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H. G. WIDMER

PROCESS AND MECHANISM FOR PRODUCING STRETCHABLE PAPER

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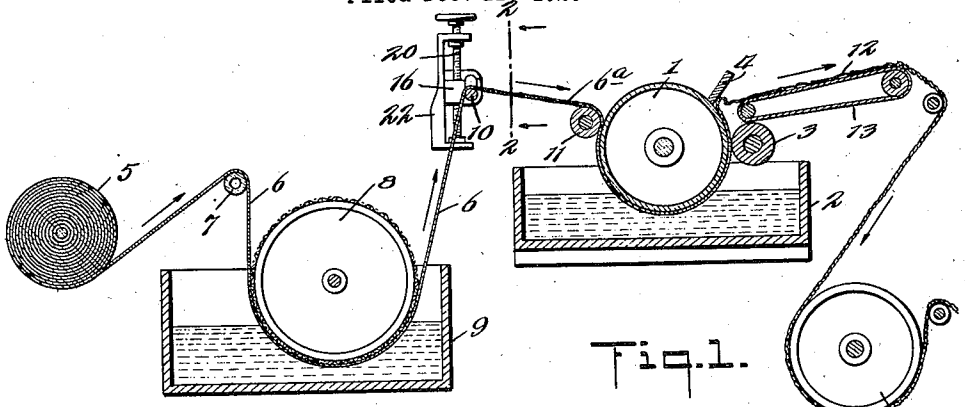


Fig. 1.

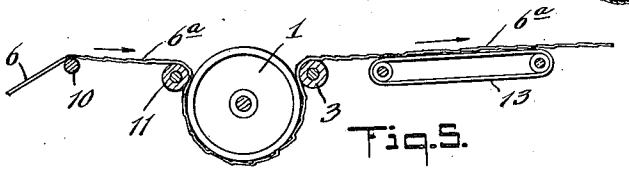


Fig. 5.

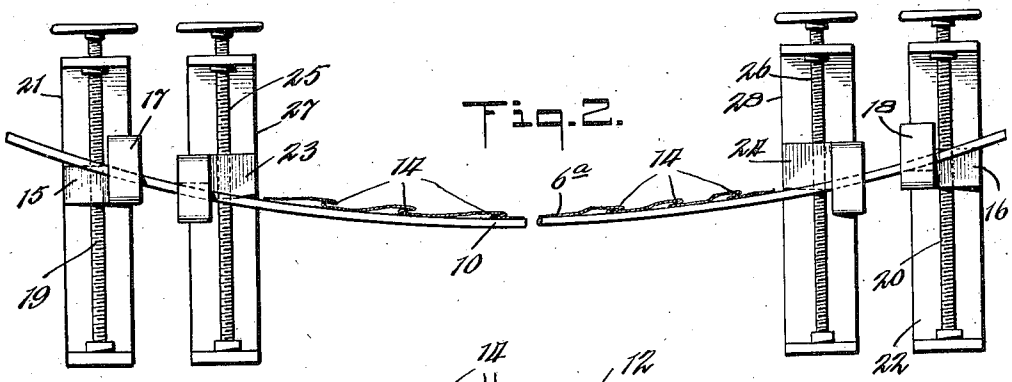


Fig. 2.

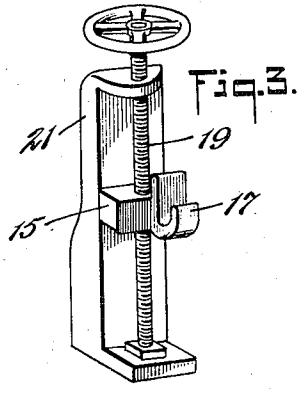


Fig. 3.

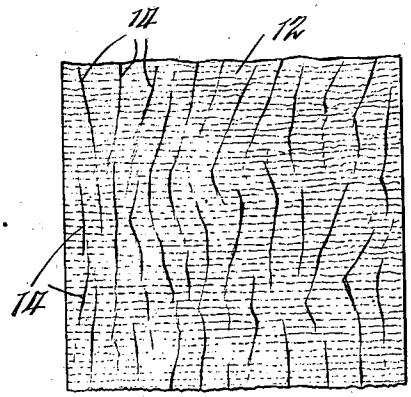


Fig. 4.

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UNITED STATES PATENT OFFICE.

