

Dec. 24, 1957

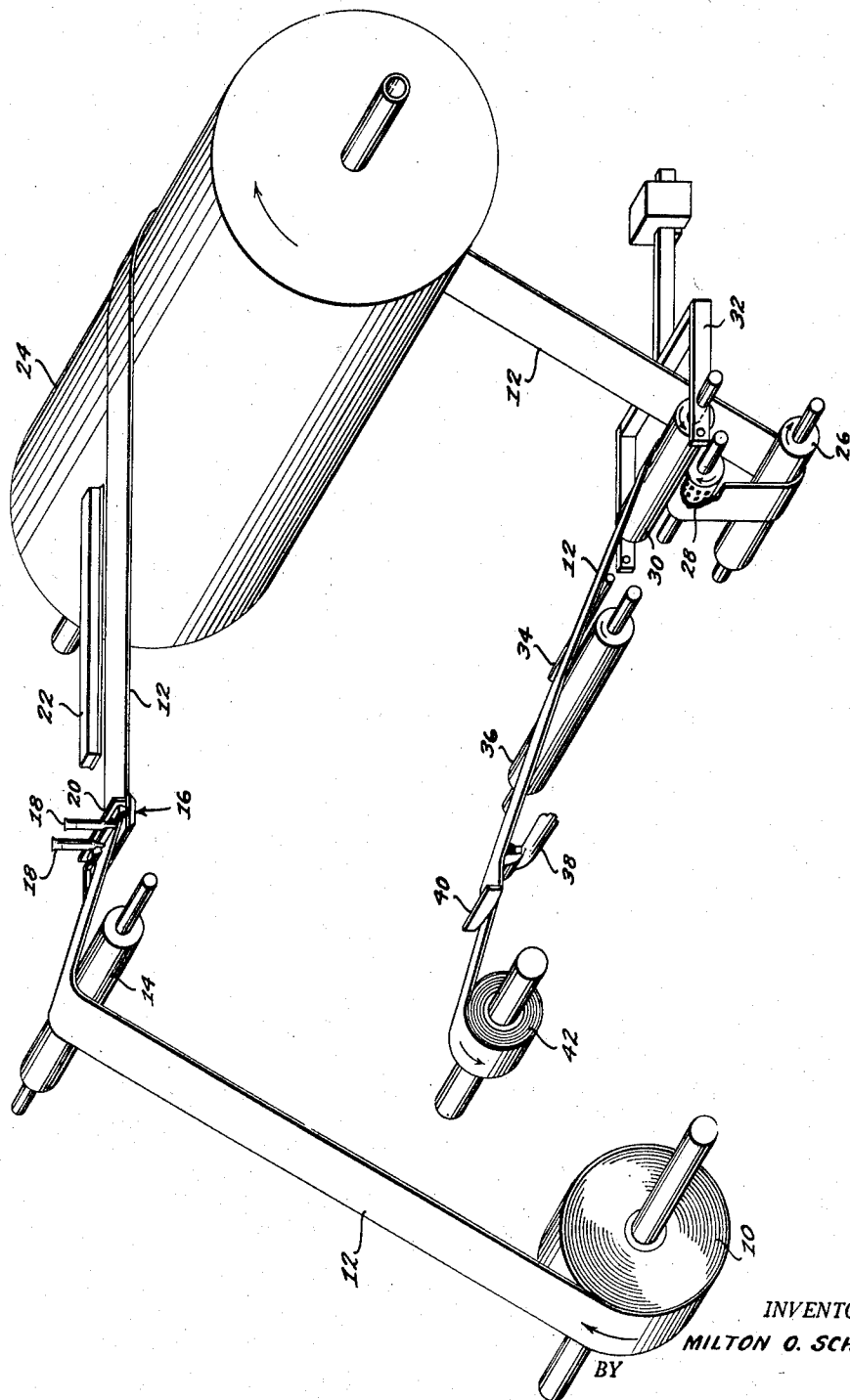
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2,817,596

