Jan. 22, 1929. 1,699,760

J. C. SHERMAN

METHOD AND APPARATUS FOR FORMING PAPER STRIPS

Filed May 4, 1925 2 Sheets-Sheet 1

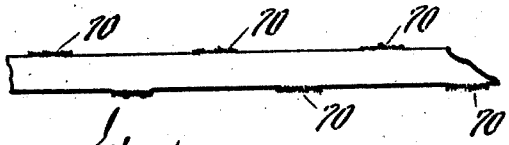


Fig. 1.

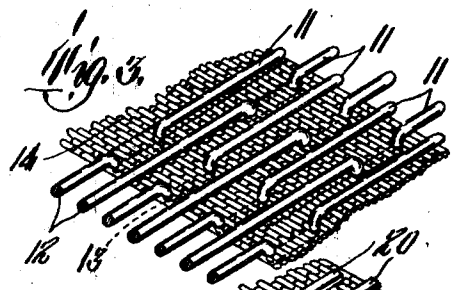


Fig. 3.

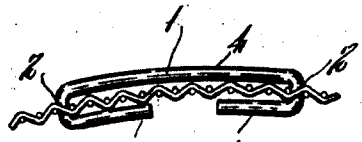


Fig. 2.

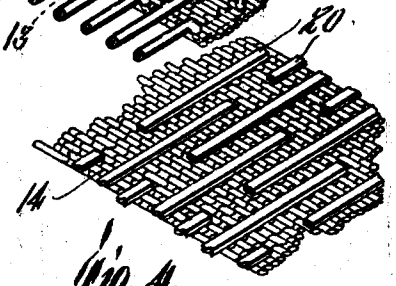


Fig. 4.

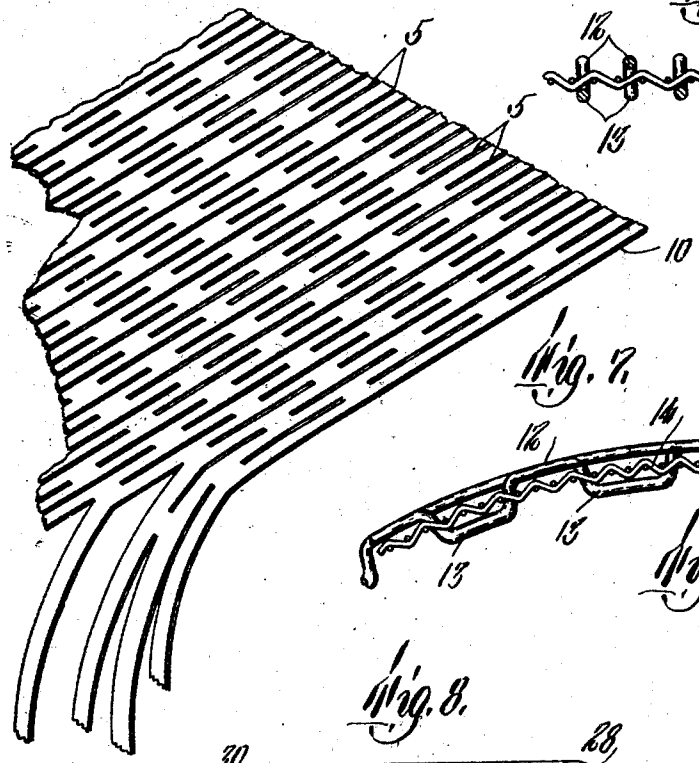


Fig. 7.

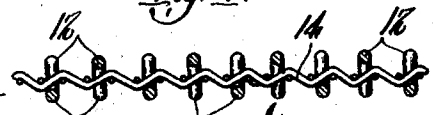
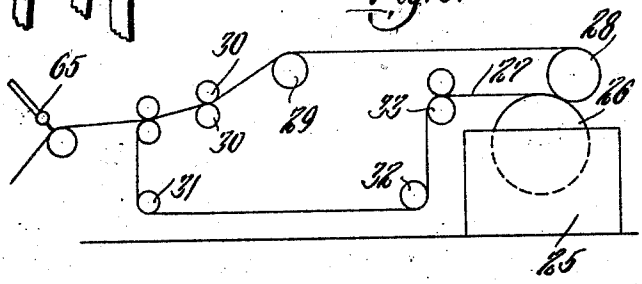


Fig. 6.

Fig. 5.

Fig. 8.



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Fig. 9.

