

Jan. 25, 1955

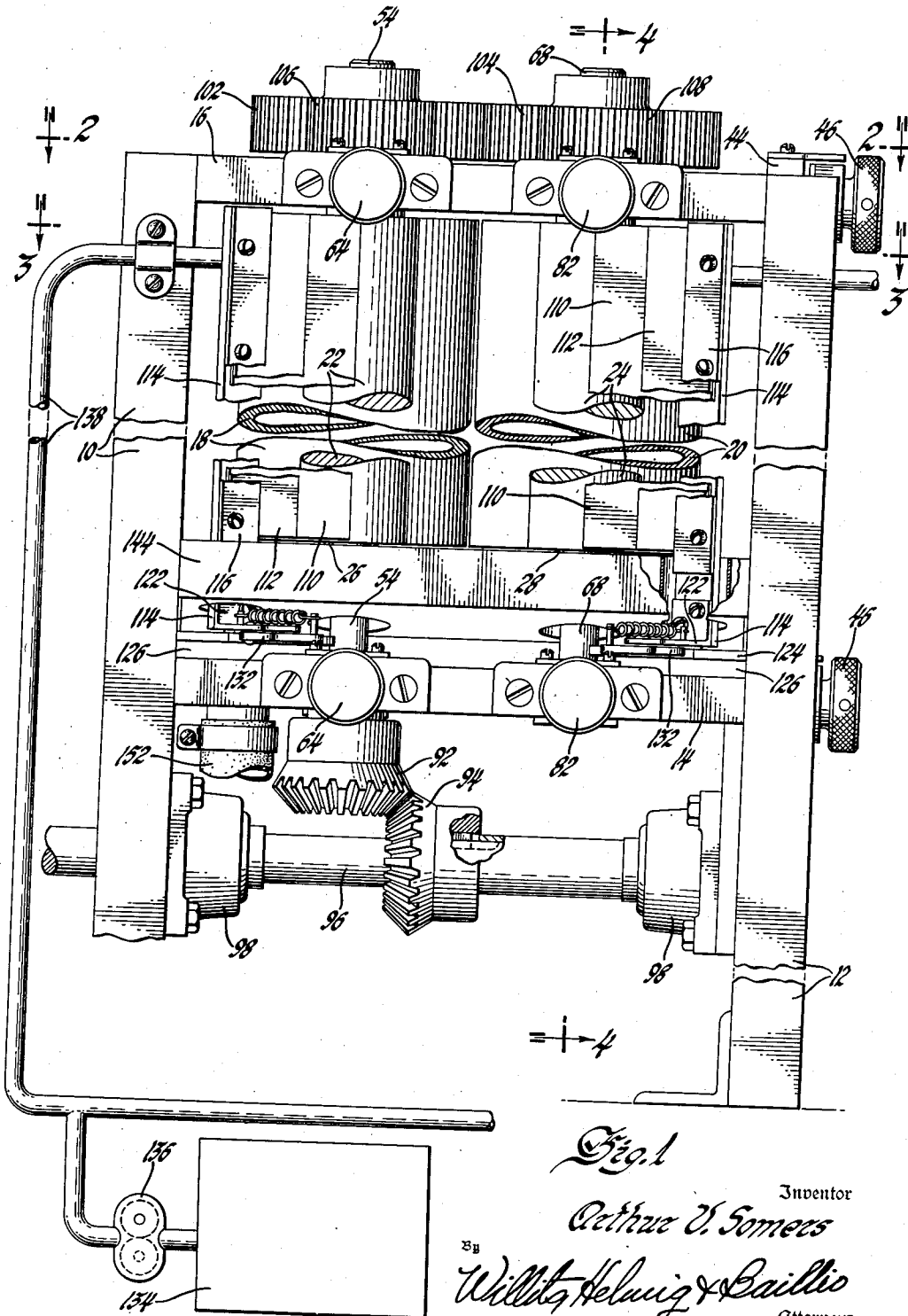
A. V. SOMERS

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ROLLER MACHINE AND METHOD FOR IMPREGNATING WEB MATERIAL

