Dec. 19, 1944. R. W. BENDER 2,365,621

APPARATUS FOR CONTROLLING THE COATING OF PAPER

Filed Aug. 3, 1940 3 Sheets-Sheet 1

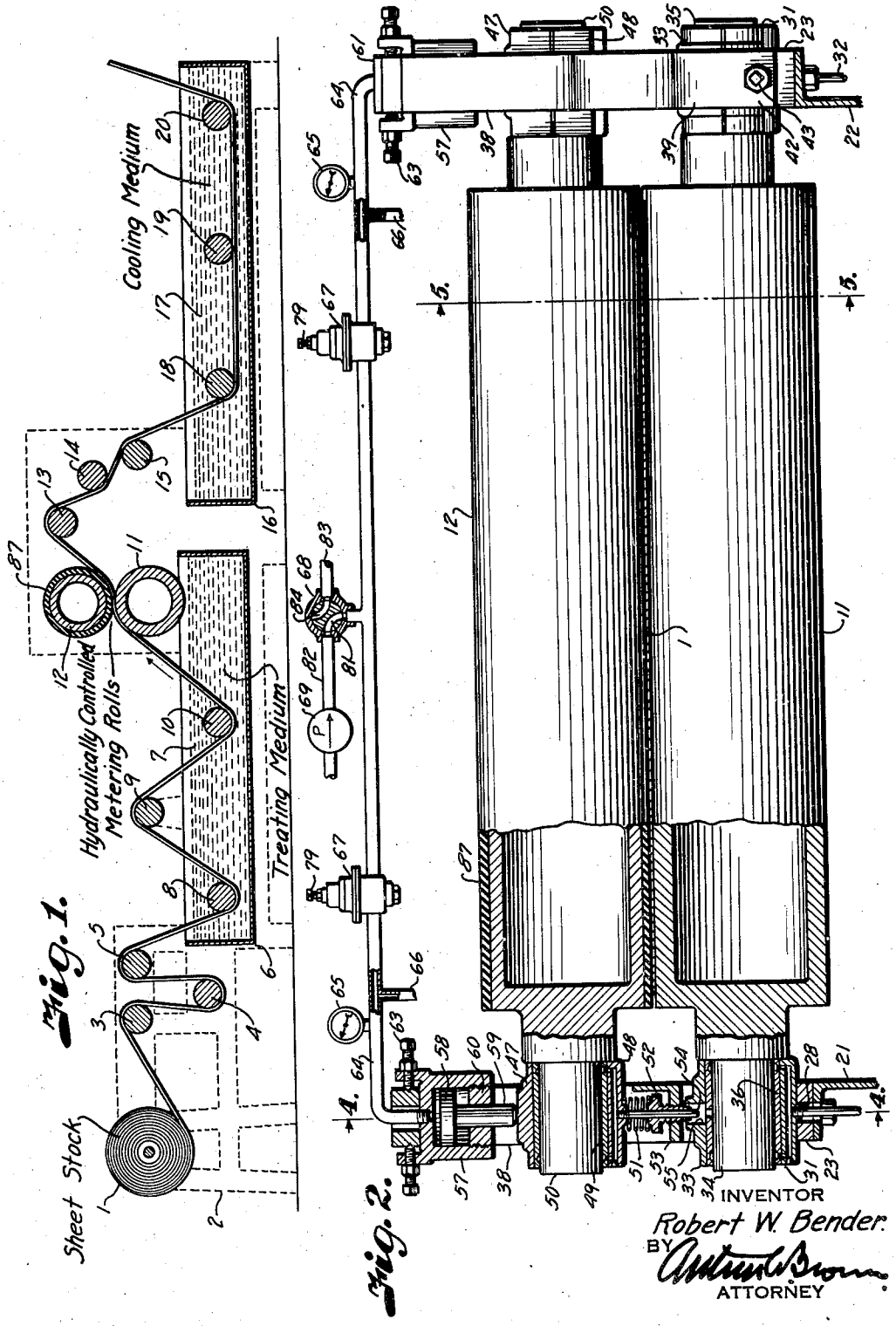


Fig. 1.

