March 13, 1928. 1,662,200

C. N. MERRILL

PAPER MAKING

Filed Sept. 23, 1925 2 Sheets-Sheet 1

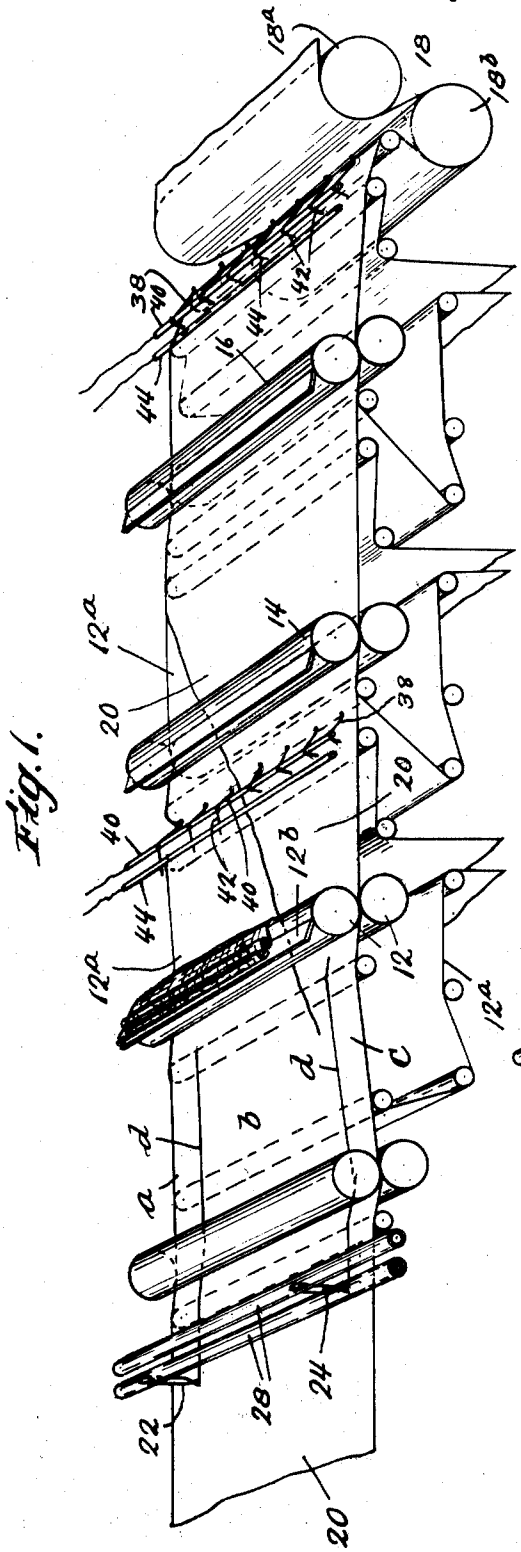


Fig. 1.

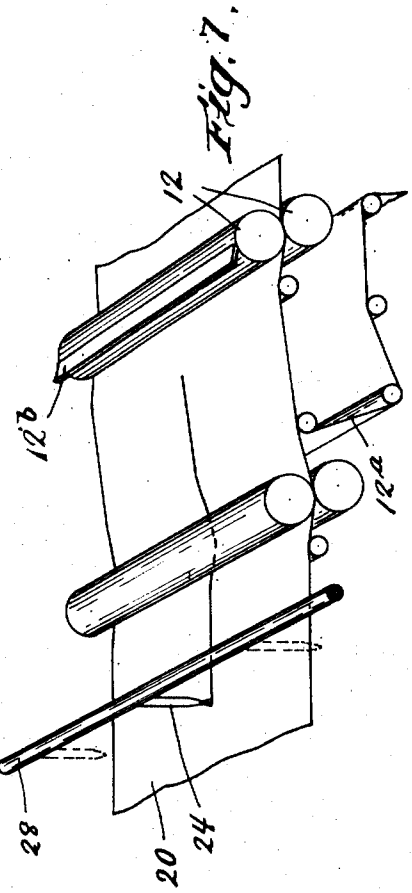


Fig. 7.

