June 26, 1934. C. G. BRIGHT 1,964,312

PROCESS AND APPARATUS FOR MAKING PAPER

Filed Jan. 18, 1934 2 Sheets-Sheet 1

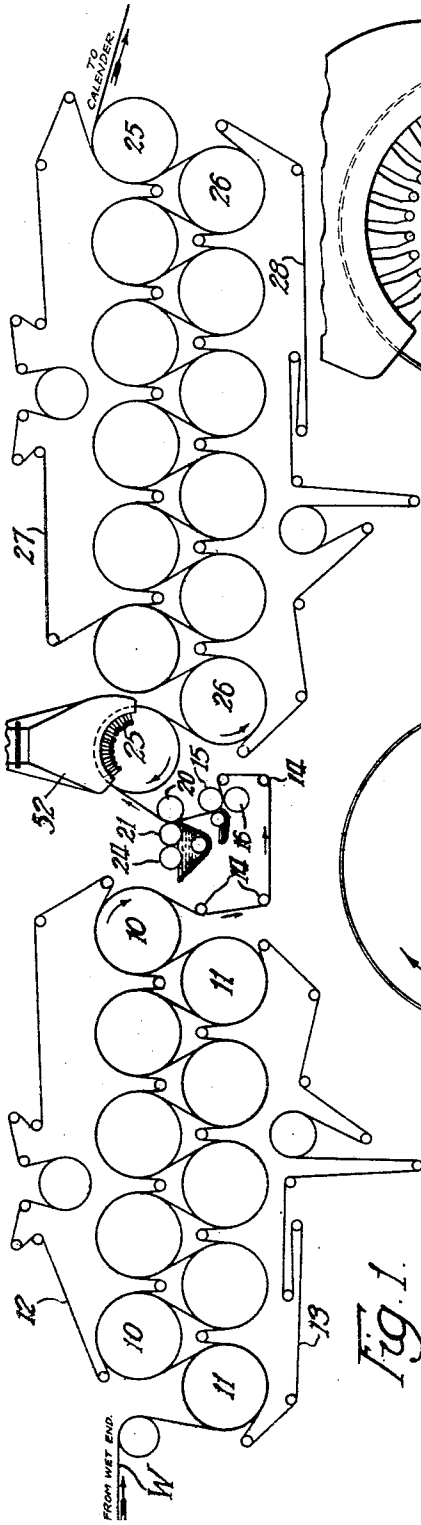

