Jan. 8, 1963 L. HORNBOSTEL 3,072,522

RECONSTITUTED CREPED PAPER AND METHOD AND APPARATUS FOR MAKING SAME

Filed Oct. 27, 1958 4 Sheets-Sheet 1

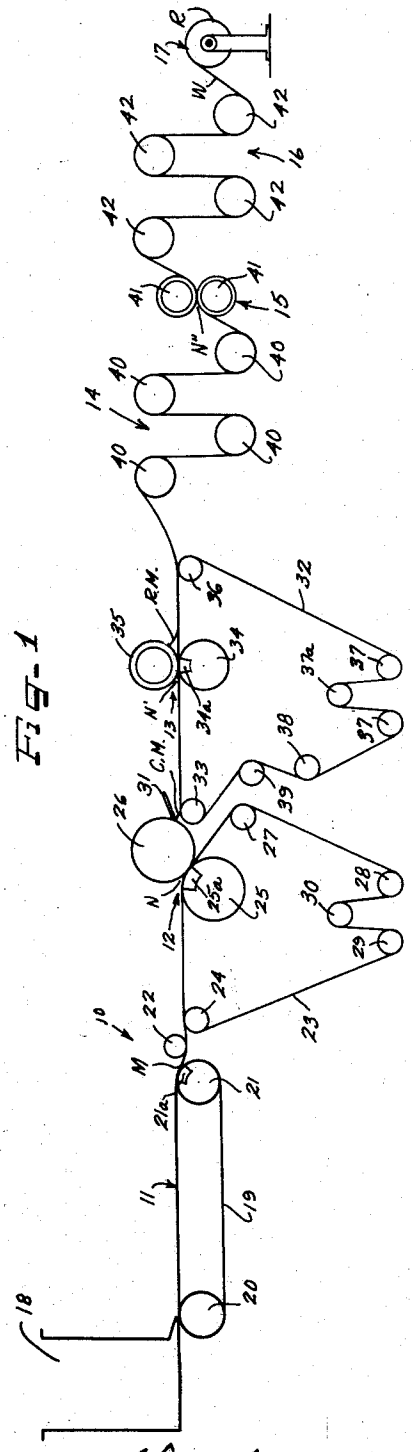

Fig. 1

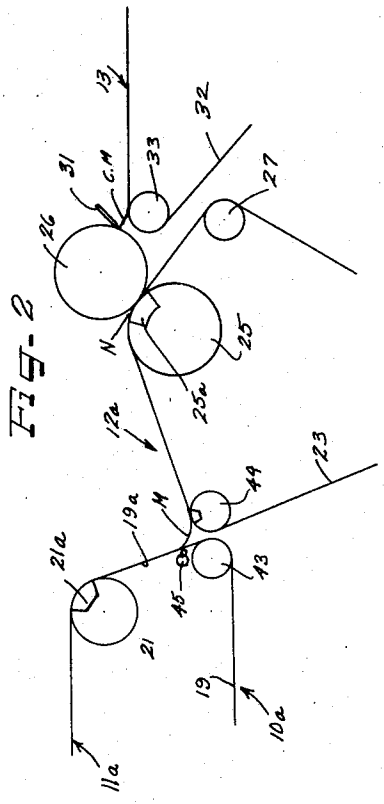

Fig. 2

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Fig. 3

