July 12, 1932. VAN HAMM WILSHIRE 1,866,689

METHOD AND APPARATUS FOR WAXING PAPER

Filed June 16, 1927 3 Sheets-Sheet 1

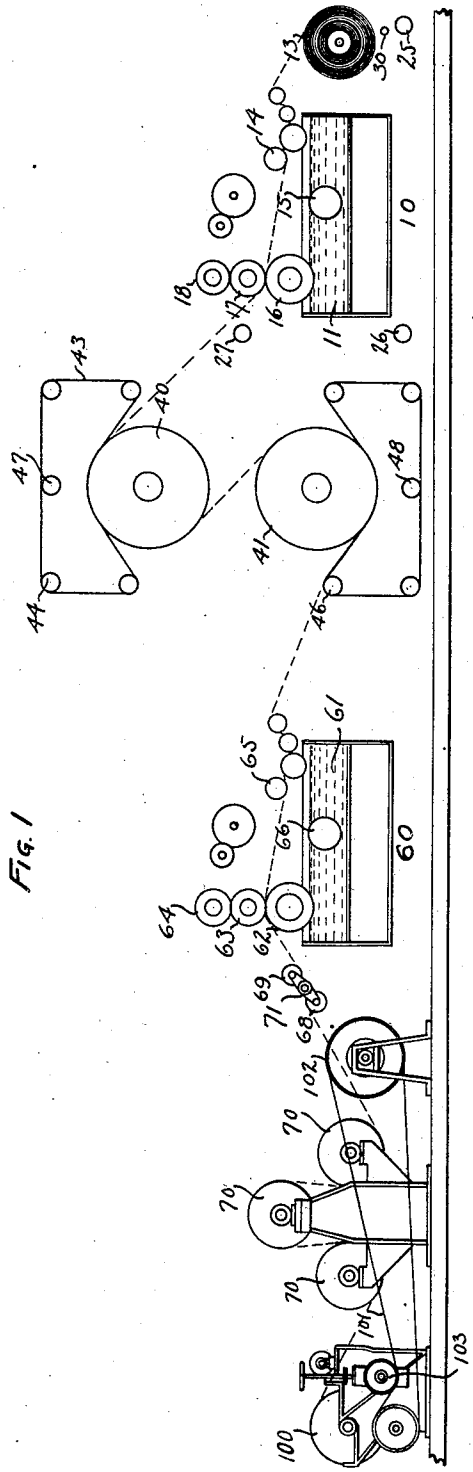


FIG. 1

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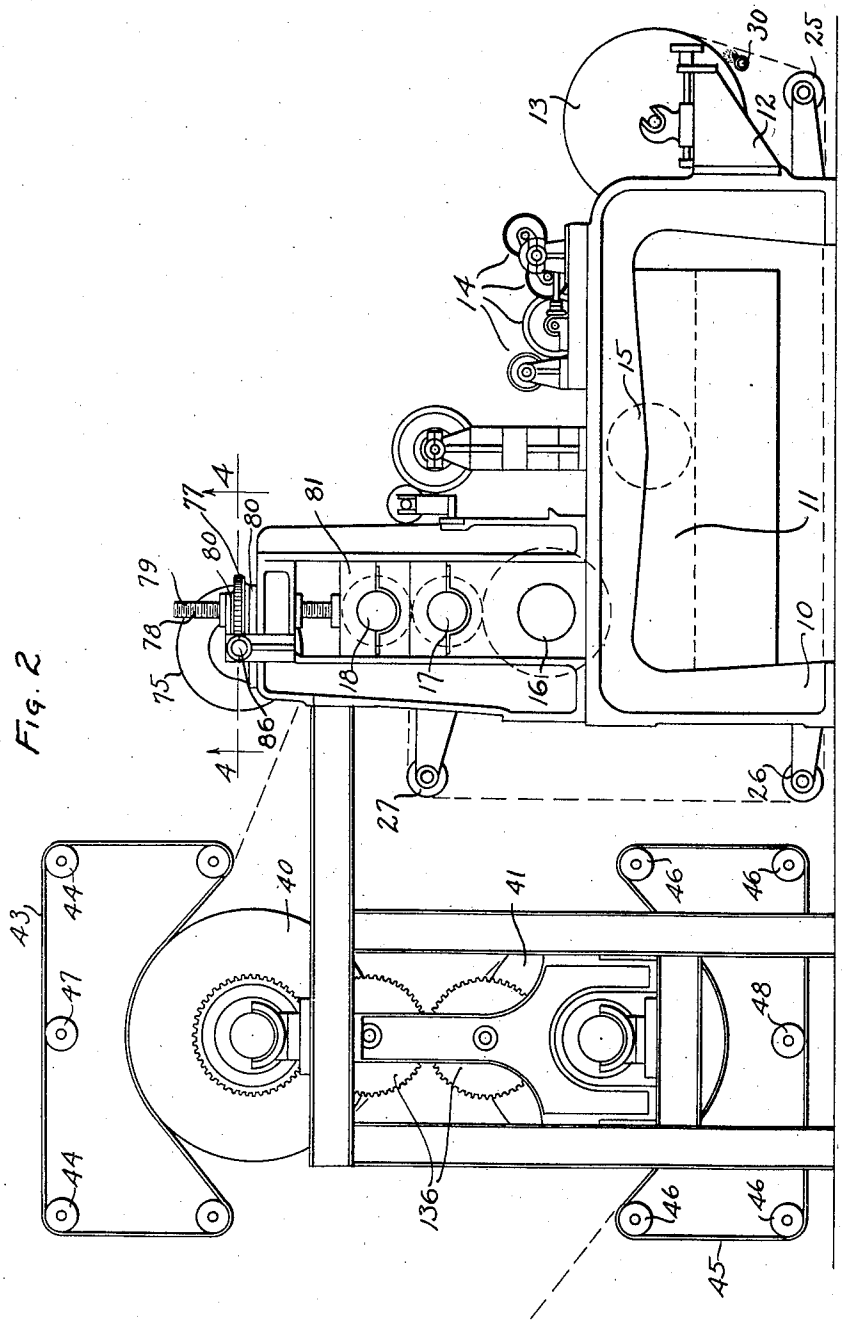