Filed March 29, 1955

5 Sheets-Sheet 1

Fig. 1



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5 Sheets-Sheet 2

Fig. 2

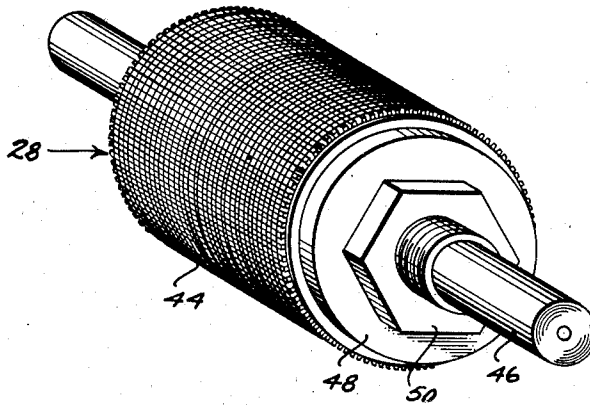


Fig. 3

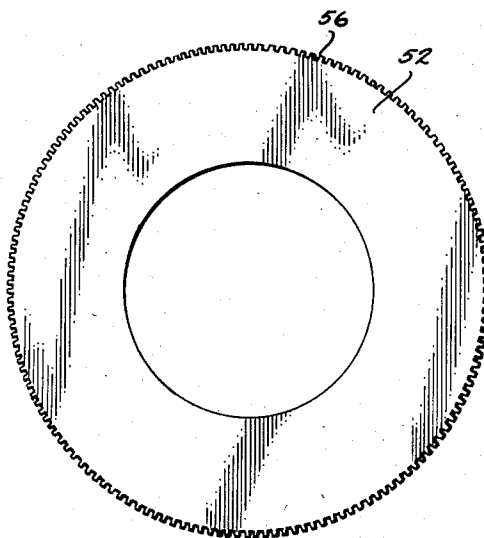
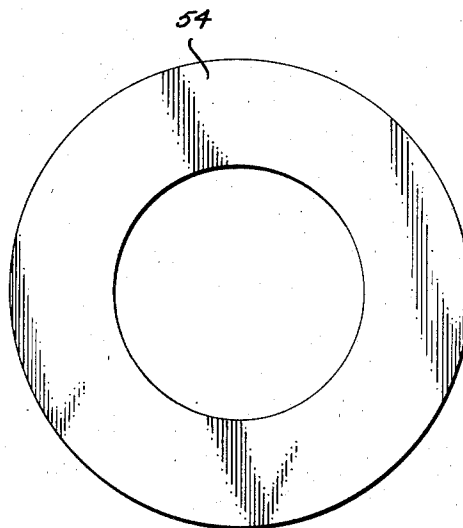


Fig. 4



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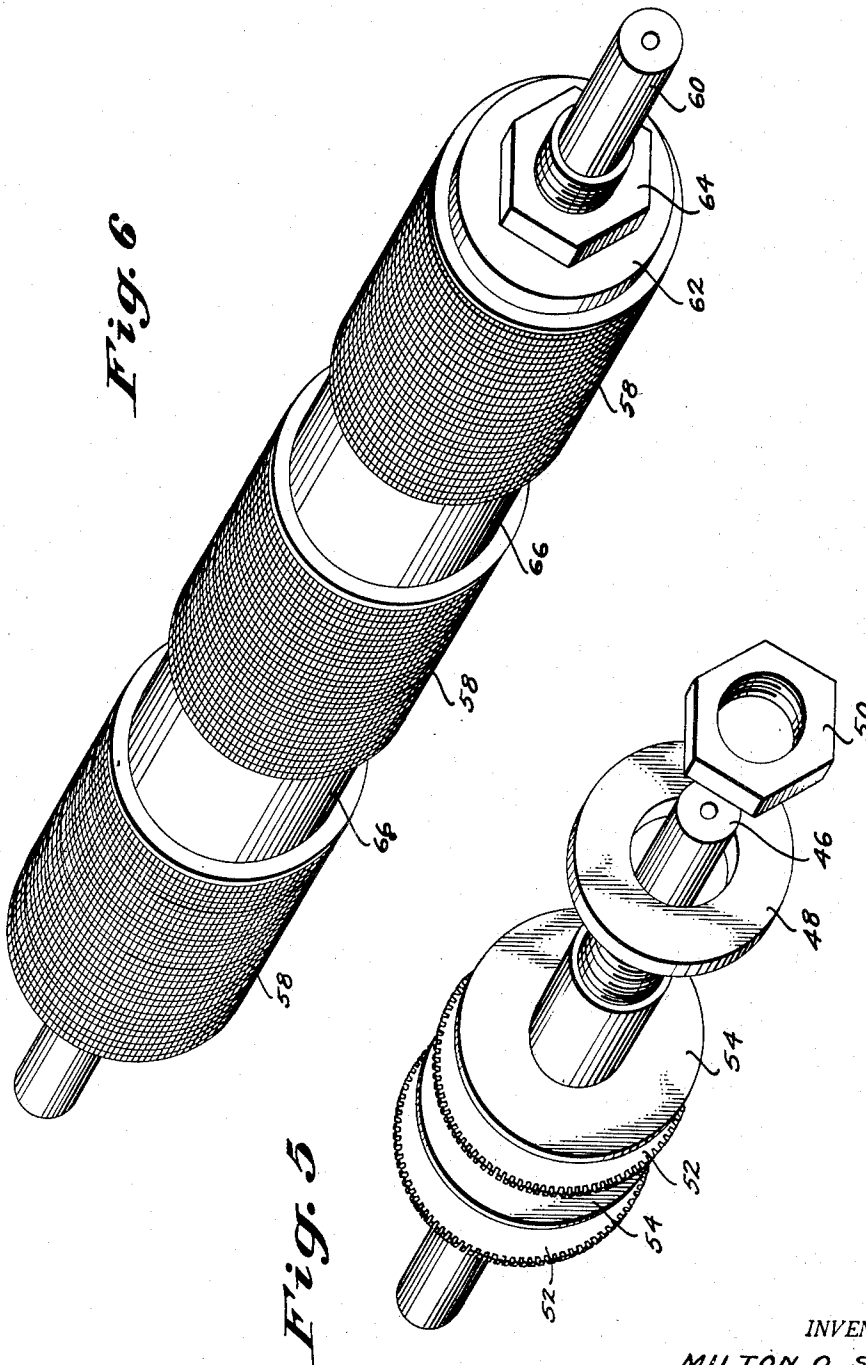
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5 Sheets-Sheet 4

