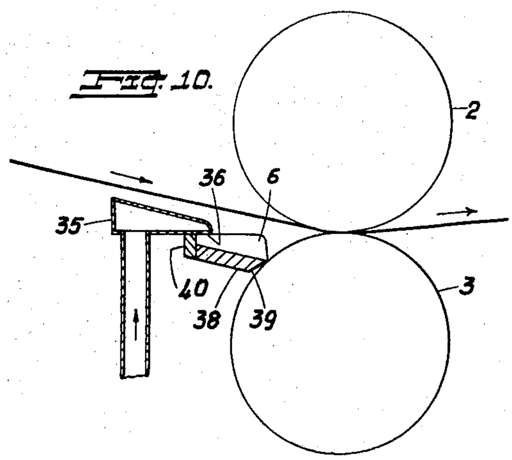
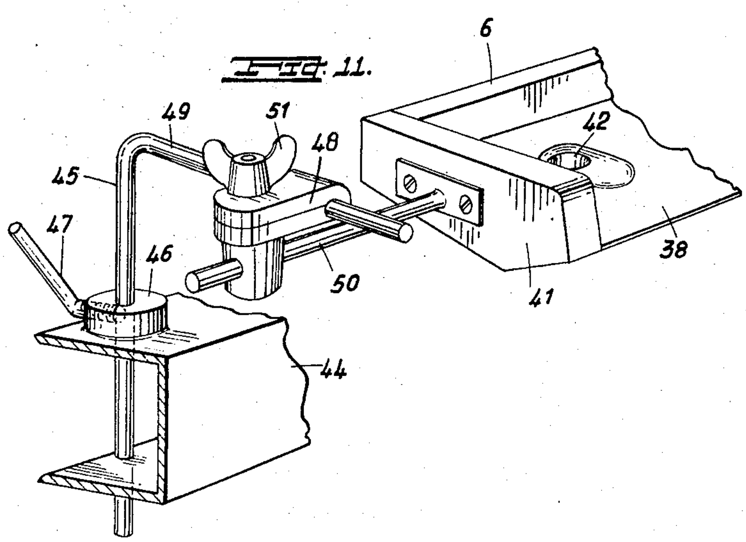


FIG. 11.



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TREATMENT OF YARNS AND THE LIKE WITH LIQUIDS

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Continuation of application Ser. No. 396,890, Dec. 8, 1953. This application Dec. 18, 1957, Ser. No. 703,574

Claims priority, application Great Britain Dec. 18, 1952

7 Claims. (Cl. 117—111)

The present invention relates to the continuous application of a substance contained in a liquid to a moving length of material such for example as yarn, sheet, rope, thread, ribbon, web, filament or assemblage of yarns, threads or filaments (hereinafter referred to as material). The substance contained in the liquid may be a solid which is dissolved, dispersed or emulsified therein.

This application is a continuation of my co-pending application Serial No. 396,890, filed December 8, 1953, now abandoned.

The invention is especially applicable to the sizing of textile materials such as yarns but is also applicable for example to the sizing of other textile materials or of paper or to the "filling" of textile materials or of paper or to the dyeing of textile materials in which processes it is desirable to ensure that a prescribed quantity of the applied substance, whether a liquid or a solid, is ultimately retained by the material per unit length thereof.

In such processes the actual amount of the applied substance taken up by the material per unit length thereof can vary during the treatment of a run of material as a result of variations in character of the liquid and in particular upon variations in the concentration of the substance therein and one object of the invention is to compensate for and correct such variations in order to keep the rate of take up of the substance per unit length of material at a substantially constant pre-determined value.

A traditional method of sizing yarn is to pass the yarn beneath a roller partly immersed in a size box and then to pass it between squeeze rolls of which the lower roll is also partly immersed in the size. The size box commonly has a capacity of about 60 to 80 gallons so that approximately that amount of size remains at the end of a sizing operation and is often wasted. A further defect of the traditional method of sizing is that it is not practicable accurately to monitor the amount of size or other liquid applied to the yarn per unit length during a sizing run.