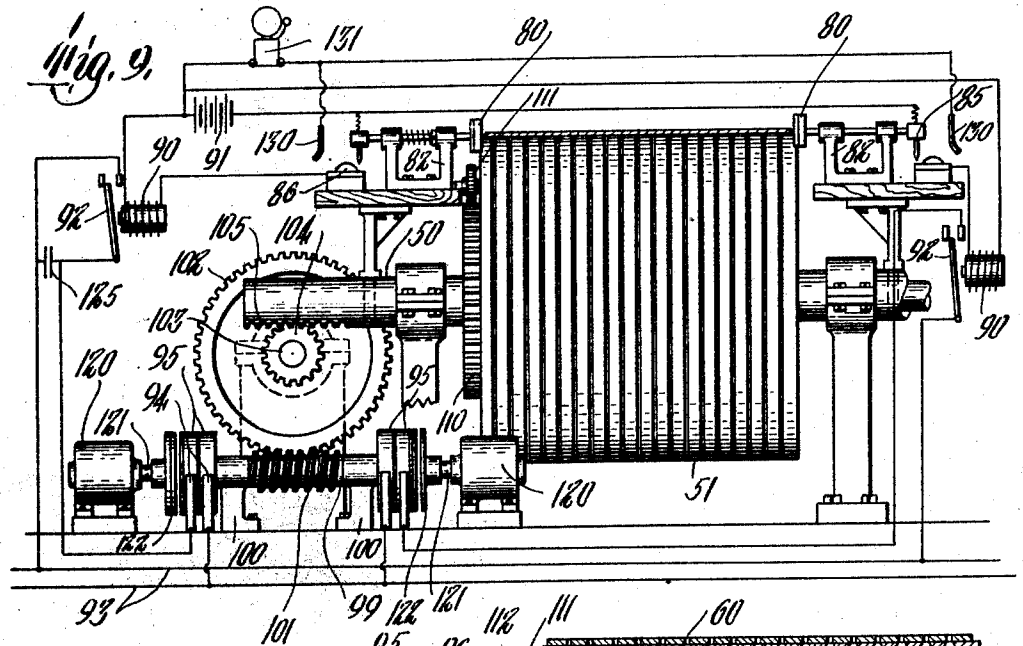


Fig. 11.

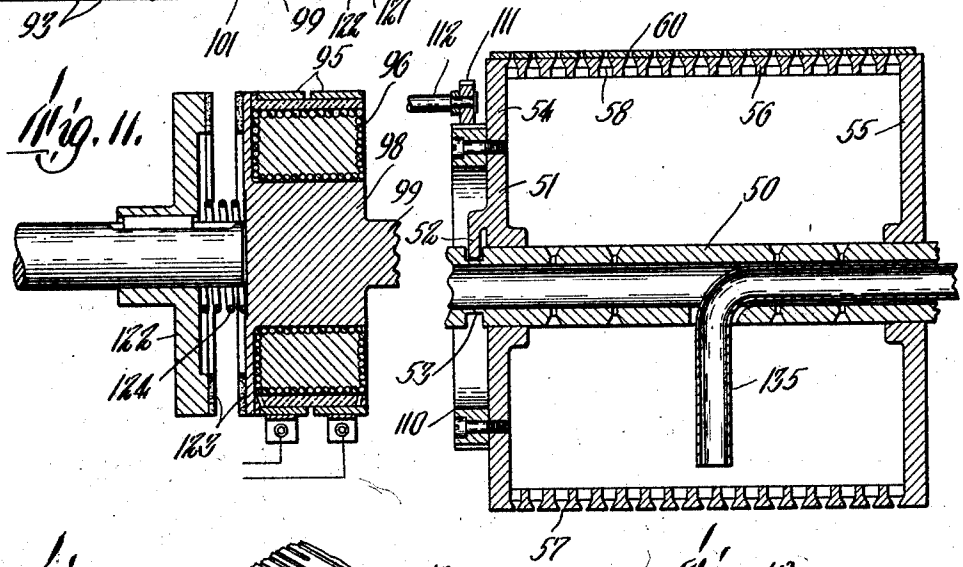


Fig. 12.