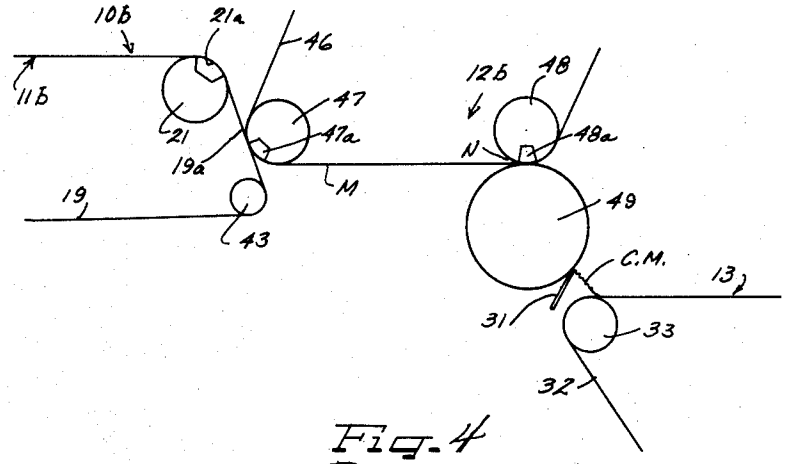

Fig. 4

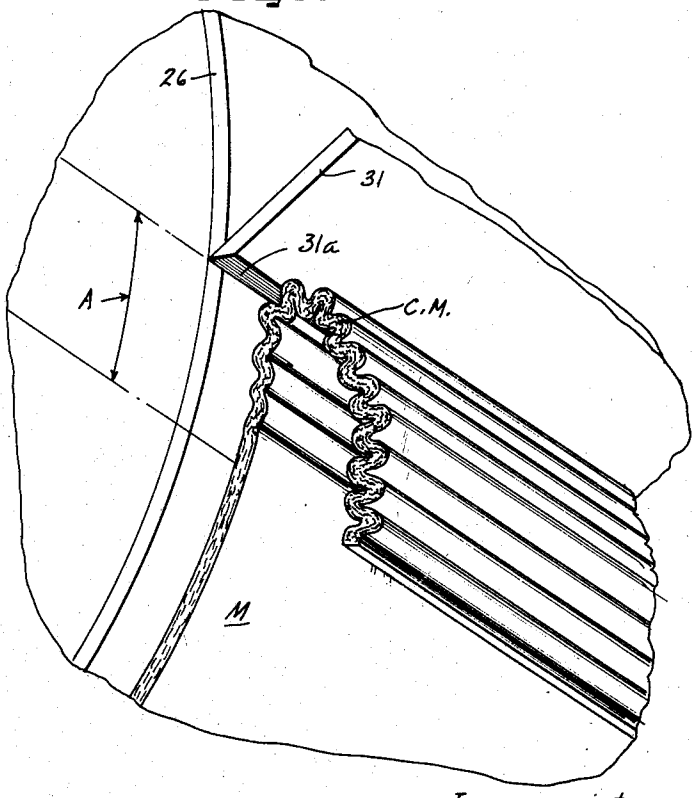

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Fig. 5

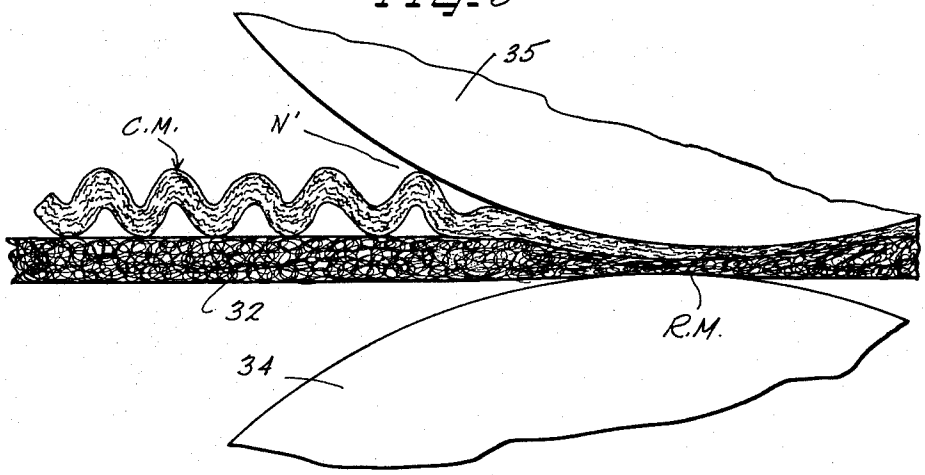


Fig. 6

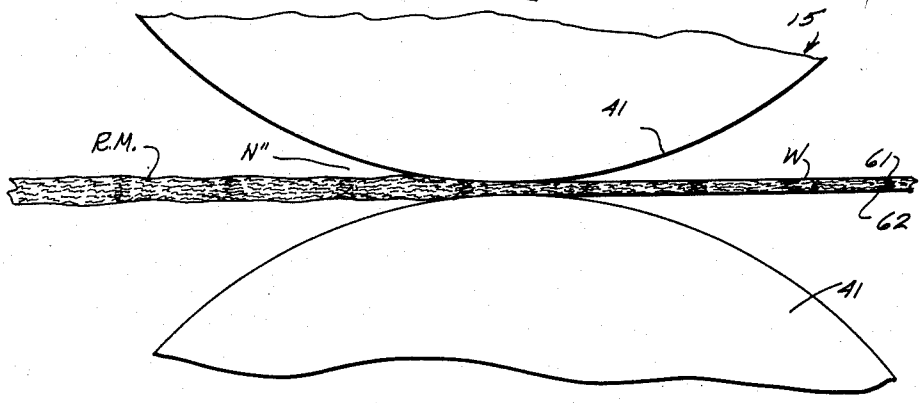


Fig. 7

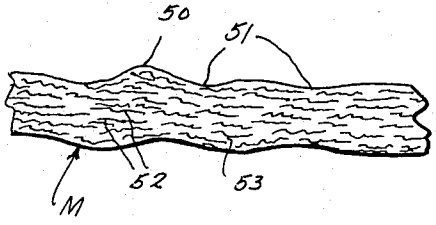
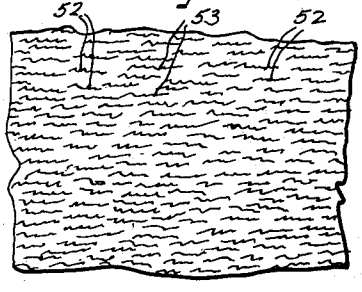


