

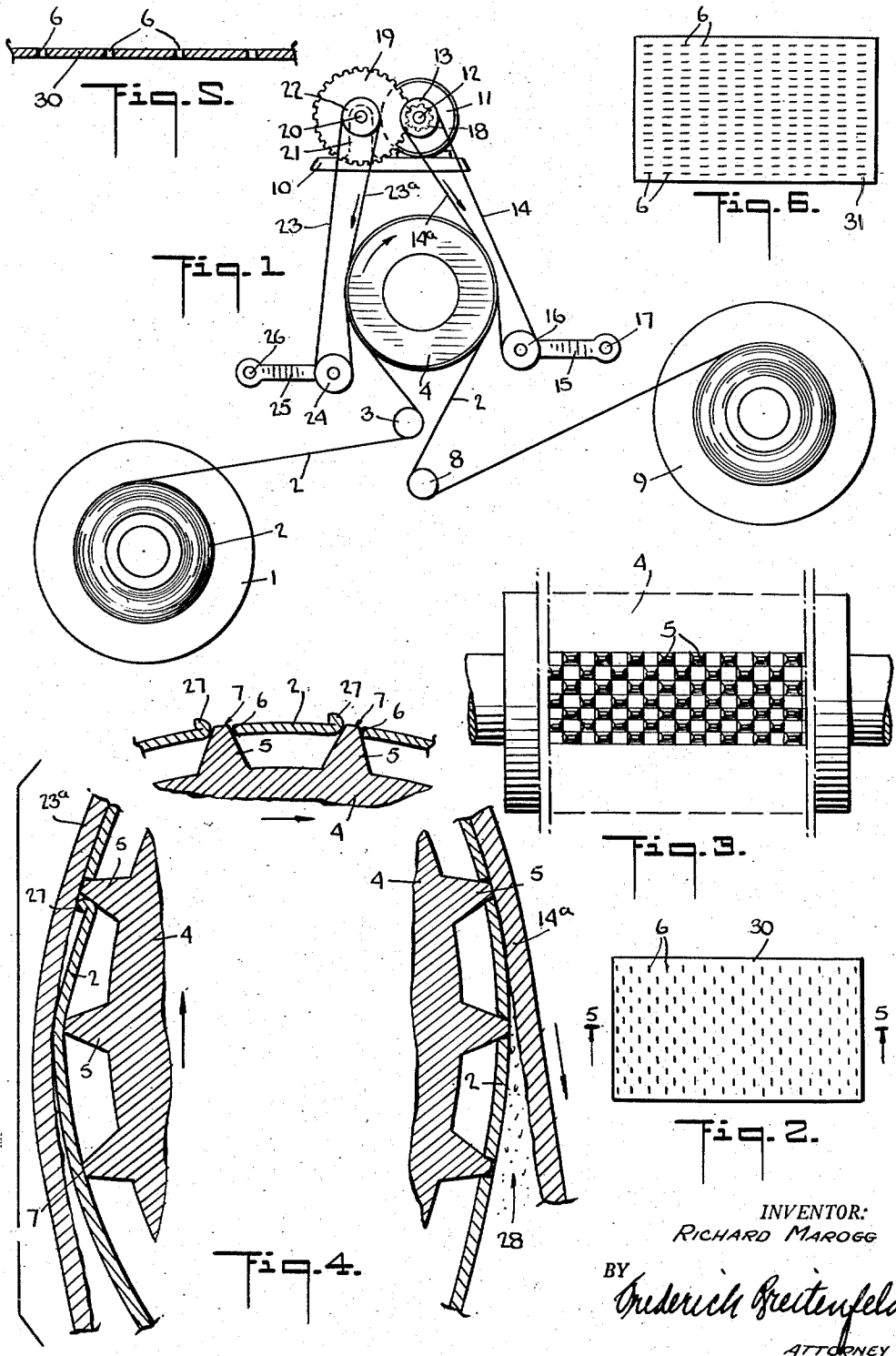
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APPARATUS FOR PERFORATING PAPER

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APPARATUS FOR PERFORATING PAPER

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This invention relates generally to apparatus for perforating paper, and more particularly to the formation of a multiplicity of relatively small but appreciable and discrete openings in a paper sheet.

The invention is admirably adapted to form perforations in paper of the character used in hair waving, but is of course applicable also to paper intended for the production of tea bags and for many other purposes requiring a perforated or foraminous material or sheet.

In the production of perforated paper of the character above described, the formation of the relatively minute openings in the paper by various known methods frequently results in producing projecting paper particles or burrs on the sheet around each of the small openings. When the paper is put to its intended use, such as serving as a wrapper for hair tresses in hair-waving methods, these parts fall off or separate from the sheet and assume the shape of flakes which become adherent to the hair and materially detract from the appearance of the coiffure. In the case of tea bag paper, the detachment of these flaky elements when the bag is saturated is not so likely to occur but when it does it causes them to mix with the tea which obviously is highly undesirable.