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4 Sheets-Sheet 1



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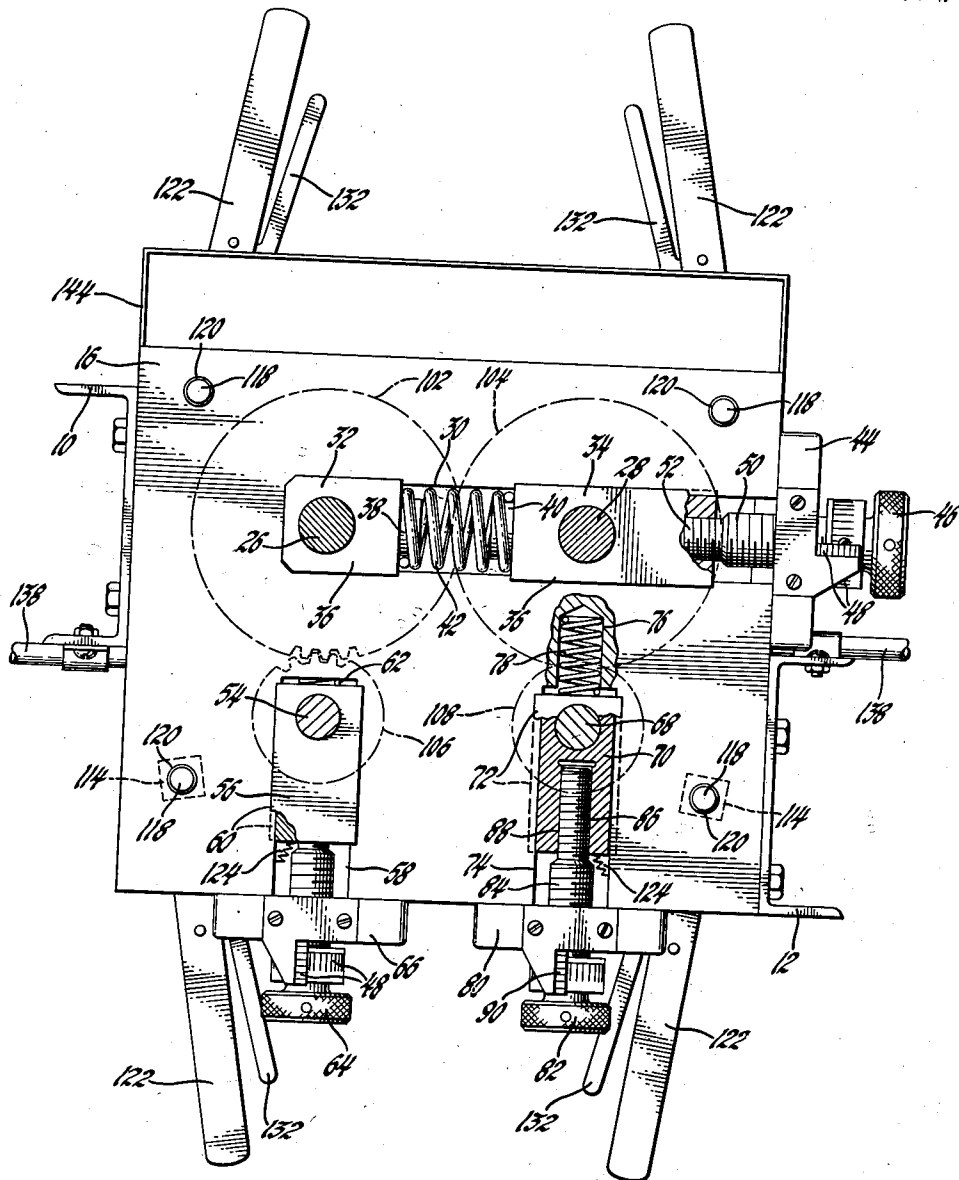


