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PROCESS OF PRODUCING PAPER

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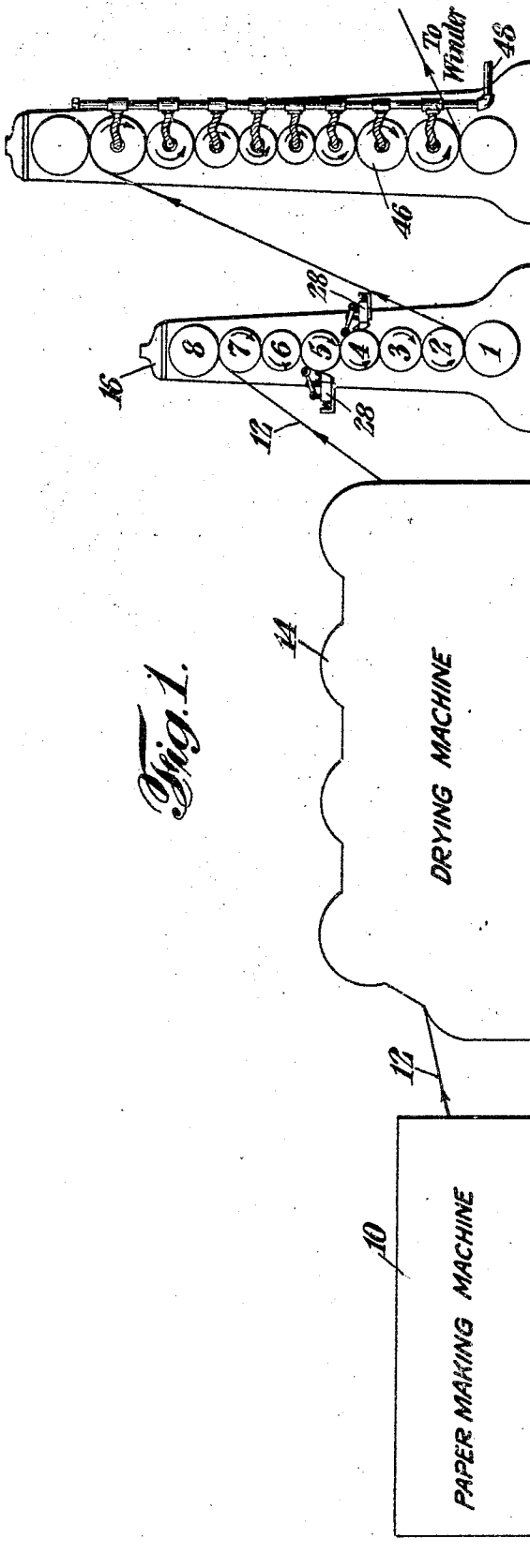


Fig. 1.

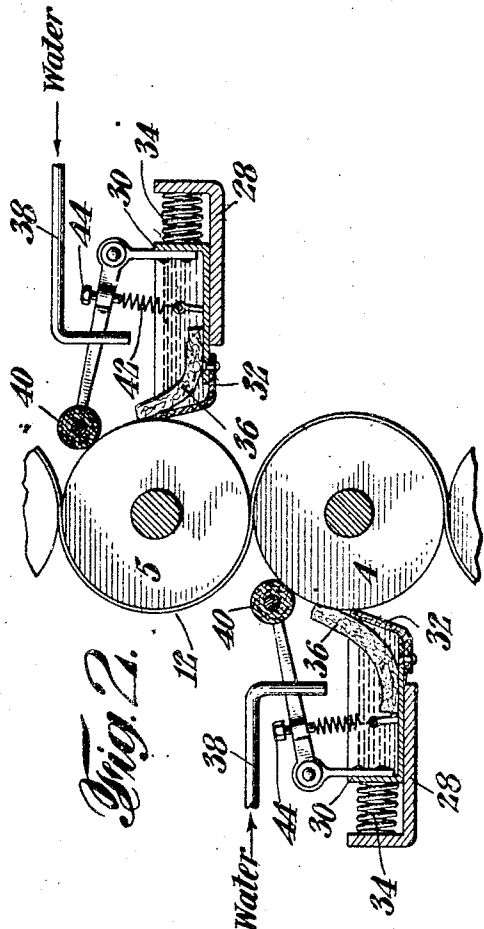


Fig. 2.