Fig. 2.

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Fig. 3.

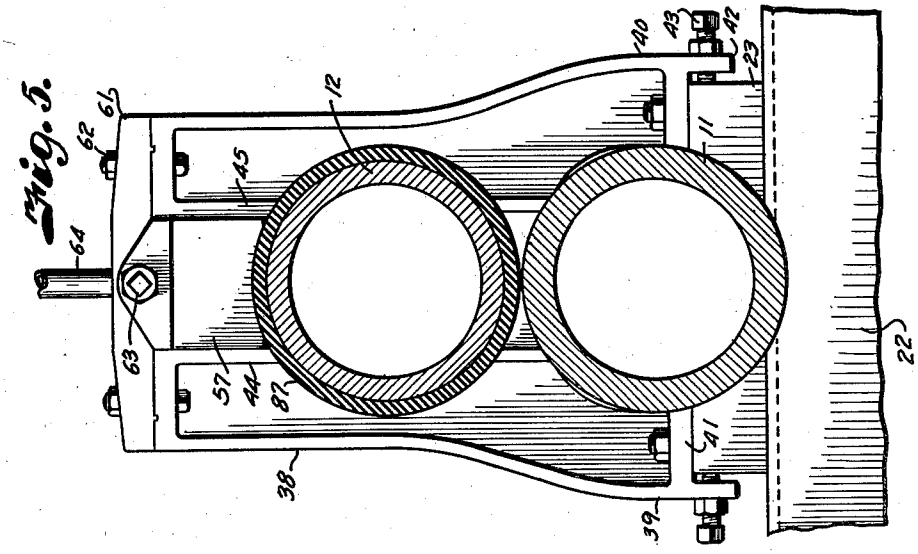


Fig. 4.

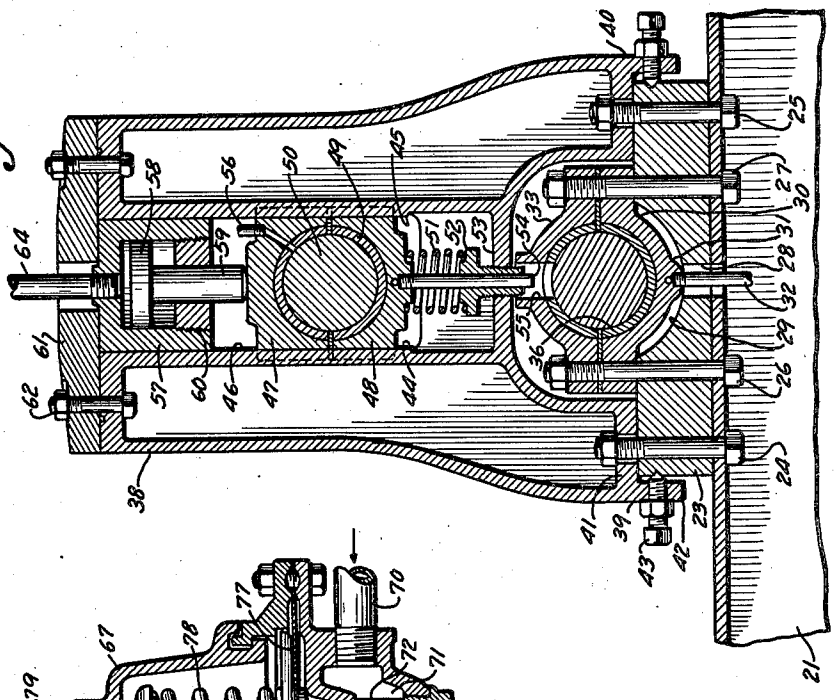
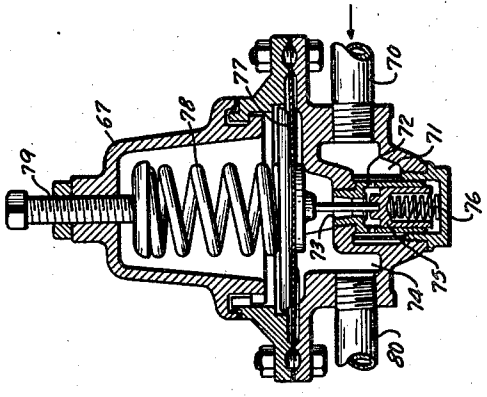