Fig. 8



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RECONSTITUTED CREPED PAPER AND METHOD AND APPARATUS FOR MAKING SAME

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Fig. 9

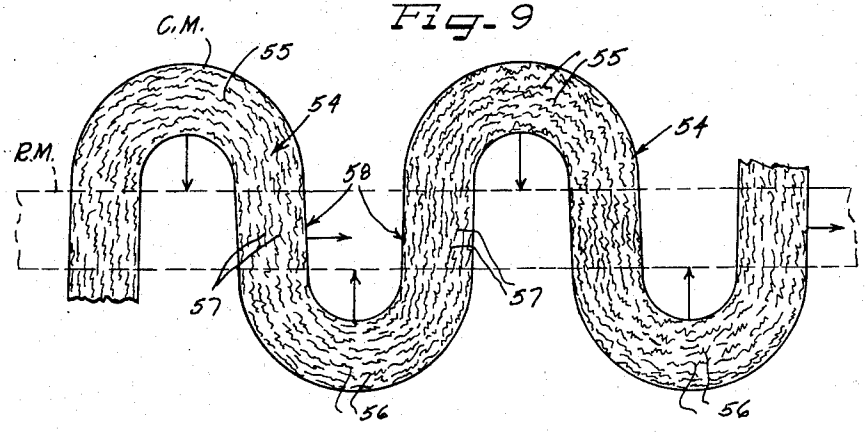


Fig. 10

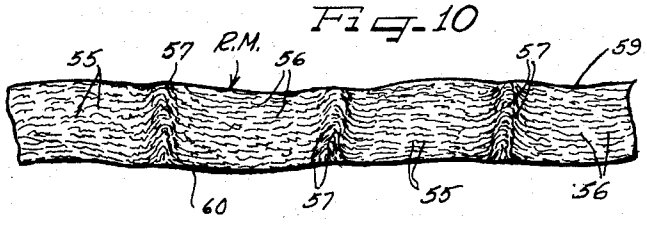


Fig. 11

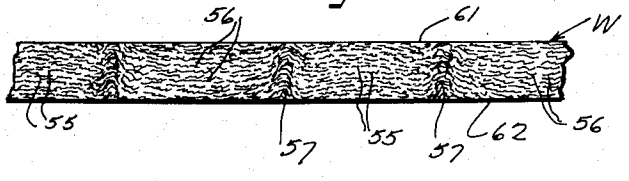
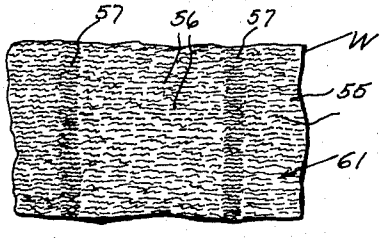


Fig. 12



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United States Patent Office 3,072,522 Patented Jan. 8, 1963

3,072,522

RECONSTITUTED CREPED PAPER AND METHOD AND APPARATUS FOR MAKING SAME

Lloyd Hornbostel, Beloit, Wis., assignor to Beloit Iron Works, Beloit, Wis., a corporation of Wisconsin

Filed Oct. 27, 1958, Ser. No. 769,872
12 Claims. (Cl. 162—113)

This invention relates to high burst strength yieldable fibrous web material and to the method of making such material, as well as the apparatus for carrying out the method. Specifically, this invention deals with reconstituted creped paper having relatively flat smooth opposed parallel faces free from conventional crepe folds but having the yieldability of creped paper in both longitudinal and transverse directions. The flat smooth faces of the paper provide good printing surfaces adapting the products of this invention for use in burst resisting printed packages such as paper bags and the like.

Conventional papers have their constituent fibers extending lengthwise of the sheet as formed on the paper-making machine due to the tendency of the fibers to become oriented in the direction of travel of the machine as they are deposited from the dilute aqueous stock onto the machine forming surface. Such conventional papers have a machine direction stretch which is only a small percentage of the cross machine direction stretch, although the machine direction tensile strength is usually greater than the cross machine direction tensile strength. Since the burst resistance of any paper is limited by the yieldability of the sheet in all directions within the plane of the sheet and the tensile strength of the sheet, it follows that conventional papers have very poor burst strength because they are substantially nonyieldable in their machine direction length and relatively low in tensile strength in their cross machine direction or transverse width. Conventional papers have, therefore, been creped to increase their yieldability in the machine direction or longitudinal length thereof, but, of course, creped papers have uneven surfaces which will not readily accept printing and are only yieldable because of the unfolding of the creped portions.

According to the present invention, there is now provided fibrillated sheet material composed of longitudinally foreshortened fibers developed from reconstituting a creped sheet under pressure while the sheet is still wet enough to refelt the fibers together in their foreshortened creped condition while the peaks of the creped folds are flattened down to form a secondary crepe within the smooth flat confines of the opposed parallel surfaces of the sheet. After the flattened pressure treated wet sheet is further dewatered sufficiently to be self sustaining, it is further compressed while in a heated condition to bond together the foreshortened fibers with the natural resins and lignins in the paper pulp. Since the reconstituting of the fibrous sheet is effected while the sheet still has a high enough water content to preclude the necessity for rewetting the sheet, the method of making the fibrillated material of this invention is economical and capable of being carried out at high speeds.

