Feb. 1, 1927. 1,616,211

J. H. A. ARMSTRONG

METHOD AND APPARATUS FOR MAKING PAPER HAVING THE APPEARANCE OF HANDMADE PAPER

Filed Oct. 7, 1921 2 Sheets-Sheet 1

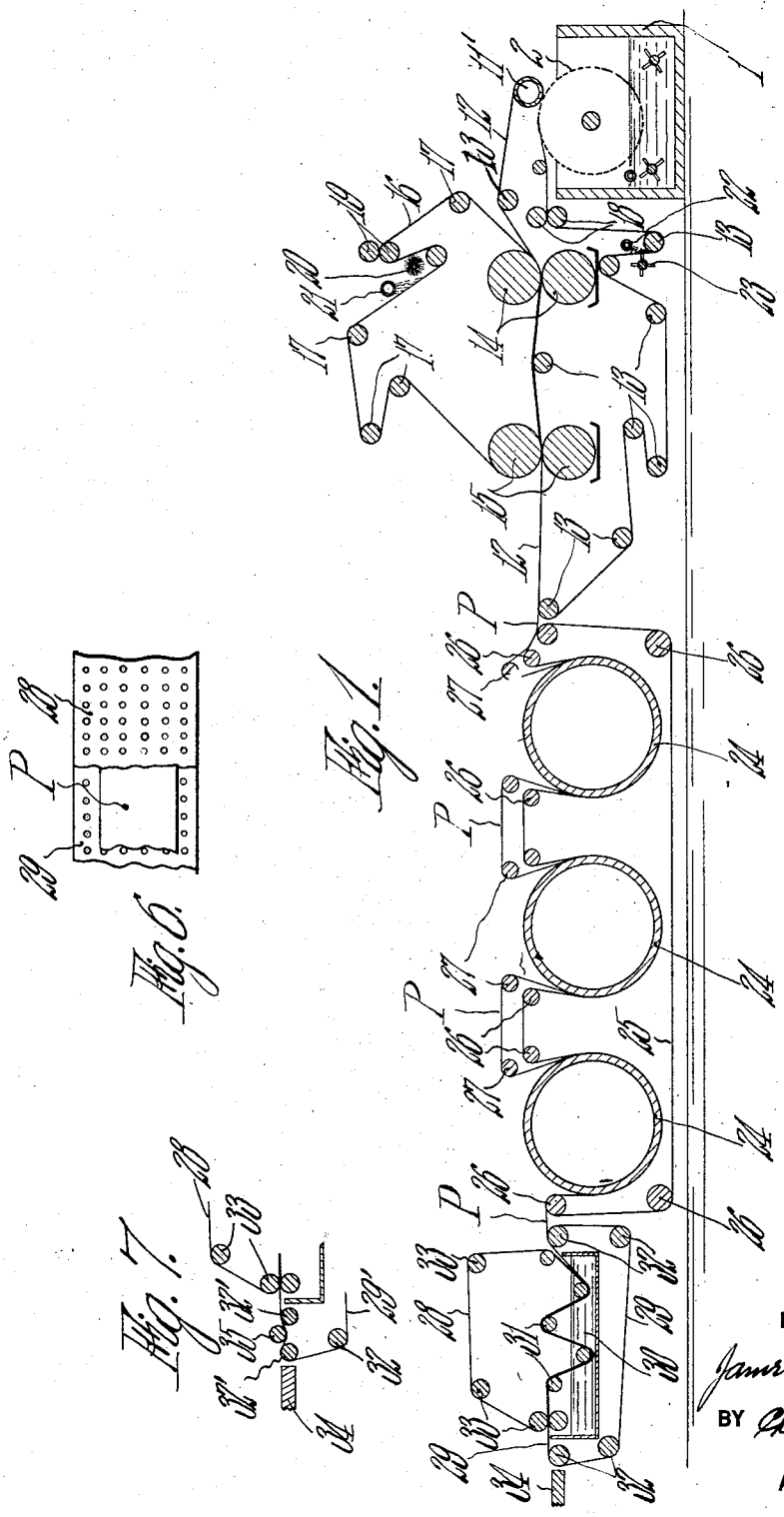


Fig. 1.



Fig. 6.



Fig. 7.

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Fig. 2.