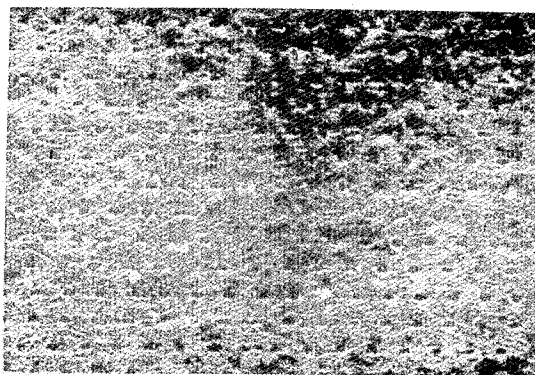


Fig. 7

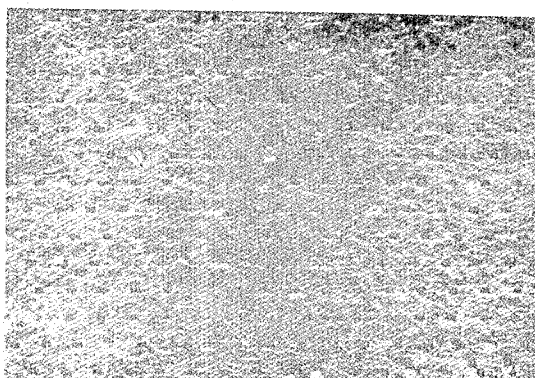
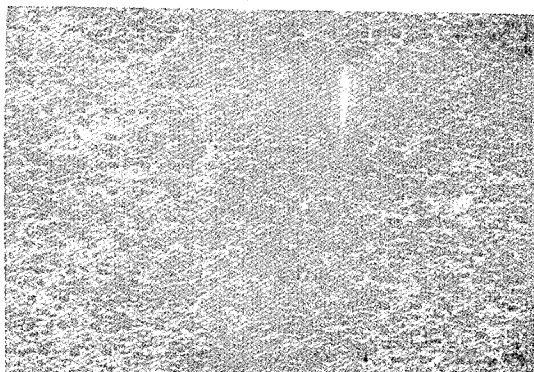


Fig. 8



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Fig. 9

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5 Sheets-Sheet 5

Fig. 10

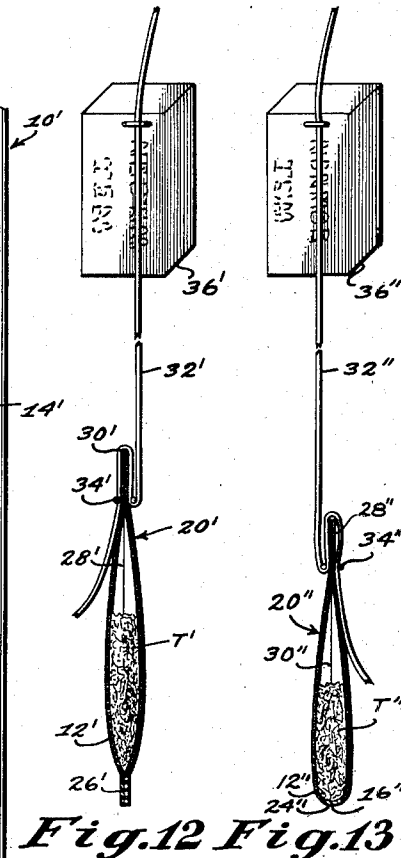
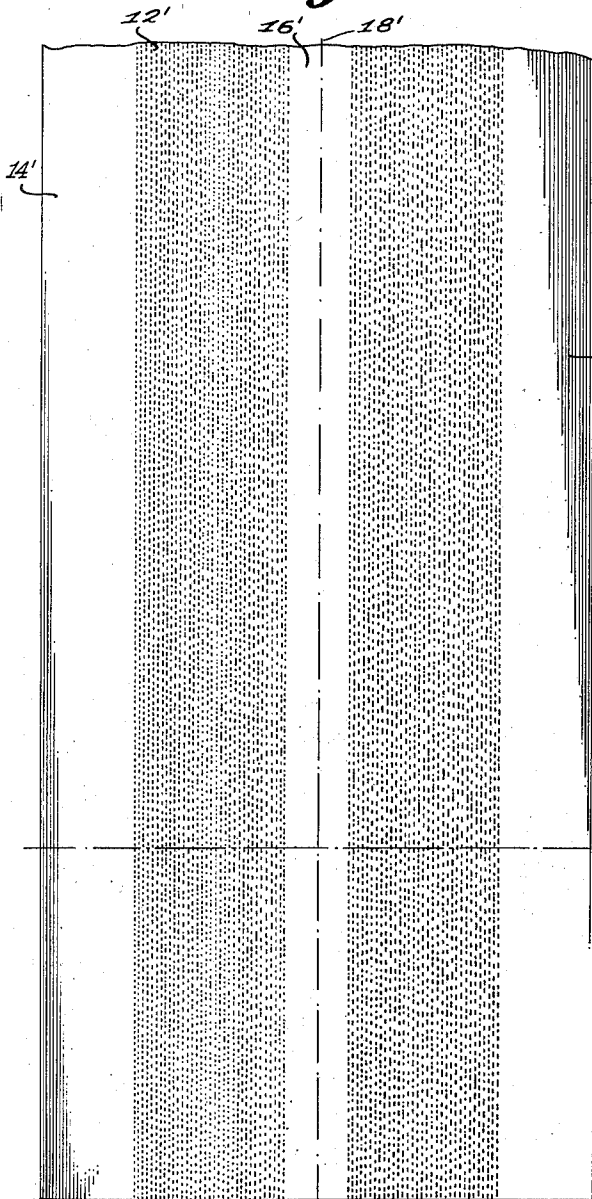


Fig. 12 Fig. 13

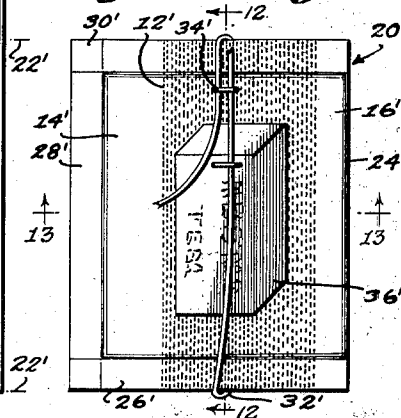


Fig. 11 INVENTOR

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2,817,596

PERFORATED PAPER

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Application March 29, 1955, Serial No. 497,509

8 Claims. (Cl. 117—4)

This invention relates generally to paper adapted for forming tea bags and the like, and more particularly to a perforated tea bag paper and to a method for perforating the paper. This is a continuation-in-part of my copending application Serial No. 448,608, filed August 9, 1954, now abandoned, which is a continuation-in-part of my copending application Serial No. 345,843, filed February 17, 1953, now abandoned, which was in turn a division of my application Serial No. 184,560, filed September 18, 1950, and now Patent 2,699,208.