The preferred method of this invention includes the deposition of a newly formed wet fibrous mat on a first press felt which carries the mat through the pressure nip of a press assembly including a heated metal creping roll receiving the mat directly thereon and equipped with a creping doctor that deposits a creped mat of high water content onto a second press felt which is driven at a slower speed than the first felt and conveys the creped mat through the pressure nip of a suction press. After passage through this suction nip, the fibers in the mat are reoriented and the mat is sufficiently reformed into a flattened sheet that it can be passed through a dryer section where

it is further dehydrated. Before the sheet is completely dehydrated, however, it is passed through the nip of breaker rolls to bond together the reoriented fibers in the sheet with the heated natural glues and resins that remain in the sheet. The sheet is then passed through another dryer section and is dried into the finished product.

As used in this specification the term "yieldable" means give or stretch of the sheet rather than limpness or conformability. Thus some sheets of this invention may be stiff or rigid as compared with conventional creped paper but will still possess a high degree of yieldability to absorb impacts.

It is then a feature of this invention to crepe a fibrous web which is still wet enough so that its fibers can be reoriented without losing their longitudinal foreshortened length from the creped mat condition while being confined between flat smooth opposed parallel surfaces to reconstitute the web and form a yieldable flat sheet of high burst strength.

Another feature of the invention is to bond together the foreshortened fibers of a flattened creped sheet with the natural binders in the sheet.

It is then an object of this invention to provide a yieldable fibrillated material having foreshortened creped fibers confined between relatively flat opposed surfaces.

Another object of this invention is to provide fibrous web material having refelted together buckled and bent fibers from a creped sheet confined between flat opposed surfaces and bonded together with thermoplastic binders.

Another object of this invention is to provide a reconstituted creped paper with compressed and buckled creped fibers confined between flat smooth opposite faces of the paper and bonded together at elevated temperatures with thermoplastic binders.

Another object of this invention is to provide a high speed economical method of making yieldable paper with smooth flat printable surfaces.

Another object of this invention is to provide a method of reconstituting creped paper to maintain the yieldability and burst strength thereof while forming smooth printable surfaces thereon.

A still further object of this invention is to provide an economical high speed method of making high burst strength papers by reorienting creped fibers in a pressure nip and by bonding together the reoriented fibers at elevated temperature with binders such as naturally occur in the paper pulp or which may be added to the paper pulp.

A specific object of this invention is to provide apparatus for producing yieldable paper at relatively high speeds which includes a paper-making machine forming section, a first press section equipped with a creping attachment, a second press section operated at slower speeds than the first section, and a dryer section with a breaker stack intermediate the ends thereof.

A still further object of this invention is to provide a paper-making machine which crepes newly formed wet fibrous mat material in a first press and then reconstitutes the creped sheet to confine buckled and creped fibers between smooth opposed parallel surfaces affording good printing faces.

Another object of this invention is to provide a method of making high burst strength yieldable paper which includes the creping of a fibrous mat while it is only 20 to 30 percent dry, followed by an immediate reconstituting of the creped mat in a pressure nip to produce a smooth faced web which is only about 25 to 40 percent dry, followed by a heating of the reconstituted web to about 40 to 60 percent dryness and pressure treating the heated web to bond together the fibers therein with thermoplastic resins and binders.

Another object of this invention is to provide an ex-

tensible paper having a degree of stretch in the machine direction of the same magnitude as the degree of stretch in the cross machine direction, together with substantially equal tensile strengths in both the machine and cross machine directions.

Other and further objects of this invention will become apparent to those skilled in this art from the following detailed descriptions of the annexed sheets of drawings which, by way of preferred examples only, illustrate apparatus, the preferred method, and the preferred products of this invention.

On the drawings:

FIG. 1 is a diagrammatic elevational view of a papermaking machine according to this invention for carrying out the method of this invention to produce the product of this invention;

FIG. 2 is a fragmentary diagrammatic view of a modified portion of the machine of FIG. 1;

FIG. 3 is a diagrammatic view of a further modified portion of the machine of FIG. 1;

FIG. 4 is a fragmentary isometric view illustrating the creping detail of the machine of FIG. 1;

FIG. 5 is an enlarged fragmentary vertical cross-sectional view of the second press of this invention illustrating the manner in which the creped mat is reformed;

FIG. 6 is an enlarged fragmentary view illustrating the bonding together of the fibers in the reformed flattened creped sheet with heated thermoplastic resins in the sheet according to this invention;

FIG. 7 is an enlarged diagrammatic cross-sectional view showing the foreshortened fibers in the wet mat as it approaches the creping doctor blade of the machine;

FIG. 8 is a plan view diagrammatically illustrating the foreshortened fibers in the section of the sheet of FIG. 7;

FIG. 9 is an enlarged diagrammatic vertical cross-sectional view illustrating the fiber arrangement in the wet mat as it passes over the creping doctor blade;

FIG. 10 is an enlarged diagrammatic longitudinal cross-sectional view of the reconstituted flattened creped sheet emerging from the second pressure nip of the machine of FIG. 1;

FIG. 11 is a view similar to FIG. 10 but illustrating the finished sheet as delivered to the reel of the machine of FIG. 1 after the fibers have been bonded together with the thermoplastic resins in the sheet; and

FIG. 12 is a view similar to FIG. 8 but illustrating the fiber arrangement of the finished sheet.