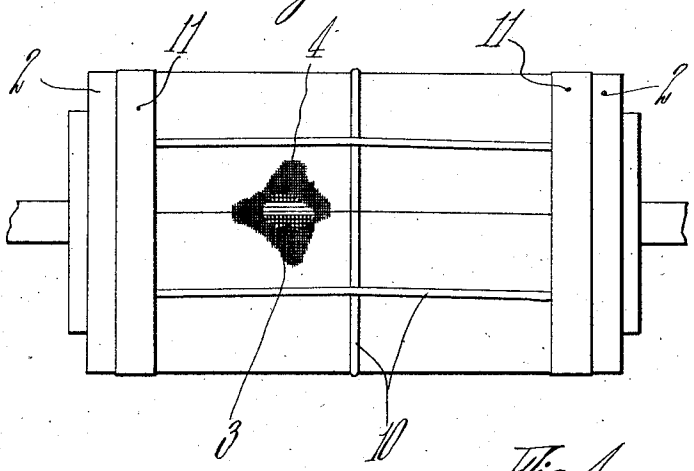



Fig. 3.

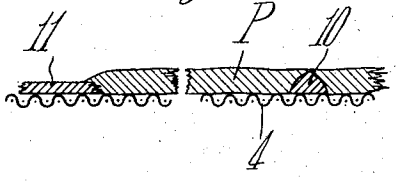



Fig. 4.

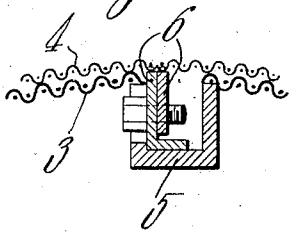
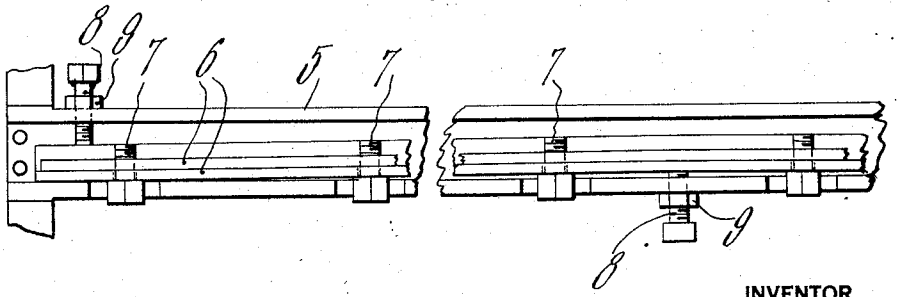



Fig. 5.




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# UNITED STATES PATENT OFFICE.

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## METHOD AND APPARATUS FOR MAKING PAPER HAVING THE APPEARANCE OF HANDMADE PAPER.

Application filed October 7, 1921. Serial No. 506,108.

The present invention relates to a method and apparatus for making paper, and has for its object more particularly the manufacture of a high grade paper having all of the characteristics and appearance of hand-made paper. A distinguishing feature of hand-made paper consists of the irregular feathered edge which borders all four sides of the sheet and known as a deckle edge, and which is produced in consequence of the particular method employed in making the paper by hand, one sheet at a time. Paper has been made on machines in a continuous web with deckle edges along the lateral sides of the sheet, but this paper obviously when cut from the web into separate individual sheets, is readily distinguished from hand-made paper by reason of the absence of the deckle edges at all the bordering sides of the sheet.

In the carrying out of the present invention of which Patent No. 1,470,675 granted to me Oct. 16, 1923, is a companion case, the paper is made by forming a continuous web of pulp preferably on a cylinder machine provided with the usual deckles for producing deckle edges along the lateral edges of the web. During the process of its formation, the web is rendered more easily frangible along predetermined lines of division, whereby at certain stages of the process and operation of the machine, it may be ruptured along said lines of division in a manner to pull out said ruptured edge into the attenuated and irregular form of a deckle edge. Individual sheets will then be produced having deckle edges at all four sides thereof similar to the hand-made sheet.

The preferred method and apparatus for carrying out the invention will now be described, which apparatus is illustrated in the accompanying drawings in which:

Fig. 1 is a view somewhat diagrammatic of certain well known elements of a paper making machine arranged for carrying out the present process;

Fig. 2 is an elevation of the rotating cylinder on which the pulp is formed;

Fig. 3 is a sectional detail through a portion of the making screen on the cylinder with a layer of pulp formed thereon;

Fig. 4 is a sectional detail through the anchoring bars for the ends of the making screen;

Fig. 5 is a plan view of said anchoring bars showing adjustable means for distorting the same;

Fig. 6 is a fragmentary detail of the perforated sizing felts;

Fig. 7 is a detail of a mechanical means for breaking the strips.

