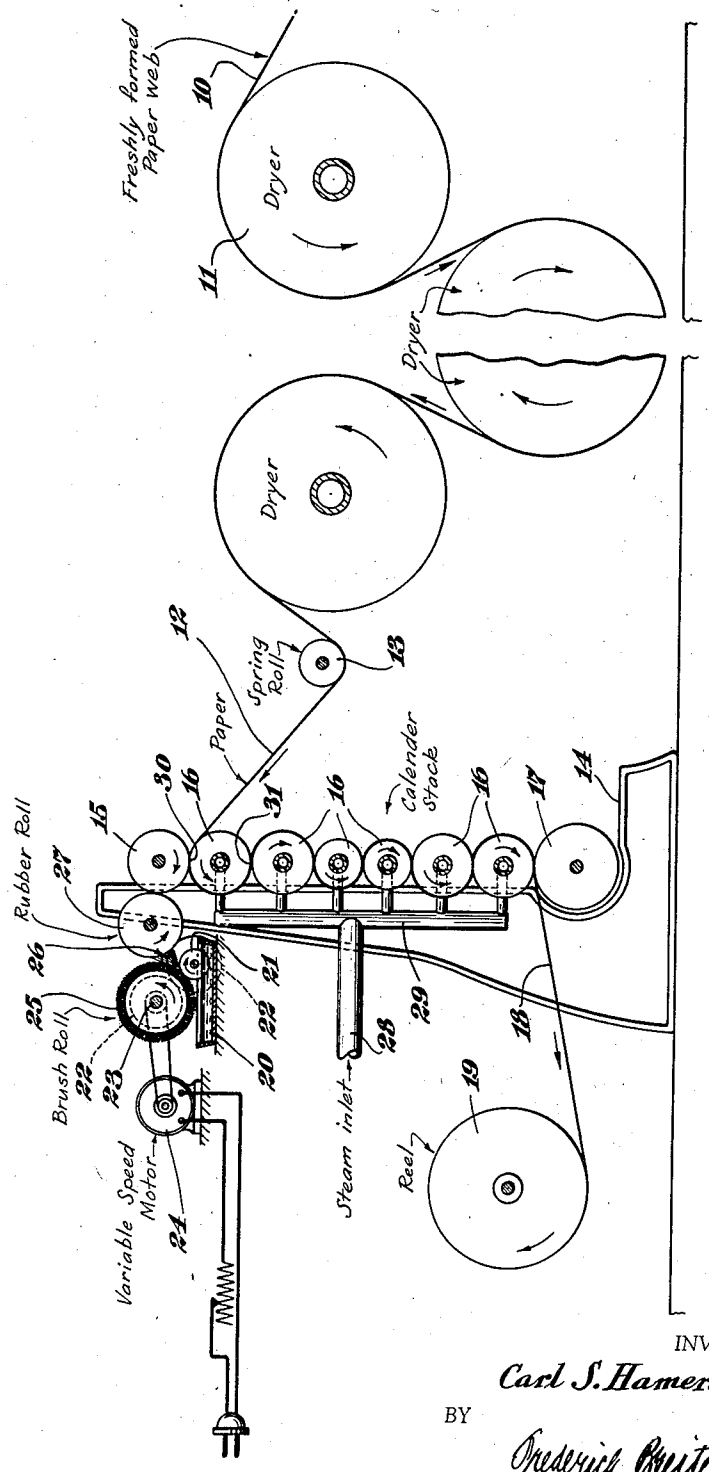
April 20, 1937. C. S. HAMERSLEY 2,077,475

METHOD AND MEANS FOR MAKING PAPER

Filed Oct. 22, 1934



INVENTOR,
Carl S. Hamersley,
BY
Frederick Breitenfeld
ATTORNEY.

Patented Apr. 20, 1937

2,077,475

UNITED STATES PATENT OFFICE

2,077,475

METHOD AND MEANS FOR MAKING PAPER

Carl S. Hamersley, New York, N. Y.