One object of the present invention is to reduce to a relatively small quantity the amount of size or other liquid which must necessarily remain at the end of a run.

Another object of the invention is, as hereinbefore mentioned, to maintain the application of the substance to the material at a uniform rate per unit length during the treatment of a run of the material. Where the substance to be applied to the material is a solid but is for convenience of application dissolved, dispersed or emulsified in a liquid, the object of the invention is of course to apply to the material a uniform quantity of the solid and to control the application of the liquid to that end.

One feature of the present invention consists in a method of continuously applying liquid to a moving length of material, such for example as size to yarn, in which the material passes between two rotating rolls and the liquid is fed to the bight between the rolls into

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which the yarn is fed without allowing either of the rolls to dip into a bath of the liquid therebeneath.

According to another feature of the invention the material is passed between two rotating rolls and a quantity of the liquid is maintained in the bight between the rolls into which the material is fed by feeding liquid directly to at least one of the rolls at a level above the lowermost part of the path of travel of the surface of the roll, whereby to avoid the need to allow the roll to pick up liquid from a bath of the liquid therebeneath.

According to a further feature of the invention the material is passed between two rotating rolls and a quantity of the liquid is maintained in the bight between the rolls into which the material is fed by feeding liquid directly to the bight or by feeding liquid directly to at least one of the rolls at a level above the lowermost part of the roll and at a position from which it will be moved to the bight by the rotation of the roll without necessarily passing through the lowermost part of the path of travel of the surface of the roll.

A further feature of the invention consists in feeding the liquid, at a rate greater than that at which it is taken up by the material, from a supply of the liquid which supply is maintained by feeding thereto a concentrated liquid at a uniform rate proportional to that at which the liquid is intended to be taken up by the material and by feeding to said supply a diluting liquid at a rate sufficient to keep said supply at a given volume. In other words the said supply of the liquid is maintained by feeding thereto a concentrated liquid at said uniform rate and by feeding to the supply a diluting liquid at a rate which is controlled so as to increase or decrease respectively when the rate at which the liquid is taken up by the material is above or below that intended.

An apparatus according to the present invention for supplying liquid to a moving length of material embodies two rolls arranged to form bights therebetween and between which the material can be passed, a small liquid reservoir for the supply of liquid to the material, at least one wall of said reservoir being constituted by the surface of one of the rolls, and means for supplying liquid to said reservoir.

Said reservoir may be wholly constituted by the surfaces of the rolls at the upper bight or by the said surfaces of the rolls and by end walls fitting into the bight or by the surface of the lower of the two aforesaid rolls and by a smaller roll in engagement therewith at a position from which the surface of the lower of said rolls moves towards the bight into which the material is fed.

Alternatively the reservoir may comprise a trough extending along one of the rolls which forms a wall of the trough along that side of the trough adjacent thereto. In such an arrangement the base of the reservoir may consist of a blade whose edge engages the roll whereby the roll will form a wall to enclose the trough along the edge of the blade in engagement therewith.

The reservoir may be supplied by a supply tank or box by means of a pump which delivers liquid to the reservoir at a substantially constant rate sufficient to cause the reservoir to overflow, a hopper being arranged beneath the rolls to catch liquid draining from the rolls and from the reservoir and to return said liquid to said supply tank or box.

The invention is further described with reference to the accompanying drawings which illustrate apparatus suitable for the application of size to yarn and in which:

Fig. 1 is a diagrammatic side view of one form of apparatus,

Figs. 2 and 3 are a diagrammatic plan and front view respectively corresponding to a portion of Fig. 1 and including some modifications thereto,

Fig. 4 diagrammatically illustrates a second mode of applying liquid to yarn or the like,

Figs. 5 and 6 are a diagrammatic fragmentary side elevation and plan view respectively showing a development of the arrangement of Fig. 4,

Fig. 7 is a diagrammatic side view illustrating a further mode of applying liquid to yarn or the like,

Fig. 8 is a front perspective view of a sizing machine according to the present invention,

Fig. 9 is a rear perspective view corresponding to Fig. 8,

Fig. 10 is a sectional view of a detail, and

Fig. 11 is a perspective view of a detail.