Fig. 1

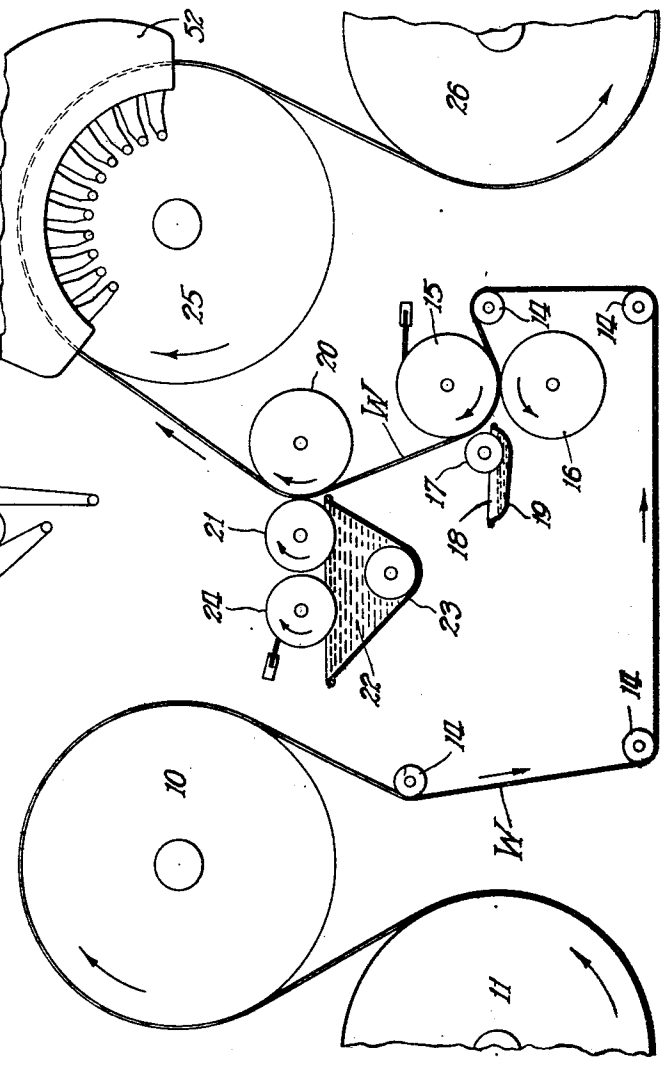

Fig. 2.

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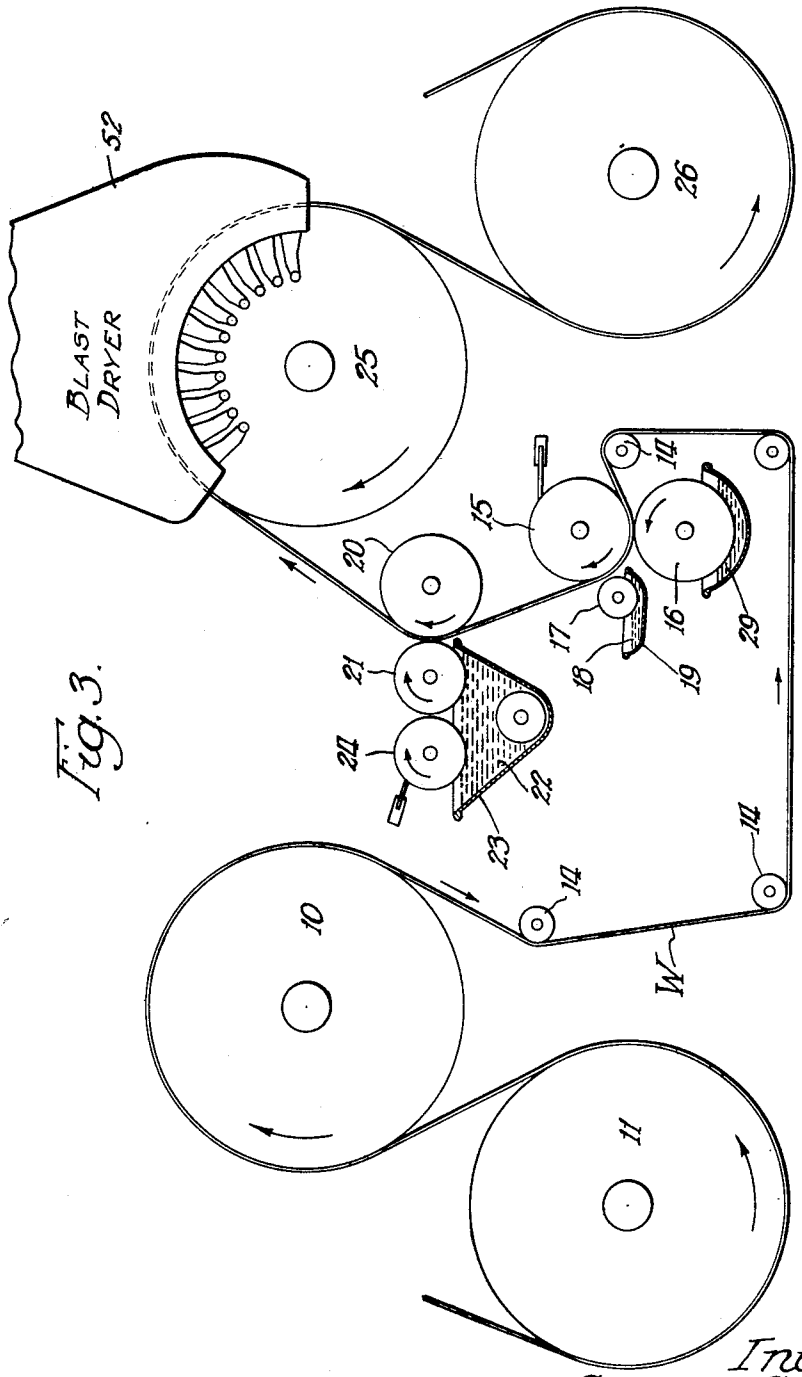

Fig. 3.