Fig. 2.



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Filed Aug. 3, 1940 3 Sheets-Sheet 3

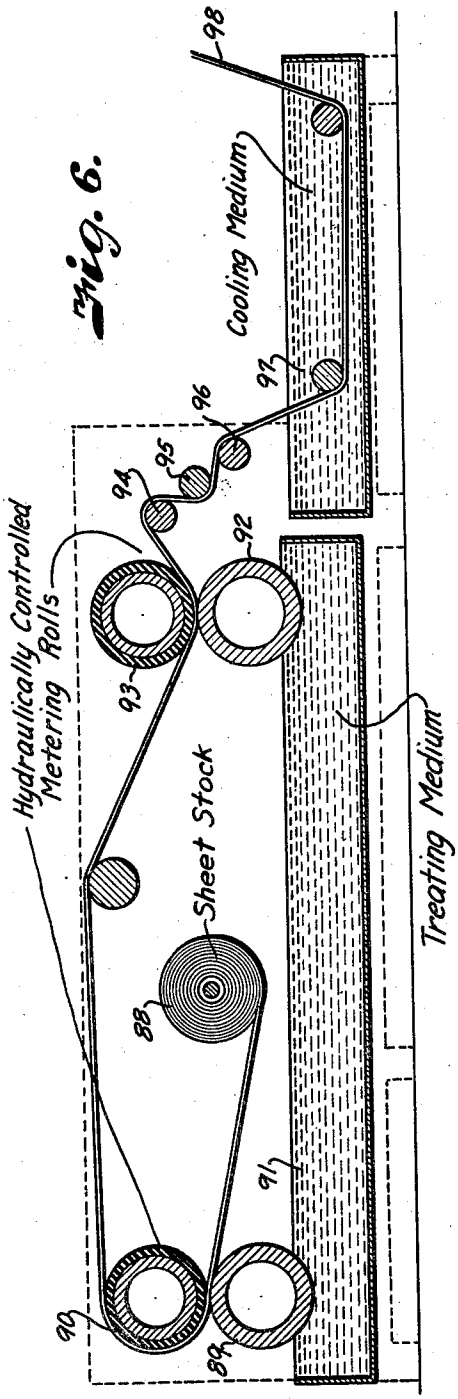


Fig. 6.