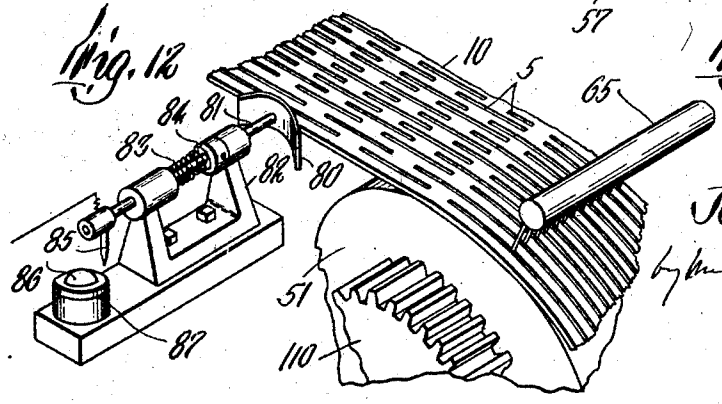


Fig. 10.

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UNITED STATES PATENT OFFICE.

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METHOD AND APPARATUS FOR FORMING PAPER STRIPS.

Application filed May 4, 1925. Serial No. 27,705.

This invention relates to a method and apparatus for making from pulp on a paper machine narrow strips of thin partially compacted pulp such that these, upon being further compacted and dried, would become paper if utilized in a paper-making machine for such purpose; these strips being suitable for the manufacture of rovings or yarn, more especially by the method and apparatus for producing such roving or yarn disclosed in my Patent No. 1,542,915, granted June 23, 1925 for paper yarn and process of producing the same. The mechanism shown in this patent is capable of forming rovings at the high speed at which a paper machine may be operated, and the present invention is designed to form the individual strips on paper-making machines while the paper is still wet so that they can be fed directly to the roving mechanism without requiring intermediate handling. For this purpose the pulp pick-up device, which may be a cylinder mold, is formed on its surface with a plurality of series of spaced alined ridges acting to produce slits defining partial lines of severance of the sheet being formed. As the pulp web is at this time relatively wet and weak, the strips are not formed completely separated but are left attached at intervals between the alined slits to present a sheet form in order that the material may be more readily handled. Individual strips at this stage of the manufacture would be excessively delicate. The pulp web is taken off the mold on a blanket in the usual manner and after removal from the blanket the severing of individual strips is completed. In order to insure that the action of the severing mechanism shall be in line with the slits formed in the web as made, mechanism for correctly relating the severing mechanism and the web should be provided. The strips as thus severed are still somewhat wet and are in proper condition to be fed directly to the roving forming mechanism which utilizes such wet strips as its material to be operated upon.

For a more complete understanding of this invention, reference may be had to the accompanying drawings in which—

Figure 1 illustrates a portion of the strip formed by the mechanism of this invention.

Figures 2, 3 and 4 are detail portions of the cylinder mold surface showing different constructions.

Figure 5 is a fragmentary cross section of the mold constructed according to the showing of Figure 3.

Figure 6 is a detail section on line 6—6 of Figure 5.

Figure 7 is a perspective of a portion of the web of partially compacted paper as removed from the cylinder mold.

Figure 8 is a diagrammatic view illustrating the formation of the web on the paper machine and the completion of its severance into strips suitable for the roving making machine.

Figure 9 is an elevation of mechanism for completing the severing of the web.

Figure 10 is a vertical section through a portion of the same mechanism.

Figure 11 is a section through an electric clutch.

Figure 12 is a fragmentary perspective showing a portion of the position controlling means for the severing mechanism.

Referring to Figures 2, 3, 4 and 7, various ways of forming the cylinder mold to produce the desired web partially severed into strips are illustrated. The cylinder mold presents a wire mesh surface on which the pulp is deposited and according to this invention this surface is broken up by a plurality of series of alined ridges which project from the surface of the wire so as to prevent the deposit of the pulp on these portions. In Figure 2 these ribs are shown as formed of sections of wire 1 inserted through openings 2 in the wire mesh surface and having their ends 3 projecting inwardly of this wire mesh folded toward each other against the mesh so as to leave the portions 4 projecting above the surface of the mesh. These wires are arranged in alined relation, but spaced apart so as to form series of alined slots 5 spaced laterally from each other as illustrated in Figure 7. Preferably the slots are staggered, thus to increase the strength of the web 10 as taken from the cylinder mold for further treatment.

