United States Patent [19]

Kishi et al.

[11] **3,877,576**

[45] **Apr. 15, 1975**

[54] **TOILET PAPER ROLL**

[75] Inventors: **Emitsu Kishi; Osamu Shinohara; Haruhisa Ishikawa,** all of Kawanoe, Japan

[73] Assignee: **Shinhama Pump Mfg. Co., Ltd.,** Kawanoe-shi, Ehime-ken, Japan

[22] Filed: **July 31, 1973**

[21] Appl. No.: **384,190**

[52] **U.S. Cl.** **206/412;** 206/389; 242/1

[51] **Int. Cl.** **B65d 85/67**

[58] **Field of Search** 242/1; 206/389, 412

[56] **References Cited**

UNITED STATES PATENTS

511,983	1/1894	Wheeler	242/1
1,780,275	11/1930	Randerson	242/1

Primary Examiner—William I. Price
Assistant Examiner—Douglas B. Farrow
Attorney, Agent, or Firm—Wenderoth, Lind & Ponack

[57] **ABSTRACT**

A paper roll comprises two overlapping webs formed into a roll. The webs are provided with perforation lines for the convenience for tearing off a sheet for use. The perforation lines on one web are adapted to locate between the perforation lines on the other web throughout the entire lengths of the webs by arranging the perforation lines in such a manner that those on the inner web are formed at regular intervals while those on the outer web are formed at variable intervals longer than the regular interval by a value which is proportional to the product of the regular interval and thickness of the web and inversely proportional to a radius of a layer of the inner web.