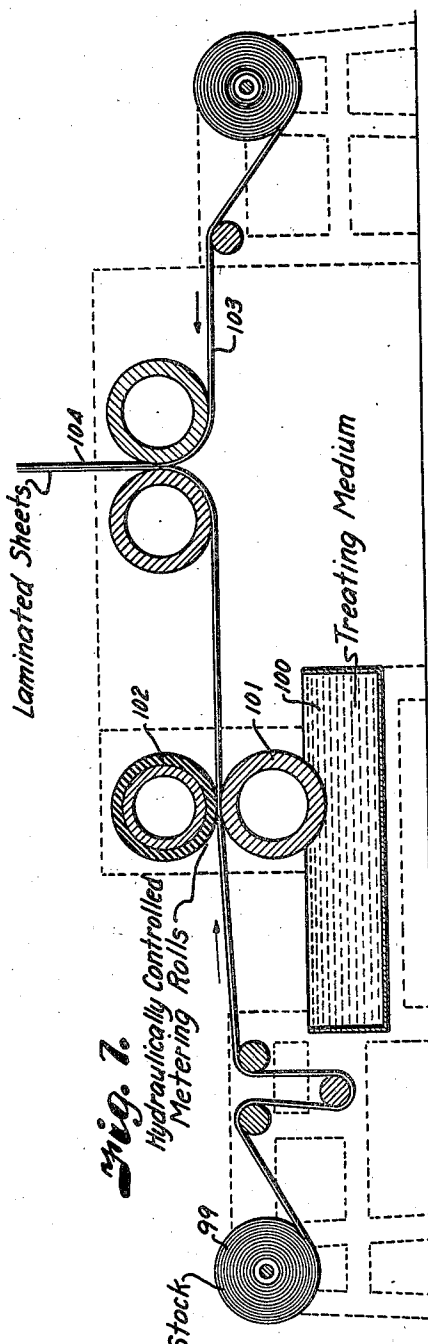


Fig. 7.

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UNITED STATES PATENT OFFICE

2,365,621

APPARATUS FOR CONTROLLING THE COATING OF PAPER

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Application August 3, 1940, Serial No. 350,851

5 Claims. (Cl. 91—31)

This invention relates to an apparatus for controlling the coating and/or impregnating of paper and like sheets with a coating medium such as wax, lacquer, synthetic resin, glucose, and other adhesives, or any fluid suitable as a coating material and more particularly to an apparatus for regulating pressure on rolls through which coating medium is metered for application to sheets, the principal objects of the present invention being to provide a convenient, relatively economical, and highly efficient apparatus of such a character.

In treating paper stock to produce coated paper it is very important that the coating medium applied to the paper be evenly spread over the entire surface of the paper and sometimes uniformly impregnated into the paper and that such coating medium be of a predetermined uniform quantity. This is for the reason that paper, for instance, is coated for a number of very definite purposes, in each of which it is usually customary for the manufacturer to sell his product by the pound to a user whose requirements are measured in area. For this reason it has become customary for the manufacturer to sell his coated product with strict guarantees on the percentages of coating to finished product weights, and variations resulting from present inefficient means of regulating the quantities of coating materials that are applied have resulted in a great deal of unnecessary expense to both the manufacturers and the consumers.

As an example, where papers are coated with wax to be used for an outer wrap for food items it has been found that a definite minimum quantity of wax on the surfaces of the paper, not only protects the wrapped item from loss of moisture through the wrapper, but is an excellent sealing medium when subjected to a certain amount of heat and pressure for a certain length of time.

In conventional processes, due to the impossibility of present equipment to maintain a uniformly minimum application of the coating material, the manufacturer is compelled to furnish sufficient wax on his entire product so that with a maximum variation of his coating it will still all have sufficient material applied to effect a proper seal in the thinnest place.

Other objects of the present invention are, therefore, to accurately regulate predetermined quantities of coating materials by the application of fluid pressure to rolls between which the coating medium is metered on and to sheets where it is desired that all of the coating material be entirely impregnated in the sheet from either side or from both sides; where it is desired to impregnate the sheet and leave a coating on one side only; to coat a sheet on one side only; to coat a sheet with a predetermined quantity of coating material on one side, and a different predetermined quantity on the opposite side of the sheet; to provide an improved pressure roller; to provide a lubricating arrangement for the bearings of the rollers; to provide for adjusting the rollers relative to each other; to provide for dissipating or relieving pressure from the rollers; to provide improved elements in the apparatus, together with novel arrangements of such elements, in an apparatus of the character and for the purposes noted.

In accomplishing these and other objects of the present invention I have provided improved details of structure, preferred forms and arrangements of apparatus by which various applications of coatings may be carried out being illustrated in the accompanying drawings wherein:

Fig. 1 is a diagrammatic view of an apparatus embodying the present invention and showing the application of treating medium to both sides of sheet stock such as paper.