Fig. 2

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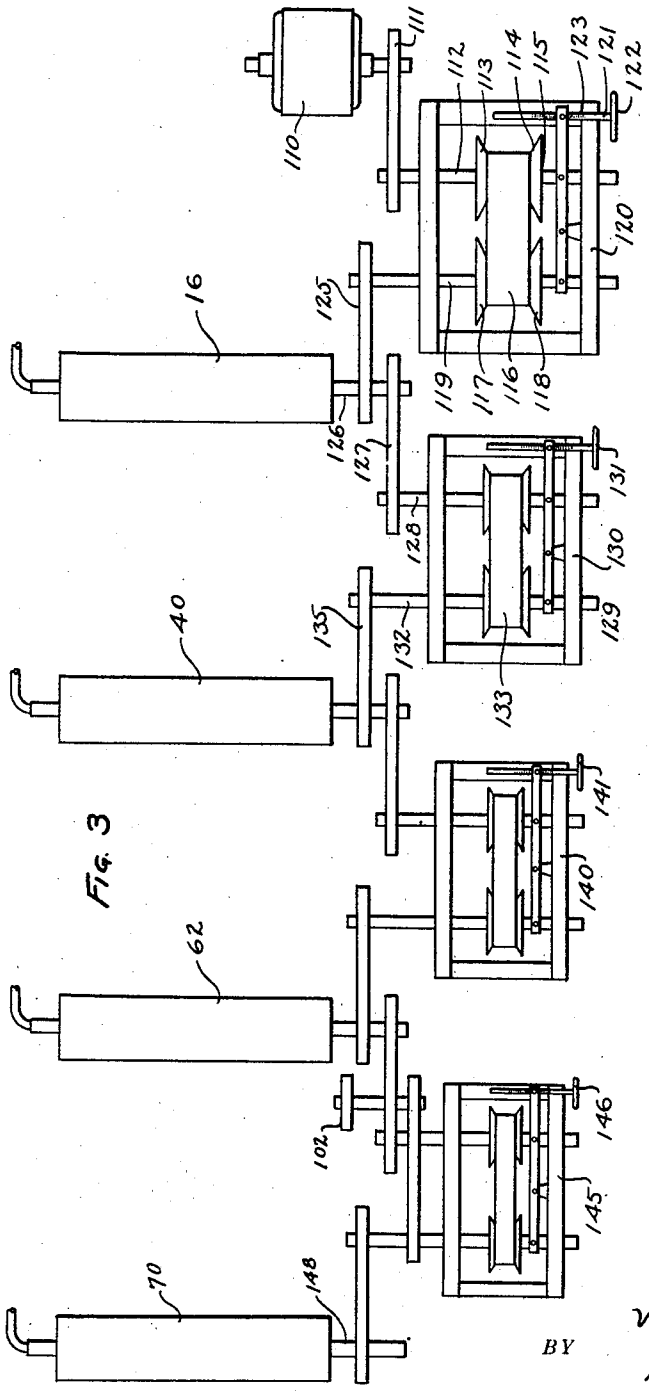