In the arrangement shown in Fig. 1 yarn **1** is fed between squeeze rolls **2** and **3** and size or other liquid, appropriately diluted, is fed from a supply or mixing tank or box **4** by a pump **5** to a reservoir **6** the edge of whose base forms a blade which engages the roll **3** near the bight between the rolls **2**, **3**. The diluted liquid is fed from the box **4** to the reservoir **6** at a rate in excess of that at which liquid is removed by the yarn **1** from the reservoir **6**. The surface of roll **3** constitutes one of the walls of the reservoir **6**. Near its rearward edge the base is provided with a low wall **7** and at each end it is provided with a low wall **8** in which a V notch or weir is preferably formed in order to keep the liquid in the reservoir at a predetermined level and to allow it to overflow at predetermined points.

A slightly modified reservoir **6** is diagrammatically illustrated in Figs. 2 and 3 which show an alternative method of allowing surplus liquid to escape therefrom.

In Fig. 3 the base has end walls **8** which are not notched. Instead of notching the end walls, outlet pipes **9** are provided at each end of the reservoir, each protruding by a given like distance above the bottom of the reservoir. The liquid is supplied to the reservoir from the mixing tank **4** at an excess rate by means of a central feed pipe **10** above which is arranged a deflector dome **11**. By using a central feed pipe **10** and the outflow pipes **9**, the liquid is caused to flow from the centre of the reservoir towards the ends **8**. To assist further the lateral flow of liquid, apertured baffle plates **12** may be introduced across the reservoir between the centre feed pipe **10** and the outflow pipes **9**. Obviously the flow could be arranged to take place in the opposite direction or alternatively a horizontal feed pipe might be arranged above the reservoir with a plurality of outlets at spaced intervals along the reservoir.

It will be clear that the rotation of the roll **3** in a clockwise direction will cause the liquid to be fed from the reservoir **6** into the bight between the rolls **2**, **3** and thus applied to the yarn **1**.

Instead of using a flat base with a wall **7** along its rear edge an upwardly curved base could obviously be employed. The blade may meet the roll **3** at any suitable angle.

In Fig. 1 a hopper **13** is arranged beneath the roll **3** to catch any liquid draining from roll **3** and to catch liquid overflowing from the reservoir **6**. A return connection **14** from the hopper leads back to the mixing box **4**. All size not applied to the yarn returns to box **4**.

In the arrangement shown in Figs. 2 and 3 the outflow pipes **9** may lead into the hopper **13** or alternatively may be connected directly with the mixing box **4**. In either case the hopper **13** would be required to receive liquid draining from the roll **3**.

In the alternative arrangement shown in Fig. 4 the yarn **1** is fed downwardly between two rolls **2** and **3** lying side by side to present an upwardly directed bight **15** which can serve as a small reservoir and into which size can be fed at an excess rate by any suitable means such as a horizontally disposed feed pipe **16** connected with pump **5** of Fig. 1 and apertured at intervals along the length thereof which lies above the bight **15**. In the arrangement shown in Fig. 4 the plane containing the axes of the rolls **2** and **3** is horizontal but the rolls need not necessarily be at the same level and the said plane may be tilted up to say 45° in either direction.

To maintain the liquid at a predetermined level in the reservoir formed by the bight **15** an end wall **17** may be provided in the bight at each end of the rolls **2**, **3** (Figs. 5 and 6). These end walls are preferably provided with an outflow pipe at a given level indicated diagrammatically in Fig. 5 by the reference numeral **18**.