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PROCESS AND APPARATUS FOR MAKING PAPER

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Application January 18, 1934, Serial No. 707,143

9 Claims. (Cl. 92—40)

This invention relates to the art of paper making and has reference more particularly to the manufacture of papers coated on the machine.

One of the objects of the present invention is to provide an improved continuous method of and apparatus for making a paper having its outer surface treated with a filler or "color", and to provide an arrangement whereby a smooth coating of such color of any desired thickness may be applied to the outer surface of the paper, without requiring the use of the customary smoothing bars or brushes for uniformly distributing the color on the surface of the paper.

According to the present process the coating or color, which may consist chiefly of an insoluble, inorganic mineral such as china clay, satin white, chalk or other suitable mineral mixed with a suitable binder such as starch or casein, or both, is applied to the paper web during the manufacture of the paper; that is, on the paper machine, preferably after the paper has passed over part of the driers.

I have found by numerous experiments that if the partly dried paper web be subjected to considerable pressure as it leaves the preliminary drying cylinders, so as to compact and smooth the surface thereof prior to the application of the coating liquid, the uniformity and smoothness of the coating on the finished product are substantially enhanced over a process which does not include such preliminary compacting and smoothing of the partly dried web. It is, of course, quite common to pass the wet web, as it leaves the couch roll of the paper machine, through one or more pairs of squeeze rolls for the purpose of expelling the bulk of the water from the web. This, however, is not the operation above described, which contemplates the application of considerable pressure to the partly dried web for the purpose of compacting and smoothing the surface thereof just prior to the application of coating thereon.

In carrying out the present process, the web is first formed in the usual manner on the paper machine, after which a substantial amount of water is removed from the web by evaporation. I then subject the partly dried web to considerable pressure to compact and smooth the surface of the same, and immediately thereafter I apply a large excess of coating liquid to a surface of the web, following which I remove the excess and then distribute and smooth the remainder by means of a wet surface perferably traveling in a counterdirection to, and in contact with, the coated web, preferably at a speed somewhat in excess of the speed of the web, after which the web is dried in the usual manner.

According to a slight modification of the above described process, before applying the excess coating I may force a filler preferably of starch or size into the surface stratum of the web which is to be coated, this being conveniently done by applying such a filler to the surface of one of the press rolls.

In order that the novel principle of the invention, the manner in which the same may be carried out, and the practical advantages flowing therefrom may be readily understood by persons skilled in the art, I have, in the accompanying drawings, illustrated diagrammatically a machine for treating a paper web embodying certain novel combinations of structural features and operating in accordance with the improved process; and referring thereto—

Fig. 1 is a diagrammatic side elevation of the machine.

Fig. 2 is an enlarged side elevation, partly in section, of the web smoothing, coating and final smoothing mechanisms.

Fig. 3 is a view similar to Fig. 2, illustrating a slight modification for impregnating the surface stratum of the web with a filler prior to the coating and final smoothing operations.

Referring first to Figs. 1 and 2, the paper web W as it comes from the wet end of the paper machine, is first passed through a series of drying cylinders 10 and 11 illustrated at the left of Fig. 1, preferably in association with upper and lower felts 12 and 13, respectively, that press the wet web into intimate contact with the cylinders, whereby a considerable amount of water is removed from the web by evaporation. From the last cylinder 10 the partly dried web passes over driven guide rolls 14 into the nip of a pair of press rolls 15 and 16, that, by the use of considerable pressure, serve to compact and smooth the surfaces of the web. Mounted opposite the upper press roll 15 and beyond the nip of the rolls 15 and 16 is an applicator roll 17 dipping into a body of coating material 18 in a suitable pan 19. The arrows in Fig. 2 show the directions of rotation of the rolls 15 and 16. The applicator roll 17 preferably rotates counter-clockwise so that its applying surface travels in the same direction as the web, and, when so rotating, its perpiheral speed is preferably somewhat less than the speed of the web, as, for example, from eighty to ninety per cent of the speed of the web. However, the function of the applicator roll 17 is to apply a large excess of the coating liquid to the previously