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PROCESS AND MECHANISM FOR PRODUCING STRETCHABLE PAPER.

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This invention relates to a new process for producing stretchable paper and also to new and improved mechanism for carrying out such process. The stretchable paper, which it is the purpose of this invention to produce, is primarily designed for wrapping or packing purposes. In the form of sheets, it may be used for wrapping up bales or heavy packages. When made up in tubular form, it may be used as barrel linings and, when made up into bags, it may be used as liners for burlap bags, barrels, drums, kegs, boxes and other containers.

Heretofore, stretchable paper has been satisfactorily made by running it through a crinkling machine, whereby permanent crinkles were formed in the paper crosswise the web which made the paper stretchable longitudinally of the web. In such paper there was no stretch transverse of the web. Attempts have heretofore been made to make paper stretchable transverse the web by cutting it into sheets and running such sheets sidewise separately between corrugating rolls. This, however, has not been satisfactory owing to the expense entailed and to the very slight stretch in the paper which the corrugations provided. Moreover, whatever advantage such corrugations afforded was only realized when the corrugations were applied to crinkled paper, to thereby make what may be called "double stretch" paper, that is, paper stretchable longitudinally and transversely. Such corrugations were entirely incapable of taking the place of or serving the purpose of crinkles.

In accordance with the present invention, irregular, discontinuous longitudinal folds are formed in a moving web of paper and preferably while the paper is wet. These folds are pressed down tight against the body of the paper so as to become permanent in the same manner as are the crinkles in crinkled paper. When such paper is put under lateral tension, incidental to its use, the folds pull out in the locality of strain and to the extent required in much the same way as do the crinkles of crinkled paper. The longitudinal folds in the paper are distributed across its width and they may vary in form, disposition, arrangement and number. Such folds may be formed continuously in the web at high speed.

Any suitable means may be used to form the folds, but the means which I have devised for this purpose are exceedingly simple and reliable, and may be readily adjusted so as to control the extent to which the folds are applied and therefore the amount of transverse stretchability imparted to the web.

Another advantage of this invention is that it may be carried out in connection with the process of crinkling the paper. Thus, paper may be produced in a crinkling machine which is not only crinkled, but is also provided with the longitudinal folds so that the paper may issue from the machine having the capacity to stretch both longitudinally and transversely and thus form "double stretch" paper. Double stretch paper made in this manner is made continuously and in one operation and at a cost which does not exceed that of crinkling the paper.

A machine built in accordance with my invention, in the preferred form, and adapted to carry out my process is shown in the accompanying drawings, wherein

Fig. 1 is a central longitudinal section of a machine adapted to produce longitudinal folds and cross crinkles in a web of paper.

Fig. 2 is an enlarged elevation showing a tracker bar for forming the longitudinal folds in the paper and taken on the line 2—2 of Fig. 1 looking in the direction of the arrow.

Fig. 3 is an enlarged detail of one of the supports for holding the tracker bar in place.

Fig. 4 is a face view of double stretch paper produced by the invention; and

Fig. 5 is a view similar to Fig. 1 but showing only such parts as are useful in applying the longitudinal folds to the paper.

I will first describe the invention as applied to producing paper which not only contains longitudinal folds to make it transversely stretchable but also contains cross crinkles to make it longitudinally stretchable. To this end, reference will first be made to Figs. 1, 2, 3 and 4. 1 is a crinkling cylinder, driven by suitable mechanism, and which rotates in the tank 2 containing hot water. Associated with it is a squeeze roll 3 and a doctor 4. 5 is the stock roll of plain

paper to be converted and from which is led the web 6 over a guide roll 7, thence under a skeleton drum 8 which rotates in a bath of hot water contained in the tank 9. The web passes thence over a concave member or tracker 10, and thence over a guide roll 11 on to the crinkling cylinder 1. The crinkling cylinder carries the paper through the hot water in tank 2 and against the doctor 4 which strips the paper from the cylinder and crinkles it to form the crinkled web 12 which is deposited upon and removed by a carrier 13 to a drier indicated by the drying cylinder 29. Squeeze roll 3 acts to squeeze the wet paper in close adherence to the crinkling cylinder before it reaches the doctor. The paper is drawn from the supply roll 5 and made to travel through the machine by the pull exerted upon it by the crinkling cylinder 1. There is nothing novel in the machine as thus described, except the member or tracker 10, the arrangement and function of which are novel and of great importance in the present invention, because it is the element which is most concerned in putting the longitudinal folds in the paper.

