

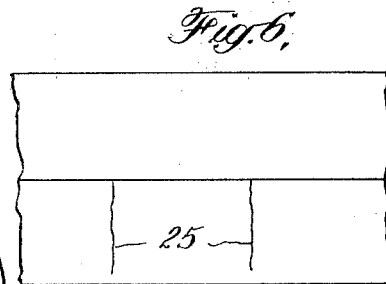
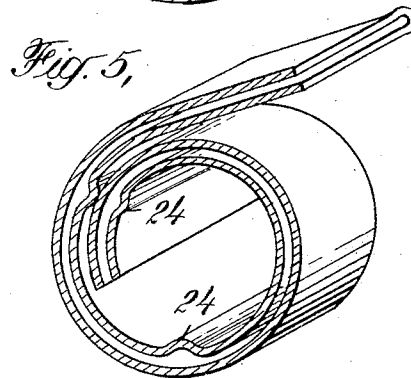
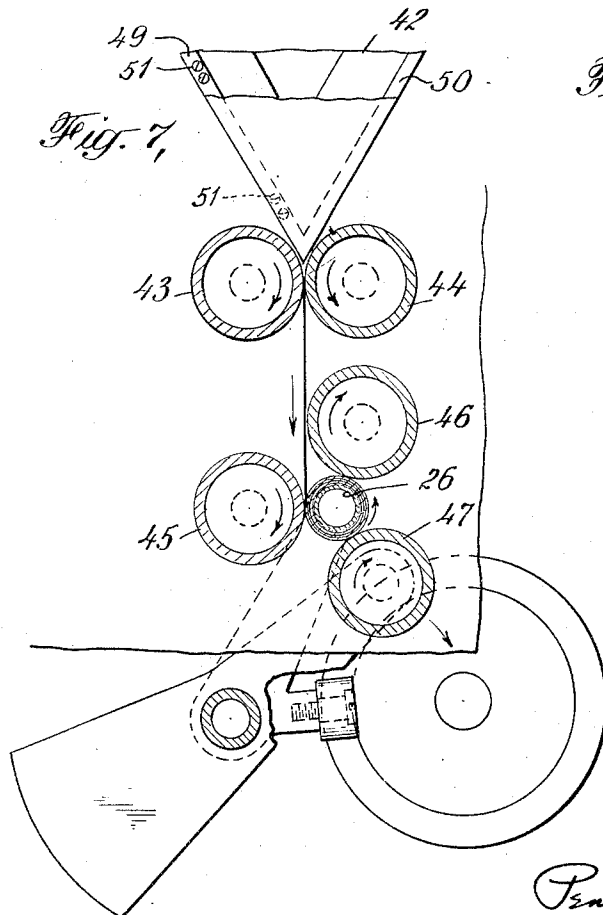
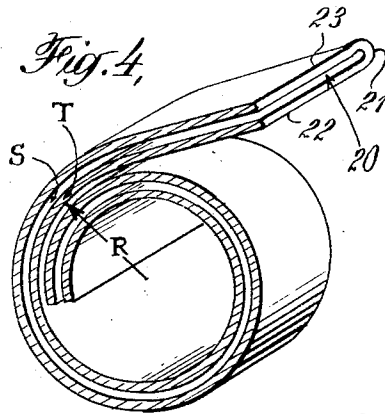
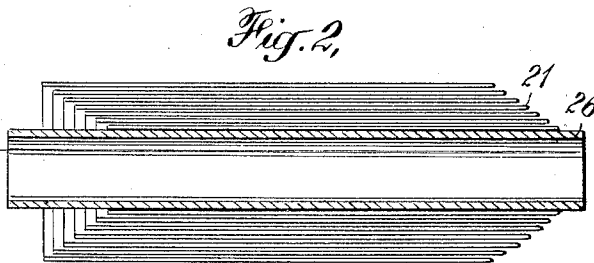
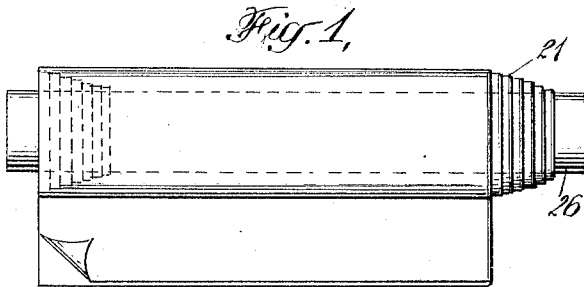
Oct. 25, 1932.