In the arrangement shown in Fig. 7 the squeeze rolls **2**, **3** are arranged one above the other as in Fig. 1 but the liquid reservoir is formed by the squeeze roll **3** and an idler roll **19** in engagement therewith, the clockwise rotation of the roll **3** carrying the liquid from the bight between the rolls **3** and **19** up to the bight between the rolls **2** and **3** through which the yarn **1** is passed. End pieces may be provided between the rolls **3** and **19** somewhat similar to those shown at **17** in the arrangement according to Fig. 5. A hopper **13** is provided beneath the roll **3** to catch any liquid draining from the rolls.

Referring again to Fig. 1, a quantity of concentrated liquor which may be little more than sufficient to deal with a given run of yarn may be contained, at the outset of a run, in a stock liquor tank **20** and fed by a metering pump **21** to the mixing box **4** at a rate predetermined by the desired rate of application of size to the yarn **1**. A diluting liquid such as hot water is fed to the mixing box **4** from a tank **22** through a valve **23** controlled by the level of the liquid in the mixing box **4** so that a constant level is maintained in mixing box **4**.

The mixing box **4** may be relatively small and may contain for example two gallons of the diluted liquor. The capacity of the reservoir **6** may be much smaller than that of the mixing box **4** and may be of the order of say one or two quarts. If the quantity of concentrated liquor required for a particular run is known accurately in advance then it is possible for the concentrated liquor to be pumped from the tank **20** to the mixing box **4** and for the diluted liquor to be pumped from the mixing box **4** to the reservoir **6** so that at the end of a run the tank **20** should be empty or substantially so leaving only about two and a half gallons of the diluted liquor in the mixing box **4** and reservoir **6** to be run to waste at the end of a sizing run.

Since the rate of supply by the pump **5** is constant and that of pump **21** is predetermined by the intended rate of application of size to yarn **1** and since the mixing box will be maintained at a given level by the supply of a diluting liquid from the tank **22** it follows that the contration of the liquid reaching the reservoir **6** will be maintained substantially at a suitable value to ensure that the solids fed by the pump **21** are substantially equal to the solids applied to the yarn. Thus, if the material passing between the rolls **2**, **3**, takes up solids at too great a rate, solids will be leaving the reservoir at a greater rate than that at which they are being supplied by the pump, and since the level of the liquid in box **4** is being maintained constant, the liquid will be diluted until its concentration is such that the material takes up the correct weight of solids. On the other hand, if the take-up of solids by the material is too low because the liquid is too highly diluted, solids will be leaving the reservoir **6** at a lower rate than that at which they are being supplied by the pump and so the concentration of the liquid will rise until it is such that the material again takes up the correct weight of solids.

Figs. 8 to 11 illustrate a practical form of apparatus which may be used for the sizing of yarn. The rolls **2**, **3** are supported by upright frame members **30** shown fragmentarily in Fig. 8. The roll **3** only is positively driven by a shaft **31** through bevel gears **32**. The small reservoir **6** is in the form of a trough and is fed with liquid from mixing tank **4** by a pump **5** through a pipe

34 which terminates in a head 35 (Fig. 10) having outlet apertures 36 which overlie the reservoir 6. Pump 5 is driven by an electric motor 37.

The reservoir 6 has a base in the form of a wooden blade 38 (Figs. 10 and 11) chamfered at 39 where it engages the roll 3 and downwardly inclined towards the roll 3. The reservoir has a rear wall 40 and end walls 41, also formed of wood. The base or blade 38 has openings 42 therethrough (Figs. 8 and 11) to allow liquid to overflow from the reservoir 6 to a hopper 13 extending therebeneath and beneath roll 3. The hopper 13 is arranged to discharge directly into the box 4 at 43 (Fig. 8).