It is important that the surface of member 10, over which the paper runs or tracks, be concave because it is this concavity of surface in such member that serves to form the folds in the paper. The member 10 may be made in various forms, but preferably it consists of a cylindrical metal bar capable of being bent so as to have the curvature desired and firmly fixed in the machine, as shown in Fig. 2. It may be located at any point in the path of the web in advance of the crinkling cylinder, but is preferably located at the point shown in Fig. 2. As the paper travels over bar 10, the drag on the paper keeps it under tension and therefore in close contact with the upper concave surface of the bar. The paper, therefore, conforms to the curvature of the bar so that the margins of the paper are elevated somewhat above the middle portion of the paper. Thus, the margins of the paper while passing over the bar 10 are brought closer together than they are when leaving the drum 8. Hence, the bar acts to crowd the paper from its margins inward towards its middle portion. This causes the paper to fold over upon itself, while passing over the bar, and form folds longitudinally of the paper. These folds are more or less tight as they pass over the bar and thereafter remain in the paper when the latter is deposited on the crinkling cylinder. The folds are pressed down tight against the body of the paper by the action of the squeeze roll 3 and are crinkled with the rest of the paper by the doctor and remain permanently in the paper in the same way as do the crinkles. These folds are indicated at 14 in Figs. 2 and 4 and that portion of the web containing the longitudinal folds only is marked 6a.

The folds 14 run in an irregular manner along the length of the paper and are discontinuous. That is to say, a fold will generally extend for not more than a few feet and then, after an interval of a few inches, a new fold will form in about the same situation relative to the width of the paper, and the folds will overlap at their ends more or less, as shown in Fig. 4. Although the folds, themselves, may vary in width and may vary in number along any given line across the web, nevertheless, in the aggregate they act practically to narrow the width of the paper to substantially the same extent so that the two margins of the paper run substantially straight and parallel with each other. Such folds make the finished product stretchable across its width because, when the paper is under lateral tension, due to its use, the folds pull out as conditions require, just as do the crinkles when the paper is under longitudinal tension. The terms "lateral" and "longitudinal" are here used with respect to the original web. Furthermore, inasmuch as these folds are in the wet paper when it passes over the bar 10 and under the squeeze roll, they offer about the same resistance to stretching strains put upon them as do the crinkles which are formed by the doctor. The paper is therefore highly efficient as a double stretch paper and, as will be seen, it is formed in one continuous operation in one and the same machine, without any separate handling because of the folds and with an economy which is not possible to attain in the making of crinkled and cross corrugated paper.

The bar 10 may be mounted in place in the machine in any convenient manner. As shown in the drawings, its ends are supported on two brackets 15 and 16 having, respectively, upwardly opening jaws 17 and 18. Passing through threaded holes in these brackets are hand-operated screws 19 and 20 which work in supports 21 and 22, respectively, secured on the side frames of the machine. 23 and 24 are two additional brackets similar to the brackets 15 and 16, except that in the former, their jaws open downwardly. Brackets 23 and 24 are adjustable by means of hand screws 25 and 26 mounted in supports 27 and 28 similar to the screws 19 and 20 and supports 21 and 22, supports 27 and 28 being secured on the side frames of the machine slightly inside of supports 21 and 22. As thus arranged, when the bar 10 is in position, resting upon the brackets 15 and 16, the brackets 23 and 24 may be pressed downwardly against the upper surface of the bar 10 by operating the adjusting screws 25 and 26, thereby giving to the bar the curvature desired. In this way, the curvature of the bar may be varied

and regulated so as to thereby regulate and predetermine the extent of the folds applied to the paper, or, in other words, the extent to which the web is narrowed by the folds, and the extent of the lateral stretchability applied to the paper by the folds. It will be appreciated that the folds formed in the paper in accordance with this invention, as exemplified in the folds 14, are quite different and distinct from the corrugations which have heretofore been applied to paper to make it stretch. Such corrugations consist of alternate furrows and ridges, the sides of which are out of contact with each other and out of contact with the body of the paper. Such corrugations are formed by pressing the paper against the corrugated surface of a cylinder and, in practice, by passing a sheet of paper between two rotating cylinders having contacting surfaces in which are cut longitudinal corrugations. On the other hand, the folds which are formed in the paper in accordance with this invention consist of tight folds in the paper, the sides of such folds being in firm contact with each other and against the body of the paper. Such folds and corrugations are, therefore, quite different in their appearance, characteristics and method of production.