Fig. 2 is a side elevational view of hydraulically controlled pressure rollers, parts thereof being shown in vertical section to more clearly illustrate the construction thereof.

Fig. 3 is a detail vertical cross-sectional view of a pressure regulator for controlling and maintaining hydraulic pressure applied to the pressure rollers.

Fig. 4 is a detail vertical cross-section through the pressure rollers shown in Fig. 2 substantially on the line 4—4 Fig. 2, and particularly illustrating the bearings and pressure regulating devices therefor.

Fig. 5 is a detail vertical cross-section through the pressure rollers on the line 5—5, Fig. 2, particularly illustrating the arrangement of a covering for one of the rollers.

Fig. 6 is a diagrammatic view of apparatus showing the application of treating medium to both sides of sheet stock and an additional thickness of medium to one side of the stock.

Fig. 7 is a diagrammatic view of apparatus showing the application of treating medium to one side of the sheet stock and the bonding of the treated sheet with another sheet to form a laminated sheet structure.

Referring more in detail to the drawings:

1, Fig. 1, designates a roll of suitable sheet stock such as paper, for example, which may, if desired, be printed, wetted, tempered, and/or precalendered previous to the treatment as presently described.

The roll of sheet stock is arranged on a suitable support indicated by dotted lines at 2, on which support may also be arranged a series of rollers 3, 4, and 5 over, under and over which, respectively, the stock may travel.

6 designates a tank in which fluid 7 is carried for treating the stock, as it travels therethrough, as by passing under a roller 8, over a roller 9 and under a roller 10 arranged in and/or adjacent the tank 6. The fluid 7 may be a suitable material such as melted wax or paraffin, or lacquer, synthetic resin, glucose or other adhesives, or any other suitable material which may be employed for impregnating the fibres of the stock and/or coating the entire surface thereof, or one side thereof.

From the coating material bath 7, the stock 1 is preferably passed between pressure rollers 11 and 12, and then, if wax is used as coating material, preferably over, under and over guide or polishing rollers 13, 14, and 15, respectively, into a tank 16 that contains a wax solidifying solution 17, such as chilled water. If lacquer or the like is used as a coating material the stock may go directly to smoothing or guide rolls for rewinding on a storage roll.

In the present instance, stock 1 may be passed under a suitable number of rollers 18, 19 and 20, in the tank 16, after which it may be directed from the tank 16 to smoothing or guide rollers for rewinding on a storage roll, not shown.

As the stock 1 passes between the rollers 11 and 12 those rollers are arranged to meter the treating material and squeeze off excess material to cause such material to drain back into the body of the coating solution. At this stage of the process, accuracy in providing a constant pressure is important for reasons above pointed out.

In order to obtain the requisite accuracy in application of constant pressure to meter or squeeze off excess in amounts of treating or coating material and leave exact predetermined quantities of coating material in, and/or on the paper stock and as a coating on the paper stock, the rollers 11 and 12, Fig. 1, are preferably supported, arranged, and operated relative to each other in the following manner:

21 and 22, Fig. 2, designate suitable primary supports, such as angle iron sills on each of which substantially duplicate aligned blocks 23, Fig. 4, are respectively mounted.

The blocks 23 each have spaced, vertically arranged apertures for receiving fastening devices, such as the bolts 24, 25, 26 and 27. Each block 23 is also provided with an aperture 28 arranged substantially centrally relative to a cut-out bearing seat 29 on the upper face of the block.

30 designates the lower half of a bearing having lateral flanges seating on the upper face of each block and having a body portion 31 depending into the seat 29 and from which a lubricant outlet 32 depends, the outlet 32 extending downwardly through the aperture 28 in each block and sill, for suitable disposition of lubricant issuing from the outlet.

33 designates the upper half of the bearing 30, which upper bearing portion has flanges mating with the flanges of the lower bearing portion in such a manner that the fastening devices 26 and 27 may secure the same together.