In my prior copending application Serial No. 123,060, filed October 22, 1949 (now abandoned), a tea bag paper is disclosed that is made from a lightweight, wet-strengthened, tissue sheet having a coating of a heat-sealing resin applied thereon and perforated with a large number of restricted openings to impart sufficient porosity to the sheet. The present invention constitutes an improvement of the perforated tea bag paper disclosed in this prior application with regard to the manner in which the perforations are formed.

A particular feature of the present invention is the production of a perforated tea bag paper with the necessary large number of perforations ruptured in the paper, but with the paper substantially free of flap portions of any sort adhering at the ruptures forming these perforations.

In the tea bag paper disclosed in my above noted prior application Serial No. 123,060 the perforations are purposely formed with regularly occurring projected areas of the paper sheet at the ruptured portions which provide flap portions in the nature of covers or shields or baffles for the perforations that prevent sifting of the ground tea leaves. According to the present invention I am able to provide perforations in the tea bag paper of my prior application that are sufficiently small in size so that no problem with sifting of the ground tea is encountered, and which, being free of flap portions, avoid any difficulty with introduction of extraneous paper particles into tea as it is brewing in the usual manner by leaching from the tea bag in hot water. Moreover, I have found that with perforations formed in accordance with the present invention the rate of leaching or extraction of the tea is very substantially improved.

Briefly described, the apparatus provided by the present invention for forming these perforations comprises a perforating roll having teeth spaced on its peripheral surface which are of uniform rectangular cross section from the face to the root thereof. This perforating roll is arranged to run against a rubber covered backing roll and thereby form a nip through which the tea bag paper sheet may be run for perforation. With the large number of fine perforations required in the tea bag paper, it is not possible to cut or punch the perforations in the sheet in the usual manner but the above noted arrangement of a perforating roll and opposed backing roll in accordance with the present invention results in rupturing the perforations in the sheet with almost comparable results. That is, the perforations are ruptured in the sheet

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cleanly for the most part with relatively few flap portions remaining at the ruptures forming the perforations.

An important factor contributing to this result is the formation of the teeth on the perforating roll with a uniform cross section, so that the size of perforation obtained is independent of the pressure applied for weighting the perforating roll against the backing roll, and this pressure may accordingly be regulated with attention only to providing the conditions that result in the best perforating action.

Another feature of the teeth formed on the perforating roll according to the present invention is that the cross sectional dimension of the teeth is made at least 50 percent greater in a direction circumferentially of the roll than longitudinally thereof. The significance of this feature is that it results in characteristically disposing any flap portions left adhering at the perforation ruptures so that they are hinged on an axis parallel with the direction of travel of the paper during perforation, and may accordingly be removed easily by the subsequent action of means such as a reversely driven brush oil, or a stationary brush and associated suction means, or both, as will be explained more in detail presently.

It should also be noted that this dimensional form of the perforating roll teeth results in a stronger perforated tea bag sheet, because the direction of travel of the paper for perforation will naturally be in its machine direction, and with the long dimension of the perforating roll teeth oriented in this direction fewer of the long fibers of the paper sheet will be cut to impair its strength.

Perforated tea bag paper formed in the above noted manner has proven very satisfactory for the manufacture of tea bags except for two tendencies: First, the tea bags made from this paper occasionally develop a short crack at one corner of the bag structure large enough to allow the tea to sift out; and, secondly, if the bags are handled roughly during or after filling with the tea they may tear slightly from attrition by the tea particles at the perforations along the rounded edge, that is, the folded or doubled edge.

I have found from my research on this problem that the above-mentioned crack at one corner of the bag structure may be caused by the following several factors. First, uneven tension on the paper as it travels through the automatic bag-forming machine, or even slight misalignment of the sheet relative to the bag-forming elements, has a tendency to form wrinkles in the paper. Second, the heat-sealing plates or jaws may press these wrinkles into sharp creases. Third, the heat-sealing plates tend to embrittle the paper, especially at the heat-sealed corners, by driving moisture out of the paper at or near the heated areas. Fourth, the perforations in the paper weaken it so that a crack may appear wherever the edge of a crease happens to coincide with a row of perforations.

I have discovered that the above-mentioned difficulties can be met, so that corner cracks of the tea bag structure are avoided, by omitting the perforations in the paper for a distance of about $\frac{1}{2}$ " to 1" from the longitudinal edges of the paper. In other words, the corner of the tea bag formed from the longitudinal edge of the paper will no longer contain the openings or perforations and will be sufficiently strong to resist cracks or tears.

To avoid the second difficulty above-mentioned, namely, tearing of the tea bags along the folded or doubled edge, I maintain the paper unperforated along the longitudinal center line, from which area of paper the folded edge is formed, for a width of about $\frac{3}{8}$ " to about $\frac{3}{4}$ ".