Application October 22, 1934, Serial No. 749,351

3 Claims. (Cl. 92—76)

My present invention relates generally to the manufacture of paper, and has particular reference to a new and improved machine and method for producing a calendered paper.

My invention is primarily adapted to be employed in the manufacture of an improved waxed paper which is lighter in weight, per ream, than ordinary waxed paper, of improved appearance, and having greater transparency. Despite its lesser weight, the waxed paper resulting from the use of the present invention has the same strength, water-resistant qualities, and sealing capabilities as ordinary waxed paper, and it costs no more to make than ordinary waxed paper.

The foregoing desirable results are achieved, briefly, by applying a wax coating to a base paper which is glossier and thinner than that which is ordinarily employed; and the characterizing features of the invention reside in an improved machine and method for producing the thinness and glossiness, by a special treatment, without any increase in expense.

The invention readily lends itself, further, to the production of a predetermined configuration or design on the paper; and, from many aspects, the invention relates, broadly, to calendering generally, whether the paper is subsequently coated with wax or not.

A fuller understanding of the features of my invention may be had by reviewing briefly the usual procedures involved in producing a specially calendered paper. After the pulp is formed into a web, and suitably dehydrated, e. g., on a Fourdrinier machine, it is continuously fed to a set of dryer rolls, and thence to and through a stack of calender rolls. The latter step is known in the trade as "machine" calendering, and the rolls are customarily of steel or similar hard metal, and are not usually heated. If greater thinness or glossiness is required, it is well known practice to subject the paper, thereafter, either to (*a*) what is known as "super-calendering", or to (*b*) what is known as "water finishing". The former procedure is usually carried out on a separate super-calendering machine, which consists of a special type of calendering rolls. This separate procedure involves considerable losses and materially increases the cost of the "super-calendered" paper which is thus produced. In the case of "water finishing", the paper emanating from the machine-calendering rolls is caused to be wetted and is thereupon fed directly to a second stack of calender rolls. The weakening of the paper, due to this rewetting, limits this process to relatively heavy papers, by which I refer broadly to papers having a weight over about twenty-five pounds per ream. The weakening effect is usually further guarded against by employing this process only with paper that has been sized, the sizing and the initial calendering step serving to prevent the rewetting from accomplishing anything more than a surface wetting of the paper.

My present invention involves no steps or procedures subsequent to the ordinary machine-calendering of a continuous paper web that has been successively formed, dehydrated, and dried. I rely for the accomplishment of the present improved results solely upon the single initial calendering operation to which the web is ordinarily subjected, and the desirable present results are achieved by a special and unique step of rewetting the web just at the instant of commencement of the calendering.

Heretofore, a rewetting of the paper at this stage of the manufacturing process has been considered utterly unfeasible, because of the weakening effect which ordinary wetting has upon an unfinished and uncalendered paper web. I have found, however, that if the rewetting is accomplished in a special and accurately controllable manner, and at the instant when the initial calendering is commenced, i. e., at the point of entrance of the paper web to the calender rolls, it is possible to produce, without loss, and without added expense, a paper which has enhanced qualities of thinness and glossiness. My experiments have led me to believe that this unique result is achieved because of the fact that the accurately controlled wetting of the paper at the critical stage mentioned, and with only a predetermined limited amount of water, does not allow the water to penetrate sufficiently to cause any disastrous weakening of the paper web. By accurately controlling the amount of water that is used, by applying it at the instant the calendering operation commences, and by heating the ordinary machine-calendering rolls, a result is achieved akin to those which have hitherto been produced, at greater expense, by the "water finishing" and "super-calendering" operations.