Fig. 2

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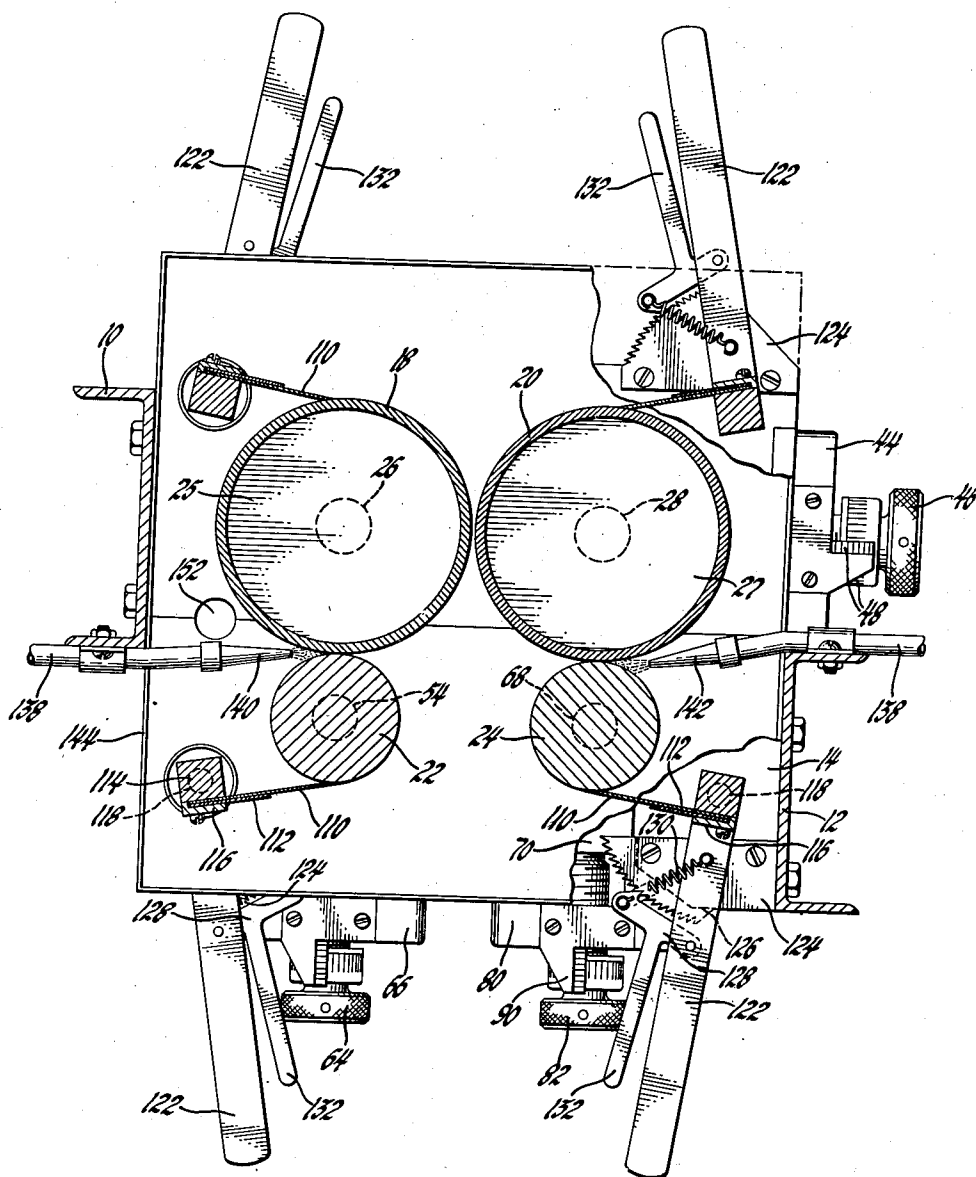