Even though the tea bag paper of the present invention is now unperforated in the particular areas above-mentioned so that the perforated portions constitute considerably less than the entire surface of the bag, the lat-

ter still allows satisfactory rapid leaching of the tea contained in the bag. In fact, the perforation arrangement employed in this paper has the particular advantage of allowing a substantially higher density of perforations to be used with a consequent smaller size of perforation, which has the important significance of serving to contain satisfactorily the higher proportion of tea dust that is thought worthwhile, according to current tea making practice, to include with the tea particles to be packaged in the tea bags formed from this paper. The higher density of perforations, of course, tends to weaken the paper in the perforated areas, but the associated arrangement of the imperforate areas as described above eliminates any disadvantage in this tendency by providing fully adequate strength in the resulting tea bag structure where strength is needed at the corners and along the doubled edge as previously noted.

Also, it should be noted that satisfactory leaching action is particularly provided for by the selectively perforated arrangement for the tea bag paper of the present invention because the perforations extend from the edge of a resulting tea bag as the handling string is attached to the opposite edge. The importance of this feature is explained as follows:

While a bag is being steeped, the string by which it is normally handled is looped over the edge of the cup or the tea pot. The lowermost edge of the bag is then the edge opposite the one to which the string is stapled or otherwise fastened. For rapid extraction of the tea, it is important that the perforations extend from the top to the lowermost edge of the bag so that the tea extract, which has a higher specific gravity than water, can diffuse readily out through the bottom of the bag. Further, when the bag is withdrawn from the tea solution, it is important that the liquid within it be free to drain out as rapidly and completely as possible.

As a result of the above-described improvements in the tea bag paper, it will work satisfactorily in the automatic bag-forming and filling machines and produce consistently perfect bags which resist damage in transport and in use, and which at the same time permit rapid and satisfactory extraction of the tea. Typical but non-limiting specifications for this improved tea bag paper, with particular reference to the perforations therein, is as follows:

	Example I	Example II	Example III
Size blank for single bag inches.....	2 $\frac{1}{16}$ x 4 $\frac{3}{8}$	2 $\frac{1}{16}$ x 4 $\frac{3}{8}$	2 $\frac{1}{16}$ x 4 $\frac{3}{8}$
Area.....sq. in.	11.8	11.8	11.8
Non-heat-sealed area of bag.....sq. in.	8.46	8.46	8.46
Size of perforations.....mm.	.12 x 0.30	0.085 x 0.32	0.085 x 0.26
Number of perforations per square inch of perforated paper.....sq. in.	858	1,066	1,300
Total area of openings per square inch of perforated paper.....	.048	0.045	0.045
Total area of openings per bag.....sq. in.	0.25	0.25	0.25

The present invention is described in further detail below in connection with the accompanying drawings, in which:

Fig. 1 is a schematic illustration in perspective of an apparatus incorporating the perforating means of the present invention;

Fig. 2 is a further perspective view of the perforating roll;

Fig. 3 is a plan view of one of the peripherally toothed discs employed in forming the perforating roll shown in Fig. 2 according to the preferred embodiment of the present invention;

Fig. 4 is a corresponding plan view of the intermediate spacing discs used in association with the toothed discs shown in Fig. 3;

Fig. 5 is a perspective view illustrating the manner in

which the perforating roll shown in Fig. 2 is built up with the toothed discs and spacing discs shown in Figs. 3 and 4;

Fig. 6 is a perspective view showing a perforating roll similar to the one shown in Fig. 2, but adapted for perforating tea bag paper in multiple strips;

Fig. 7 is a photolithograph of the actual photomicrographs of the tea bag paper after being acted upon by the perforating roll of the present invention, the side of the paper shown being the side opposite to the one running in contact with the roll;

Figs. 8 and 9 are corresponding photolithographs showing the perforated tea bag, respectively, after it has been acted upon by a reversely driven cleaning roll, and then further acted upon by a stationary brush and suction means;

Fig. 10 is a plan view of a perforated paper web arranged as preferred according to the present invention for forming tea bags;

Fig. 11 is a side elevation of a tea bag formed according to the present invention from a paper web such as is illustrated in Fig. 10;

Fig. 12 is a sectional detail taken substantially on the line 12—12 in Fig. 11, but with a handling string element shown extended as in use; and

Fig. 13 is a similar sectional detail rotated 90° as on line 4—4 in Fig. 2, and with the handling string element shown extended from the side edge of the tea bag opposite the doubled edge thereof.

Referring now to the drawings, and more particularly at first to Fig. 1 for a detail description of one embodiment of the invention, the reference numeral 10 indicates a supply roll of the lightweight, wet-strengthened tissue sheet adapted for use as tea bag paper in accordance with the disclosure in my above noted prior application Serial No. 123,060. The web 12 being withdrawn from the supply roll 10 is shown as being of a width suitable for forming a single strip of tea bag paper, although a wider sheet might be used as well with corresponding changes otherwise in the apparatus for forming the tea bag paper in multiple strips, as will be pointed out further below.

As disclosed in the above noted copending application, the tissue sheet of the type employed in forming the web 12 may be produced in the usual manner on a conventional Fourdrinier paper machine from kraft pulp or other suitable pulps, the significant point being that inexpensive pulps, such as kraft, can be used with excellent results. The weight of the tissue sheet produced in this manner should come within the range of about 10 grams to 30 grams per square meter, and advantageously within the range from about 15 grams to 20 grams per square meter; and the sheet should be wet-strengthened in the course of formation by incorporating in the furnish a suitable wet-strength resin, such as melamine, or by impregnating the sheet in a conventional size press with a solution of urea-formaldehyde resin.