Inventor,
Charles Neal Merrill
by
Attorney

March 13, 1928. 1,662,200

C. N. MERRILL

PAPER MAKING

Filed Sept. 23, 1925 2 Sheets-Sheet 2

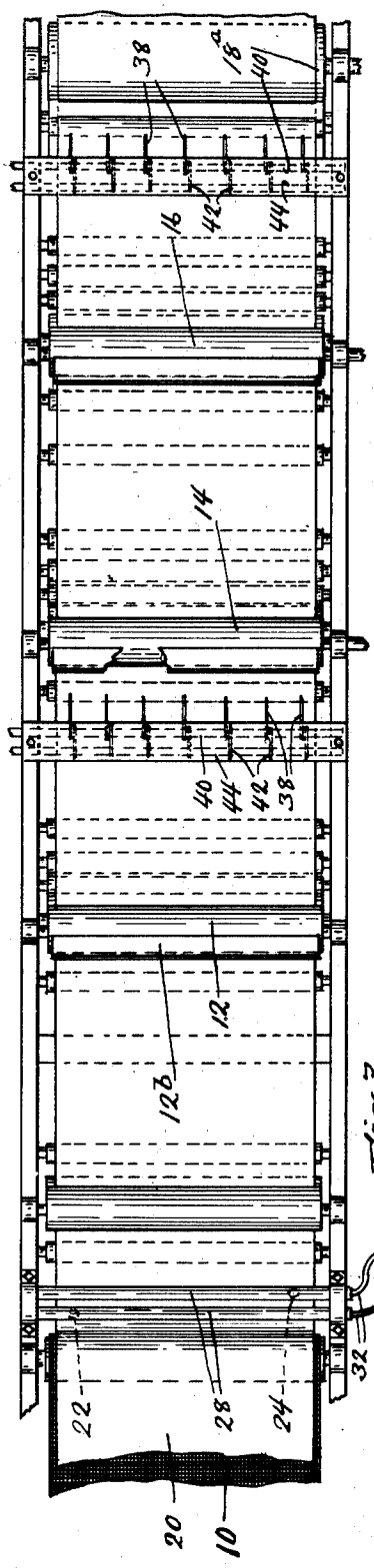


Fig. 3.

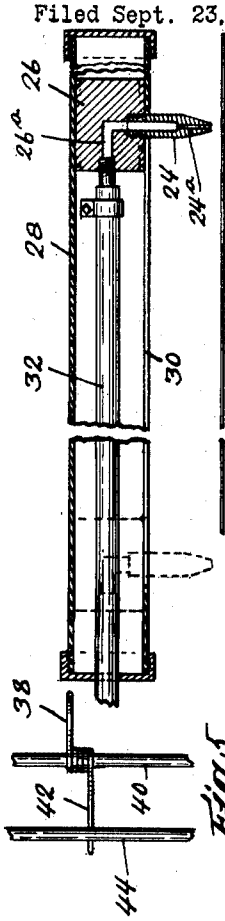


Fig. 6.

Fig. 5.

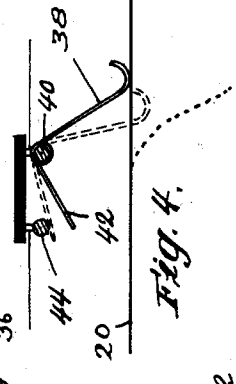


Fig. 4.