Instead of forming the slot defining ribs in the manner illustrated in Figures 3, 5 and 6, they may be formed by continuous wires 11 having alternate portions 12 and 13 lying above and below the pulp-receiving surface of the wire mesh 14. In Figure 4 another means for forming these slots is shown, comprising bars 20 or metal ribbons or inter-

mittent strips of solder soldered or otherwise fixed to the outer face of the wire mesh 14. With any of these constructions the web as taken off from the web forming mechanism is substantially as illustrated in Figure 7, having parallel series of spaced aligned slots 5 therein. The cylinder mold 26 picks up the pulp from the vat 25, as illustrated diagrammatically in Figure 8. The pulp is taken off on the blanket 27 at the couch roll 28, and passes along the blanket over the roll 29 and between the squeeze rolls 30. The web of pulp is then separated from the blanket, the blanket returning about the rolls 31, 32 and 33 in any usual or suitable manner. The web is then sufficiently strong to be handled by itself, but it still contains considerable water. It is then in condition to be completely severed into strips of wet partially formed paper which are in condition to be delivered directly to the roving forming mechanism.

This mechanism for completing the severing of the strips is illustrated particularly in Figures 9 to 12. Referring first to Figure 10, at 50 is shown a shaft on which is journaled a drum 51, a portion of this drum as at 52 being formed to project within an annular groove 53 in the shaft to prevent relative axial movement therebetween. This drum comprises end walls 54 and 55 joined by a tubular wall 56. This wall 56 is provided with peripheral grooves 57 spaced to correspond to the spacing between the series of slots 5 formed in the web of pulp, and these grooves communicate with the interior of the drum through perforations 58. The web of pulp, as at 60, is passed over this drum while the drum is being rotated at substantially the speed of the pulp, the pulp and drum being so relatively disposed that the slots 5 come opposite to the peripheral grooves 57 of the drum. The surface of the drum thus acts as a slotted support. A series of jets of fluid under pressure, such as air or water, preferably water, is positioned at 65 extending across the length of the drum, these jets being positioned in alinement with the peripheral grooves 57. As the web of pulp progresses over the drum these jets pass through the slots in the pulp, the grooves 57 and the perforations 58 into the interior of the drum, and when the solid portions between the ends of adjacent alined slots are encountered these jets act to cut through the web forcing the material between the side edges of the grooves 57 from the remainder of the web and projecting the material thus removed through the perforations 58 into the drum, together with the fluid from the jets. By this means the severing of the web into strips along the partial lines of severance determined by the slots 5 is effected. As the material is thus torn or washed away from the remaining portions of the web, the eges of the strips at these points are left somewhat more ragged than the edges of the slotted portions which are produced by the ridges on the surface of the cylinder mold, as is illustrated in Figure 1. When these strips are being formed into rovings in the manner illustrated in the patent hereinbefore referred to, these roughened edges are of some advantage in that they facilitate the engagement of the edge fibers with those within the edges of the strip and tend to increase the interlocking or interfelting of the fibers in the roving material.

Of course it is important that the web of slotted pulp and the drum 51 be maintained in such relative position that the slots 5 shall continuously register with the grooves 57 of the drum and as the web of pulp is comparatively weak sensitive mechanism must be used to maintain such alinement. Mechanism for this purpose is shown in detail in Figures 9, 11 and 12. Referring more especially to Figures 9 and 12 it will be seen that there are provided a pair of shoes 80 arranged to bear against the side edges of the web as it approaches the drum 51. Each of the shoes 80 is fixed to one end of a rod 81 slidably mounted in a suitable bearing 82 and pressed under a light spring tension against the edge of the pulp as by means of a light coil spring 83 surrounding the rod 81 and bearing at one end against a portion of the bearing 82 and at the other end against a collar 84 fixed to the rod 81. At the outer end of the rod 81 is mounted an electric terminal point 85 which is adapted to pass into a mercury globule 86 carried in a cup 87 when the shoe 80 is moved laterally away from the center line of the web of pulp to a sufficient extent. Similar contact making and breaking mechanism is associated with each of the shoes 80 and is operative to make contact between the corresponding point 85 and globule 86 on outward movement of the shoe. When contact is made between the point 85 and the globule 86 an electric circuit is closed through a relay at 90 from a source of low potential current 91. This relay acts to close a contact 92 controlling a circuit leading from a source of relatively high potential, such as electric service lines 93 through a pair of brushes 94 and conducting rings 95 on which these brushes bear, to a solenoid 96 in one portion 98 of an electrically actuated clutch. There are two of these clutch elements 98 positioned at opposite ends of a shaft 99 journaled in suitably fixed bearings 100. Between these bearings the shaft 99 is formed as or has fixed thereto a worm 101. This worm meshes with a worm gear 102 carried on a jack shaft 103. Also fixed to this jack shaft is a pinion 104 which engages in rack teeth 105 on the shaft 50. By rotation of the worm 101, therefore, it is evident that the shaft 50 may be reciprocated axially carrying the drum 51 therewith, the drum, however, being free to rotate on the shaft 50. It is rotated in time with

the travel of the pulp web thereover by any suitable means, but as herein shown the end plate 54 of the drum has a ring gear 110 thereon with which meshes a pinion 111 fixed to a driving shaft 112 which is driven in any suitable manner in time with the paper machine to cause the drum to rotate with the desired peripheral velocity. The pinion 111 is shorter axially than the ring gear 110 so that it may be maintained in proper meshing relation therewith throughout the entire range of axial motion of the drum 51 relative thereto.