The reservoir 6 is supported at each end from a beam 44 (Figs. 8 and 11) by inverted L-shaped angle members 45 of circular section, of which each passes through holes in the flanges of the beam 44 and through a block 46 secured, as by welding, to the upper flange. Each angle member can be held at any desired elevation by a pinching screw 47 which engages in a threaded opening in the block 46. A clamp 48 is supported on the upper arm 49 of each of the angle members 45 and supports a spindle 50 extending from one end of the reservoir 6. The clamp 48 can be tightened to lock itself upon the arm 49 and the spindle 50 by means of a wing nut 51. Thus, the level and the angularity of the reservoir 6 can readily be adjusted in relation to the roll 3.

Referring again to Fig. 8, water enters the mixing box 4 through a pipe 52 under the control of an electromagnetic valve 53 which in turn is controlled by an electrical liquid level detector 54 which projects downwardly into the box 4.

Water is discharged from pipe 52 through apertures in a gallery pipe 55 which lies above an outlet slot 56 in the horizontal end of a pipe 57 through which concentrated size is supplied to the box 4.

A deflector plate 58 extends downwardly into the box 4 and the pump 5 draws from the right hand side of the deflector plate as viewed in Fig. 8. A small space is left between the sides of the deflector plate 58 and the walls of the box 4 to enable the liquid to pass from the left hand side to the right hand side of the deflector plate 58, whereby to ensure an adequate mixing of the water with the more concentrated size before the mixture reaches the pump 5.

A pipe 60 is provided to feed steam into the box 4 in order to heat the liquid therein. A separate size feed pipe 61 is provided for priming the box 4 at the commencement of a run.

The concentrated size is supplied from a tank 62, shown diagrammatically in Fig. 9, and is fed at a constant rate to the pipe 57 by means of a metering pump 63 driven from the shaft 31 through a gearbox 12 which can be manipulated or modified to change the gear ratio thereof. Concentrated size is supplied from the tank 62 to the metering pump 63 by means of a feed pump 64 and pipe 65. A branch pipe or by-pass 66 leaves the pipe 65 at a point 67 near to the metering pump 63 and discharges to the tank 62 so that the pump 64 is able to circulate the concentrated size downwardly through the pipe 65 to a point very near to the pump 63, and then to return it through the pipe 66 to the tank 62, so that size of uniform quality will be drawn by the metering pump 63.

Although the invention has been described with reference to the application of size to yarn, it will be appreciated that it can be used for the application of a liquid to any material in the length to which it is desired to apply a liquid or a solid contained in a liquid at a specified rate per unit length.

I claim:

1. A method of continuously applying, at a substantially uniform rate, to a material a substance contained in a liquid, which comprises the steps of feeding to a mixing zone concentrated liquid containing said substance at a rate of feed substantially equal to the rate at which the

substance is to be taken up by the material, feeding to said mixing zone a diluting liquid, passing said material between two rotating rolls disposed side-by-side to one another, continuously withdrawing and circulating diluted liquid from said mixing zone at a rate in excess of that at which diluted liquid is taken up by the material, feeding said withdrawn liquid to an upwardly directed bight between said rolls to establish a quantity of liquid in said bight, draining and returning to said mixing zone excess withdrawn liquid, sensing any variations in the quantity of diluted liquid in said mixing zone and varying the rate of feed of diluting liquid thereto in accordance therewith.

2. A method of continuously applying at a substantially uniform rate to a material a substance contained in a liquid, which comprises the steps of feeding to a mixing zone concentrated liquid containing said substance and at a rate of feed substantially equal to the rate at which the substance is to be taken up by the material, feeding to said mixing zone a diluting liquid, establishing a reservoir of liquid solely in the vicinity of and at least adjoining the nip between two rolls disposed side-by-side to one another by continuously and positively withdrawing diluted liquid from said mixing zone at a rate in excess of the rate at which it is taken up by the material, making withdrawn liquid available for said reservoir by feeding said withdrawn liquid to an upwardly directed bight between said rolls, and returning excess withdrawn liquid to said mixing zone, passing said material through said reservoir prior to engaging it with said rolls and passing it between said rolls, measuring any variation in the quantity of liquid in said mixing zone and altering the rate of addition of diluent to the mixing zone inversely to any such measured variation to maintain the rate of take-up of said substance by the material substantially at said substantially uniform rate.