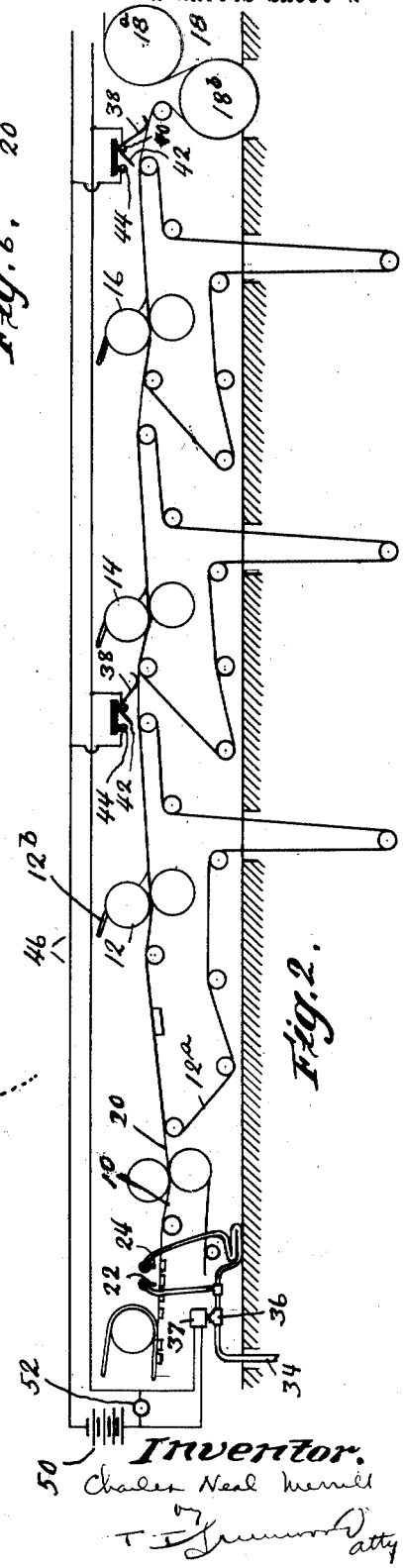


Fig. 2.

Inventor.
Charles Neal Merrill
T. E. Timmons Atty

Patented Mar. 13, 1928. 1,662,200

UNITED STATES PATENT OFFICE.

CHARLES NEAL MERRILL, OF MILLINOCKET, MAINE, ASSIGNOR TO GREAT NORTHERN PAPER COMPANY, OF MILLINOCKET, MAINE, A CORPORATION OF MAINE.

PAPER MAKING.

Application filed September 23, 1925. Serial No. 58,168.

This invention relates to paper making and has particular reference to automatic means for maintaining the continuity of the paper sheet in the paper making machine when breaks or tears form in the sheet.

The actual production of a Fourdrinier machine is much less than the calculated production assuming continuous operation during working hours. This deficiency is principally due to the cessation of production when the sheet breaks as it passes through the machine. A break usually starts at one side of the sheet and, wherever it starts, it travels across the sheet, making ordinarily a diagonal or V-shaped tear which, unless stopped in some manner, will sever the sheet. If the paper sheet is broken entirely across, it is necessary to re-thread a narrow strip called a lead strip through the machine from the paper making wire, which operation necessarily takes a substantial amount of time. In the aggregate, the loss of production thus occasioned is serious. If, however, when a break occurs in the sheet, a strip of the paper sheet can be preserved unbroken and the strip thus left continues to pass through the machine, all the time required to re-thread the strip through the machine will be saved and after the cause and result of the break has been remedied, the lead strip can be widened out to the full width of the sheet in the usual way.

It is an object of this invention to provide a paper making machine with means to prevent the complete severance of the paper sheet when a break occurs therein.

A further object is to provide means to terminate the break before it traverses the entire width of the sheet.

A yet further object of the invention is the provision of means to maintain the continuity of the sheet in the machine when a break forms in the sheet and to cut the broken section out of the sheet.

A further object of the invention is generally to improve paper making machines and methods.

Under present practice when a break occurs in the paper sheet, the break travels across and completely severs the sheet at about the point in the machine where the break starts. The machine tender is then required to draw the lead strip former, or squirt, which is a nozzle, adapted to discharge a fine high-pressure stream of water through the paper sheet, across the machine at and above the paper making wire from one side nearly to the other, thus cutting off a portion of the sheet and forming a lead strip therein. The cut-off portion of the sheet is dropped through the floor and is returned to the beaters and the lead strip is re-threaded through the machine at serious expense of time and labor. The squirt is then returned gradually across the paper sheet to its original position, thus broadening out the lead strip to the full width of the sheet.

In accordance with this invention means are provided at the paper-making wire to separate a narrow strip or strips from the remainder of the sheet by a longitudinal space after the tear starts and before the tear has progressed across the entire sheet. When the tear reaches the longitudinal space thus formed, the tear will stop, thus leaving the narrow strip which continues to pass through the machine. As soon as the cause and result of the break have been remedied, the narrow strip is widened out in the usual manner until the full sheet is again formed, thereby entirely eliminating the previously necessary re-threading step.

Fig. 1 is a fragmentary perspective view of that portion of a Fourdrinier paper making machine with which this invention is associated.