2 Claims, 3 Drawing Figures

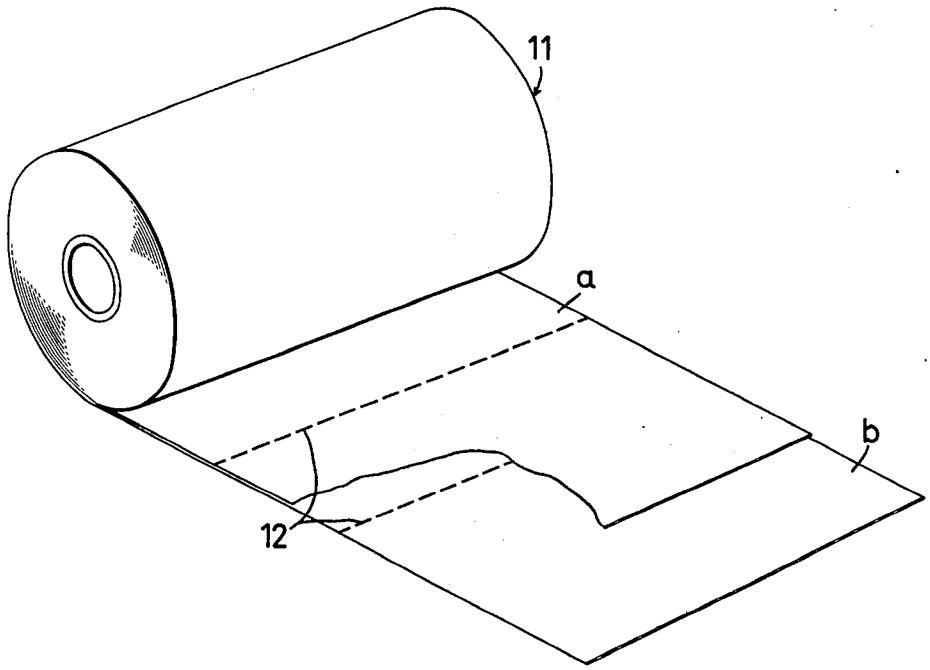


FIG. 1

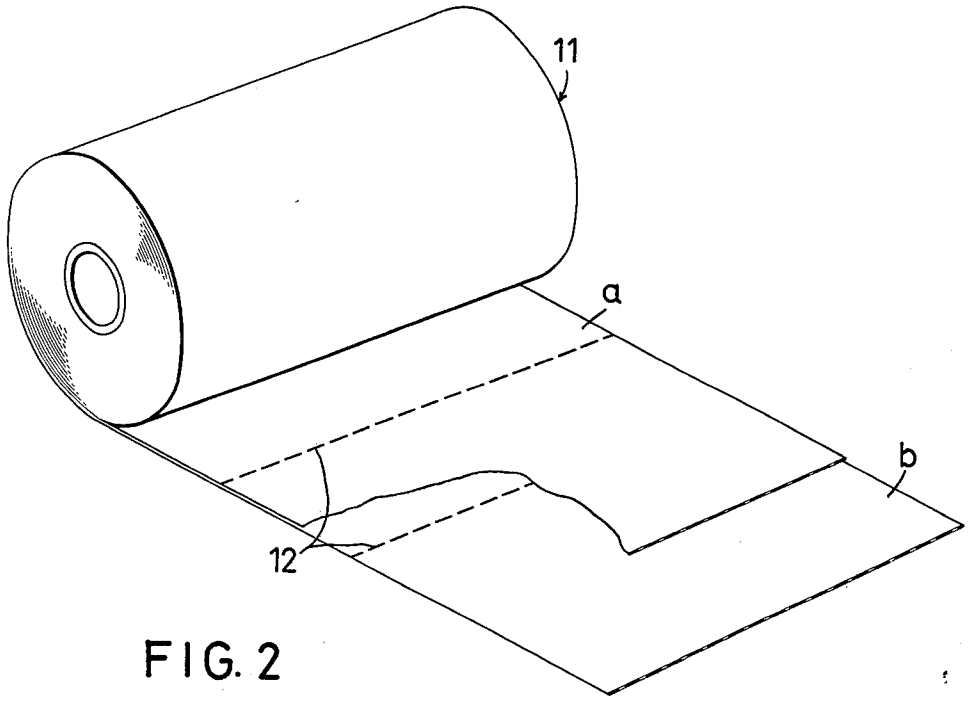


FIG. 2

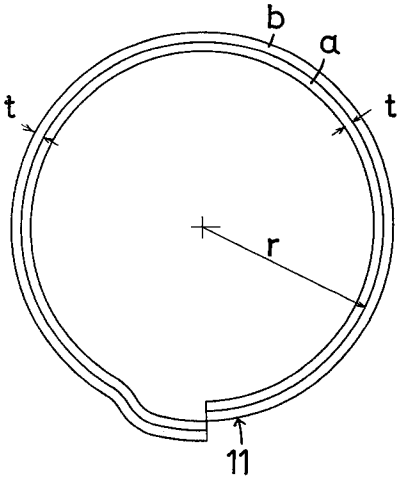
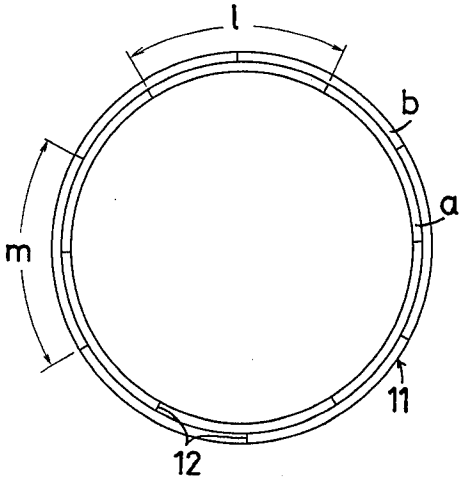


FIG. 3



TOILET PAPER ROLL

The present invention relates to a paper roll for use for toilet paper, paper towel and the like.

It is known that two webs of paper having transverse perforations or slits at regular intervals are wound into a roll so that the perforations or slits of one web may position between those of the other web for the convenience of tearing off a next sheet since the free end of one web of the paper roll contained in a casing alternately appears from the guide opening of the casing by drawing the other web. In such a paper roll, therefore, it is most preferable that the perforations or slits of one web are located halfway between the adjacent perforations or slits of the other web.

In the conventional paper roll, however, since two webs of paper with perforation lines formed at regular intervals are overlapped one on the other and wound into a roll, there occurs a difference between the peripheral length of the outer web and that of the inner web owing to a thickness of paper, thereby causing the positions of the perforation lines of the outer web to shift in relation to those of the inner web, and in the worst case, causing the perforation lines of the outer and inner webs to overlap.

A primary object of the present invention is to obviate the defect of the conventional paper roll and to provide a paper roll wherein the perforations or slits of one web are positioned halfway between the adjacent perforations or slits of the other web throughout the entire lengths of the two overlapping webs.