The web 12 is trained from the supply roll 10 upward and over a guide roll 14 to a coating station 16 at which a heat-sealing resin may be applied as also disclosed in my prior application, there being shown in the drawing a pair of metering containers 18 from which the resin may be supplied at a regulated rate behind a knife applicator or doctor blade 20 against which the paper web 12 runs. The tissue sheet forming the web 12 may be made heat-sealable, in accordance with the disclosure of my prior application, by a coating of vinyl resin, such as vinyl butyral or a copolymer of vinyl chloride and vinyl acetate, and the like. This coating may be applied in restricted areas, if desired, to correspond only with the locations at which the web 12 is finally to be heat sealed in forming tea bags therefrom, but usually it will be more convenient to make an overall coating application of the vinyl resin in an amount of about 15% to 20% based on the dry weight of the coated paper. Beyond the coating station 16, the web 12 may be suitably

trained beneath a source of infrared heat, as at 22, and then over a heated drying drum 24, to dry the resin coating.

From the drying drum 24, the web 12 is passed downwardly under a guide roll 26 and then through the nip formed by a perforating roll 28 formed in accordance with the present invention, and a rubber covered backing roll 30 which is adjustably weighted in opposed relation to the perforating roll 28 by suitable means as indicated by the reference numeral 32.

The perforated web 12 may then be passed over a spreader bar as at 34, over a reversely driven brush roll as indicated at 36 for removing flap portions adhering at the ruptured perforations, past a stationary brush and associated suction means as illustrated at 38 for further removal of flap portions and cleaning of the web 12, under a further spreading device as at 40, and finally rewound in roll form at 42.

The form of perforating roll 28 employed according to the present invention is illustrated further in Fig. 2 of the drawing in which the peripherally toothed body of the roll as at 44 is shown mounted on a mandrel 46 between retaining collars 48 and jam nuts 50 (compare Fig. 5). The body 44 of the perforating roll 28 could, if desired, be made as a solid unit, but it is preferably formed in accordance with the present invention of an alternating series of toothed discs 52 (see Fig. 3) and intermediate spacing discs 54 (see Fig. 4), the diameter of the spacing discs 54 being not greater than the root diameter of the teeth 56 formed at the periphery of the discs 52.

The teeth 56 in the discs 52 may be machined after the alternating series of discs 52 and 54 have been placed on the mandrel 46, as illustrated in Fig. 5, and locked in place between the retaining collars 48 and jam nuts 50, by cutting or milling spaced grooves parallel to the mandrel axis in the peripheral surface of the result in roll body 44. Usually, however, the teeth 56 may be formed with greater facility and to better advantage by stamping or die cutting them in the individual discs 52 beforehand, in which case they may be assembled on the mandrel 46 without any attempt to align the teeth 56 of the individual discs 52.

In forming the perforating roll 28 in this manner, the toothed discs 52 may suitably be cut from shive stock of about 0.007" thickness, with teeth 56 having a width of about 0.011", and with a spacing of at least comparable width provided between the teeth 56. The spacing discs 54 may in turn be formed from a material such as spring steel having a thickness at least about as great as the spacing provided on the discs 52 between the teeth 56. This arrangement makes it possible to provide easily a very high density of teeth 56 on the peripheral surface of the perforating roll 28, and thereby obtain the large number of tiny ruptured openings in the tea bag paper necessary for providing a satisfactory extraction rate.

In order to provide an extraction rate which is acceptable in tea bag paper, I have found that the teeth 56 should be formed with a density of at least 500 teeth per square inch, with each tooth of a size such that the corresponding number of perforations ruptured in the paper will form an open area of at least 5 percent of its total area (excluding unperforated heat-sealing margins, of course). A perforating roll 28 formed with toothed discs 52 and spacing discs 54 in the dimensions noted above results in spacing the teeth 56 with a density of 837 per square inch, and provides a corresponding density of ruptured perforations in the tea bag paper forming an open area of 7.0 percent of its total area.

Fig. 6 of the drawings shows a modified arrangement of a perforating roll of the type just described above that is adapted for large-scale production by means of a plurality of roll bodies 58 for forming multiple strips of tea bag paper simultaneously. The roll bodies 58 are formed in this instance just as the single roll body 44

described above, and are mounted in the same way on a mandrel 60 between retaining collars 62 and jam nuts 64, with the addition of spacing sleeves 66 between the roll bodies 58. The dimensions of the roll bodies 58 and the spacing sleeves 66 are determined by the width of the perforated area and the width of the unperforated sealing margin desired in the finished tea bag paper strip. After perforation in multiples with a roll of this sort the tea bag strips are separated by slitting at the middle of the unperforated areas.

Actual illustrations, magnified in size, of tea bag paper formed in accordance with the present invention are shown in Figs. 7, 8 and 9 of the drawings, and in each case the direction of travel of the tea bag web during processing was horizontally to the left as seen in the drawings. In Fig. 7, the tea bag paper is shown just after perforation with a roll such as the roll 28 described above, and it will be noted the paper even at this point has very few flap portions (as indicated by the strikingly high-lighted areas) adhering at the ruptures forming the perforations. Also, it will be noted that the ruptured perforations are longer in the direction of web travel than they are wide, and that the flap portions that appear are characteristically hinged on an axis parallel to the direction of web travel as previously mentioned above. This characteristic disposition of the flap portions that are present after the perforating roll is passed makes them particularly susceptible to removal with any convenient means for brushing the web in a direction opposite to its travel, which may be used in association with an air moving device, such as an air blower or such means, for carrying away the removed flap portions and thereby cleaning the web of extraneous paper particles.