Fig. 2 is a diagrammatic side elevation of Fig. 1.

Fig. 3 is a plan view of Fig. 2.

Figs. 4 and 5 are side and plan views respectively of a break-detector.

Fig. 6 is a sectional elevation through one of the squirts and illustrating its normal relation with the paper sheet at the Fourdrinier wire.

Fig. 7 is a detail illustrating a modified form of a squirt which may be used with this invention.

The paper making machine here shown comprises a Fourdrinier wire 10 on which

the paper is made, a plurality of presses, 12, 14 and 16 and a drier 18. The wet paper sheet 20 passes in the usual manner from the wire to the felt 12^a of the first press 12 and thence in succession to the remaining presses where some of the water in the wet paper sheet is pressed out; and the partially dry sheet passes, for the complete drying thereof, to the drier 18 and about the drying rolls, of which two rolls 18^a and 18^b are here shown.

That portion of the paper sheet between the paper-making wire and the drier is wet and consequently weak and is easily broken or torn if the tension on the sheet at the presses, or at the driers, is not properly adjusted, or if the paper is stressed unduly in some other manner. The break or tear usually progresses diagonally across the sheet and, unless prevented, travels entirely across, and severs, the sheet, and thereby renders necessary the re-threading thereof

In accordance with this invention means are provided to preserve the continuity of the paper sheet when a break occurs therein and to arrest the progress of the break so that a strip of the paper sheet is preserved intact which, after the causes and results of the break have been remedied can be broadened out to regain the full width of the paper sheet, all without stopping the passage of the unbroken strip through the machine.

For this purpose, I provide means actuated by a break in the paper sheet to separate the sheet into two or more longitudinal sections or strips, which are separated from each other by a space or slot and are so arranged that a break in the paper sheet can travel across one of the sections into the slot, but the slot will be a barrier to further progress of the break and will prevent it from passing into the other section. One section or strip of the paper sheet will thereby be preserved and subsequently can be broadened out to the full width of the sheet.

The paper separating, or strip-forming, means comprise one or more squirts which include one or more nozzles normally disposed above the paper sheet at the paper making wire and within the margins of the paper sheet. Two nozzles 22 and 24 are here shown, which are disposed, when operated, to separate the sheet into three longitudinal sections *a*, *b* and *c* which are separated by slots *d*. The sections *a* and *c*, which form lead strips, are relatively narrow and one or the other is adapted to be preserved intact when a break occurs in the sheet and is subsequently enlarged to the full width of the paper sheet, whereby to carry the full width of the sheet through the machine. Said nozzles 22 and 24 are supported above the paper making wire by means which permits the nozzles to be moved in both directions entirely across the sheet.

The construction of the nozzles and their supporting means is identical and but one need be described. The nozzle 24 is provided with a small orifice 24^a through which a fine jet of water is adapted to be forcibly discharged whereby to cut through the paper sheet. The nozzle is removably screw-threaded in a supporting block 26 which is slidable within a tubular holder 28, which holder is disposed above and transversely of the paper making wire and the paper sheet thereon. The bottom portion of the holder is formed with a longitudinal slot 30 therein through which said nozzle is loosely extended, and said slot serves to prevent undue movement of the nozzle outwardly beyond the edge of the sheet. A flexible water pipe or hose 32 is extended into the holder and is secured to said block 26 and is in communication with said nozzle through a passage 26^a in said block. The pipes form means by which the nozzles may be moved manually across and off the paper sheet whereby to broaden out the lead strips. The nozzles are normally disposed above the sheet and adjacent the opposite edges of the paper sheet; but they may be set anywhere above the paper sheet and moved in either direction, when desired.

Said flexible pipes 32 are connected to a water supply pipe 34 which is in communication with a source of water under pressure; and the flow of water through said nozzles is controlled by an electro-magnetically operated valve 36 which is adapted normally to be closed and has a solenoid 37 for opening it and suitable means, not shown, for closing it when the solenoid is de-energized.

When the paper sheet passes unbroken through the machine, no water is adapted to flow through the nozzles 22 and 24. When, however, a break occurs in the sheet, break-detecting means are automatically actuated by the break to effect the opening of said valve 36 and the operation of the squirts to separate the paper sheet into a plurality of longitudinal sections.