In Fig. 5 is shown those elements of a machine which operate upon the web 6 to form the longitudinal folds therein and without crinkling the paper. The parts shown in Fig. 5 are the same as the corresponding parts in Fig. 1 and are, therefore, given the same reference numerals.

In Fig. 5 the web 6, after passing through the bath 9, such as that shown in Fig. 1, passes over the bar 10 where the longitudinal folds are formed in the paper which thereupon becomes the web 6^a. Such web 6^a then passes over the guide roll 11 on to the power-driven rotating cylinder 1 against which the wet paper is pressed by the squeeze roll 3 and is delivered as the finished web 6^a on to the carrier 13 which carries the paper to a suitable drier. The machine parts in Fig. 5 differ from those shown in Fig. 1 only in the fact that in Fig. 5, tank 2, drier 29 and doctor 4 are omitted. When the paper issues from the machine of Fig. 5, it contains only the longitudinal folds 14 and is not crinkled. It, therefore, has the capacity for lateral stretch only. Such paper may be cut up into suitable lengths and utilized as baling sheets, or made up into tubular barrel linings or bags for lining purposes. Such paper may be successfully utilized as a substitute for crinkled paper, the amount of stretch imparted to the paper by reason of the longitudinal folds approximating that of crinkled paper. The amount of lateral stretch thus imparted to the web may be regulated and predetermined by varying the curvature of the bar 10, as heretofore explained, or the web may be made to pass successively over several curved bars 10. While bar 10 is the preferred means for imparting the longitudinal folds to the web because of its simplicity, reliability and ease of adjustment, it will be realized that means quite different from said bar may be utilized to form the folds in the paper, and that any means suitable for this purpose is within the scope of the invention.

It will be further observed that the bar 10 may be raised or lowered by means of the adjusting screws 19, 20, 25 and 26 so as to vary the pitch of the web between the bar and guide roll 11 or the angle formed by that portion of the web between drum 8 and bar 10 with that portion of the web between bar 10 and roll 11. The higher this bar is raised, within limits, the more would the web be narrowed by the formation of the longitudinal folds.

What I claim is:—

1. The process of making stretchable paper which consists in forming in the paper tight, irregular, discontinuous longitudinal folds distributed throughout the length and breadth of the paper.

2. The process of making stretchable paper which consists in forming in the paper while it is wet tight, irregular, discontinuous longitudinal folds distributed throughout the length and breadth of the paper.

3. The process of making paper transversely stretchable continuously in the web which consists in running the web in the direction of its length and continuously forming therein tight, irregular, discontinuous longitudinal folds distributed throughout the web.

4. The process of making paper transversely stretchable continuously in the web which consists in running the web in the direction of its length and continuously forming therein, while the paper is wet, tight, irregular, discontinuous longitudinal folds distributed throughout the web.

5. The process of making stretchable paper which consists in forming in the paper a series of irregular, discontinuous longitudinal folds and pressing said folds down flat against the body of the paper while it is wet to make the folds permanent.

6. The process of making paper transversely stretchable continuously in the web which consists in running the web in the direction of its length and subjecting it to the action of a former to form irregular, discontinuous longitudinal folds distributed throughout the web.

7. The process of making paper transversely stretchable continuously in the web which consists in running the web in the direction of its length and directing it in a

concave path to form irregular, discontinuous longitudinal folds distributed throughout the web.

8. The process of making paper transversely stretchable continuously in the web which consists in running the web in the direction of its length and subjecting it while in a wet condition to the action of a former to form irregular, discontinuous longitudinal folds distributed throughout the web.

9. The process of making paper transversely stretchable continuously in the web which consists in running the web in the direction of its length and subjecting it to the action of a former to form irregular, discontinuous longitudinal folds distributed throughout the web and then pressing the folds down flat against the body of the paper to make them permanent.

10. The process of making paper transversely stretchable continuously in the web which consists in running the web in the direction of its length and directing it in a concave path to form irregular, discontinuous longitudinal folds distributed throughout the web and then pressing the folds down flat against the body of the paper to make them permanent.