This is illustrated by Fig. 8 of the drawings, in which the perforated tea bag paper is shown after subsequent brushing with a reversely driven gabardine covered roll as described above and illustrated in the drawings at 36. A gabardine cover has been found to provide a very effective brushing action with the lightweight tissue sheet from which the tea bag paper in the present case is made, and it will be seen in Fig. 8 that a still smaller number of adhering flap portions appear than in Fig. 7. Fig. 9 shows the tea bag paper after it has been further acted on by a stationary brush and associated suction means as indicated in the drawings at 38, and after which it will be noted the sheet is substantially free of any adhering flap portions at all.

The paper web indicated generally by the reference numeral 10' in Fig. 10 represents a web of tea bag paper formed from a lightweight, wet-strengthened, tissue sheet having a coating of a heat-sealing resin applied thereto and perforated with a large number of restricted openings as at 12' to impart sufficient porosity to the sheet, as disclosed above.

The web 10' is further characterized, as shown in Fig. 10, by imperforate portions at the side edges of the web, as indicated by the reference numeral 14', and at the longitudinal center of the web, as at 16'. The side edge imperforate portions 14' extend for a distance inwardly of the web 10' that substantially exceeds the extent at which these side edges are heat-sealed in forming the tea bag structure as will be explained further presently. Also, the center imperforate portion 16' extends for a substantial distance on each side of the longitudinal center of the web (indicated in Fig. 10 by a broken line at 18') about which the web 10' is doubled in forming the bag structure. As already noted above, the width of these imperforate portions from a practical standpoint in actual tea bag making operation should be from about 1/2" to 1" for the side edge imperforate portions 14' and from about 3/8" to 3/4" for the center imperforate portion 16'.

Fig. 11 of the drawings shows a tea bag 20' formed from a paper web 10' such as is illustrated in Fig. 10 and described above, the tea bag 20' comprising structurally a rectangular paper sheet or blank that may be considered

to have been taken from the web 10' between the broken transverse lines 22' in Fig. 10 and doubled upon itself to form the bag structure shown in which the doubled edge is represented at 24'.

In actuality, the automatic bag-forming machines operate to double the leading portion of the web 10' continuously about its longitudinal center 18' as it is fed continuously to heat-sealing jaws which heat-seal the leading free edges transversely of the doubled web to form a bottom edge bag seal as at 26' adjacent, or at right angles to, the doubled edge 24', and which further heat-seal the free edges of the doubled web opposite the doubled edge 24' in bag height as at 28' to form a side edge bag seal. Tea particles as at T' in Fig. 12 are then introduced at the pocket thus formed in the doubled web, and the web is advanced a distance equal to the bag height so that the next application of the transverse heat-sealing jaws will close the bag structure about the tea particles T' by forming a top edge bag seal as at 30' simultaneously with the bottom edge seal 26' for a succeeding bag structure, the closed bag structure completed at this time being subsequently served from the doubled web and a handling string element 32' being fastened at or adjacent to the top edge bag seal 30' by a staple 34' or other suitable securing means with a handling tab 36' shown fastened to the string element 32' in the usual fashion.

It should be noted in particular with regard to the structure of the tea bag 20' shown in Fig. 11 that the imperforate side edge and center portions 14' and 16' provide a bag structure in which the corners contain no perforations and are therefore free of the tendency toward corner cracking from the manner in which it is handled in the bag-forming machine. Also, it should be further noted that, as previously pointed out above, the perforations 12' extend continuously between the imperforate portions 14' and 16' from the top edge bag seal 30' to the bottom edge seal 26' (compare Figure 12), so that perforations 12' are disposed immediately adjacent the bottom edge seal 26' for effective leaching action as the tea bag 20' is arranged from the handling element 32' for steeping, as illustrated in Fig. 12.

In addition, this disposition of the perforations 12' for effective leaching action is provided in the tea bag of the present invention whether the tea bag has the handling string element secured at an edge adjacent the doubled edge 24' as in Fig. 12, which is the more common arrangement, or has it secured at the side edge opposite the doubled edge as in Fig. 13. Fig. 13 illustrates this point by showing a tea bag 20'' which is comparable in all respects to the tea bag 20' of Fig. 12 except for the different point of securing the handling string element. In the tea bag 20'', the doubled edge 24'' appears in rounded form because of the supported disposition of the tea particles T'' directly against this edge, and it will be seen that the center imperforate portion 16'' is therefore extended in nearly a flat disposition so that the adjacent perforations 12'' are for all practical purposes disposed at the bottom of the tea bag 20'' for proper leaching and draining action. In this connection, it might also be noted that the center imperforate portion 16'' should desirably be restricted to as small a width as possible in the tea bag 20'' of Fig. 13 in order to maintain this bottom disposition of the perforations 12'' to the best advantage, the width of the center imperforate portion 16'' preferably being about $\frac{3}{8}$ " as previously indicated above and at a minimum being enough to avoid the doubled edge 24'' by a substantial enough margin to insure adequate strength at the adjacent tea bag corners and to render the doubled edge 24'' effectively resistant to attrition by the contained tea particles T''.

Otherwise, the tea bag 20'' in Fig. 13 has an adjacent side edge seal indicated at 30'' and a side edge seal shown at 28'' opposite the doubled edge 24'', with a handling string element 32'' fastened as by a staple 34'' adjacent

the opposite side edge 28'' and a handle tab 36'' secured on the string element 32'' in all respects like the comparable arrangement of the tea bag 20' previously described above.