Trunnions 34 and 35, Fig. 2, of the roller 11 are mounted in bushings 36, arranged in the bearings 30—33. It has been found preferable to form the roller 11 of polished chilled iron and the roller is also preferably of substantially hollow structure as shown.

38, Fig. 4, designates one of a duplicate pair of standards each having diverging legs 39 and 40 which form a yoke adapted to straddle the bearing 30—33 in such a manner that the bases 41 of the legs seat on the blocks 23.

The legs 41 have depending flanges 42 on their outer lower ends provided with apertures for receiving fastening devices, such as set screws, 43, by which the standards 38 are held in desired position relative to the bearings for the roller 11. The bases of the legs are also provided with apertures by which the fastening devices 24 and 25 may hold the standards 38 relative to the sills supporting them.

The standards each comprise spaced channels 44 and 45 that form a guide 46 therebetween for a bearing element consisting of upper and lower bearing portions 47 and 48 which have cooperative bearing seats that receive a cylindrical bushing 49 in which trunnions 50 at each end of the roller 12 are mounted. The lower bearing portion 48 of the bearing in each standard 38 rests on the upper end of a spring 51, preferably of considerably greater power than is required to lift the roller 12. The lower end of the spring seats on an adjusting screw 52, which has a threaded lower end engaged in a threaded aperture in a cross member 53 of the standards 38 above the bearing 30—33.

A lubricant outlet 54 is mounted in a bore in the screw 52 and communicates with the bearing 47—48 in such a manner as to drain off lubricant of that bearing and transfer it through an opening 55 in the bearing member 33 to each trunnion of the roller 11 for ultimate exhaust through the outlets 32. The upper half of each bearing 47—48 has a lubricant inlet 56 which communicates with the bearing seats to supply lubricant to the trunnions of the roller 12.

It has been found highly desirable to apply fluid, such as hydraulic, pressure on the roller 12 relative to the roller 11, in order to provide constant and uniform pressures. A piston cylinder 57 is thus preferably mounted in each guide 46 of the standards 38, the piston cylinders having a piston 58 therein, which piston has a rod 59 engageable in the present instance, with the upper face of the upper portion of the bearing 47—48. The piston cylinders may be suitably closed at their lower ends, as at 60.

61 designates a cap structure for each standard engaged with the upper ends of the arms of the standards 38, as by fastening devices 62, the cap members forming a support against upward movement of the piston cylinders 57, which may be adjusted longitudinally relative to the rollers, as by the set screws 63.

64 designates a pressure line opening into the

piston cylinders 57 above the pistons 58 for applying hydraulic pressure to the pistons to exert downward pressure on the trunnions of the roller 12 relative to the roller 11 to meter material passing between the rollers and squeeze any excess in treating medium from the stock 1 as it passes between the rollers.

A pressure gauge 65 is mounted in the line 64 adjacent the piston cylinder of each standard, and a bleeder line 66 opens from the line on the piston cylinder side of a pressure regulator 67 that is interposed between each piston cylinder and a valve 68 that controls admission of fluid pressure medium from a pump 69 into the line 64.

The pressure regulators 67 are each of suitable construction and for example of the type illustrated in Fig. 3 in which an inlet line 70 opens into a high pressure area 71, the fluid pressure medium entering a port 72 and passing through a port 73 into a low pressure area 74. The size of the port 73 is controlled by a valve 75 seating on a spring 76 and having a stem engaged with a diaphragm 77 which acts against a spring 78 that may be adjusted in a suitable manner as indicated at 79.

Fluid pressure medium issues from the regulator outlet 80 under control of the valve 75 and spring controlled diaphragm for passage into the piston cylinders to actuate the pistons and force the roller 12 downwardly.

The regulators serve the purpose of providing for differences in pressure applied to opposite ends of the roller 12, if and when desired.