Fig. 3

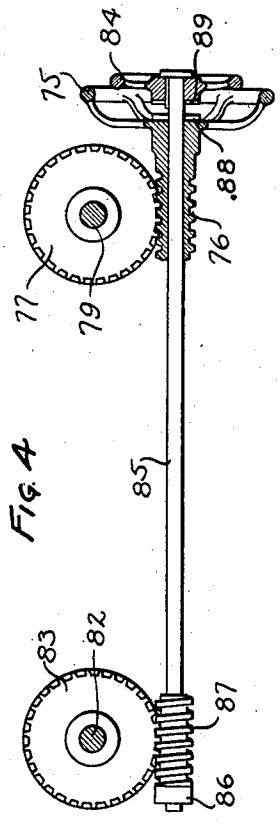


Fig. 4

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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR WAXING PAPER

Application filed June 16, 1927. Serial No. 199,353.

This invention relates to paper coating and one object of the invention is to provide a process by which the paper may be treated as it travels continuously from one step to the next, so as to be supplied with a surface layer of coating material which is thereafter caused to be impregnated into the paper, after which a second surface coating is applied on the impregnated paper so as to obtain a transparent and waterproof sheet, of superior characteristics.

Another object of the invention is to provide an apparatus for effecting coating of paper, utilizing such process.

Another object of the invention is to provide apparatus of this character having guide means for conducting the paper so that it may be caused to travel in either direction through the coating rolls to cause either one side or the other to be coated as desired.

A further object of the invention relates to the supply of moisture to both sides of the paper in a novel manner before it is subjected to the waxing operation.

Still further objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings.

In the drawings Fig. 1 is a diagrammatic view in elevation of the apparatus showing the general scheme of operation;

Fig. 2 is a view on an enlarged scale in side elevation of the first waxing tank and its heated rollers;

Fig. 3 is a diagrammatic view showing the adjustable drive mechanism by which the various rolls are rotated; and

Fig. 4 is a transverse section on the line 4—4 of Fig. 2.

Referring to the drawings by reference numerals and more particularly to Fig. 2 a machine standard designated generally 10 is shown as supporting a tank or container 11 in which the melted wax is contained. Suitable heating means, not shown, is provided for maintaining the temperature of the wax at such a temperature as to be properly applied to the paper. Adjacent one end of the standard is a reel support or bracket 12 on which may be mounted a roll of paper, 13, which may supply the paper to the waxing process. Supported on the top of the standard 10 are a number of guide and tensioning rollers, as shown at 14. An immersion roller 15 is also provided, under which the paper may be passed. The paper may be supplied from the reel 13 through the rollers 14 directly to the roll 16 or may if desired be first dipped into the wax before it is passed to this roll by passing under the immersion roll 15. In either event the paper as so coated is thereafter subjected to the additional steps hereinafter described. When passed under the roll 15, the paper of course receives a greater quantity of wax. The roll 16 is so located as to dip into the melted wax in the tank 11 and directly above it is mounted a roll 17 which may if desired be heated internally as by means of the customary steam supply lines so as to have its surface maintained at a predetermined temperature calculated to maintain the wax coating sufficiently warm until the paper reaches the roll 40. These two rolls 16 and 17 are relatively adjustable so that upper roll 17 may act as a squeeze roll while the lower roll 16 functions to transfer wax to the surface of the paper. A top squeeze roll 18 is located above the intermediate roll 17 and the proper pressure may be maintained between the various rolls by means of a suitable pressure adjusting device.

The regulating device by which the pressure exerted between the rolls 17 and 18 and between the rolls 16 and 17 is controlled, as shown in Figs. 2 and 4, comprises a handwheel 75, provided on a short worm shaft 76 mounted in suitable fixed bearings, not shown but of any suitable and conventional character. This worm shaft 76 engages a wormwheel 77 which is provided with internal threads engaging the threads 78 on a vertical shaft 79 and held against axial movement by the upper and lower bearing members 80.

The shaft 79 is restrained against rotational movements and is attached at its lower end to the upper side of the top bearing block 81 of roller 18 at one end thereof. A downward pressure may be applied to the top bearing

block to create the proper pressure between the three rolls 16, 17 and 18 at one end of these rolls by manipulation of the hand-wheel 75. A similar threaded vertical shaft 82 is provided at the other end of these rolls on the top bearing block at that end and a second worm-wheel 83 is threaded on this shaft so that it may be rotated to cause endwise movement of the shaft 82 and regulate the pressure between the rolls at that end, the rolls, of course, having similar bearing blocks at each end. The worm-wheel 83 is rotated by the second hand-wheel 84 which is slidably keyed on the rotatable shaft 85 mounted in a bearing 86 at one end and rotatable within the hollow worm shaft 76 at the other end.