11. The process of making paper transversely stretchable continuously in the web which consists in running the web in the direction of its length and subjecting it while in a wet condition to the action of a former to form irregular, discontinuous, longitudinal folds distributed throughout the web and then pressing the folds down flat against the body of the paper to make them permanent.

12. The process of making paper transversely stretchable continuously in the web which consists in running the web in the direction of its length and during its movement wetting it, then forming irregular, discontinuous longitudinal folds in the web, pressing said folds down flat and drying the paper.

13. The process of making double stretch paper which consists in forming irregular, discontinuous longitudinal folds in the paper and then crinkling the paper across said folds.

14. The process of making double stretch paper which consists in crowding the paper from its margins toward the middle while the paper is running in the direction of its length, to form irregular, discontinuous longitudinal folds in the paper and then crinkling the paper across said folds.

15. The process of making double stretch paper which consists in forming irregular discontinuous longitudinal folds in the paper and pressing the folds down flat against the body of the paper and then crinkling the paper across said folds.

16. The process of making double stretch paper which consists in forming irregular, discontinuous longitudinal folds in the paper while it is wet and then crinkling the wet paper across said folds.

17. The process of making double stretch paper which consists in crowding the paper from its margins toward the middle while the paper is wet and running in the direction of its length, to form irregular, discontinuous longitudinal folds in the paper and then crinkling the wet paper across said folds.

18. The process of making double stretch paper which consists in forming irregular, discontinuous longitudinal folds in the paper while it is wet and pressing the folds down flat against the body of the paper and then crinkling the wet paper across said folds.

19. The process of making paper transversely and longitudinally stretchable continuously in the web which consists in running the web in the direction of its length and during its movement wetting the paper, then forming irregular, discontinuous longitudinal folds throughout the paper, pressing said folds down flat against the body of the paper, crinkling the web across said folds and drying the web.

20. The process of making paper stretchable continuously in the web which consists in running the web in the direction of its length, wetting it, and then crowding the margins of the web inward toward the middle and thereby forming irregular, discontinuous longitudinal folds in and throughout the web.

21. The process of making paper stretchable continuously in the web which consists in running the web in the direction of its length, wetting it, and then directing the web in a concave path and thereby forming longitudinal folds in and throughout the web.

22. The process of making paper stretchable continuously in the web which consists in running the web in the direction of its length, wetting it, crowding the margins of the web inward toward the middle and thereby forming irregular, discontinuous longitudinal folds in and throughout the web and then pressing said folds down flat against the body of the paper to make the folds permanent.

23. The process of making paper stretchable continuously in the web which consists in running the web in the direction of its length, wetting it, then directing the web in a concave path and thereby forming longitudinal folds in and throughout the web and then pressing said folds down flat against the body of the paper to make the folds permanent and drying the web.

24. In a machine for making paper transversely stretchable continuously while it is

running in the web, the combination of means for wetting the paper and means for forming tight, irregular, discontinuous longitudinal folds therein distributed throughout the web.

25. In a machine for making paper transversely stretchable continuously while it is running in the web, the combination of means for wetting the paper, a fold-former for forming irregular, discontinuous longitudinal folds therein distributed throughout the web and means for pressing said folds down flat against the body of the paper to make said folds permanent.

26. In a machine for making paper transversely stretchable continuously while it is running in the web, the combination of means for wetting the paper and means for forming tight longitudinal folds therein distributed throughout the web, said last-mentioned means being adjustable to regulate the aggregate extent of the folds applied to the paper across its width.

27. In a machine for making paper transversely stretchable continuously while it is running in the web, the combination of means for wetting the paper, a fold-former for forming longitudinal folds therein distributed throughout the web, said fold-former being adjustable to regulate the aggregate extent of the folds applied to the paper across its width, and means for pressing said folds down flat against the body of the paper to make said folds permanent.

28. In a machine for making paper transversely stretchable continuously while it is running in the web, the combination of means for wetting the paper and a concave member over which the web runs for forming tight longitudinal folds therein distributed throughout the web.

29. In a machine for making paper transversely stretchable continuously while it is running in the web, the combination of means for wetting the paper, a concave member over which the web runs for forming longitudinal folds therein distributed throughout the web, said concave member being adjustable to regulate the aggregate extent of the folds applied to the paper across its width, and means for pressing said folds down flat against the body of the paper to make said folds permanent.