The valve 68 is preferably of 3-way type in which the port 81 normally connects the line 64 with a line 82 to the pump 69. It is apparent that the valve may be turned to communicate the outlet line 83 with the line 64 by turning the valve to communicate the port 84 with line 64 to relieve the pistons, cylinders and roller 12 of pressure.

The pump 69 may be of suitable type and a source of fluid supply, not shown, may be provided for the pump, together with a sump, not shown, for receiving and/or circulating fluid pressure medium from the line 64 through the outlet 83 and if desired back to the pump.

While the amount of treating material to be applied to the sheet stock may be very accurately predetermined and the squeezing or metering action of the roller 12 relative to the roller 11 may also be very accurately predetermined, the constant predetermined pressures applied to the treated paper may be relatively large and in order to avoid injuring the stock it has been found desirable to coat the roller 12 with a rubber or similar cover 87.

In operating the apparatus for carrying out this invention, adjustments are made to allow spacing the rollers relative to each other by manipulation of the adjusting devices 79 on the pressure regulators 67, the adjustments of which, when pressure fluid medium is passed therethrough, being indicated on the gauges 65.

When, therefore, sheet stock is applied to the treating bath for coating and/or impregnating the stock and then to and between the rollers 11 and 12 for metering or controlling the amount of material retained in and on the paper, the pump 69 is actuated and fluid pressure medium passes into the line 64. The pressure medium passes through the regulators into the piston cylinders above the pistons therein to force the piston rods 59 downwardly against upward pressure of the springs 51 into engagement with the upper portion of the bearing 47—48 to cause a uniform constant pressure on opposite ends of the roller 12 relative to roller 11, the uniformity of constant pressure being determined and maintained by the regulators. The bleeders 66 cause flow through the line to keep the regulators in operation.

As it becomes necessary, lubricant may be applied to the lubricant inlets 56 of the bearings 47—48 which lubricant passes to the lower roller bearing portions through the outlet 54 into the bearings 30—33 for the lower roller 11, and from the lower roller bearings through the outlets 28 for suitable disposition.

After a sheet of stock has been treated and squeezed in the manner described, valve 68 may be turned to relieve pressure on the rollers, whereupon the springs 51 act to separate the rollers to provide for inserting another sheet of coated, treated paper between the rollers for carrying out this invention in connection with additional stock.

In Fig. 6, an apparatus is shown by which sheet stock 88 may be treated on both sides as by the apparatus shown in Fig. 1, one side of the stock being provided with an additional coating or treatment.

In this instance, the stock is preferably passed between rollers 89 and 90, the roller 89 being partly immersed in a bath 91 of suitable treating material in such a manner as to apply a coating of material to one side of the stock. The rollers 89 and 90 are similar in character to the rollers 11 and 12 shown in Fig. 2, are operated and controlled by fluid pressure and meter the treating material relative to the treated stock to coat and/or impregnate the stock with predetermined quantities of treating material. From the rollers 89 and 90, the stock is passed between rollers 92 and 93. The rollers 92 and 93 are similar to the rollers 11—12 and 89—90 in construction, operation and function, and are adjusted relative to the stock passing therethrough in such a manner as to provide for coating and/or impregnating the stock with a different amount of material from the rollers 89—90 to vary the amount of material in or on opposite sides of the stock.

The roller 92, in this instance, is arranged to depend into the treating material bath 91 for picking up material and applying it to one side of the stock 88 to provide a thick coating thereon or impregnation therein depending upon the pressure applied to the treated stock by fluid control of relative pressure between the rollers.

From the rollers 92 and 93, the stock may pass over polishing or guide rollers 94, 95 and 96 into a suitable treating medium bath 97, such as chilled water, for hardening or finishing the treatment of the sheet stock. The finished stock may then be directed, as at 98, toward winding or storage facilities, not shown.