In another embodiment of this invention fibers of the thermoplastic resins, such as Vinyon, a copolymer of vinyl chloride and vinyl acetate, cellulose acetate and the like are incorporated in the paper during its formation on a conventional Fourdrinier paper machine. The resulting sheet is composed of intermeshed fibers of heat sealable resin and cellulose fibers. The weight of the sheet produced in this manner should come within the range of about 10 grams to 30 grams per square meter and from 10 to 30 percent by weight of the sheet should be thermoplastic fibers. For example, if 20 percent thermoplastic fibers are incorporated in a paper sheet weighing about 10 grams per square meter it will be composed of about 8 grams cellulose fiber and 2 grams thermoplastic fiber. This sheet is wet strengthened during its formation by incorporating in the furnish a suitable wet strengthening resin if it is to be used for making tea bags. Obviously, the coating step described in conjunction with the foregoing embodiment is not required in this embodiment because those thermoplastic fibers at the surface of the sheet can be used as the adhesive in forming the bag. Other steps in the process, such as drying and perforating, are the same as those described in the foregoing.

Although methods of forming a heat sealable product have been described in detail in the foregoing, it is to be understood that many other suitable means for applying the resin to the surface of the paper or for incorporating it in the paper can be utilized. It is essential, however, that the process selected for coating the paper or impregnating it with the resin will not interfere with the perforating step. One suitable method for applying a coating of thermoplastic fibers which is tightly adherent to the sheet involves floating a water suspension of the thermoplastic fibers over the wet sheet of cellulose fibers on the paper machine and thereafter simultaneously drying the cellulose fibers and the thermoplastic coating.

While in the foregoing this invention is described in detail with respect to the formation of tea bags, the foraminous paper is likewise suitable for other purposes such as for containing powdered coffee or for use in hair waving operations to cover the hair or, for instance, as a substitute for cheesecloth, or for instance, any other like purposes where easy transfusion of a fluid is desired. If an adhesive or other suitable means for securing the edges of the tea bag are applied when the bag is formed, a heat sealing compound need not be either incorporated in the paper or coated thereon when the sheet is formed, and, in some uses, such paper need not be wet strengthened.

This invention has been described in detail above for purposes of illustration only and is not intended to be limited by this description or otherwise except as defined in the appended claims.

I claim:

1. A perforated tea bag paper comprising a lightweight tissue sheet having a basis weight within the range from 10 to 30 grams per square meter, said tissue sheet being formed of wood fibers and containing a wet-strengthening agent, and being coated with a heat-sealing thermoplastic resin by which it is rendered substantially impervious to water, and the perforations being ruptured in said sheet with a regular spacing and with a density of at least about 500 perforations per square inch, the ruptures forming said perforations being substantially free of flaps and providing an open area in said sheet in the order of about 5 to 7 percent of its total perforated area.

2. A perforated tea bag paper comprising a lightweight tissue sheet having a basis weight within the range from 10 to 30 grams per square meter, said tissue sheet being coated with a heat-sealing thermoplastic resin by which it is rendered substantially impervious to water, and the perforations in said tea bag paper being ruptured in said

tissue sheet with a regular spacing and with a density of at least about 500 perforations per square inch, the ruptures forming said perforations being substantially free of flaps and providing an open area in said sheet in the order of about 5 to 7 percent of its total perforated area.

3. A perforated tea bag paper as defined in claim 2 and further characterized in that said perforations have a length that is at least about 50 percent greater than the width thereof, with said length lying in the machine direction of the paper.

4. A perforated tea bag paper comprising a selectively perforated web having a width proportioned for doubling about the longitudinal center thereof in forming tea bags therefrom, said web being formed of a lightweight tissue sheet having a basis weight within the range from 10 to 30 grams per square meter and being coated with a heat-sealing thermoplastic resin by which it is rendered substantially impervious to water, said web being imperforate at the side edges thereof for a distance inwardly of said web that substantially exceeds the extent in which said side edges are to be heat sealed in forming said tea bags, and said web having perforations ruptured therein between said imperforate portions with a regular spacing and with a density of at least about 500 perforations per square inch, the ruptures forming said perforations being substantially free of flaps and providing an open area in said sheet in the order of about 5 to 7 percent of its total perforated area.

5. A perforated tea bag paper as defined in claim 4 and further characterized in that an additional imperforate portion is provided in said web for a substantial distance at each side of the longitudinal center thereof, and said perforations are ruptured between said first mentioned imperforate portions and said additional imperforate portion.

6. A perforated paper comprising a lightweight tissue sheet having a basis weight within the range from 10 to 30 grams per square meter, said tissue sheet being heat

sealable and being substantially impervious to water, and the perforations in said paper being ruptured in said tissue sheet with a regular spacing and with a density of at least about 500 perforations per square inch, the ruptures forming said perforations being substantially free of flaps and providing an open area in said sheet in the order of about 5 to 7 percent of its total perforated area.

7. A perforated paper comprising a lightweight tissue sheet having a basis weight within the range from 10 to 30 grams per square meter, said tissue sheet being substantially impervious to water, and the perforations in said paper being ruptured in said tissue sheet with a regular spacing and with a density of at least about 500 perforations per square inch, the ruptures forming said perforations being substantially free of flaps and providing an open area in said sheet in the order of about 5 to 7 percent of its total perforated area.

8. A perforated paper sheet comprising a lightweight tissue sheet having a basis weight within the range of from about 10 to 30 grams per square meter, said tissue sheet being substantially impervious to water and composed of intermeshed fibers of cellulose and a heat sealable thermoplastic, the perforations in said sheet being ruptured therein with a regular spacing and with a density of at least about 500 perforations per square inch, the ruptures forming said perforations being substantially free of flaps and providing an open area in said sheet in the order of about 5 to 7 percent of its total perforated area.

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