As shown on the drawings:

The machine **10** of FIG. 1 includes a Fourdrinier forming section **11**, a first creping press section **12**, a second press section **13** for reconstituting the creped mat, a first dryer section **14** for receiving the reconstituted mat from the second press section, a breaker stack section **15**, a second dryer section **16**, and a reel **17**.

The forming section **11** includes a stock inlet **18** for delivering dilute aqueous paper stock to the top run of a looped Fourdrinier forming wire **19** trained around a breast roll **20** and a suction couch roll **21**. Drainage of water from the stock through the forming wire along its upper run between the breast and couch rolls and drainage of additional water into the suction gland **21***a* of the couch roll **21** results in the formation of a wet soggy mat M of intermingled fibers with the majority of the fibers extending lengthwise of the mat in the direction of travel of the machine. The mat is removed from the couch roll end of the upper run of the forming wire under a stripping roll **22** and only has a very short unsupported draw enroute to the top run of a bottom press felt **23** of the first press section **12**. This felt **23** is trained around an oncoming directing roll **24** which is positioned closely adjacent the stripping roll **22** and adjacent the couch roll end of the forming section **11** and thence through the pressure nip N of the first press which is composed of a bottom suction press roll **25** and a heated chilled iron top creping roll **26**. A suction gland **25***a* in the suction roll **25** removes water from the oncoming side of the nip N to further dewater the wet soggy mat M. After passing through the nip N, the felt **23** is sloped downwardly to a directing roll **27** away from the mat. The felt then travels around bottom guide rolls **28** and **29** and over a stretcher roll **30**.

The mat M adheres to the heated creping roll **26** which is preferably maintained at temperatures between 160° F. and 250° F. and is stuck firmly to the smooth plain metal surface of the creping roll to move therewith around an ascending quadrant to a creping doctor **31**. The doctoring blade **31** is directed toward the creping roll **26** at an angle to provide a doctoring angle of approximately 90° with respect to the roll face and at a position where the mat M travels on the roll about one-quarter of a roll turn.

The mat M entering the nip N is very wet being in the order of 15 to 25 percent bone dry. At the creping doctor **31** this mat is still very wet and is only about 25 to 30 percent bone dry.

The creped mat C.M. is scraped from the roll **26** at the doctor **31** and drops onto the top run of a press felt **32** of the second press section **13**. This felt **32** advances at a slower rate of speed than the felt **23** to accommodate foreshortening of the mat M into the creped mat C.M. The reduction in speed of the felt **32** depends upon the amount of crepe put into the mat and generally is of the order of 90 percent of the speed of the felt **23**. The felt **32** is trained around an oncoming directing roll **33** which positions the felt to have a receiving end of its top run under the creping doctor **31** and closely adjacent the doctor so that the creped mat C.M. will drop onto the top run of the felt **32** without being stretched and without tearing. The creped mat C.M. has such a high water content that it is very fragile and its fibers can be easily disrupted. The top run of the press felt **32** carries the creped mat C.M. through the nip N′ of a second press assembly including a bottom suction press roll **34** with a suction gland **34***a* keeping the oncoming side of the nip dewatered and a top rubber covered roll **35**. After passage through the nip N′ the felt **32** has its top run continued beyond the nip, and the felt is then trained around a roll **36** and thence downwardly around the bottom halves of rolls **37**, and over a stretcher roll **37***a* between the rolls **37**. After passage around the last bottom roll **37**, the felt is guided over a roll **38** and behind a roll **39** which keeps the ascending run of the felt enroute to the directing roll **33** spaced from the descending run of the felt **23** and permits the roll **33** to be positioned under the roll **26**.

The creped mat C.M. is reconstituted in the nip N′, and a flattened reconstituted mat R.M. emerges from the nip N′ on the rubber covered roll **35** to drop therefrom on the ascending side of the roll onto the top run of the felt **33** downstream from the nip and thence into the first dryer section **14** around the dryer cylinders **40** thereof. The reconstructed mat R.M. has a moisture content of the order of 30 to 40 percent bone dry. This reconstructed mat is now sufficiently self-sustaining to pass along an open draw into the first dryer section **14**, and the dryer section has enough drying capacity to supply a mat of about 50 to 60 percent bone dryness to the breaker stack **15**. This breaker stack is composed of a pair of rubber covered press rolls **41** providing a nip N″ therebetween having sufficient pressure to cement together the reoriented fibers with thermoplastic binders occuring in the sheet at the elevated temperatures of the sheet imparted thereto by the drying cylinders **40**. At this point, the sheet is generally heated to about 170° F. to 215° F. A web W is formed from the reconstructed mat R.M., and this web is passed around the several drying cylinders **42** of the dryer section **16** to be further dehydrated to the conventional 6 to 15 percent dryness of commercial papers. The web W is then wound into a roll R on the reel **17**.