smoothed surface of the web, and for the fulfilment of this duty it might rotate in the reverse direction and/or at a different relative speed than that above indicated. From the rolls 15, 17, the web passes over a backing or abutment roll 20, preferably of rubber, or rubber surfaced, and facing the backing roll 20 is a metal roll 21 which is spaced from the roll 20 a regulable distance suitable for reducing the excess coating to a coating of the desired or required thickness. This roll 21, which I term a smoothing roll, has the double function of doctoring off the excess of coating applied by the roll 17 and thoroughly smoothing the remainder on the web surface. For the performance of this latter function, I find it advantageous to wet the surface of the roll 21 with a very thin film of the coating liquid for which purpose the roll 21 dips into a body 22 of liquid contained in a pan 23, and the thickness of the film is determined by a doctor roll 24 adjustably mounted in exact parallelism with roll 21. I have not herein illustrated the means for adjusting the position of roll 21 relatively to roll 20 and of roll 24 relatively to roll 21, means for this purpose being fully disclosed in my pending application Serial No. 658,731, filed February 27, 1933, issued as Patent No. 1,957,817 dated May 8, 1934.

Fig. 2 also shows by arrows the relative directions of rotation of the rolls 20, 21 and 24. The peripheral speed of the roll 21 is greater than the speed of the web, being preferably about 1.35 times the latter, and its retreating surface serves to doctor off the excess portion of the coating applied to the web by roll 17, such excess portion falling into the pan 23, while its approaching surface serves to uniformly spread and smooth the film of coating remaining on the web. Of course, there is some intermingling of the two thin films on the roll and web at their point of juncture which effects a very thorough and uniform distribution on the web, but the thickness of the coating is not substantially increased or built up, unless an extra heavy coating is desired, in which case either the smoothing roll 21 is shifted slightly away from the roll 20 or the doctor roll 24 is so adjusted as to slightly increase the thickness of the film on the smoothing roll 21.

The pressure applied between the press rolls 15 and 16 will preferably be about 150 to 160 pounds per lineal inch, but it may vary from almost nothing up to 250 pounds, depending on the finish, basis weight, surface characteristics desired, etc. The applicator roll 17 has no pressure against the web and roll 15.

From the rolls 20, 21, the web may pass over a series of drying cylinders 25 and 26 and carrying felts 27 and 28 therefor, structurally identical with the same equipment between the wet end of the machine and the coating devices. From the last drum 25, the coated and dried web will preferably pass to the usual calendar rolls.

The salient novel feature of the present process consists in first compacting and smoothing the surface of the partly dried paper web by the application of considerable pressure thereto, prior to the application of the coating. The subsequent operations of then applying an excess amount of liquid coating to the surface of the web after the latter has passed the smoothing press rolls, and then removing the excess and smoothing the remainder by a surface pre-wetted by the coating liquid and traveling in a counterdirection to the web preferably at a greater speed and in wiping contact with he residual film on the web are preferably employed, and cooperate with the initial smoothing of the partly dried web in insuring against a rough or uneven coating by preventing the formation of ridges, ripples, waves, gaps or pits in the coating surface, and producing a coating of remarkable uniformity and smoothness.

The modification illustrated in Fig. 3 merely adds the feature of forcing into the partially dried web a surface filler in the nature of a size or binder, which may also contain a pigment if desired, before the excess coating is applied. This is conveniently accomplished by causing the lower press roll 16 to dip into a body of size 29 in a pan 30, whereby a film of such size is carried up by the roll 16 and forced into the surface stratum of the web as the latter passes through the nip of the rolls 15 and 16 and is smoothed thereby. Obviously, the product of this process has not only the coating described in connection with Figs. 1 and 2, but also a surface filler of size or size and pigment underlying said coating and incorporated in the surface stratum of the web. This application of a starch size is useful in manufacturing varnished label papers for the purpose of preventing the penetration of the varnish through to the back of the paper.