The accurate control of the amount of water that is employed in my process is achieved by means of a device which produces an accurately controllable spray. The device may take various forms, but I prefer to employ a brushing roll which cooperates with a roller partially immersed in a pan of water, whereby the relative speeds, and the variations of speed, of the brushing roll may be relied upon to produce a spray of accurately controllable character. While this spray

may, under certain circumstances, be directed upon the initial calender roll, it is sometimes preferable to employ an intermediate rubber roll which may or may not be configured with a predetermined design, such as a plurality of closely spaced, parallel lines or markings. In either event, the film of water which is transmitted by the initial calender roll to the paper entering the calender stack is extremely thin and accurately controllable. I estimate that the film of water in question has a thickness no greater than about .0001 inch.

The foregoing general objects and features of my invention, and such other objects and features as may hereinafter be pointed out or may appear, are more fully illustrated in the accompanying drawing, in which—

The figure is a diagrammatic side view of the calendering end of an ordinary paper-making machine.

Upon referring to this figure, it will be understood that the freshly formed paper web **10** is emanating, in a continuous manner, from the felts or other dehydrating elements of the paper-making machine. It encounters the initial dryer roll **11**, and after a circuitous path around a plurality of heated dryer rolls it is ultimately directed, as at the point **12**, to the top of a stack of calender rolls. A spring roll **13** is preferably applied to the web at this stage to keep it properly tensioned.

The calender rolls are mounted upon a suitable framework **14**, and consist of a top or initial calender roll **15** and a series of successively contacting rolls **16**, the lowest one of which contacts with the end or bottom roll **17**. The paper web enters the stack between the roll **15** and the adjacent roll **16**, and is directed downwardly through successive rolls, emanating finally, as at **18**, and being wound up upon a reel **19**.

In accordance with my invention, the paper is rewetted by a predetermined, accurately controllable amount at the exact instant of time that the calendering operation commences. In the embodiment herein illustrated by way of example, I provide a pan of water **20** within which a roller **21** is partially immersed. The latter roller is geared, as by the gearing **22**, to a shaft **23** which is driven by the variable speed motor **24**. The shaft **23** carries the brush roll **25** whose bristles are adapted to brush against the surface of the roller **21** and direct an accurately controllable spray **26** against the surface of an intermediate applicator roller **27**. The latter roller is preferably of rubber, and transmits a very fine film of water, by contact, to the initial calender roll **15**. This, in turn, transmits the water to the paper at the instant the paper comes into contact with the roll **15**.

In accordance with my invention, the rolls **16** are caused to be heated, as, for example, by introducing steam through the inlet **28** and distributing it to the rolls by means of the manifold **29**.

By providing a suitable gear relationship between the shaft **23** and the roller **21**, and by varying this relationship whenever necessary, also by varying the speed of the motor **24**, the amount of water in the spray **26** can be controlled with extreme accuracy. As a result, the paper, when the calendering commences, is not subjected to any usual type of rewetting, which would probably be disastrously weakening in its effect, but is, on the contrary, subjected to a rewetting of accurately controlled character. I have found that a film of water upon the roll **15** having a thickness of approximately .0001 inch is adequate to accomplish the present desirable results.

The paper, though unsized and uncalendered, remains not only unimpaired by this rewetting, but is subjected during its passage through the rolls **16** to a calendering treatment which has a remarkable and unusual effect upon the glossiness and thickness of the resulting sheet that is wound upon the reel **19**. The result is, in fact, akin to that which has heretofore been accomplished only by means of far more expensive procedures. I am led to believe that one of the reasons why the paper remains unimpaired by the rewetting is due to the fact that the water does not have sufficient time to penetrate materially into the fibers of the paper. The paper web usually travels at a rate of approximately five hundred feet per minute, and since the diameter of the second calender roll (i. e., the first of the rolls designated **16**), is approximately ten inches, it takes less than one-sixth of a second for the rewetted paper to pass from the point **30** to the point **31**, at which point further calendering immediately takes place. Furthermore, the heating of the rolls leads to a rapid dissipation of the water that was used in rewetting the paper.