In the modified machine arrangement **10***a* of FIG. 2, the forming wire **19** of the forming section **11***a* after being trained over the suction area **21***a* of the suction couch roll **21** is directed downwardly and forwardly to a turning roll **43**, thereby providing a downwardly inclined run **19***a* conveying the mat M to the first creping press section **12***a* including the same constituent parts as the press section **12**, which parts have been identified with the same reference numerals. The oncoming directing roll of the press felt **23**, however, is preferably a suction transfer roll **44** and to initiate the transfer from the run **19***a* to the top run of the felt **23**, an air jet or water mist spray jet device **45** is positioned in the loop of the wire **19** adjacent the turn roll **43** so that the mat M is easily transferred from the run **19***a* to the felt **23** without disrupting fibers. After the mat M is deposited on the felt **23**, it is treated in the same manner as described in connection with FIG. 1.

In FIG. 3, a modified machine **10***b* has the forming section **11***b* thereof equipped with the same Fourdrinier forming wire run as the machine **10***a*, and identical parts have been marked with the same reference numerals. In the machine **10***b*, however, the first creping press section **12***b* is equipped with a top press felt **46** which is trained around a suction transfer roll **47** that picks up the mat M from the run **19***a* of the forming wire to convey the mat on its bottom run to the first pressure nip N defined by a top suction press roll **48** and a bottom heated creping roll **49** which is also composed of cast iron. The mat M passes through the nip N and is stuck to the surface of the heated creping roll **49** where it travels on the descending side of the roll to the creping doctor **31**. The creped mat C.M. is then dropped onto the top run of the felt **32** of the second press section **13** and is treated in the same manner as described in FIG. 1.

The suction gland **47***a* of the transfer roll **47** is used to assist in the release of the web from the forming wire **19** and to retain the web on the felt **46**. Some moisture is removed and the moisture content of the mat M entering the nip N is normally in this same range described in connection with FIG. 1. The suction gland **48***a* in the top suction press roll **48** maintains the oncoming side of the nip N dewatered to prevent rewetting of the mat.

As shown in the isometric view of FIG. 4, as the mat M on the creping roll **26** approaches the active edge **31***a* of the creping doctor **31**, the mat is pushed back and begins to buckle along an area of the roll designated at A. In this area, the fibers of the very wet soggy mat M are compressed and buckled back into the body of the mat while it is still on the creping roll **26**. Since the mat is not confined on its outer face, it is free to pucker and a creping effect will occur. This creping effect is gradually build up as the mat in zone A approaches the doctoring edge **31***a* whereupon the mat will be convoluted or creped. While the drawing shows the convolutions or creped pleats extending transversely across the illustrated portion of the mat, it will of course be understood that the pleats will be discontinuous and somewhat undulated across the width of the mat as is conventional in creped paper.

FIGS. 7 and 8 illustrate diagrammatically the condition of the fibers in the mat M along the zone A in advance of the doctor blade edge **31***a*. As shown in FIG. 7, the mat is unevenly puckered or undulated to provide alternating hills or crests **50** and valleys or troughs **51**. The fibers of this mat portion are foreshortened especially in their machine direction and are undulated or buckled as shown both in the vertical and horizontal sections of the mat. The foreshortened fibers **52** in the hill or crest zones of the mat are somewhat humped up in a convex configuration, while the fibers **53** in the trough or valley portions of the mat are oppositely curved in a somewhat concave arrangement. The foreshortening of the fibers is illustrated by the undulations of the individual fibers.

When the mat M of FIGS. 7 and 8 is doctored off of the roll **26**, and the creped mat C.M. is formed, the undulations are enhanced, as shown in FIG. 9, to provide the crepe folds **54** extending alternately upwardly and downwardly without straightening out the undulated foreshortened fibers. The undulated fiber arrangement in the creped mat includes convex fibers **55** more bowed or humped up than the fibers **52** in the crest areas of the mat M. Similarly, the trough portions have the fibers **56** thereof more concave or depressed than the fibers **53** in the trough areas **51** of the mat M. The fibers **55** and **56** alternate with substantially vertical fibers **57** in the leg portions **58** which join the crests and trough portions of the mat C.M.

As shown in FIG. 5, the mat C.M. on the second press felt **32** enters the nip N′ of the second press with the folds upstanding on the felt as shown. The mat C.M. remains in a very wet condition and the fibers in the folds thereof are refelted in the nip N′ to form a reconstituted mat R.M. as shown in FIG. 10. In this reforming of the web, the crests of the creped mat C.M. are pushed down and the troughs are pushed up as indicated in FIG. 9, while the legs **58** are somewhat rolled forwardly so that the fibers **57** thereof assume somewhat of an S-shaped configuration as shown in FIG. 10. The fibers are reoriented both transversely and longitudinally because the crepe folds or pleats are uneven and discontinuous across the sheet. The reconstructed mat R.M. thus has substantially flat opposed top and bottom faces **59** and **60** in relatively parallel relation with some undulations. The reconstructed mat R.M. has alternating longitudinally spaced areas of convex fibers **55** and concave fibers **56** joined through S-curved fibers **57** with each of the fibers still retaining the foreshortened undulated condition of the fibers **52** and **53** in the mat M as formed in the area A on the creping roll.