The shaft 85 carries a worm 87 which causes the rotation of the worm-wheel 83 when the governing hand-wheel 84 is operated. The two hand-wheels 84 and 75 are adjacently arranged and adapted to be clutched together when the hand-wheel 84 is moved inwardly so as to be capable of simultaneous operation, in which case the same angular movement of the two hand-wheels affects corresponding equal movements of the shafts 82 and 79 to equally vary the pressure at opposite ends of the rollers. To interconnect the two hand-wheels they are provided with clutch members 88 and 89 respectively which may be engaged by moving the hand-wheel 84 inwardly along the shaft 85. However it will be apparent that by sliding the hand-wheel 84 outwardly along the shaft 85, to unclutched position either hand-wheel may be operated separately if desired to regulate the pressure at either end of the rollers without correspondingly changing the pressure at the opposite end. Very fine changes in the pressure of the rollers may be made by the arrangement provided and the rotation of the hand-wheels may be effected without undue physical exertion.

After the surface coating is applied to one or both sides of the paper as it passes by the rolls 16, 17 and 18 the paper travels to the two heated rolls 40 and 41 which are mounted in suitable bearings adjacent to the machine 10 and in alignment therewith so as to receive the paper strip continuously from the waxing rolls. The two hot rolls 40 and 41 are heated in any suitable manner, as by means of the customary steam supply pipes, and the paper is adapted to travel as shown in the dash lines in Fig. 2, over the upper roll 40 and under the lower roll 41 so that both sides of the paper will come in contact with the rolls, which may be revolved at the same speed as the travel of the paper or at a speed different from the speed of the paper so that they may have a smoothing effect on the wax. The two hot rolls 40 and 41 are driven by a source of power and the same is also true of the waxing roll 16 as will be later more fully set forth. As the paper travels in contact with the heated surface of the rolls 40 and 41 the surface coating of wax on the paper is caused to be impregnated into the body of the paper by reason of the heat and pressure which are applied to the wax. The rolls 40 and 41 as clearly shown in Figs. 1 and 2, are of large diameter, and as the paper is in contact with the hot surfaces of these rolls throughout a large part of the peripheries of these rolls, it will be apparent that the wax on the paper will be thoroughly impregnated into the body of the paper to lend transparency to the paper. Before reaching the heated rolls 40 and 41 the wax is merely impregnated into the surface of the paper and not into the body of the paper since the time of application of the heated wax to the paper is comparatively short as compared to the time in which the traveling web is affected by the hot rolls 40 and 41. The diameters of the rolls 40 and 41 are such as to give what may be termed a sustained heating action as distinguished from that caused by a small guide or ironing roll or by a wax applying roll. The pressure on the coated paper, which is wrapped partly around the hot rolls 40 and 41, is applied by reason of the normal tension in the paper which is kept taut, and which may be supplemented by reason of a traveling flexible web sheet 43 which is formed as an endless strip of material such as felt guided on the guide rollers 44 so as to be in contact with a considerable part of the paper on the surface of the roll 40. A similar endless sheet of material 45 mounted upon guide rollers 46 is adapted to be in contact with a considerable portion of the surface of the lower hot roll 41. The paper travels between the webs 43 and 45 and the outer surface of the rolls 40 and 41 respectively. The tension of the webs may be regulated by the adjustable rollers 47 and 48 which are movable in any usual way toward and away from the axes of the hot rolls to permit exertion of the proper pressure on the paper as it travels along with the heated surface of the hot rolls 40 and 41. The surface coating of wax applied to either one or both sides of the paper will therefore be caused to be heated and pressed into the body of the paper after which the paper may be subsequently treated to apply one or more surface coatings of wax to the paper sheet as will be later described.

After the impregnation of the wax into the body of the paper it may be desired to apply a coating or coatings to the surface of the paper to obtain a smooth coating and waterproof product. The paper can therefore travel to a second waxing element designated generally 60, see Fig. 1, which is provided with a second waxing tank 61 for supplying melted wax to the paper. This is accomplished by means of the waxing roll 62, intermediate heated roll 63 and top squeeze roll 64 shown only diagrammatically in Fig. 1,

but similar in structure and mounting to the three rolls 16, 17 and 18 of the first machine 10 shown in Fig. 2. Suitable guide and tensioning rollers 65 similar to the rollers 14 of machine 10 are provided so that the paper may be kept taut as it travels from the hot rolls to the waxing rolls of machine 60. An immersion roll 66 similar to immersion roll 15 is provided. The machine 60 is located in line with the hot rolls 40 and 41 of the machine portion 10 and the various steps take place successively one after the other as the paper travels from the supply reel 13 to the rewind reel 100 shown in Fig. 1.