The break-detecting means comprises an electric circuit-controller having a weighted arm 38 which is pivotally-mounted on a rod 40 and is adapted to bear upon and be supported by the unbroken moving sheet. Said arm is provided with a contact finger 42 which is disposed below and in position to make electrical engagement with a contact rod 44, which rod is disposed in parallel relation with and is insulated from said rod 40. Said arm 38 is adapted normally to be supported by the paper sheet in raised position and with its contact finger 42 free from engagement with said rod 44. When, however, the paper is broken under said arm, the support of said arm is removed and the arm drops, thereby moving said

contact finger and rod 44 into electrical engagement. This operation is arranged to close a control circuit 46 which includes the electromagnet of the valve 36 and a suitable source of energy, as the battery 50, and thereby to cause the squirts to operate.

Break detectors may be located at any point of the paper sheet at which a break is likely to occur, as between the paper-making wire and the driers or, as here shown, at the pass of the paper sheet between the first and second presses, and between the last press and the drier. Preferably a plurality of break-detectors are disposed in relatively close order on said rods 40 across the sheet so that a break causes the operation of one of said arms 38 soon after the break forms. Any one, or all, of the arms 38 are adapted to effect the operation of the squirts.

Under normal operation and when the paper sheet is passing through the machine unbroken, all of the arms 38 are supported in raised position by the sheet and, consequently, the valve 36 remains closed and the squirts are inoperative. When, however, a break occurs in the sheet, as between the paper-making wire and the first press and at the edge of the paper sheet adjacent the nozzle 22, Fig. 3, the break will progress diagonally across the sheet towards the other side as the sheet travels through the first press.

When the broken sheet passes beneath the arms 38 disposed between the first and second presses, one or more of said arms will drop whereby to open the valve 36 and cause jets of water to flow through the nozzles 22 and 24 and thereby sever the sheet into three separated strips *a*, *b* and *c*, these strips passing forwardly through the machine as the break travels transversely across the sheet. The speed of travel of the sheet, however, is ordinarily greater than the speed of travel of the tear across the sheet so that, under ordinary circumstances, the break will sooner or later reach the longitudinal slot formed in the paper sheet by the nozzle 24 and will thereby be stopped. That portion of the paper sheet behind the tear will roll up on doctor 12^b of the first press while the lead strip *c* formed by the nozzle 24 will continue on through the remainder of the paper making machine thereby preserving the continuity of the paper sheet. The machine tender may be warned of the break in the paper sheet by a suitable alarm 52, as a bell or lamp which is operated conjointly with the opening of the water valve 36. The machine tender will thereupon note which strips of the sheet are preserved, in this case, the lead strip *c* and, after the cause of the break has been removed, will move one of the nozzles as the nozzle 22 to cut off the lead strip *a* and then move the other nozzle 24 gradually across the moving paper sheet whereby to cut out the broken section of the sheet at the Fourdrinier wire and to enlarge the lead strip to the full width of the paper sheet so that the full width again passes through the entire machine. Preferably both nozzles should be moved and in the same direction, across and off the paper sheet as otherwise one of the nozzles could continue to cut the sheet and prevent the broadening of the sheet through the machine.

The passage of the full width of the paper sheet through the machines raises the arms 38 of the break detectors and thereby opens the circuit for the electro-magnetic valve 36 and stops the action of the squirts. The nozzles can thereupon be returned to their normal position.

A plurality of squirts is important; one squirt 24^a centrally placed with reference to the paper sheet as illustrated in Fig. 7, and movable in both directions across the sheet might catch most breaks but two or more squirts are much better.

It is common to maintain a stream of water constantly flowing from a squirt, usually, adjustable, against each edge of the sheet to keep a smooth edge. These edge squirts are not shown as they are not material to this invention.

I claim:

1. The method of preserving the continuity of the paper sheet in a paper making machine, which consists in directing streams of water downward on the paper making wire, when a break occurs in the sheet, so as to form longitudinal sections in the moving paper sheet, one containing the break and another being free of the break, and passing the break-containing section to waste while continuing to pass a free section through the machine.