Fig. 3

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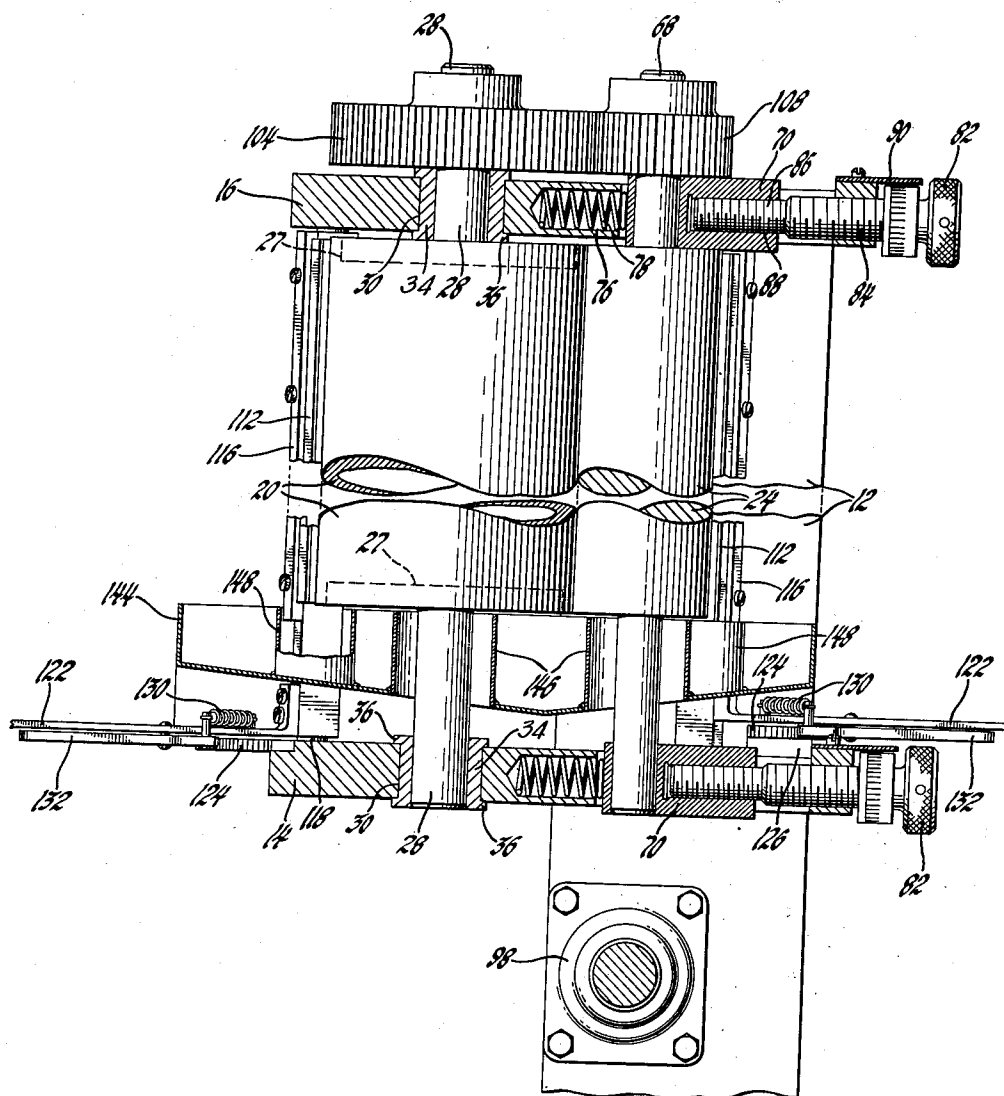


Fig. 4

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ROLLER MACHINE AND METHOD FOR IMPREGNATING WEB MATERIAL

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9 Claims. (Cl. 117—60)

This invention relates to impregnating and more particularly to a vertical roll impregnating and coating machine.

The invention is illustrated on a vertical coating or impregnating machine. The sheet material, such as cloth or paper, that is to be impregnated is guided in a vertical position between the two vertical applicator rolls which move the material and apply an even impregnation or coating of the required weight to each side of the material. The distance between these rollers is adjustable to provide for sheet materials of different thickness and to vary the thickness of the coating or the porosity and penetration of the impregnation. The impregnating material is applied by a supply nozzle to the trough between each applicator roll and its measuring roll. The measuring roll is adjustably mounted so that the space between it and the applicator roll allows the applicator roll to be coated with the correct thickness of coating compound to be applied to the sheet material. In order to apply a normal coating or an absorbed impregnation, the rolls are spaced apart approximately the thickness of the paper. However, in order to apply a partial impregnation for filter materials, the rolls are spaced apart about half the thickness of the sheet material and a reduced amount of coating compound is used. In order to prevent the formation of coating material deposits on both the applicator and measuring rolls a spring steel scraper knife engages each of the rolls to remove the coating compound once during each revolution of the rolls. A pan is located beneath all the rolls to return the excess coating compound to a sump.

The primary object of the invention is to provide in an impregnating machine an applicator roll to apply an impregnation of a restricted amount of compound evenly throughout the thickness of the sheet material.

Another object of the invention is to provide in a vertical impregnating machine having a pair of applicator rolls, a measuring roll for the applicator rolls to apply a measured thickness of coating compound and a scraper knife for each roll to maintain them in a clean condition.

Another object of the invention is to provide an impregnating machine roll which is cleaned, coated with a measured uniform thickness of coating compound and applies the compound to the sheet material in each revolution of the roll.

These and other objects of the invention will be more fully explained in the following drawings and specification.

Figure 1 shows a partial front elevation view of the coating machine with parts broken away to show the details.

Figure 2 is a section of Figure 1 on the line 2—2 in the direction of the arrows with parts broken away.

Figure 3 is a section of Figure 1 on the line 3—3 in the direction of the arrows with parts broken away.

Figure 4 is a partial section of Figure 1 on the line 4—4 in the direction of the arrows.