The impregnated paper after contacting on opposite sides with the hot rolls 40 and 41 and being supplied with a surface coating of wax of predetermined proper thickness by passing above the waxing roll 62 or under the moving roll 66 is then passed over a pair of smoothing or polishing rolls 68 and 69 which are adapted to be adjusted bodily in relation to one another so as to cause the paper to remain in contact with these rolls for the proper time to cause the smoothing of the surface coating as the paper travels to the next step of the process. The polishing rolls 68 and 69 are preferably heated and positively driven by a suitable connection to the rotating waxing roll 62, this connection being not shown but of any suitable conventional character, as by means of a chain, so that their surfaces are relatively movable with respect to the surface of the paper and thus smooth and polish the surface of the paper and the surfaced coating of wax. They are supported on trunnions which are mounted on end straps as shown in Fig. 1 so that the rolls may be swung together about the axis 71 to permit an adjustment in the surface contact of the rolls with the paper, or to entirely remove the rolls from contact with the paper if this should be desired.

After passing over or between the polishing rolls 68 and 69 the paper is applied to cooling rolls 70 with which the paper contacts, these cooling rolls rotating at a speed corresponding to the speed of the paper so that the paper remains in contact with the cold surfaces of these rolls to cool the paper and the wax to a proper temperature before the paper travels to the rewind reel. These cooling rolls 70 are cooled by brine or by suitable cooling water or refrigerant, and may be of any suitable size and number.

The rewind reel 100 is mounted so as to be driven by a belt 101 operated from a drive wheel 102. This belt is adapted to make frictional contact with the axle of the rewind reel so as to compensate for the change in its diameter as the paper is supplied to it. This compensation is, of course, accomplished by the frictional engagement of the belt with the axle, and the amount of tension on the belt may be varied by the adjustable mechanism 103.

Referring again to Fig. 2 the reel support 12 is adapted to hold a reel of dry paper 13 so that the paper may be led off upwardly to the guide and tensioning rollers 14 to wax the lower side of the paper as it travels over the waxing roll 16, it being understood that the waxing roller 16 picks up wax on its surface and transfers it to the underside of the paper contacting therewith as the paper travels towards the left in this figure between rolls 16 and 17. After traveling over the hot rolls to impregnate the wax into the paper it may be again coated on the side which originally was coated by its passage to the left in Fig. 1 over the second waxing roll 62, and the underside of the paper is given a second coating during this step before it is led to the cooling rolls.

The reel 13 is also adapted to supply the paper in a downward direction where it may pass over the guide roller 25 adjacent the front of the machine and then over suitable guide rollers 26 and 27 conveniently mounted to guide the paper so that it may travel to the right instead of to the left over the intermediate roll 17 and under the squeeze roll 18. The paper is then supplied to the hot impregnating rolls 40 and 41 after passing partly around the squeeze roll 18. In this manner a coating of wax may be applied to the side of the paper corresponding to the upper side of the paper when this paper again is coated by passing over the second waxing roll 62. The wax is picked up by roll 16 and transferred to roll 17 which in turn supplies it to the paper. The paper travels from the reel 13 directly under the machine and then over the waxing roll from the back of the machine traveling towards the right and in this manner a coating of wax may be applied to one side of the paper, this wax being then impregnated into the paper after which the second waxing roller 62 applies a second coating of wax on the surface of the paper. However the paper is thus, in effect inverted, so that the second coating will be applied to the opposite side of the paper.

Adjacent the reel 13 is a moisture supply pipe 30 which is adapted to supply a limited quantity of water spray or steam to moisten the paper before the paper is coated so that the wax may be more easily absorbed by the body of the paper, and, that the ultimate product will contain a suitable proportion of moisture. The mosture content of the paper evaporated by the subsequent steps of the waxing process is thus compensated for so that the finished product contains the desired amount of moisture. This addition of water vapor or spray to the uncoated paper is especially advantageous where the paper after being coated on one or both sides, is subjected to the continued or sustained heating of the

impregnating rolls 40 and 41 which would otherwise drive off a very substantial amount of the initial moisture content of the paper, and leave a comparatively brittle product. The moisture supply pipe 30 is located adjacent to the paper strip as it comes from the reel and also adjacent to the outside layer of paper on the reel, and because of this location the spray may be applied simultaneously to both sides of the paper. The supply pipe 30 is provided with suitable control means such as a valve, not shown, so that the amount of moisture supplied to the paper may be regulated as desired.