Referring more particularly to the drawings, the paper making machine illustrated is of the cylinder type wherein 1 indicates the pulp vat in which the forming cylinder 2 is rotatably mounted in the usual way. The peripheral wall of said cylinder is constituted by a somewhat coarse and heavy wire mesh 3 serving as a base for the fine wire mesh or making screen 4 upon which the web of pulp is formed during the rotation of the cylinder. The ends of the base screen 3 terminate as shown in Fig. 4 at the upturned sides of a channel bar 5 extending transversely of the cylinder and fastened securely at the end walls thereof in any suitable manner. Transverse anchoring bars 6 for the ends of the making screen 4 are adjustably mounted within the channel bar 5 and are arranged as shown to serve as a means for anchoring the adjacent ends of said making screen 4. A series of screw bolts 7 mounted in one of said anchoring bars and having a screw threaded engagement with the other of said anchoring bars are adapted to draw the same tightly together for closely abutting the ends of said making screen. Adjusting bolts 8 with locking nuts 9 are screw threaded in the channel bar 5 and arranged to engage opposite sides of the anchoring bars at the center and end portions thereof, as shown, to distort or bend the same at the center along the central circumferential line of cylinder for the purpose to be hereinafter described.

Preferably fixed to the surface of the making screen 4 and projecting upwardly from the surface thereof are a series of strips or bars 10 of imperforate material, such as metal. These strips 10 may be disposed in various spaced relationship upon the surface of the making screen and are for the purpose of producing deep indentations in the layer of pulp being formed on the screen, as shown in Fig. 3. The indentations thus produced constitute lines of division between individual sheets of the pulp web, along which said pulp web may be ruptured

at a later stage of the process in a manner to produce the deckle edges.

The dimensions and cross-sectional contour of said indenting strips 10 should preferably be such as to produce lines of division in said layer of pulp which will taper gradually to the thinnest part of said pulp layer, and thus avoid any sharp cut line of demarcation between the individual sheets when the same are afterwards pulled apart or ruptured along said lines of division. Indenting strips of broader base than height and of the general cross-sectional contour, as shown in Fig. 3, have been found to successfully accomplish the above result. It will be observed particularly that the indenting strips do not project entirely through the layer of pulp, but are always intended to leave a thin, fragile, bridging connection between the individual sheets, so that said pulp may be handled in the machine as a continuous web. In addition to the indenting strips 10, the cylinder 2 has mounted thereon the side deckles 11 which are of the usual character for determining the width of the pulp web being formed on the screen, and which produce the deckle edges along the longitudinal side edges of said web.

It will be noted by referring to Fig. 2 that the transversely arranged indenting strips 10 are distorted or bowed slightly at their centers so as to incline from the circumferential edges of said cylinder toward the central circumferential line thereof. The above mentioned distortional inclination is in a direction reverse to that of the rotation of the cylinder whereby the central portion of each transverse line of division formed on the pulp web, as it leaves the cylinder will lag behind slightly for a purpose hereinafter described.

The couch roll 11′ is mounted in the usual way to coact with the cylinder 2 and an endless bottom felt 12 passes around said couch roll for taking up the web of pulp in a continuous manner from the cylinder 2. The bottom felt 12 runs from the couch roll successively through pairs of press rolls 14 and 15 and around suitable guide rolls and tension rolls 13, so as finally to return to the couch roll. In addition to the bottom felt 12, an endless top felt 16 running around suitable guide rolls and tension rolls 17 is arranged to engage the upper side of the pulp web and pass therewith successively through press rolls 14 and 15. The employment of the top and bottom felts 12 and 16 in engagement with opposite sides of the pulp web as it passes through the several pairs of press rolls serves to provide a free outlet at both sides of the web for the escape of water as it is progressively pressed out of said pulp during the passage of the latter successively through the said pairs of press rolls. The two pairs of press rolls 14 and 15 are preferably arranged, as shown, to carry the pulp web with its top and bottom felts in substantially a horizontal line through the wet end of the machine.

It will be understood that the press rolls 14 and 15 have the usual crowned cylindrical walls, common to all pressure rolls of this character, so as to insure a uniform degree of pressure throughout the width of the pulp web. This crowned formation of said press rolls in paper making machines causes, as is well known, the center of the web to advance therethrough slightly faster than the lateral edges thereof. A result of this slight acceleration of the web along its center line in the present machine is to bring the transverse indented lines of divison of said web forwardly at the centers thereof and thus straighten them out from the distortion previously mentioned, so that when the pulp web leaves the press rolls 15, the transverse lines of division run straight across the web and at right angles to the sides thereof. This action insures that the individual paper sheets when pulled apart from the web will have straight regular sides. The amount of distortion given to the indenting strips 10, as previously described, should be adjusted by the bolts 8 to just compensate for the distortion in an opposite direction which will be given to the lines of division in the pulp web as it passes through the press rolls.