The worm 101 is adapted to be rotated in one or the other direction, this being accomplished as shown in the drawings by one or the other of a pair of continuously running motors 120. The armature shaft 121 of each of these motors has slidably keyed thereto a clutch disk element 122 of magnetizable material serving as an armature for the adjacent solenoid 96 and arranged in cooperative relation to one of the elements 98. As shown each of these elements 122 and 98 is provided with a facing 123 of friction material. Each of the clutch elements 122 is normally held out of engagement with its mating element 98 by means of a spring 124 reacting between these elements, but whenever either one of the clutch solenoids 96 is energized, the mating clutch element 122 is drawn against the corresponding element 98 against the pressure exerted by the spring 124 and when this occurs the corresponding element 98 is caused to rotate with the element 122 in the direction of rotation of this element by its motor 120.

The closing of the contact between the point 85 and the globule 86 at either side of the web of paper thus causes a corresponding clutch element 98 to become energized so as to couple this clutch element with one of the motors 120 thus to effect a rotation of the worm 101 in a direction to move the drum 51 in the same direction as the movement of the web of paper and the consequent movement of the shoe 80 to bring the grooves in the drum into mating relation with the slots in the web.

In order to avoid arcing at the high voltage contact at the relay 90, it may be desirable to shunt a condenser across the terminals of this contact as shown at 125. In order that movement of the drum axially to correct any misalinement between the slots in the paper and the drum grooves shall stop when such alinement is effected, the contact making mechanism including the shoes 80 and their mountings are shown as carried by the shaft 50 to move axially therewith. Thus as the drum is moved to make a correction of misalinement the mounting of the shoe 80 which causes the correction to be effected is moved away from the edge of the pulp so that its contact point 85 is moved out of contact with the globule 86, thus breaking the contact by the time the drum has moved to its new corrected position. If it should happen that the motion of the shoe is excessive so that the drum could not be moved to compensate therefor, the point 85 passes through and beyond the globule 86, thus breaking the controlling contact for the correcting mechanism, but bringing this contact point 85 into electrical connection with a supplemental contact as 130 which may be caused to close a circuit through an alarm device at 131 to notify the operator of the abnormal condition, or if desired it might be employed to stop the machine automatically by any suitable stop mechanism. For convenience an alarm has been indicated in the drawing. The fluids passing from the jets to the interior of the drum and carrying pulp bridges therewith may be removed from the drum interior as by means of a suction pipe 135 extending through the shaft 50 and being downwardly turned within the drum and extending toward the lower surface thereof.

By this mechanism it is clear that the pulp is first formed as a web partially severed by slots into strips and that when the pulp has become sufficiently dry to possess sufficient strength for handling, it is completely severed into strips by cutting out the "bridges" of pulp between the ends of alined slots, and that the strips delivered from the drum are then still moist and suitable for making into rovings.

It should be noted that this invention is not limited to the use of the described apparatus at the location indicated in the drawings. Thus, it is possible to cause the pulp to be separated into narrow strips after the application of one set of squeeze rolls after being removed from the blanket and prior to the application thereto of a second set of squeeze rolls, and several such variations of the sequence of operations are obvious to any one familiar with the paper-making arts. It would also be within the scope of the present invention to permit the paper to dry before completing its severance into strips, though generally this would not be preferred.

Having thus described certain embodiments of this invention it should be evident to those skilled in the art that various changes and modifications might be made therein without departing from its spirit or scope as defined by the appended claims.

I claim:

1. The method of forming strips of partially compacted paper suitable for making rovings which comprises forming from wet pulp a web of partially compacted paper having spaced alined slots therein, and completing the severing of said web into strips along the lines of said slots.

2. The method of forming strips of partially compacted paper suitable for making rovings which comprises forming from wet

pulp a web having spaced alined slots therein and while wet completing the severing of said web into strips along the lines of said slots.