The paper strip or web is caused to travel continuously from the supply reel to the rewind reel and for this purpose some of the rolls over which the paper passes are driven by a suitable source of power at the proper speed. The paper should be kept suitably taut as it travels from one step to the next, to compensate for shrinkage or expansion due to the changes in temperature and to varying characteristics of different types of paper as it travels from one step to the next. A single source of power is therefore utilized to drive the various rolls so that they may be kept in properly timed relation, and speed adjusting mechanism is provided so that any of the driven rolls may be caused to rotate faster or slower, this mechanism being constructed to permit of fine and accurate speed adjustments in such a manner as not to alter the proper speed of those rolls or driven members which later cooperate with the paper web.

Referring now to Fig. 3 the means for rotating the first waxing roll 16, the hot roll 40, the second waxing roll 62 and the cooling rolls 70 is diagrammatically shown. An electric motor 110 is connected by a chain or belt 111 to a main drive shaft 112. On this main drive shaft are mounted two halves or sections 113 and 114 of a pulley designated generally 115. The beveled or inclined inner faces of this pulley are engaged by a belt 116 having inclined sides sloping at an angle corresponding to the angle of the bevel of the pulley sections. The belt 116 drives a second set of pulley sections 117 and 118 of a second pulley which is mounted on and drives the shaft 119. The shaft 119 and the main drive shaft 112 are mounted in a suitable frame 120. This frame also supports an adjustable mechanism 121 herein shown as a hand operated wheel 122 adapted to rotate a threaded shaft 123 so that the pulley section 118 and the pulley section 114 may be moved in opposite directions along their respective shafts to which they are splined or otherwise attached. This causes an effective change in the pulley diameters without variation in the belt length, which remains constant. Fine speed control of the driven shaft 119 in relation to the drive shaft 112 is accomplished by this adjustment; and, since the shaft 119 serves to drive the remaining parts of the machine, the speed of the entire machine may be controlled by the operation of the handwheel 122. The shaft 119 supplies power by means of the belt or chain 125 to drive the shaft 126 of the first waxing roll 16 which is also connected by means of the belt or chain 127 to a main drive shaft 128 of a second speed adjustment device designated generally 129, from which power is supplied in turn to another speed adjustment device, and so on. The speed of the several rolls of the various roll units may be thus varied through small increments of change in relation to other parts of the apparatus. Each of the speed adjusting mechanisms has the same relatively adjustable cone pulley construction.

The main shaft 128 of the speed adjusting mechanism 129 is mounted in a frame 130 and a hand operated adjusting wheel 131 moves one section of one of the pulleys in the opposite direction from the movement of a section of the other pulley to cause adjustments of the speed of the shaft 132 in relation to the shaft 128. The pulley sections provided on the shafts 128 and 132 are interconnected by the driving belt 133 having inclined sides and it will be understood that the entire speed changing device 129 is exactly similar to the speed changing device first described except that it is of smaller size and proportions, since the power supplied by the shaft 132 is considerably less than the entire power supplied from the shaft 119, and from the motor 110 which also drive the first waxing roll 16.

The shaft 132 drives a belt or chain 135 to operate the hot roll 40 it being understood that the hot roll 40 is connected as shown in Fig. 2 to the hot roll 41 by means of suitable gears or sprockets 136 so that the hot rolls will operate together and at coordinated speed.

A third speed adjusting device designated generally 140 is provided with a second handwheel 141 to relatively adjust the speed of rotation of the second waxing roll 62 and hot roll 40. This speed adjusting device 140 corresponds exactly to the speed adjusting device 129 except that it is of smaller size and proportions than the device 129 since a smaller amount of power is supplied from it. A fourth speed adjusting device 145 with an adjusting wheel 146 similar to the adjusting device previously described is provided to interconnect the shaft 147 of the second waxing roll 62 and the shaft 148 by which the various cooling rolls are operated. By means of the mechanism just described the paper as it travels from one step to the next may be kept taut and variations in the length of the paper due to shrinkage or expansion may be compensated for by means of the minute relative changes which are permitted in the

speed of the various driven rolls of the apparatus. The V-shaped belts by which the power is transmitted in the various speed adjusting devices produce substantially a positive drive of the various rolls. Moreover the speed of one roll may be adjusted to run slower or faster and such an adjustment will not change the speed coordination or relative speed of rolls which subsequently coact with the paper, since the subsequent rolls are driven from the roll in question. For example, if all the rolls are operating to keep the paper properly taut with the exception of roll 40 for example, which might permit a slackness between it and the preceding roll, then the speed of roll 40 may be adjusted to the proper value by adjustment of belt 133 and such adjustment does not interfere with the tautness of the paper between rolls 40, 62, 70, etc., which are subsequent in operation, since the coordination of the speed of roll 40 and the subsequent rolls 62 and 70 is maintained. Individual adjustment of all the following rolls when one roll is operating at an improper speed is therefore unnecessary.