Suitable squeeze rolls 18 are provided for the bottom felt and squeeze rolls 19 for the top felt. A rotating brush 20 is arranged to engage the top felt 16 so as to continually raise the nap on the surface of said felt which is presented to said web. A cleaning spray 21 is also provided for the top felt 16, and cleaning spray 22 and beater 23 is also provided for the bottom felt as shown.

The pulp web indicated at P in Fig. 1, after passing through the press rolls at the wet end of the machine, is lead from the lower felt 12 to the dry end of the machine, which may be constituted by one or more drying cylinders 24 of the usual type. An endless felt or apron 25 is guided in the usual manner over rolls 26 so as to run in wrapping engagement with a portion of each drying cylinder and carry the continuous web of pulp into contact with said drying cylinder for being gradually dried thereby. Guide rolls 27 are provided to guide the web of pulp in the usual manner from one drying cylinder to the other.

After passing around said drying cylinders, the pulp web is led between top and bottom engaging felts or aprons 28 and 29 respectively, which felts receive and guide said web into and out of a sizing bath 30. The felt aprons 28 and 29 are preferably perforated, as shown in Fig. 6, so as to give the

sizing liquid in the bath free access to the web and also to permit the ready egress of the excess of sizing liquid from the web as it leaves said bath. Suitable guide rolls 31 are arranged to guide the travel of said bottom felts in and out of said sizing bath in the manner shown in Fig. 1. Further guide rolls 32 are provided for the bottom felt 29 and guide rolls 33 for the top felt 28

The web of pulp which has been substantially dried and formed into paper during its passage around the drying cylinders is subjected to a remoistening action as it passes through the sizing bath 30, which serves to soften the texture of said paper and render the same more easily frangible along the lines of division which have been formed in the web in the manner described. The paper thoroughly moistened by the sizing bath is delivered in a continuous web from the felt 29 upon a table 34, and at this stage of the operation, the web, while still in a wet, moistened condition, is pulled apart or ruptured along the lines of division which have been formed whereby individual sheets are obtained with feathered or deckle edges at all sides thereof.

The moistened web as it is delivered to the table 34 may be separated into sheets by hand or the web may be passed through bending rolls such as illustrated in Fig. 7 to mechanically pull apart the sheets. In this case the lower apron 29′ of the sizing bath carries the web over rolls 32′ and under roll 35 so as to give a sharp bend first one way and then the other, to the web which will cause the sheets to separate at the lines of division and be delivered to the table 34.

It is important to note, that the sheets are subjected to a tensile strain in pulling them apart so as to produce an irregular torn edge as distinguished from the clean cut edge produced by a knife or shears. Furthermore, the sheets are preferably pulled apart while still wet, both to insure their separation along the weakened lines of indentation, and also because the wet and softened pulp more readily attenuates into the irregular feathered edge desired. The individual paper sheets thus prepared may then be suitably plated and finished in the usual way.

What is claimed is:

1. The process of making separate sheets of deckle edged paper which comprises the forming of a continuous web of pulp on a making screen with indented lines of division between separate sheets and transversely of the web being formed, each transverse line being distorted to protrude rearwardly at its center in the reverse direction to the travel of said web, running the pulp in a continuous web form said making cylinder through press rolls to remove water from the web, causing said press rolls to advance the web relatively faster at the center of the web so as to deliver the same with the indented lines of demarcation straight across the web, and after said web has passed through said press rolls pulling apart the separate sheets of the web along said indented lines of division.

2. The process of making separate sheets of deckle edged paper which comprises the forming of a continuous web of pulp on a making screen with indented lines of division between the separate sheets in the web being formed, running the pulp in a continuous web from said making screen through press rolls to remove water from the web of pulp, then running said continuous web through driers and next through a sizing bath, and while said web is still moist from the sizing bath, pulling apart the separate sheets of the web along said indented lines of division.