In Fig. 7, 99 designates a roll of sheet stock to be treated with suitable material 100, preferably on only one side thereof. In this instance, the stock preferably passes from the roll to and between hydraulically operated and controlled rollers 101 and 102, the former preferably depending into the supply of treating material to pick up the same and apply it to the sheet stock; the application of hydraulic pressure to the rollers and material treated stock providing for metering the material on and into the stock to coat and/or impregnate the stock with material

to a degree depending upon relative hydraulically controlled pressures between the rollers.

If desired, the sheet stock 99, when coated on one side, may be employed to engage another sheet 103 to form a laminated sheet structure 104, substantially in the manner shown, which may be wound and stored for future suitable use.

It is apparent, therefore, that by providing a fluid control, to effect constant pressure in the manner described, a uniform treating, impregnating and/or coating medium of any suitable material is applied to sheet stock such as paper in which the body, one side, or the entire surface is treated, covered, or impregnated with a desired amount of material for many purposes.

It is also apparent that a convenient, relatively economical and highly efficient apparatus for treating sheet stock with suitable material is provided by the present invention.

What I claim and desire to secure by Letters Patent is:

1. In an apparatus of the character described comprising means for applying a wax coating to paper stock, a pair of rollers adapted to have the wax coated stock passed therebetween, and means for applying hydraulic pressure to one of said rollers relative to the other for forcing wax into the fibres of the paper and for metering the coating of the wax on said stock including a pair of standards, aligned bearings in said standards supporting the ends of said rollers, and means interposed between said bearings for normally resiliently separating the same.

2. In an apparatus of the character described, a pair of rollers, and means for applying hydraulic pressure to one of said rollers relative to the other including a pair of standards, aligned bearings in said standards supporting the ends of said rollers, means interposed between said bearings for normally resiliently separating the same, piston cylinders mounted on said standards having pistons engageable with the ends of one of said rollers for exerting forces against said roller of greater strength than the resilient means in the direction of the other roller, fluid pressure lines leading to said cylinders, and means for feeding said fluid pressure lines.

3. In an apparatus of the character described comprising means for applying a coating and/or impregnating medium to paper, a pair of rollers adapted to have the coated paper passed therebetween, and means for applying pressure to one of said rollers relative to the other for fixing predetermined portions of the coating medium in and on said coated paper including a pair of standards, aligned bearings in said standards supporting the ends of said rollers, piston cylinders mounted on said standards for exerting forces against said roller in the direction of the other roller, a fluid pressure line leading to said cylinders, means for feeding said fluid pressure line with sufficient pressure medium to exert suitable forces and a pressure regulator in said line between the feed line and piston cylinders.

4. In an apparatus of the character described comprising means for applying a coating and/or impregnating medium to paper, a pair of rollers adapted to have the coated paper passed therebetween, and means for applying pressure to one of said rollers relative to the other for fixing predetermined portions of the coating medium in and on said coated paper including a pair of standards, aligned bearings in said standards supporting the ends of said rollers, piston cylinders mounted on said standards having pistons engageable with the ends of one of said rollers for exerting forces against said roller in the direction of the other roller, a fluid pressure line leading to said cylinders, means for feeding said fluid pressure line, with sufficient pressure medium to exert suitable forces, and a valve for controlling supply and exhaust from said line relative to said line feeding means.

5. An apparatus of the character described comprising means for applying a coating and/or impregnating medium to paper including a pair of rollers adapted to have the paper passed therebetween, means for applying pressure to one of said rollers relative to the other for fixing predetermined portions of the coating medium in and on said paper including a pair of standards, aligned bearings in said standards supporting the ends of said rollers, piston cylinders mounted on said standards having pistons engageable with the ends of one of said rollers for exerting forces against said roller in the direction of the other roller, a fluid pressure line leading to said cylinders, means for feeding said fluid pressure line with sufficient pressure medium to exert suitable forces, and a valve for controlling supply and exhaust from said line relative to said line feeding means.

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