The expedients heretofore commonly resorted to in forming perforations in paper are punching operations or piercing procedures. The former is the process most likely to result in the undesirable burrs and flakes above mentioned; but piercing procedures employing pointed or attenuated needles or the like have another disadvantage and that is that in forming the holes the paper is not removed but merely bent over, as a result of which the holes frequently re-close and thus the desired permeability of the paper to the passage of liquids is impaired.

It is a general object of the present invention to provide an apparatus by which paper can be perforated in the desired fashion without recourse to punching or ordinary piercing or slitting operations, and without engendering the disadvantages heretofore encountered. The present apparatus achieves the desired result in an entirely new way that is speedy, reliable, economical, and thoroughly practical for either small or large scale operations.

It is a more particular object of the invention to provide an apparatus by which the perforated paper can be produced in the form of a continuous or lengthy web for subsequent severance into sheets of the required size, the holes in the paper being sharply defined and excess material completely removed from the web.

Briefly stated, the invention involves the formation of holes by an abrasive action upon one face of the paper while the other face is maintained in non-slip contacting engagement with a series of relatively closely spaced anvil surfaces of unyielding material such as metal. In the preferred embodiment of the invention these surfaces are defined by projections on a rotating roll, and the abrasion is achieved by a coated sheet or belt such as sandpaper or the like. One of the special features of the invention

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resides in the employment of two abrasive elements one of which abrades the paper web in one direction, the other subsequently causing abrasion in another direction.

With these and other objects in view, I have devised the arrangement of parts described hereafter and more particularly pointed out in the claims appended hereto.

In the accompanying drawing, wherein an illustrative embodiment of the invention is disclosed,

Fig. 1 is a front elevational view of a paper-perforating apparatus made according to the invention;

Fig. 2 is a face view of an illustrative sheet, adapted for use in the hair waving art or for other purposes, produced from the perforated paper web shown in Fig. 1;

Fig. 3 is a face view of an illustrative embossing roll;

Fig. 4 is an enlarged sectional view of portions of the embossing roll and abrading elements, showing the co-operation of the same in forming apertures in the paper web and then removing the displaced material;

Fig. 5 is a greatly enlarged sectional view, taken substantially on the line 5—5 of Fig. 2; and

Fig. 6 is a face view of a modified form of sheet showing by way of example how the apertures may be positioned differently from those found in the sheet of Fig. 2.

Referring to the drawing, and more particularly to Fig. 1 thereof, 1 indicates a supply roll or bobbin, containing a substantial supply of the unperforated paper 2 which is in the form of a continuous or lengthy web. The paper generally used for the purposes heretofore mentioned may be relatively thin tissue, and it is led from the bobbin 1 around a guide pin 3 from which it is guided to and around the rotative embossing roll 4, which is rotated in the direction of the arrow. The embossing roll 4 is provided on its periphery with a plurality of spaced, triangulated or pyramidal unyielding anvil surfaces or projections 5, the shape and size and arrangement thereof being determined by the shape and spacing of the perforations or holes required to be produced in the paper web. In the form shown, each of the pyramidal projections 5 has an elongated, relatively blunt flat end surface 7 smaller in area than the base of the projection. The surfaces 7 contact with the travelling paper web 2 to urge the web against an abrasive element to produce the openings 6 in a manner to be described.

As will be clearly seen in Fig. 1, the paper web 2 extends partially around the embossing roll 4 in intimate contact with the ends 7 of the projections 5 thereon, and then extends around a guide pin 8 to a motor-driven take-up bobbin 9 on which the perforated web is wound. The travelling web 2 moves at the same rate as the peripheral speed of the roll 4, whereby the paper 2 is maintained in non-slip contacting engagement with the anvil surfaces 7.

Mounted adjacent to the embossing roll 4, on a suitable support 10, is an electric motor 11, the shaft 12 of which carries a pulley 13, around which an endless abrasive element in the form of a sanding belt 14 extends. A stretch 14a of this sanding belt 14 is maintained in firm contact with the web of paper 2 that extends over the embossing roll 4. The sanding belt 14 is maintained in the desired constant firm contact with the travelling web of paper by means of the adjustable tensioning link 15, which has one end pivoted at 17 to a suitable fixed part of the apparatus, and carries a pulley 16 at its opposite end around which the sanding belt 14 extends. The speed of travel of the belt 14 in the direction of the arrow in Fig. 1 is greater than the travelling movement of the paper web 2, hence there is relative movement between the sanding belt 14 and the travelling paper web, resulting in an abrading action.