2. The method of preserving the continuity of the paper sheet in a paper making machine when a break occurs in the sheet, which consists in directing streams of water downward on the papermaking wire so as to form longitudinal sections in the moving paper sheet, one containing the break and another being free of the break, and passing the break-containing section to waste while continuing to pass a free section through the machine, and subsequently enlarging the free section to the full width of the paper sheet.

3. The method of preserving the continuity of the paper sheet in papermaking machines when a break occurs in the sheet, which consists in directing streams of water onto the sheet on the papermaking wire to separate the moving sheet behind the break into longitudinal sections one of which is

free of the break, and enlarging a free section to the full width of the paper sheet and severing the remainder from the sheet.

4. The method of preserving the continuity of the paper sheet in a paper making machine when a break occurs in the sheet, which consists in directing streams of water onto the paper on the papermaking wire so as to separate the moving sheet behind the break into longitudinal sections one of which is free of the break and into and across another of which the break may travel, and enlarging the free section to the full width of the paper sheet and severing the remainder from the sheet.

5. The method of preserving the continuity of the paper sheet in a paper making machine, which consists in slotting the moving paper sheet longitudinally in the rear of the break and between the break and one side of the sheet when a break occurs in the sheet, whereby to form a barrier opposing the progress of the break.

6. The method of preserving the continuity of the paper sheet in a paper making machine, which consists in slotting the moving paper sheet longitudinally in the rear of the break and between the break and one side of the sheet by directing streams of water onto the paper on the paper making wire when a break occurs in the sheet, whereby to form barriers opposing the progress of the break.

7. A paper making machine having means to preserve the continuity of the paper sheet when a break occurs in the sheet including means automatically operable by the break to slot the moving paper sheet between the break and one side of the sheet, whereby to arrest the progress of the break at the slot, and means to extend the slot transversely across the sheet to the other side thereof whereby to sever the broken section from the sheet and restore the sheet to its full width.

8. A paper making machine having means to preserve the continuity of the paper sheet when a break occurs in the sheet including means to form slots in the moving paper sheet so as to position at least one slot between the break and one side of the sheet, whereby to arrest the progress of the break at the slot, and means to move the slotting means transversely across the sheet to the other side thereof, whereby to sever the broken section from the sheet and restore the sheet to its full width.

9. A paper making machine having means to preserve the continuity of the paper sheet when a break occurs in the sheet including a Fourdrinier wire, means disposed at the wire to form slots in the moving paper sheet so as to position at least one slot between the break and one side of the sheet, whereby to arrest the progress of the break at the slot, and means to extend the slot transversely across the sheet to the other side thereof whereby to sever the broken section from the sheet and restore the sheet to its full width.

10. In a paper making machine, means rendered effective by a break in the paper sheet to form two longitudinal sections in the moving sheet, one of which is free from the break and into and entirely across the other of which the break may travel, and means to move said separating means across the break-containing section, whereby to sever it from the sheet and to enlarge the free section to the full width of the sheet.

11. In a paper making machine, means controlled by a break in the paper sheet, and break-stopping means rendered effective by the aforesaid means to limit the transverse extent of the break in the sheet.

12. In a paper making machine, means controlled by a break in the paper sheet, and break-stopping means rendered effective by the aforesaid means to prevent the complete severance of the moving sheet by the break.

13. In a paper making machine, means controlled by a break in the paper sheet, and break-stopping means rendered effective by the aforesaid means to form a lead strip in the sheet and to arrest the progress of the break at the lead strip.

14. In a paper making machine, means rendered effective by a break in the moving paper sheet to form a lead strip in the sheet and to arrest the progress of the break at the lead strip, and means to sever the broken section from the moving sheet and to expand the lead strip to the full width of the sheet.

15. In a paper making machine, means rendered effective by a break in the moving paper sheet to form a slot in the moving sheet between the break and one side of the sheet, whereby to arrest the progress of the break at the slot, and means to extend the slot across the sheet in a direction to widen the unbroken portion of the sheet to the full width of the sheet.

16. In a paper making machine, a paper cutter disposed above the moving paper sheet in position to form a longitudinal slot and two longitudinal sections therein, and means rendered effective by a break in the moving paper sheet to effect the operation of said cutter.

17. In a paper making machine, a paper cutter disposed above the moving paper sheet in position to form a longitudinal slot and two longitudinal sections therein, means rendered effective by a break in the moving paper sheet to effect the operation of said cutter, and means to move the paper cutter across one of said sections whereby to sever it from the sheet.