It will now be readily apparent that a waxing apparatus has been herein provided which is capable of applying a surface coating or coatings of wax and impregnating the paper with wax in a variety of ways so as to produce a transparent and waterproof paper of a high quality and without the use of an excessive amount of coating or waxing materials. The apparatus herein set forth permits the paper to be fed continuously from the supply reel to the rewind reel while the waxing steps take place. The paper is first coated on one or both sides of the paper and on either the upper or the lower side thereof depending upon the manner in which the paper is supplied to the waxing roll. The surface coating of material is then caused to be impregnated into the body of the paper by causing the paper to be subjected to the action of the hot rolls 40 and 41. During this operation the endless webs 43 and 45 may be utilized to press the paper against the hot rolls. This acts to prevent the formation of air bubbles, which mar the uniformity of the coating. After this step is completed the paper is supplied directly to the second waxing step by the suitable guide and tensioning rollers and thus a coating of wax may be applied to the impregnated paper on one or both sides of the paper dependent upon whether the paper travels over the waxing roll or dips bodily into the melted wax. The paper may be either waxed directly by the waxing roll which dips into the melted wax or by the immersion roll, or the roll which dips into the melted wax may transfer a predetermined amount of wax to a secondary waxing roll shown at 63 above which the squeeze roll is located. After the impregnated paper is again given a surface coating the paper may, if desired, be subjected to the action of the polishing rolls to smooth the surface, and the paper then travels to the cooling rolls, rotating in contact with their cooled surfaces before being wound again on the rewind reel.

The paper produced is of a uniform quality since the various steps are continuous during the travel of the paper, and the apparatus is such that the paper produced may have exceptional waterproofing qualities or transparency.

While the methods herein described, and the forms of apparatus for carrying these methods into effect, constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise methods and forms of apparatus, and that changes may be made in either without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In the coating of paper, the method which comprises adding moisture to the paper to be coated, preliminary to the applying of the coating, in a degree to compensate for the moisture driven off from the paper during the applying of the coating, and then applying a coating of wax to the surface of the said moistened paper.

2. In the coating of paper, the method which comprises adding moisture to a traveling sheet of paper to be waxed, preliminary to the waxing operation, in a degree to compensate for the moisture driven off from the paper during the waxing operation, then applying a coating of wax to the surface of said moistened traveling sheet of paper, and then causing the impregnation of the wax into the body of the paper.

3. Apparatus of the character described for applying a coating to a traveling sheet of paper which comprises a container for holding a supply of melted wax, cooperating waxing and squeeze rolls associated with said container for applying a surface coating of wax to the traveling sheet of paper, a hot roll of large diameter adjacent said container over which the coated paper may pass to cause the wax of said surface coating to penetrate the paper, and an external pressure applying means adapted to press said paper against said heated roll comprising an endless web of flexible material and guide rollers therefor arranged to cause said web to press against the paper on the heated roll as the paper travels over the said heated roll.

4. Paper waxing apparatus comprising a container for melted wax, a waxing roll therefor, an intermediate roll and a squeeze roll, and guide means for supplying the paper to travel in one direction or the other through said rolls.

5. Paper waxing apparatus comprising a container for melted wax, a waxing roll therefor, an intermediate roll and a squeeze

roll cooperating with said waxing roll, guide means for supplying the paper to travel in one direction or the other through said rolls, and a paper reel support adjacent said container, said guide means being located above and below the container level to conduct the paper either above or below the container in its passage to said rolls to cause either side of the paper to be supplied with a surface coating of wax.

6. Paper waxing apparatus comprising a container for supplying melted wax, waxing and squeeze rolls therefor, a reel support adjacent said supply of melted wax, and moisture applying means adjacent said reel for supplying moisture to the paper before it comes from the reel.

7. Paper waxing apparatus comprising a container for a supply of melted wax, wax applying means therefor, a reel support adjacent said container, and moisture applying means adjacent said reel for supplying moisture to the paper as it comes from the reel, and located directly adjacent the outer paper layer on the reel and directly adjacent the paper leaving the reel so as to simultaneously spray moisture on the outer paper layer on the reel on one side of the paper and on the paper as it leaves the reel on the opposite side of the paper.