An impregnating machine made in accordance with the invention is illustrated in the drawings. The machine is supported on a frame consisting of the side members 10 and 12 and a lower horizontal plate 14 and an upper horizontal plate 16. Between these plates and in a vertical position the main applicator rolls 18 and 20 are mounted. The sheet material to be coated or impregnated is drawn between these rolls and the coating compound is applied at the same time. The coating compound is applied to the applicator roll 18 in a measured thickness by the measuring roll 22 which is ro-

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tably mounted in the upper and lower frame plates in substantial contact with the applicator roll 18. A second measuring roll 24 is vertically mounted between the frame plates 14 and 16 in close proximity to the applicator roll 20 in order to apply a measured amount of coating compound to the applicator roll 20.

The applicator roll 18 has end plates 25 which support the stub shafts 26 extending from each end of the roll 18, and the applicator roll 20 has end plates 27 which support the stub shafts 28 extending from each end of the roll 20. The stub shafts 26 and 28 are mounted in similar adjustable bearings located in both the lower plate 14 and the upper plate 16. The upper adjustable bearing is best illustrated in Figure 2. The plates 14 and 16 have transverse grooves 30 to receive the adjustable bearing blocks. Each groove has a bearing block 32 which supports the stub shaft 26 and is slidably mounted in the inner end of the groove. A block 34 which supports the shaft 28 is slidably mounted in the intermediate portion of groove 30. The blocks 34 have flanges 36 at each edge which engage a face of the plates to hold the blocks in the grooves 30 in the plates. The blocks 32 have similar flanges 36 which engage the opposed faces of each plate to hold the block in the groove 30. The blocks 32 have a cylindrical spring support 38 and the blocks 34 have a cylindrical spring support 40, both extending along the axis of the grooves 30 and facing each other. A coil spring 42 fits over the cylindrical spring supports 38 and 40 and provides a resilient separating means between the blocks. At the outer end of the groove 30 a transverse bridge 44 is secured to the edge of the plate 16 across the groove and supports in alignment with the central axis of the groove a micrometer screw 46 which moves the block 34 with respect to the block 32 and thus adjusts the space between the rolls 18 and 20. The micrometer screw 46 and the bridge 44 have suitable measuring indicia 48 to determine the distance between the rolls. The micrometer screw 46 has a large section 50 threadably engaging a bore in the bridge 44. A smaller section 52 of the micrometer screw 46 is threadably secured in a bore in the block 34. Due to the difference in pitch or the number of threads per inch of the threaded sections 52 and 50, the block 34 will be moved relative to the bridge 44 when the micrometer screw 46 is rotated. In one embodiment of the invention the micrometer screws have eight threads to the inch in the larger section 50 and ten threads to the inch in the smaller section 52. Thus when the screw 46 is turned there is differential movement between the block 34 and the bridge 44 to adjust the space between the rolls 18 and 20.

The measuring roll 22 has stub shafts 54 extending from each end. The shafts are journaled in adjustable bearing blocks 56 slidably mounted in a slot 58 in both the upper plate 16 (Figure 2) and the lower plate 14. The blocks 56 are held in the slot by flanges 60 which engage both faces of the plates 14 and 16. The coil spring 62 positioned in a recess in the end of slot 58 engages the block 56 to prevent movement between the thread connections of the micrometer screw 64 which is threaded into both the bridge 66 and the block 56. The measuring roll 24 has similar stub shafts 68 extending from both ends and supported in similar adjustable bearing supports mounted in the plates 14 and 16. The adjustable bearing supports are the same as adjustable bearing 56 and are shown more in detail in Figure 2. The adjustable bearing consists of a block 70 having a suitable bearing aperture for the shaft 68. The block 70 has flanges 72 at each edge which engage the opposite faces of the plates to slidably hold the block in the slot 74. At the inner end of the slot 74 a bore 76 is provided in the plate to form a seat for the coil spring 78 which engages one end of the bearing block 70. A bridge 80 is secured to the edge of the plates across the throat of the slot 74. A micrometer screw 82 has a large cylindrical threaded portion 84 threaded into an aperture in the bridge and a small cylindrical threaded portion 86 threaded into a bore 88 in one end of the bearing block 70. The threads on the large cylindrical portion 84 and the smaller portion 86 have a different pitch or a different number of threads to the inch, so that there is differential movement between

the bridge and the bearing block when the micrometer screw 82 is rotated. The micrometer screw 82 has suitable indicia means 90 so that the distance between the measuring roll 24 and the applicator roll 20 can be measured.