Secured to the motor shaft 12 is a pinion 18 in mesh with a larger gear 19 fixed on a shaft 20 rotative in a suitable bearing bracket 21 mounted on the support 10. Also secured on the shaft 20 is a pulley 22 and extending

around the pulley 22 is another abrasive element in the form of a sanding belt 23. The opposite end of this belt extends around a pulley 24, rotatively mounted at the end of an adjustable tensioning link 25 pivoted at 26 on a suitable fixed portion of the apparatus. The sanding belt 23 is movable in the direction of the arrow, and has a stretch 23a maintained in firm contact with the paper web as the web proceeds from the guide pin 3 and initially contacts with the projections 5 on the embossing roll 4.

The operation is as follows: As the paper web 2 travels around the embossing roll 4, it is maintained in contact with the stretch 23a of the sanding belt 23, and since this stretch of the belt travels in a direction opposite to the direction of movement of the paper web in this part of the travel of the web, the sanding belt applies an abrading action against the paper web and more particularly to those parts of the web which are firmly pressed into contact with the sanding belt 23 by the flat ends 7 of the projections 5. The firm contact of these parts of the paper web with the sanding belt 23 results in the formation of the apertures 6, and obviously these apertures correspond substantially in shape and size and arrangement to the ends 7 of the projections 5.

In some instances, the formation of these apertures by the abrasive action of the belt 23 produces burrs or displaced parts as shown at 27 (Fig. 4) and it is desirable that these be removed. This is done by the sanding belt 14, having its area of contact with the paper web circumferentially spaced from, preferably substantially diametrically opposite to, the area of contact between belt 23 and the web. When the stretch 14a of sanding belt 14 contacts with the paper web 2, the projecting parts or burrs 27 (if any) will be buffed off as indicated at 28 in Fig. 4, and the resultant apertures 6 in the web will be sharply defined and perfectly clean around their edges. If desired, a suction nozzle may be located adjacent to the roll 4 where the perforated web leaves, to pick up and eliminate all loose paper particles.

After leaving the embossing roll 4, the perforated web proceeds around the guide pin 8 to be thereafter wound up on the take-up roll 9. Subsequently, the web can be cut into sheets of desired size, such as seen at 30 in Fig. 2, or at 31 in Fig. 6, the primary differences between these two sheets being in the disposition of the apertures 6 in them, the apertures in one of the sheets being in staggered relation and extending transversely of the length of the sheet, and those in the other sheet being in uniform rows and extending longitudinally of the sheet.

While I have shown the apertures 6 to be elongated or slot-like in shape, it will be apparent that these apertures may be shaped in other ways, the shaping being primarily determined by the formation of the nubs or projections 5 which urge the web into contact with the stretch 23a of the sanding belt 23. These nubs or projections may be made in various shapes and arrangements to suit requirements.

Also, while I have shown a first abrading element 23 contacting the web in one region of the web and a second abrading element 14 functioning in a later region of travel, it will be understood that one abrading element may be sufficient under certain circumstances. Furthermore, the directions of abrasive action, while different from each other, need not necessarily be parallel to the direction of web travel, as shown, nor directly opposite.

In general, it will be understood that many of the details herein described and illustrated may be modified by those skilled in the art without necessarily departing from the spirit and scope of the invention as expressed in the appended claims.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. A paper-perforating apparatus comprising a roll having a face provided with a plurality of projections, means for maintaining a travelling paper web in contact with the ends of the projections, and a pair of movable abrasive belts maintained in operative contact with the web at circumferentially spaced regions on the roll, said abrasive belts being movable to first form perforations in the web and then abrasively remove surplus paper particles produced by the perforating operation.

2. A paper-perforating apparatus as provided for in claim 1, in which one of said belts is movable in a direction opposite to the travel of the web in its region of contact with the web, and the second belt is movable in a direction similar to that of the web in its region of contact therewith, the latter belt being movable at a faster rate than that of the paper web.

3. A paper-perforating apparatus comprising a rotating roll having a face provided with a plurality of unyielding projections arranged in relatively close proximity to one another but with appreciable spaces between them, means for guiding a travelling paper web to and around said roll in non-slip contact with the ends of said projections, a first abrasive belt, means for maintaining it in operative contact with the exterior surface of the web during the first part of the web travel around said roll, a second abrasive belt, and means for maintaining it in operative contact with the exterior surface of the web during a later part of said web travel around said roll.

4. In a paper perforating apparatus, the combination with the elements set forth in claim 3, of means for moving said belts in abrading directions with respect to said web, said means causing one of said belts to move relative to the web in one direction and the other belt to move relative to the web in another direction.

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