3. A method for having a material take up at a substantially uniform rate a substance contained in a liquid, which comprises the steps of establishing a mixing zone, feeding a concentrated liquid containing said substance to said mixing zone at a controlled rate substantially equal to the rate at which the substance is desired to be taken up by the material, feeding a diluent to said mixing zone for mixing with said concentrated liquid, and forming a diluted liquid, establishing an applying zone remote from said mixing zone for applying said substance to the material, moving said material through said applying zone, circulating the diluted liquid from the mixing zone to the applying zone by causing the diluted liquid to move from the mixing zone to the applying zone at a constant rate in excess of rate of take up of diluted liquid by the material, returning excess diluted liquid from said applying zone to said mixing zone, measuring any variation in the quantity of liquid in the mixing zone, and altering the rate of addition of diluent to the mixing zone inversely to any such measured variation.

4. Apparatus for applying a substance contained in a liquid at a substantially uniform rate to a material, comprising two squeeze rolls disposed side-by-side to one another and between which the material can be passed, a mixing box remote from the rolls to contain a supply of liquid, means for positively feeding liquid from said mixing box at a substantially constant rate greater than that at which liquid is taken up by the material, directly to at least one of the rolls at a position which will enable the liquid to reach the material passing through the bight between the rolls, means for draining excess liquid back to the mixing box, means for feeding concentrated liquid to said mixing box at a substantially uniform metered rate which will give the intended rate of take-up of the substance by the material, means for supplying a diluting liquid to the mixing box, and means for controlling the supply of the diluting liquid to the

mixing box in dependence upon the liquid level in the mixing box so as to keep the level of the liquid in the mixing box substantially constant.

5. Apparatus for coating a length of material with a substance contained in a liquid comprising a pair of squeeze rolls between which the material can be passed, a mixing box spaced from said rolls for containing a supply of the liquid, means for positively withdrawing and circulating liquid from said mixing box, at a rate greater than that at which liquid is taken up by the material, directly to at least one of the rolls in a position which will enable the liquid to reach the material passing through the bight between said rolls, means for draining excess liquid back to said mixing box, means for positively feeding concentrated liquid to said mixing box at a substantially uniform metered rate corresponding to the rate of take-up of the substance by said material, means for supplying a diluting liquid to said mixing box, means for measuring variations in the quantity of liquid in said mixing box, and control means responsive to said measuring means for controlling the rate of feed of diluting liquid to said mixing box.

6. Apparatus according to claim 5 including a tank for containing concentrated liquid, a metering pump connected between said concentrated liquid tank and said mixing box, variable ratio transmission means between said pump and at least one of said rolls, a circulating pump independent of said metering pump for withdrawing and circulating liquid from said mixing box.

7. Apparatus for applying a substance contained in a liquid at a substantially uniform rate to a moving length of material comprising two squeeze rolls between which the material can be passed, a liquid reservoir for the supply of liquid to the material, at least one wall of said reservoir being formed by the surface of one of the rolls, a mixing box to contain a supply of the liquid, means for feeding the liquid from said mixing box to said reservoir at a rate greater than that at which the liquid is taken up by the material, means for draining excess liquid back to the mixing box, means for feeding concentrated liquid to said mixing box at a substantially uniform rate relative to the speed of the material passing through said rolls, means for supplying a diluting liquid to said mixing box, means for sensing any variation in the quantity of liquid in said mixing box, and means responsive to said sensing means for controlling the supply of diluting liquid fed to said mixing box in accordance with the measured variations in the quantity of diluted liquid in said mixing box.

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