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PROCESS OF PRODUCING PAPER

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This invention relates to a process whereby paper of a particular finish can be produced under such conditions that the density of the finished product can always be controlled right from the initial steps. The process is particularly intended for the production of insulating paper such as is used in covering of high tension cables where both the finish and density are of primary importance.

Heretofore in order to give the paper the desired finish it has been customary to submit it to what is known as a supercalendering operation. In that process a fully dried web of paper is first passed through a moistening machine where it is subjected to a spray or mist of water and then ordinarily is rolled up and allowed to wait a few minutes so that the moisture can properly temper the whole body of the paper. After the web is thus moistened, the paper is passed through a calender in which alternate rolls are faced with metal and with compressed paper and the metal faced rollers are heated. The rubbing action which results from this treatment gives a somewhat different effect from that where all of the rolls are of metal and its use has heretofore been considered necessary to give the desired finish for insulating paper of the type referred to.

It is to be noted that the supercalendering operation demands at least two distinct operations with the paper wound up between them. This is not only expensive, but also renders it very difficult to keep a constant check on the density of the finished product. There are many variable factors entering into the question of density which must be watched through the production of the paper all the way from the screen to the end of the drier; where the operation is broken it is difficult to keep these variables under exact control and a slight change in any one of several factors may cause a resulting change in density sufficient to injure the value of the product for electrical purposes.

By the process which is the subject of this application, the web is moved continuously from the screen through and out of the final calender, with the result that there is only a brief time between the formation of the

paper and its completion. Due to this small time lapse, any tendency toward variation in the density of the finished product may be noted and immediately corrected. There is also a saving in operating cost and a reduction in the percentage of sheets that are torn and broken.

My invention is based upon the discovery that if the web as it comes from the drier is partly calendered to compact the surface, water can be applied directly to both faces of the sheet in rather large quantities and if the amount of such water is properly controlled the sheet will not be weakened to the breaking point and the water can be entirely dried out in the subsequent calendering operation, and at the same time the desired finish can readily be given to the paper.

In carrying out the invention, the paper passes continuously from the screen to the drier and thence to the calender stack. Here it is passed through several nips to harden its surface somewhat and then the water is applied to both faces of the sheet. This application of water is preferably accomplished by forming films of water on the face of two calender rolls which in turn carry the water to the paper. By applying the water to the calender rolls in the form of a film the thickness of the film and thus the amount of water transmitted to the paper can be controlled with considerable accuracy. In this operation the moisture content of the paper should be brought up to the figure in the order of from 15 to 25% of moisture, 20% being a good working percentage to aim at. The paper that has thus had its surface layers well moistened continues through several additional nips which equalizes the moisture content over the surface. This moistening and preliminary calendering is preferably done in one calender stack and the final finishing is preferably conducted in an adjoining stack to which the paper passes directly from the bottom roll of the first stack. In the second stack the rolls are heated sufficiently to have a material drying action on the paper. Thus all of the rolls except the top and bottom roll can be heated with exhaust steam at a temperature of a few degrees above the

boiling point. All of the rolls in this stack, like the first stack, are preferably metal faced. The action of the heated rolls on the wet surface of the paper gives it the desired finish and at the same time dries out the sheet. I believe that this result is due to the fact that the surface layers are wet to a somewhat greater degree than in the supercalendering operation but there is not sufficient time allowed for the water to thoroughly permeate so that the sheet is uniformly wet, due to the fact that the sheet moves directly from the moistening operation to the heated rolls where drying starts. An even more important result of the continuous operation right from the formation of the paper until its final finishing, is the control of density. If at any time the density of the finished stock is found to show a variation from the desired point, the operator can recognize this before such variation becomes serious and immediately can vary some of the preliminary steps in the production of the paper in such a way as to overcome the difficulty. If desired, the paper may be semi-calendered while in the drier as is well understood in the art. This will not materially modify the subsequent procedure.

For the purposes of illustration I show in the accompanying drawing the essential portions of the paper making machine used for carrying out my process, with the preliminary elements simply indicated as they form no part of the present invention except that they are directly connected with the finishing elements. In this drawing, Fig. 1 is a diagrammatic side view showing the course of manufacture, and Fig. 2 is a sectional view of two of the rolls on the first calender stack and the mechanism for forming controlled water films on these rolls.