3. The process of making separate sheets of deckle edged paper which comprises the forming of a continuous web of pulp on a making screen with indented lines of division between the separate sheets in the web being formed, running the pulp in a continuous web from said making screen through a series of press rolls to remove water from the web, then running said continuous web through driers and next between oppositely contacting perforated conveying belts through a sizing bath, and while said web is still moist from the sizing bath, pulling apart the separate sheets of the web along said indented lines of division.

4. In a paper making machine, a cylinder comprising a making screen having imperforate strips projecting from the surface of said screen and extending across the same in spaced apart relation, said strips being inclined from the circumferential edges of said cylinder toward a central circumferential line thereof.

5. In a paper making machine, a cylinder comprising a making screen having imperforate strips projecting from the surface of said screen and extending across the same in spaced apart parallel relation, said strips being inclined from the circumferential edges of said cylinder toward a central circumferential line thereof, and means for adjusting the inclination of said strips.

6. In a paper making machine, a cylinder comprising a making screen having imperforate strips projecting from the surface of said screen and extending across the same in spaced apart parallel relation, said strips being inclined from the circumferential edges of said cylinder toward a central circumferential line thereof, transverse anchoring bars on said cylinder to which the abutting ends of said screen are fastened, means for drawing said anchoring bars together, and adjustable means for bending said bars at their center, so that said screen and strips

are distorted in a direction along the central circumferential line of said cylinder.

7. In a paper making machine, in combination, a pulp vat, a rotating cylinder comprising a making screen having spaced apart imperforate strips projecting from the surface thereof, a series of pairs of press rolls and top and bottom felts engaging opposite sides of a continuous pulp web as it passes successively through said press rolls, one or more drier cylinders and a felt for carrying said continuous pulp web in contact with said drier cylinder or cylinders, a sizing bath, and top and bottom contacting felts for carrying said continuous pulp web in and out of said sizing bath.

8. In a paper making machine, in combination, a pulp vat, a rotating cylinder comprising a making screen having spaced apart imperforate strips projecting from the surface thereof, a series of pairs of press rolls and top and bottom felts engaging opposite sides of a continuous pulp web as it passes successively through said press rolls, one or more drier cylinders and a felt for carrying said continuous pulp web in contact with said drier cylinder or cylinders, a sizing bath, top and bottom contacting felts for carrying said continuous pulp web in and out of said sizing bath, said last named felts being perforated.

9. In a paper making machine, in combination, a pulp vat, a rotating cylinder comprising a making screen having spaced apart imperforate strips projecting from the surface thereof, said strips being arranged in parallel relation across said screen and inclined from the circumferential edges of said cylinder toward the central circumferential line of said cylinder and in a direction opposite to the rotation of said cylinder.

10. In a paper making machine, in combination, a pulp vat, a rotating cylinder comprising a making screen having spaced apart imperforate strips projecting from the surface thereof, said strips being arranged in parallel relation across said screen and inclined from the circumferential edges of said cylinder toward the central circumferential line of said cylinder and in a direction opposite to the rotation of said cylinder, a couch roll, a bottom felt passing around said couch roll for taking up a continuous web of pulp, a plurality of pairs of press rolls between which said felt and pulp web is adapted to run, said press rolls having crowned peripheral surfaces acting to advance the center of said pulp web slightly faster than the lateral edges thereof.

11. The process of making separate sheets of deckle edged paper which comprises the forming of a continuous web of pulp on a making screen with indented lines of division to form weakened portions between the separate sheets in the web, running the continuous web thus formed from the making screen through press rolls to remove water from the web of pulp, continuing the run of said continuous web through driers, and finally breaking said web into separate sheets along said indented and weakened lines of division.

12. The process of making separate sheets of deckle edged paper which comprises the forming of a continuous web of pulp on a making screen with indented lines of division to form weakened portions between the separate sheets in the web, running the continuous web thus formed from the making screen through press rolls to remove water from the web of pulp, continuing the run of said continuous web through driers, remoistening said web after passing through the driers, and finally breaking said web into separate sheets while still moist and soft along said indented and weakened lines of division.

13. In a paper making machine in combination, a pulp vat, a rotating cylinder comprising a making screen having spaced apart imperforate strips projecting from the surface thereof a distance less than the thickness of the pulp web to be formed thereon, a couch roll for taking off a continuous web from said making cylinder, press rolls, a series of drying cylinders and means for conducting said continuous web from said press rolls to said drying cylinders, a felt passing successively around said drying cylinders for carrying the continuous web in contact with said drying cylinders, and means for guiding said web away from said felt while passing between successive drying cylinders.

In testimony whereof I have affixed my signature.

JAMES H. A. ARMSTRONG.