18. In a paper making machine, a paper cutter disposed above the moving paper

sheet in position to form a longitudinal slot and two longitudinal sections therein, means rendered effective by a break in the moving paper sheet to effect the operation of said cutter, and means to move the paper cutter across one of said sections whereby to sever it from the sheet and to enlarge the remaining section to the full width of the paper sheet.

19. In a paper making machine, a nozzle arranged in position to direct a jet of water through the moving paper sheet, whereby to separate it into two longitudinal sections, and means rendered effective by a break in the paper sheet to admit water to said nozzle.

20. In a paper making machine, a nozzle arranged in position to direct a jet of water through the moving paper sheet, whereby to separate it into two longitudinal sections, means rendered effective by a break in the paper sheet to admit water to said nozzle, and means to move said nozzle transversely of the paper sheet.

21. In a paper making machine, a nozzle arranged in position to direct a jet of water through the moving paper sheet, whereby to separate it into two longitudinal sections, means rendered effective by a break in the paper sheet to admit water to said nozzle, and means to move said nozzle across one of said longitudinal sections whereby to sever said section from the sheet and enlarge the remaining section to the full width of the sheet.

22. In a paper making machine, a water squirt disposed above the paper sheet and normally within the margin and adjacent one edge thereof, and means rendered effective by a break in the moving paper sheet to operate said squirt to sever the sheet into two longitudinal sections.

23. In a paper making machine, a water squirt disposed above the paper sheet and normally within the margin and adjacent one edge thereof, means rendered effective by a break in the moving paper sheet to operate said squirt to sever the sheet into two longitudinal sections, and means to move said squirt across the paper sheet at least to the other edge thereof, whereby to sever one of said longitudinal sections from the sheet.

24. In a paper making machine, a water squirt normally disposed above the paper sheet, and means rendered effective by a break in the moving paper sheet to admit water to the squirt, whereby to cause it to operate to separate the moving paper sheet into two longitudinal sections.

25. In a paper making machine, two water squirts normally disposed above the paper sheet, adjacent the opposite margins thereof, and means rendered effective by a break in the moving paper sheet to admit water to said squirts whereby to separate the moving sheet into three longitudinal sections.

26. In a paper making machine, two water squirts normally disposed above the paper sheet adjacent the opposite margins thereof, means to admit water thereto whereby to separate the moving sheet into three longitudinal sections, and means to move the squirts transversely across the sections.

27. In a paper making machine, two water squirts normally disposed above the paper sheet adjacent the opposite margins thereof, means to admit water thereto whereby to separate the moving sheet into three longitudinal sections, and means to move the squirts entirely across the paper sheet from their normal position.

28. In a paper making machine, two water squirts normally disposed above the paper sheet adjacent the opposite margins thereof, means to admit water thereto whereby to separate the moving sheet into three longitudinal sections, and means to move each squirt across the paper sheet from its normal position, whereby to sever two of said three longitudinal sections from the paper sheet.

29. In a paper making machine, two water squirts normally disposed above the paper sheet adjacent the opposite margins thereof, means to admit water thereto whereby to separate the moving sheet into three longitudinal sections, and means to move said squirts independently and in either direction across the paper sheet.

30. In a paper making machine, means to separate the moving paper sheet into a plurality of longitudinal sections, and electrically-actuated means to govern the operation of said separating means.

31. In a paper making machine, electrically-controlled means to separate the moving paper sheet into a plurality of longitudinal sections, and means including an electric circuit-controller operated by a break in the paper sheet to effect the operation of said separating means.

32. In a paper making machine, electrically-controlled means to separate the moving paper sheet into a plurality of longitudinal sections, and means to control said separating means including a plurality of electric circuit-controllers disposed transversely of the paper sheet in position to be actuated by a break in the paper sheet.

33. In a paper making machine, a water squirt arranged above the moving paper sheet in position to separate it into two longitudinal sections, a valve controlling the supply of water to said squirt, and means to govern the operation of said valve including an arm normally supported in an inoperative position by the unbroken sheet and ar-

ranged to move into position to effect the control of said valve when the support of the sheet is removed.