In the drawing the numeral 10 indicates the paper forming machine which may be of any usual construction and which will embody the usual controls for varying the thickness and quality of the paper. From the forming machine 10, the paper 12 passes to the drier 14 which is also to be understood as embodying the usual controls and other details of construction. When the paper 12 passes from the drier 14 it is brought through calender stack 16 in which the rolls are metal faced. The rolls in the calender stack 16 are numbered from 1 to 8 inclusive beginning at the bottom. After the paper has passed between rolls 7 and 8 and 6 and 7 it approaches the nip between rolls 5 and 6 where one face is moistened, and the other face is moistened at the nip between the rolls 4 and 5. To supply the water for this moistening the rolls 4 and 5 are provided with moistening devices as shown in detail in Fig. 2. It is to be understood that these are similar except for their reversal of position and that they ex-

tend for substantially the full length of the roll.

Each of the moistening devices comprises a support 28 carrying a metal trough 30 which has no metal side toward the roll. In place of such metal side toward the roll, a piece of sole leather 32 is fastened on the underside of member 30 and presses against the roll so as to hold water closely adjacent the roll but without there being any danger that the roll will be scratched. The trough is pressed toward the roll by a spring 34. In each trough 30 is positioned a piece of heavy felt 36 which extends up above the leather member 32 and contacts with the face of the roll. Each trough may be kept full of water in any desired way as by a pipe 38. The wet felt 36 will cover the face of the roll with a film of water, and in order to control the thickness of this film a felt roller 40 is carried by each trough 32 and is tensioned toward the main roll on the calender by spring 42, the tension of which may be varied as by a thumb nut 44. The roll 40 will act as a squeegee to cause excess water to run back into the trough 30 and permit only the desired amount of water to continue to remain on the face of the roll and ultimately come in contact with the paper.

After the paper has been moistened on rolls 4 and 5 it continues down to the bottom of the stack and then is brought up to the top of an adjoining stack where all of the rolls are metal faced and where all except the top and bottom rolls are steam heated as by the steam connections 46 which lead from a steam pipe 48. In passing through the second calender stack the sheet is dried and given the desired finish so that it can go direct to a winder for shipment. The paper can be watched as it emerges from the second calender stack, and if it is found that there is a change in density a proper adjustment can be made in the paper forming machine or in the drier so as to immediately correct the difficulty. The finish can also be varied by the amount of water transmitted to the paper from the troughs 32, as well as by the other factors known in the art.

It is to be understood that the equipment described is shown primarily for illustrating one way in which my process may be carried out, and that other forms of equipment may be used.

What I claim is:

1. The process of producing paper which comprises the steps of forming the paper in a web and passing such web continuously and from the point of formation through a dryer, from the dryer to calender rolls where the paper is partly calendered to compact the surface, then directly applying a film of water by means which allow a fine adjustment, the web being run at such speed and the paper being wet to such a degree that

thorough permeation of the web does not take place and then running the paper through calender rolls heated to substantially 212° F.

2. The process of treating paper which comprises the steps of passing the paper between adjacent calender rolls adjusted to compact the surface, supplying sufficient amounts of water in the form of films to the faces of such rolls to wet both surfaces of the paper without saturating the paper and thereafter passing such paper without interruption of movement through a series of calender rolls heated to substantially 212° F.

3. A process as specified in claim 2 wherein the amount of water added to the paper brings its moisture content by weight to between 15% and 25%.

4. An apparatus for finishing paper, comprising a series of calender rolls, a pair of water troughs positioned alongside of adjacent rolls but on opposite sides thereof, absorbent means for conducting water from such troughs to the faces of such rolls and separate adjustable means for limiting the amount of water that is permitted to remain on such rolls.

5. A structure as specified in claim 4, in which means is provided for pressing said troughs towards said rolls and said troughs are made with the side towards said rolls formed of leather so that the rolls will not be scratched.

6. The process of forming insulating paper comprising the steps of forming a web of paper, partly calendering such paper so its surface is compacted, applying water to the partly calendered paper, and then before the paper becomes thoroughly permeated by such water, subjecting the same to heated calenders which finish and dry the same, the paper in all the said steps being continuously conducted from one operation to the next without a break.

7. The process as specified in claim 6, wherein the amount of water applied to the paper brings the percentage of water contained therein up to between 15% and 25%.

8. The process as specified in claim 6, wherein the heated calenders are heated to approximately 212° F.

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