The above and further objects of the invention will now be described in detail with reference to the accompanying drawings, in which:

FIG. **1** is a perspective view of the paper roll according to the present invention, partially broken;

FIG. **2** is an explanatory diagram showing a cross section at an arbitrary diameter of the paper roll; and

FIG. **3** is the same diagram as above with slits or perforations added thereto.

Referring to FIG. **1**, the numeral **11** is a paper roll for use for toilet paper, paper towel and the like, said paper roll comprising two webs *a* and *b* formed into a roll while overlapping one on the other. Lines **12** are transversely perforated on the webs *a* and *b* at predetermined lengthwise intervals, and adapted to be located halfway between adjacent lines **12** of another web for tearing off a sheet alternately.

Referring to FIGS. **2** and **3**, how the interval between each line **12** is determined will now be explained. The reference *t* designates thickness of the webs *a* and *b*, the reference *r* designating a radius of the outer periphery of the inner web *a*. A cross section of the webs *a* and *b* is considered as a circle since the value of *t* is negligibly small. Therefore, the outer peripheral length of the web *a* is $2\pi r$, while that of the web *b* is $2\pi(r+t)$. Consequently, the peripheral length of the outer web *b* is longer by $2\pi t$ than that of the inner web *a*, and such difference occurs for every layer of the overlapping two webs *a* and *b*. Therefore the difference is accumulated as the number of the layers increases, the final difference being the number of the rounds multiplied by $2\pi t$. Thus, if the lines **12** on each web are formed at the same intervals, the positions thereof on one web vary relatively to those of the other web, and the thicker the web is, the larger the difference will become since the value of *t* becomes larger.

Referring now to FIG. **3**, the interval between the lines **12** on the web *a* is shown by *l*, while that on the web *b* being *m*, said *l* being assumed as a constant, the one layer of the overlapping webs *a* and *b* being assumed as a circle. Provided that the lines **12** on one web are located halfway between adjacent lines **12** on the other web, and that the interval *l* can be included *n* times in an arbitrary layer of the inner web *a*, the interval *m* on the outer web *b* is necessarily included *n* times in the same layer.

Thus, in the case of the inner web $a: n = 2\pi r/l$

While, in the case of the outer web $b: n = 2\pi(r+t)/m$

Therefore: $m = 2\pi(r+t)l/2\pi r = l + tl/r$

Accordingly, when the interval *m* is adapted to be longer by tl/r than the constant interval *l* on the inner web *a*, the positions of the lines **12** on the outer web *b* do not vary in relation to those of the lines **12** on the inner web *a*. Thus the interval *m* of the outer web *b* varies according to the increase of the layers of the webs, i.e., the increase of the value of the radius *r*. Of course the above equation is maintained whatever the value of the thickness *t* may be.

As mentioned above, when the perforation lines on the inner web *a* are formed at fixed intervals and the perforation lines on the outer web *b* are formed at variable intervals according to the above equation, the perforation lines of one web in the paper roll formed from above two webs can locate halfway between adjacent lines of the other web whatever the thickness of the web and the diameter of the paper roll may be.

In using the paper roll according to the present invention, the paper roll is accommodated in a suitable container having a guide opening for drawing the free end of the paper roll out of the container, and a sheet for use is torn off along the perforation line. When drawing the paper from the container, the perforation lines on each web appear alternately out of the container, and when a sheet is torn off from one web, half of a sheet of the other web remains outside of the container thereby enabling a next sheet to be dispensed with ease.

What is claimed is:

1. A paper roll comprising two overlapping webs of paper with transverse perforation lines at predetermined intervals, said perforation lines on one web adapted to be located halfway between adjacent perforation lines on the other web so that the perforation lines on the inner web are provided at fixed intervals while the perforation lines on the outer web are provided at variable intervals longer than the fixed intervals on the inner web by a value which is proportional to the product of the fixed interval and thickness of the web and inversely proportional to a radius of the paper roll.

2. A paper roll comprising two overlapping webs with transverse perforation lines at predetermined intervals, said perforation lines on one web adapted to be located halfway between adjacent perforation lines on the other web so that the perforation lines on the outer web are provided at fixed intervals while the perforation lines on the inner web are provided at variable intervals less than the fixed interval on the outer web by a value which is proportional to the product of the fixed interval and thickness of the web and inversely proportional to a radius of the paper roll.

* * * * *