I claim:

1. The improved continuous process of making coated paper, which comprises forming a web, then removing a substantial amount of water therefrom by evaporation, then smoothing the partially dried web by pressure, then applying an excess amount of coating to a surface of the web, and then removing a portion of said coating and smoothing the remainder on the web.

2. The improved continuous process of making coated paper, which comprises forming a web, then removing a substantial amount of water therefrom by evaporation, then smoothing the partially dried web by pressure, then subjecting a surface of the web to a traveling coated surface so related thereto as to deposit an excess amount of coating on the web, and then subjecting said web surface to a wet surface traveling in the reverse direction and suitably related thereto to remove a portion of said coating and smooth the remainder on the web.

3. The improved continuous process of making coated paper, which comprises forming a web, then removing a substantial amount of water therefrom by evaporation, then smoothing the partially dried web by pressure, then subjecting a surface of the web to a coated surface traveling in the same direction but at less speed to thereby deposit an excess amount of coating on the web, and then subjecting said web surface to a thinly coated surface traveling in the reverse direction and suitably related thereto to remove a portion of said coating and smooth the remainder on the web.

4. The improved continuous process of making coated paper, which comprises forming a web, then removing a substantial amount of water therefrom by evaporation, then smoothing the web by pressure and forcing a filler into a surface thereof, then applying an excess amount of coating to said surface, and then removing a portion of said coating and smoothing the remainder on the web.

5. The improved continuous process of making coated paper, which comprises forming a web, then removing a substantial amount of water therefrom by evaporation, then smoothing the web by pressure and forcing a filler into a surface thereof, then subjecting said surface to a traveling

coated surface so related thereto as to deposit an excess amount of coating on the web, and then subjecting said web surface to a wet surface traveling in the reverse direction and suitably related thereto to remove a portion of said coating and smooth the remainder on the web.

6. The improved continuous process of making coated paper, which comprises forming a web, then removing a substantial amount of water therefrom by evaporation, then smoothing the web by pressure and forcing a filler into a surface thereof, then subjecting said surface to a coated surface traveling in the same direction but at less speed to thereby deposit an excess amount of coating on the web, and then subjecting said web surface to a thinly coated surface traveling in the reverse direction and suitably related thereto to remove a portion of said coating and smooth the remainder on the web.

7. Apparatus adjunctive to a paper making machine for coating the web as it comes from the wet end of the machine, comprising, in combination, means for removing a substantial amount of water from the web by evaporation, means for subjecting the partially dried web to pressure for smoothing the same, means for subsequently applying an excess amount of coating to a surface of the web, and means for subsequently removing a portion of said excess coating and smoothing the remainder on the web.

8. Apparatus adjunctive to a paper making machine for coating the web as it comes from the wet end of the machine, comprising, in combination, means for removing a substantial amount of water from the web by evaporation, a pair of press rolls through which the partially dried web is passed to smooth the same, an applicator roll serving to apply an excess amount of coating to a surface of the web beyond said press rolls, a backing roll over which the web is then passed, a smoothing roll cooperating with said backing roll to remove a portion of the coating applied by said applicator roll and smooth the remainder on the web, and means for wetting the peripheral surface of said smoothing roll.

9. Apparatus adjunctive to a paper making machine for surface filling and coating the web as it comes from the wet end of the machine, comprising, in combination, means for removing a substantial amount of water from the web by evaporation, a pair of press rolls through which the partially dried web is passed to smooth the same, means for supplying a filler to the surface of one of said press rolls whereby said filler is forced into the surface stratum of the web, an applicator roll serving to apply an excess amount of coating to the filled surface of the web beyond said press rolls, a backing roll over which the web is then passed, a smoothing roll cooperating with said backing roll and rotating in a counter-direction to the direction of travel of said web and at a greater peripheral speed than the latter, said smoothing roll serving to doctor off a portion of the coating applied by said applicator roll and to smooth the remainder on the web, and means for wetting the peripheral surface of said smoothing roll.

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