The reconstituted mat R.M., as indicated above in the description of FIG. 1, is then heated and dried to moisture content of about 50 percent bone dryness and is then placed through the nip N″ of the breaker stack which, as shown in FIG. 6, decreases the thickness of the mat to the finished web W. In the nip N″, the reconstituted mat R.M. is at a sufficiently high temperature so that the natural lignins, resins and other binders occurring in the paper stock are in a thermoplastic condition to cement together the undulated fibers in their foreshortened state and form a strong web W. This web W has smooth flat printable parallel top and bottom faces **61** and **62** with cemented together foreshortened fibers within the confines of these faces as shown. The web W preferably has a transverse or cross machine degree of yieldability of the same order as the longitudinal or machine direction stretch. Further, the tensile strength of the web W is substantially equal in both the machine and cross machine directions. A uniformly "square" sheet strength is thereby obtained.

In one typical production of bag paper according to this invention, kraft paper stock was fed to the forming section of the machine to produce a 40-pound basis weight paper, and the machine was operated so that the wet mat entering the creping press was about 18 to 20 percent bone dry, while the creped mat C.M. entering the second press was about 25 to 28 percent bone dry, the reconstructed mat R.M. was about 33 to 35 percent bone dry, and the heated reconstructed mat entering the breaker stack was about 55 percent bone dry. The finished web had a machine direction stretch of 6.1 percent, a cross machine direction stretch of 5.7 percent, a machine direction tensile strength of 17.2 pounds per inch of width, and a cross direction tensile strength of 15.4 pounds per inch of width. Standard specifications for the elongation of 40-pound basis weight craft bag paper to rupture is 1:8 percent in the machine direction, and 3:8 percent in

the cross machine direction. Thus, the product of this invention had an increased machine direction elongation in a factor of over 200 percent.

In the preferred operation, the second press had a nip pressure of about 300 pounds per lineal inch, the doctor blade was oscillated, and the creping roll was chilled cast iron that was not scored by the doctor.

From the above description, it will be understood that this invention now provides a reconstituted creped paper having smooth flat faces, enhanced extensibility, and uniform tensile strength in both the machine and cross machine directions.

I claim as my invention:

1. The method of making paper of enhanced yieldability which comprises laying fibers containing binders in an aqueous medium on an foraminous forming surface, draining liquid from the fibers on said surface, forming a fibrillated wet mat on said forming surface, transferring the wet mat from the forming surface to a first felt, pressing the wet mat on the felt against a hard heated surface, transferring the wet mat to said surface, scraping the wet mat from said surface while simultaneously compressing and buckling the fibers in the wet mat and forming creped folds, depositing the creped wet mat on a slower moving second felt, passing the creped wet mat on said second felt through the nip of a second press while the mat is still wet enough to have the fibers relocated and thereby reorienting the fibers in said nip to suppress the creped folds while maintaining the fibers in a foreshortened undulated yieldable condition, heating the thus reconstituted mat to plasticize the binders therein, and pressing the heated reconstituted mat to bond the fibers together in foreshortened yieldable condition.

2. The method of making a smooth surfaced creped paper of enhanced yieldability which comprises forming a wet mat of binder containing fibrillated material with the fibers thereof lying in a direction along the length of the mat, pressing the wet mat against a hard creping roll, advancing the wet mat on the roll in tight adherent relation therewith, scraping the wet mat from the roll to crepe the mat and foreshorten the fibers thereof, pressing the creped wet mat while it is still wet enough to have its fibers relocated and of the order of 25 to 40% bone dry through the nip of a press exerting sufficient nip pressure on the wet mat to effect the relocation of the fibers without stretching them from their foreshortened condition while simultaneously flattening the faces of the mat, heating the flattened mat to a temperature sufficiently high to plasticize the binders in the mat, pressing the heated flattened mat through another nip having a sufficiently high nip pressure for smoothing the faces of the mat and for forcing the binders into the fibers to cement the fibers together, and further drying the resulting web issuing from said second nip.

3. The method of making a flattened creped paper with smooth printable surfaces and having a high degree of yieldability without relying on the unfolding of creped folds to produce such yieldability which comprises forming a wet fibrillated mat about 15 to 25 percent bone dry, passing the mat through a first press against a creping roll, doctoring the mat from the creping roll to form a creped mat about 25 to 30 percent bone dry, passing the creped mat while it is still only about 25 to 30 percent bone dry through a second nip to remove further water therefrom and to reorient the fibers while smoothing the faces of the mat to produce a flattened mat about 30 to 40 percent bone dry, heating the mat from the second press and simultaneously removing additional moisture therefrom to form a mat about 50 to 60 percent bone dry, subjecting the heated mat to high pressure for cementing together the fibers therein and for further smoothing the surfaces of the mat, and further drying the resulting web to a commercial paper dryness.