The stub shaft 54 on the measuring roll 22 is extended below the plate 14 and has a bevel gear 92 secured thereon. This gear meshes with bevel gear 94 on the main drive shaft 96. The drive shaft 96 may be suitably supported in bearings 98 secured to the side frame elements and is driven by any suitable power means. At the upper end of the machine all the stub shafts 26, 28, 54 and 68 extend above the upper plate 16. A gear 102 is secured to the stub shaft 26 and the gear 104 is secured to the stub shaft 28. These gears are intermeshed and have substantially the same root diameter as the diameter of the rolls 18 and 20. Thus the rolls 18 and 20 are driven in equivalent rolling contact or at the same peripheral speed. The stub shaft 54 has a gear 106 fixed thereto and the stub shaft 68 has a gear 108 fixed to it above the plate 16. The gears 106 and 108 have the same root diameter as the measuring rolls 22 and 24 respectively and mesh with the gears 102 and 104 respectively on their adjacent applicator roll shafts. Thus the two applicator rolls 18 and 20 are driven in equivalent rolling contact and the measuring rolls 22 and 24 are each driven in equivalent rolling contact or at the same peripheral speed with their respective applicator rolls.

A scraper knife 110 engages each of the rolls which have a hard surface and are preferably made of steel as illustrated to remove the coating compound from each of the rolls once during each revolution. Each of the scraper blades 110 is made of spring steel and has a reinforcing spring plate 112 and is secured to a vertical supporting bar 114 by a clamp 116. The vertical supporting bar 114 has cylindrical bearing portions 118 at each end which are mounted in the bearings 120 in the top plate 16 and the bottom plate 14. Just above the lower plate 14 a horizontal extending control arm 122 is secured to the support 114 for the knife 110. A ratchet sector 124 is secured to the lower plate 14 and spaced sufficiently above the plate by the block 126 to clear the adjusting screw and the adjustable bearing. The ratchet sector 124 has a series of ratchet teeth arranged on an arc concentric with the pivotal axis of bearing 120 for the scraper knife 110. Since the lower plate 14 extends further on the measuring roller side of the machine, the sector plate 124 on this side of the machine has a slightly different shape than the sector on the other side of the machine. This change in shape is merely to facilitate securing to the plate 14. The ratchet pawl 128 is pivotally mounted on the lever 122 and has a spring 130 continuously holding the pawl in contact with the ratchet sector 124. The pawl 128 has an integral handle 132 so that the pawl may be released by hand to release the knife from the roll. The operating handle 122 and the ratchet mechanism are the same for each of the scraper knives 110.

The supply system for the coating compound which is best shown in Figure 1 has the supply tank 134 for the compound. The compound is then pumped by the pump 136 to a supply conduit 138 which supplies the coating compound to the nozzle 140 and the nozzle 142. The nozzle 140 delivers the compound to the vertical trough between the applicator roll 18 and the measuring roll 22 at the top of the vertical rolls and the side where the rolls are approaching each other. The nozzle 142 similarly supplies the compound at the upper portion of rolls 20 and 24 where they approach each other. A pan 144 is positioned beneath the rolls and scraper knives to catch the excess coating compound. Since the pan must be apertured for the passage of the lower roll shafts, cylindrical wells or walls 146 surround each of the roll shafts and are secured to the base of the pan and extend to the top thereof. These walls 146, as best shown in Figure 4, are slightly larger than the shafts but are smaller than the rolls in order to catch any excess coating compound that may drip or be scraped off the rolls. To prevent the flow of compound through the apertures for the scraper knife supports, wells or cylindrical walls 148 are secured to the base of the pan around the aperture for these scraper blade supports. The bottom of pan 144 is pitched toward the center

so that the impregnating compound drains to the drain outlet conduit 152.