34. In a paper making machine, electrically-controlled means to separate the moving paper sheet into a plurality of longitudinal sections, and means to govern the operation of said separating means including an electric circuit controller having a member thereof arranged to be supported in an inoperative position by the unbroken sheet and to move to an operative position when the support of the sheet is removed.

35. In a paper making machine, electrically-controlled means to separate the moving paper sheet into a plurality of longitudinal sections, and means to govern the operation of said separating means including a plurality of electric circuit controllers disposed transversely above the paper sheet and each having a member thereof arranged to be supported in an inoperative position by the unbroken sheet and to move to an operative position when the support of the sheet is removed.

36. In a paper making machine, electrically-controlled means to separate the moving paper sheet into a plurality of longitudinal sections, and means to govern the operation of said separating means including a plurality of electric circuit controllers disposed transversely above the paper sheet, one or more of which are arranged to be operated by a break in the paper sheet.

37. In a paper making machine, means to separate the moving paper sheet into a plurality of longitudinal sections, and means to operate said separating means including a break-detector disposed in position to be actuated by a break in the paper sheet.

38. In a paper making machine, means to separate the moving paper sheet into a plurality of longitudinal sections, and means to operate said separating means including a plurality of break-detectors disposed transversely of the paper sheet, one or more of which are adapted to be operated by a break in the sheet.

39. In a paper making machine, a break-detector disposed in position to be actuated by a break in the paper sheet, and an alarm device actuated by said break-detector.

40. In a paper making machine, a paper making wire, a drier, means disposed at the paper making wire to separate the moving paper sheet into a plurality of longitudinal sections, and means disposed at the pass of the paper sheet between the wire and drier and operated by a break in the paper sheet to actuate said separating means.

41. In a paper making machine, a paper-making wire, a drier, means disposed at the paper making wire to separate the moving paper sheet into a plurality of longitudinal sections, means disposed at the pass of the paper sheet between the wire and drier and operated by a break in the paper sheet to actuate said separating means, and means to operate said separating means to sever the broken section from the paper sheet, and to broaden out the remaining section to the full width of the sheet.

42. In a paper making machine, means to separate the moving paper sheet into a plurality of longitudinal sections, and means to control the operation of said separating means including an arm normally supported in an inoperative position by the paper sheet and arranged to fall into an operative position when a break in the paper sheet is beneath said arm.

43. In combination with a paper making machine, means controlled by a break in the paper sheet passing through the machine, and brake-stopping means caused to operate by the aforesaid means to separate longitudinally an unbroken strip of the paper sheet from the broken portion without stopping the passage of the unbroken strip through the machine.

44. In combination with a paper making machine, means caused to operate by a break of the paper sheet passing through the machine to separate longitudinally an unbroken strip of the paper sheet from the broken portion without stopping the passage of the unbroken strip through the machine, and means to enlarge the unbroken portion to the full width of the paper sheet.

45. In combination with a paper making machine, a plurality of squirts arranged above the paper making wire and having connection with a water supply under pressure, a valve for controlling the flow of water from said supply to said squirt, means for opening said valve rapidly when the paper sheet breaks so that a stream of water from said squirt shall separate the paper sheet into longitudinal strips, and means for moving said squirts crosswise with relation to the movement of the sheet.

46. In combination with a paper making machine, a squirt arranged above the paper making wire and having connection with a water supply under pressure, a valve for controlling the flow of water from said supply to said squirt, means for opening said valve rapidly when the paper sheet breaks so that a stream of water from said squirt shall separate the paper sheet into longitudinal strips, and means for drawing said squirt crosswise with relation to the movement of the paper sheet so as to broaden out to the full width of the paper sheet either of the strips which has been separated by said stream of water.

47. In a paper making machine, two water squirts normally disposed above the paper sheet adjacent the opposite margins thereof, means to admit water thereto to cut the sheet

into three longitudinal sections, and means to move the squirts across the paper.

48. In a paper making machine, two water squirts normally disposed above the paper sheet on the paper making wire and adjacent the opposite margins of the sheet, means responsive to a break in the paper sheet in front of said squirts to admit water to said squirts, and means to move the squirts in the same direction across the paper.

In testimony whereof, I have signed my name to this specification.

CHARLES NEAL MERRILL.