8. Apparatus of the character described for applying a coating to a traveling sheet of paper comprising a container for holding a supply of melted coating material, means associated with said container for applying a surface coating to the traveling sheet of paper, a large hot roll adjacent said container over which the coated paper may pass with sustained surface contact to cause the surface coating to penetrate the body of the paper, and means for applying a surface coating to either one or both sides of the paper as desired after the paper leaves said hot roll.

9. Apparatus of the character described for applying a coating to a traveling sheet of paper comprising a container for holding a supply of melted wax, means associated with said container for applying a coating of wax to either one or both sides of the traveling sheet of paper, impregnating means adjacent said container for causing the surface coating of wax to be impregnated into the body of the paper and comprising a hot roll of large diameter with which the paper is in sustained engagement, and means for applying an additional surface coating of wax to the surface of the paper.

10. Apparatus of the character described for applying a coating to a traveling sheet of paper comprising wax applying means arranged to coat either one or both sides of the paper as desired, impregnating means subsequently effective on the paper to cause the impregnation of the surface coating of wax into the body of the paper, and additional wax applying means for applying a surface coating of wax to the impregnated paper.

11. Apparatus of the character described for applying a coating to a traveling sheet of paper, comprising a container for holding a supply of melted wax, wax applying means associated with said container, said wax applying means having provision for coating either one or both sides of the paper, a hot roll adjacent said container over which the coated paper may pass with large surface contact to cause the wax of said coating to penetrate the body of the paper, a second container for holding a supply of melted wax, and a second waxing means associated with said second container, said second waxing means having provision for waxing either one or both sides of the impregnated paper.

12. Apparatus of the character described for applying a coating to a traveling sheet of paper comprising a series of paper engaging rolls adapted for successive cooperation with a traveling paper web, and mea. s for driving said rolls at various speeds comprising a source of power, and mechanical connections from said rolls to said source of power, said connections having provisions for varying the speed of a roll relatively to rolls previously cooperating with the paper while maintaining the same relative speed between that roll and the other rolls subsequently cooperating with the paper.

13. Apparatus of the character described for waxing a paper web comprising a series of rolls adapted for successive cooperation with the paper and means for driving said rolls at various speeds comprising a source of power and mechanical connections from said rolls to said source of power, said connections comprising speed changing devices between adjacent rolls providing for small increments of speed adjustments, the speed changing devices of a roll supplying power for driving rolls subsequently cooperating with the paper.

14. In a coating of paper, the method which comprises applying surface coating of wax to the surface of a traveling sheet of paper, subjecting the coated paper to a sustained heating action to cause the wax of said coating to thoroughly penetrate the body of the paper, then applying a second surface coating of wax to the previously coated surface, and thereafter cooling the paper without impregnation of said second surface coating.

15. In the coating of paper the method which comprises applying a controlled surface coating of wax to the surface of a traveling sheet of paper, subjecting the coated paper to a sustained concomitant pressure and heating action to cause the wax of said surface coating to thoroughly penetrate the body of the paper, and then applying a con-

trolled surface coating of wax to the previously coated surface without impregnation of the wax.

16. In a coating of paper, the method which comprises applying a hot coating of wax to both sides of the surface of a traveling sheet of paper, immediately thereafter subjecting the coated paper to a sustained impregnating action to cause the wax of said coating to thoroughly penetrate the body of the paper, then applying a surface coating to both sides of the paper, and cooling the paper.

17. The paper waxing process comprising moving a paper web, applying a surface coating of melted wax on both sides of the moving paper web, thereafter causing the surface coating to be thoroughly impregnated into the body of the paper, subsequently applying a surface coating of wax to the paper, and cooling the paper without impregnation of the subsequently applied surface coating.

18. The paper coating process comprising applying a surface coating of melted wax on a paper web, thereafter engaging the paper web with a hot surface for a sustained period of time to thoroughly impregnate the wax into the body of the paper, and then applying a surface coating of wax to both sides of the paper and subsequently cooling the paper.

19. In the coating of paper with wax to provide a substantially transparent and waterproof paper, the method which comprises applying a coating of wax of controlled uniform thickness to the surface of a traveling sheet of paper, thereafter subjecting the paper to a sustained heating action to cause the complete and thorough impregnation of the coating of wax into the body of the paper, and then applying the second surface coating of wax to the paper without impregnation of the wax.

In testimony whereof I hereto affix my signature.

VAN HAMM WILSHIRE.