4. The method of making high burst strength paper especially suitable for bags and the like packages which comprises forming kraft paper stock into a wet mat of about 18 to 20 percent bone dryness, nip pressing the mat in a creping press against a heated creping roll, creping the mat off of the roll to produce a creped mat of about 25 to 28 percent bone dryness, passing the creped mat while it is still only about 25 to 28 percent bone dry through a second nip to remove additional water therefrom and to flatten the folds of the crepe and reorient the fibers between substantially parallel flat top and bottom faces of the mat for forming a reconstructed mat of about 33 to 35 percent bone dryness, heating the reconstructed mat to temperatures sufficiently high to plasticize the natural binders occurring in the mat and to remove further water from the mat to form a heated mat of about 50 to 60 percent bone dryness, subjecting the thus heated mat to high pressures in a third nip to cement together the fibers and to further smooth the faces of the mat, and further drying the resulting web to commercial paper dryness.

5. In the method of making high burst strength paper having smooth printing faces the steps which comprise feeding a wet fibrillated web of about 15 to 25% bone dryness to a creping press, creping the wet web in said press, pressing the creped web while it is still only about 25 to 40% bone dry to flatten the creped folds thereof and to reorient and mush down the fibers for producing a reconstituted web, and further drying the reconstituted web to produce a finished sheet of paper.

6. A paper-making machine which comprises a forming section, a first creping press section, a second press section, a first dryer section, a breaker stack section, and a second dryer section, said creping section having a felt conveying a wet mat from the forming section through the nip of the creping press, said creping section having a hard creping roll receiving the mat thereagainst and a scraper for removing a creped mat from the roll, said second press section having a felt for receiving the creped mat from the scraper and a suction dried nip receiving the mat and felt therethrough to reconstitute the creped mat into a web having opposed flat faces and foreshortened longitudinally extending fibers between the faces adapted to be elongated to permit stretching of the web, said first dryer section heating and drying said reconstituted web to plasticize binders therein and to reduce the moisture content thereof, said breaker stack section compressing the web to cement together the reconstituted fibers, and said second dryer section drying the web to commercial dryness.

7. A paper-making machine which comprises a stock inlet, a traveling stock forming means adapted to form a mat of fibrillated material from stock fed thereto by said inlet, a first press felt receiving the mat from the forming means, a creping press receiving the felt and mat through the nip thereof, said press including a creping roll receiving the mat thereagainst and a creping doctor for scraping a creped mat from the roll, a second felt receiving the creped mat from the doctor, a second press having a nip receiving the second felt and creped mat therethrough, a first dryer section receiving the mat from the second press, a breaker stack receiving the mat from the first dryer section, a second dryer section receiving the mat from the breaker stack, and a reel receiving the mat from the second dryer section.

8. A paper-making machine which comprises a forming section adapted to deliver a wet fibrillated mat, a creping press section having a bottom felt with a top run receiving the web from the forming section to convey the mat through the nip of the creping press against a creping roll of the press, a doctor removing a creped mat from the creping roll, a second felt having a top run receiving the creped mat from the doctor, means for driving the second felt at a slower speed than the first felt, a suction press defining a nip receiving the felt and creped mat there-

through, and dryer means receiving the mat from the second press.

9. In a paper making machine a mat forming section, a creping press including a looped felt with a top mat conveying run, a suction press roll in the loop of the felt, a plain creping roll coacting with the suction press roll to define a pressure nip, a creping doctor coacting with the creping roll to remove a creped web from the roll, and a directing roll in the loop of the felt to position the felt for receiving the mat directly from the forming section without subjecting the mat to an unsupported draw of appreciable length.

10. In a paper making machine a forming section having a looped forming wire with a top forming run, a suction couch roll receiving the wire therearound, a turning roll below the suction couch roll and coacting therewith to define an inclined run of the forming wire, a creping press section having a looped bottom felt with a top run receiving the mat from the inclined run of the forming wire and a creping press assembly including a suction roll in the loop of the felt and a top creping roll coacting therewith to define a nip.

11. In a paper making machine including a forming section, a top press felt, a suction transfer roll in the loop of the felt for transferring a web from the forming section to an under run of the felt, a suction press roll in the loop of the felt, a bottom creping roll coacting with the suction press roll to define a pressure nip receiving the mat and felt run therethrough, and a creping doctor coacting with the creping roll to remove a creped web from the roll.

12. In a paper making machine a forming section, a creping press assembly immediately adjacent said forming section, said creping press assembly including a looped conveyor felt receiving the mat from the forming section, blower means for transferring the mat from the forming section to the felt, a suction press roll in the loop of the felt defining a suction area receiving the felt and mat thereover, a creping roll coacting with the suction press roll to define a pressure nip and receiving the mat directly thereagainst, and a creping doctor downstream from the nip coacting with the creping roll to remove a creped web therefrom.

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