30. In a machine for making paper transversely stretchable continuously while it is running in the web, the combination of means for wetting the paper, a variably adjustable flexible bar against which the web runs for forming longitudinal folds therein distributed throughout the web, and means for pressing said folds down flat against the body of the paper to make said folds permanent.

31. In a machine for making paper transversely and longitudinally stretchable continuously while it is running in the web, the combination of means for wetting the paper, means for forming tight, irregular, discontinuous longitudinal folds therein distributed throughout the web, and means for crinkling the web across said folds.

32. In a machine for making paper transversely and longitudinally stretchable continuously while it is running in the web, the combination of means for wetting the paper, a fold-former for forming irregular, discontinuous longitudinal folds therein distributed throughout the web, means for pressing said folds down flat against the body of the paper to make said folds permanent, and means for crinkling the web across said folds.

33. In a machine for making paper transversely and longitudinally stretchable continuously while it is running in the web, the combination of means for wetting the paper, means for forming tight, irregular, discontinuous longitudinal folds therein distributed throughout the web, said last-mentioned means being adjustable to regulate the aggregate extent of the folds applied to the paper across its width, and means for crinkling the web across said folds.

34. In a machine for making paper transversely and longitudinally stretchable continuously while it is running in the web, the combination of means for wetting the paper, a fold-former for forming irregular, discontinuous longitudinal folds therein distributed throughout the web, said fold-former being adjustable to regulate the aggregate extent of the folds applied to the paper across its width, means for pressing said folds down flat against the body of the paper to make said folds permanent, and means for crinkling the web across said folds.

35. In a machine for making paper transversely and longitudinally stretchable continuously while it is running in the web, the combination of means for wetting the paper and a concave member over which the web runs for forming tight longitudinal folds therein distributed throughout the web, and means for crinkling the web across said folds.

36. In a machine for making paper transversely and longitudinally stretchable continuously while it is running in the web, the combination of means for wetting the paper, a concave member over which the web runs for forming longitudinal folds therein distributed throughout the web, said concave member being adjustable to regulate the aggregate extent of the folds applied to the paper across its width, means for pressing said folds down flat against the body of the paper to make said folds permanent, and means for crinkling the web across said folds.

37. In a machine for making paper transversely stretchable continuously while it is running in the web, the combination of a cylinder upon which the paper is deposited and by means of which the web is advanced, means for wetting the paper, and means for forming irregular, discontinuous longitudinal folds therein, while the paper is wet, distributed throughout the web.

38. In a machine for making paper transversely stretchable continuously while it is running in the web, the combination of a cylinder upon which the paper is deposited and by means of which the web is advanced, means for wetting the paper, means for forming irregular, discontinuous longitudinal folds therein while the paper is wet, distributed throughout the web, and means for pressing said folds down flat against the body of the paper to make said folds permanent.

39. In a machine for making paper transversely stretchable continuously while it is running in the web, the combination of a cylinder upon which the paper is deposited and by means of which the web is advanced, means for wetting the paper, and a variably adjustable flexible bar against which the web runs for forming longitudinal folds therein, while the paper is wet, distributed throughout the web.

40. In a machine for making paper stretchable continuously both longitudinally and transversely, while it is running in the web, the combination of a cylinder upon which the paper is deposited and by means of which the web is advanced, means for wetting the paper, means for forming irregular, discontinuous longitudinal folds therein, while the paper is wet, distributed throughout the web, and means for forming crinkles in the paper across said folds.

41. In a machine for making paper stretchable continuously both longitudinally and transversely, while it is running in the web, the combination of a cylinder upon which the paper is deposited and by means of which the web is advanced, means for wetting the paper, means for forming irregular, discontinuous longitudinal folds therein, while the paper is wet, distributed throughout the web, means for pressing said folds down flat against the body of the paper to make the folds permanent, and means for forming crinkles in the paper across said folds.

42. In a machine for making paper stretchable continuously both longitudinally and transversely, while it is running in the web, the combination of a cylinder upon which the paper is deposited and by means of which the web is advanced, means for wetting the paper, a variably adjustable flexible bar against which the web runs for forming longitudinal folds therein, while the paper is wet, distributed throughout the web, and means cooperative with said cylinder for forming crinkles in the paper across said folds.

This specification signed this 7th day of December, 1925.

HOWARD G. WIDMER.