If desired, the rubber roll **27** may be configured, e. g., by a plurality of closely spaced parallel markings, or in any other desired manner, and I have found that the use of such a roller results in producing a corresponding highly attractive configuration in the finished paper.

In certain instances, the intermediate roller **27** may be omitted, and the accurately controllable spray **26** may be caused to play directly upon the initial calender roll **15**.

It will also be understood that other methods of producing such an accurately controllable wetting may be employed without departing from the spirit of the invention, although the brush roller, as herein illustrated and described, has proven admirably satisfactory.

The resultant paper, while its enhanced glossiness and thinness render it useful per se, is particularly adapted for the manufacture of waxed paper. The greater glossiness produces a greater repellance toward wax, and during the waxing procedure a lesser amount of wax is required to produce a waxed paper of predetermined moisture resistance and calibre. In fact, five pounds of wax, applied to a ream of the present paper (24″×36″), produces a finished wax paper that is comparable in partctically all respects to an ordinary waxed paper that has required as much as ten pounds of wax per ream. Apparently, the surface coating of wax is in each case of approximately the same thickness, but by applying the coating to the present paper base less of the wax is wasted by penetration into the interior of the paper base. The economic advantages of the present inention will be, of course, obvious to those skilled in the art. Chief among the advantages is the fact that the enhanced glossiness and calendering is achieved without necessitating any recourse to expensive additional procedures; and that the results may be achieved with papers of the lighter weight class, by which I refer broadly to papers having a weight between approximately fourteen and twenty-two pounds per ream.

It is to be understood that the reference herein, and in the appended claims, to the wetting of the paper "at the instant of commencement of the

calendering treatment" is intended to include any accurately controlled wetting of the paper at a point so closely before or after the commencement of calendering, that no opportunity is afforded for any appreciable weakening of the paper.

In general, it will be understood that changes in the details, herein described and illustrated for the purpose of explaining the nature of my invention, may be made by those skilled in the art without departing from the spirit and scope of the invention as expressed in the appended claims. It is, therefore, intended that these details be interpreted as illustrative, and not in a limiting sense.

Having thus described my invention, and illustrated its use, what I claim as new and desire to secure by Letters Patent is—

1. In a paper-making machine, a set of dryer rolls, a stack of calender rolls, means for continuously feeding a freshly formed paper web to the dryer rolls and thence directly to the calender rolls, and means for continuously wetting the initial calender roll to a controllable limited degree, whereby the web is rewetted to a corresponding limited degree at the instant of commencement of the calendering treatment; said means comprising a device adjacent to said roll for producing an accurately controllable spray, and an applicator roll having a configured rubber surface and adapted to receive the water of said spray and transfer it by contact to said calender roll.

2. In a paper-making machine, a set of dryer rolls, a stack of calender rolls, means for continuously feeding a freshly formed paper web to the dryer rolls and thence directly to the calender rolls, and means for continuously wetting the initial calender roll to a controllable limited degree, whereby the web is rewetted to a corresponding limited degree at the instant of commencment of the calendering treatment; said means comprising a pan of water, a roll partially immersed therein, means for brushing the water from the surface of said roll in the form of an accurately controllable spray and an applicator roll having a rubber surface and adapted to receive the water of said spray and transfer it by contact to said calender roll.

3. In a paper-making machine, a set of dryer rolls, a stack of calender rolls, means for continuously feeding a freshly formed paper web to the dryer rolls and thence directly to the calender rolls, and means for continuously wetting the initial calender roll to a controllable limited degree, whereby the web is rewetted to a corresponding limited degree at the instant of commencement of the calendering treatment; said means comprising a pan of water, a roll partially immersed therein, a rotating brush for brushing the water from the surface of said roll in the form of a spray, means for controlling the speed of rotation of said brush, and an applicator roll having a rubber surface and adapted to receive the water of said spray and transfer it by contact to said calender roll.

C. S. HAMERSLEY.