3. The method of forming strips of partially compacted paper suitable for making rovings which comprises forming from wet pulp a web having spaced alined slots therein, and directing a fluid under pressure against said web in alinement with and between said slots to thus complete the severing of the web into strips.

4. The method of forming strips of partially compacted paper suitable for making rovings which comprises forming from wet pulp a web having spaced alined slots therein, and directing a fluid under pressure against said wet web in alinement with and between said slots to thus complete the severing of the web into strips.

5. The method of forming strips of partially compacted paper suitable for making rovings, which comprises forming a web comprising partly separated strips, and subjecting said web to jets of fluid under pressure along the lines of partial separation to complete the severance of the web into the desired strips.

6. The method of forming strips of partially compacted paper suitable for making rovings which comprises supporting one side of a wet web except along spaced lines, and directing a fluid jet against the face of said web at said unsupported portions to sever the web therealong.

7. The method of making strips of partially compacted paper suitable for making rovings, which comprises subjecting a web of partially compacted and partially severed wet pulp to jets of fluid under pressure along the lines of partial severance to complete the severance of said web into the desired strips.

8. The method of making strips of partially compacted paper suitable for making rovings, which comprises depositing and forming wet pulp as a web partially severed into strips, and then completing the severance of said web into strips.

9. In combination, means for continuously depositing and forming a web of interfelted material partially severed into strips, and means for progressively completing the severance of said web into strips as it comes from said forming means.

10. In combination, means for forming a partially severed web from wet fibrous material, and water jets acting along the lines of partial severance to complete the severance of the web into strips.

11. In combination, means for continuously forming a web of interfelted fibrous material having a series of alined slots therein, and means for completing the severing of said web into strips along the lines of said slots.

12. A machine of the class described comprising means for continuously forming a web of wet pulp having a plurality of series of alined spaced slots arranged lengthwise thereof, and means acting before said web dries for progressively completing the severing thereof into strips partially defined by said slots.

13. A machine of the class described comprising a drum over the surface of which a web of sheet material may be passed, said drum having peripheral grooves arranged in parallel relation perpendicular to its axis, and means for forcing the material of said web opposite thereto into said grooves to sever said web into strips.

14. A machine of the class described comprising a drum over the surface of which a web of sheet material may pass, and means acting automatically to maintain said drum in a predetermined relation laterally of said web.

15. A machine of the class described comprising a rotatable and axially movable drum over which a web of sheet material may be passed, and means guided by the lateral position of said web for moving said drum axially to tend to maintain said drum in a predetermined relation to said web.

16. A machine of the class described comprising a rotary hollow drum over the surface of which sheet material may be passed, said drum having parallel peripheral grooves therein communicating through perforations with its interior, means for projecting fluid jets against said web opposite to said grooves to project the material of said web through said grooves and perforations into said drum to thus sever said web into strips, and means for removing the material so projected from the interior of said drum.

17. A machine of the class described comprising a slotted support, means for passing a web of paper across said support, and means for directing a fluid jet against the opposite face of said web opposite to said slots to sever said web.

18. A machine of the class described comprising means for forming a web of partially compacted paper with series of spaced alined slots therein, a support grooved to correspond with the slots of said web, means for passing said web across said support, said slots and grooves being in register, and means for directing a fluid jet toward the grooves of said support for breaking through the spaces in said web in alinement with the slots therein to complete the severance of said web into strips.

19. A machine of the class described comprising means for forming a web of partially compacted paper with series of spaced alined slots therein, a support grooved to correspond with the slots of said web, means for passing said web across said support, said slots and grooves being in register, means for directing a fluid jet toward the grooves of said support

for breaking through the spaces in said web in alinement with the slots therein to complete the severance of said web into strips, and means for maintaining said web and said support with their slots and grooves in registration.

20. A machine of the class described comprising a rotatable and axially movable drum over which a web of sheet material may be passed, said drum having spaced peripheral grooves therein, means for projecting fluid jets against the outer face of said web opposite to said grooves to sever the web into strips, and means for automatically adjusting the axial position of said drum in accordance with the lateral position of said web.

21. A machine of the class described comprising a drum over which a web of sheet material may pass, an axially movable shaft on which said drum is journaled, means for rotating said drum, means acting on lateral movement of said web within predetermined limits to cause corresponding axial movement of said drum to tend to maintain a predetermined relation between said drum and web, and means acting on the movement of said web beyond said predetermined limits to effect an indication thereof.

In testimony whereof I have affixed my signature.

JOHN C. SHERMAN.