This machine is particularly designed to apply a resin impregnation to filter papers. The amount of resin applied to the paper and the porosity of the paper govern the final porosity and filter capacity and characteristics of the paper. Filter paper may be strengthened by impregnating the paper with between 35% resin with relation to the impregnated paper in weight and a fully saturated impregnation. Filter papers generally have a resin content between 30 and 60%. However, since the quality of the filter paper does not materially change between these limits, it is desirable to use only 35 to 40% resin or only sufficient resin to sufficiently strengthen the paper in order to save resin. The partial or unsaturated impregnation of filter paper has been effected in other methods by diluting the resin with an excess of organic solvent prior to impregnation and evaporating the solvent from the paper after impregnation. This process employing the solvent is not only expensive since the solvent is lost by evaporation but is dangerous since the solvent may be inflammable or toxic. Thus it was important to devise an impregnating or coating machine which could be regulated to apply a controlled amount of high solids content resin without excessive dilution to the paper. Since the pure resin is too viscous to handle in the normal commercial processes, the commercial grade high solids content resins contain only sufficient solvent to reduce the viscosity sufficiently to facilitate handling. In order to control the amount of resin applied in this machine careful attention is given to providing fine micromatic adjustments to position the various rolls with regard to each other. In this machine the continuous strip of sheet material enters in a vertical position through the large space between the measuring rollers 22 and 24 and then between the applicator rolls 18 and 20. The applicator rolls 18 and 20 both apply impregnating compound to the paper or sheet material and grip the sheet material sufficiently to draw the paper through the machine at the same speed as the rolls are rotated. This is important both to grip the paper and to force the compound into the fibers and is accomplished by finely adjusting the distance between the rolls in relation to the thickness of the paper. The paper must move at the same speed as the applicator rolls to have uniform impregnation. The distance between the applicator rolls is varied by simultaneously adjusting the top and bottom micrometer screws 46. This machine can apply a normal coating or a fully saturated impregnation to the sheet material when the rolls are set at approximately the same distance apart as the thickness of the paper. However, a sheet of material with a coating or impregnation of this type would not be sufficiently porous for use as a filter unless the resin is diluted. Filter materials such as filter paper are partially impregnated to increase the wet strength but to retain the porosity. This is done by applying a restricted amount of strengthening compound such as resin to the applicator rolls and setting the distance between the applicator rolls equal to half the thickness of the paper. The paper is squeezed between the steel applicator rolls and the resin material is forced into the fibers. Though the amount of resin applied to the applicator rolls is less than the amount necessary to saturate the filter material, it is forced into the material to impregnate the complete thickness of the sheet when the sheet is compressed. Due to the resiliency of the fibers of the sheet, it substantially returns to its original thickness when a solvent, such as an organic solvent, which does not destroy the resiliency of the paper is used. Solvents which destroyed the resiliency of the paper so that it did not expand after passing through the applicator rolls should not be used in this process. The resin content of the paper may vary between 30 and 60 per cent of the impregnated paper by weight. The paper retains its wet strength and resin is saved if only 35 to 40% resin is used. The fibers are coated to provide additional strength and the voids between the fibers are not filled to retain sufficient porosity for filtering by this impregnation.

When the impregnating and coating compound leaves the nozzles 140 and 142 and is deposited at the top between the applicator roll 18 and the measuring roll 22 and the applicator roll 20 and the measuring roll 24 respectively, the compound runs down in the bottom

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of the vertical trough between the rolls and provides a continuous pocket or supply of resin throughout the length of the rolls. By adjusting both the upper and lower micrometer screws the space between the measuring roll 22 and the applicator roll 18 may be accurately adjusted to apply a desired thickness or coating of resin on the applicator roll 18. A similar measuring roll 24 is adjusted with respect to applicator roll 20 by means of adjusting screw 82. The scrapers 110 clean each roll once during each revolution and thus prevent the accumulation of oxidized impregnating compound on the rolls, and thus enable continuous application of a uniform impregnating or coating deposit on the sheet material. The pawl 128 and ratchet 124 connected to the scraper handle 122 provide an adjustable stop means to resiliently hold the scraper knife against the rolls.

The above impregnating machine is illustrative of the invention. It will be appreciated that many modifications of this machine may be made within the scope of the invention as defined in the depending claims.

I claim:

1. In an impregnating machine, a pair of cooperating vertical applicator rolls, means to prevent slippage between said rolls, a measuring roll positioned vertically adjacent an applicator roll, means to prevent slippage between said applicator roll and said measuring roll, means to supply fluid to fill the pocket between said applicator roll and said measuring roll, means to adjust said measuring roll to apply a coating of the desired thickness to the applicator roll, and means to scrape the applicator and measuring rolls once during each revolution.

2. In an impregnating machine, a pair of cooperating vertical applicator rolls, means to prevent slippage between said rolls, a measuring roll positioned vertically adjacent an applicator roll, means to prevent slippage between said applicator roll and said measuring roll, means to supply fluid to fill the pocket between said applicator roll and said measuring roll, means to adjust said measuring roll to apply a coating of the desired thickness to the applicator roll, a spring steel scraper blade engaging each of the applicator rolls and the measuring rolls, said scraper blade being pivotally mounted, and adjustable stop means to hold said scraper in resilient engagement with said roll.

3. In an impregnating machine, an applicator roll vertically and rotatably mounted, a vertical measuring roll positioned adjacent and parallel to the applicator roll, adjustable bearing support means to rotatably support and to adjust the measuring roll with respect to the applicator roll, gear means between said applicator roll and said measuring roll to drive the applicator roll and measuring roll at the same peripheral speed, conduit means to supply the impregnating compound to the top of the trough between the applicator roll and the measuring roll on the side where the rolls approach each other, a scraper knife resiliently engaging each of said rolls, and a drain pan positioned beneath the rolls to catch the excess impregnating material.

4. In an impregnating machine, two parallel applicator rolls, adjustable bearing support means to rotatably support the applicator rolls in a vertical position to adjust the distance between the rolls, a measuring roll positioned adjacent and parallel to each applicator roll, adjustable bearing support means to rotatably support the measuring roll in a vertical position to adjust each measuring roll with respect to the adjacent applicator roll, conduit means to supply the impregnating compound to the top of the trough between the applicator roll and the adjacent measuring roll on the side where the rolls approach each other, a scraper knife resiliently engaging each of said rolls, and a drain pan positioned beneath the rolls to catch the excess impregnating material.

5. In an impregnating machine, two parallel applicator rolls, adjustable bearing support means to rotatably support the applicator rolls in a vertical position to adjust the distance between the rolls, gear means to drive said applicator rolls at the same peripheral speed, a measur-

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ing roll positioned adjacent and parallel to each applicator roll, adjustable bearing support means to rotatably support the measuring roll in a vertical position to adjust each measuring roll with respect to the adjacent applicator roll, gear means between each of said applicator rolls and said measuring rolls to drive the applicator and measuring roll at the same peripheral speed, conduit means to supply the impregnating compound to the top of the trough between the applicator roll and the adjacent measuring roll on the side where the rolls approach each other, and a scraper knife resiliently engaging each of said rolls.

6. In an impregnating machine, a pair of cooperating vertical applicator rolls, means to drive said applicator rolls, a measuring roll positioned vertically adjacent an applicator roll, means to drive said measuring roll, means to supply fluid to fill the pocket between said applicator roll and said measuring roll, means to adjust said measuring roll to apply a coating of the desired thickness to the applicator roll, and means to scrape the applicator and measuring rolls once during each revolution.

7. In an impregnating machine, a pair of cooperating applicator rolls, means to prevent slippage between said rolls, a measuring roll positioned parallel and adjacent an applicator roll, means to prevent slippage between said applicator roll and said measuring roll, means to supply fluid to fill the pocket between said applicator roll and said measuring roll, means to adjust said measuring roll to apply a coating of the desired thickness to the applicator roll, and means to scrape the applicator and measuring rolls once during each revolution.

8. In an impregnating machine, a pair of cooperating applicator rolls, means to drive said applicator rolls, a measuring roll positioned parallel and adjacent an applicator roll, means to drive said measuring roll, means to supply fluid to fill the pocket between said applicator roll and said measuring roll, means to adjust said measuring roll to apply a coating of the desired thickness to the applicator roll, and means to scrape the applicator and measuring rolls once during each revolution.

9. A method of impregnating sheet material having a normal thickness comprising the steps of applying a coating having a measured uniform thickness to provide an amount of impregnating compound which is insufficient to saturate the sheet material in its normal condition and thickness to an applicator, compressing the dry sheet material by contact with the coated applicator to a uniformly reduced thickness less than its normal thickness, simultaneously transferring the entire amount of the coating on the applicator directly to the dry sheet material by direct contact of the uniform thickness coating in its original position on the applicator with the dry sheet material, simultaneously forcing the impregnating compound transferred to the sheet material into the compressed sheet material of reduced thickness to uniformly impregnate the sheet material substantially throughout its reduced thickness, and permitting the sheet material to expand to substantially its normal thickness to provide a sheet material partially impregnated substantially uniformly through its normal thickness and having voids between the coated fibers.

References Cited in the file of this patent

UNITED STATES PATENTS

890,221	Davidson et al. -----	June 9, 1908
1,255,245	Taylor -----	Feb. 5, 1918
1,317,340	Wiegand et al. -----	Sept. 30, 1919
2,094,111	Willis -----	Sept. 28, 1937
2,117,491	McConnell -----	May 17, 1938
2,119,480	Codwise -----	May 31, 1938
2,133,933	Daley -----	Oct. 18, 1938
2,274,792	Jennings et al. -----	Mar. 3, 1942
2,326,429	Black et al. -----	Aug. 10, 1943
2,406,470	Maxim et al. -----	Aug. 27, 1946
2,409,629	Heritage -----	Oct. 22, 1946
2,474,201	Raymond et al. -----	June 21, 1949