N. MARCALUS

1,884,784

PAPER ROLL

Original Filed Aug. 19, 1930 2 Sheets-Sheet 1



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Fig. 8,

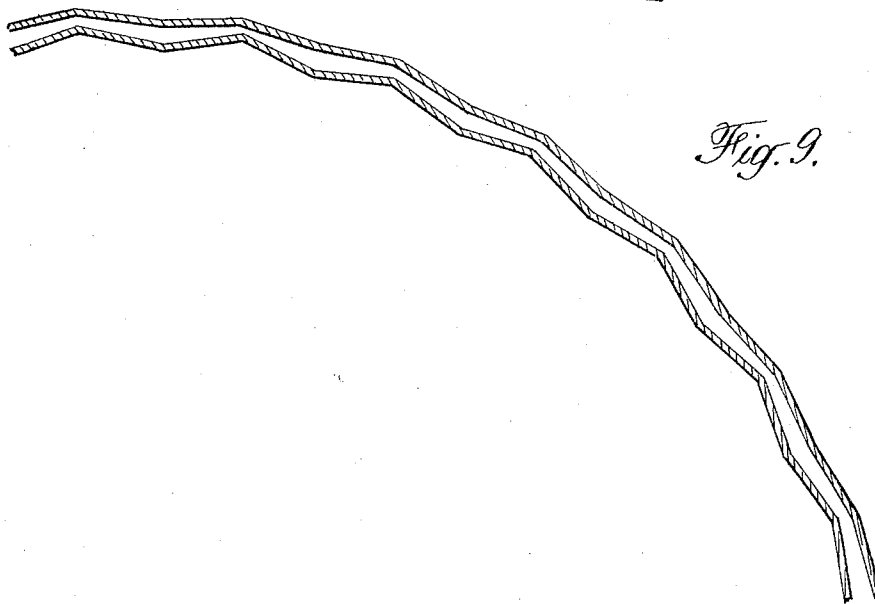
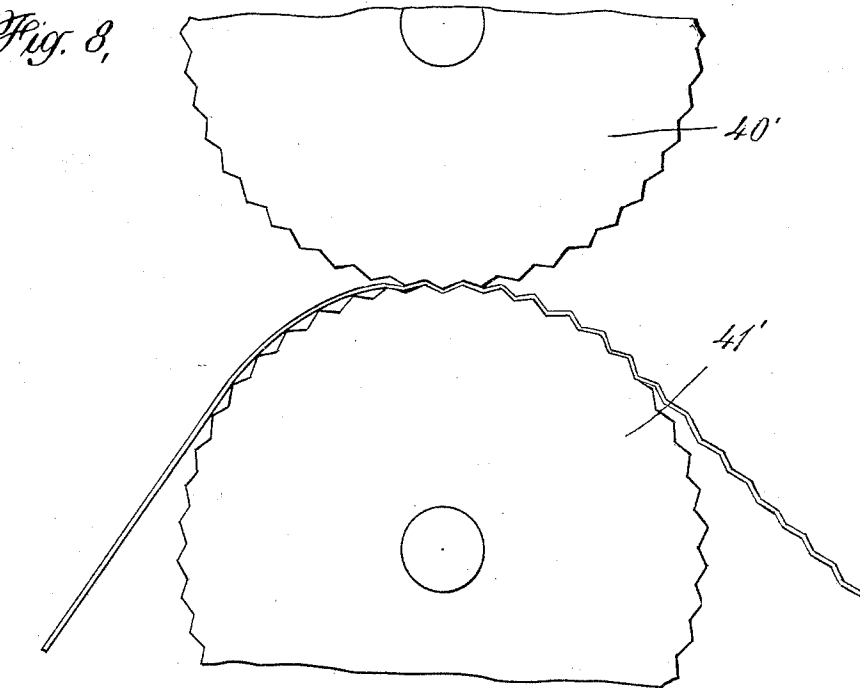


Fig. 9.

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PAPER ROLL

Original application filed August 19, 1930, Serial No. 476,428. Divided and this application filed June 9, 1931. Serial No. 543,063.

This invention relates to a paper roll, the present application constituting a division of my copending application Serial No. 476,428 filed August 19, 1930.

It is common commercial practice to retail paper wound upon cardboard cores, for example waxed paper used for wrapping foods. For convenience in merchandising, as well as in using, these rolls are usually made about twelve inches long so that the width of the wound strip is only twelve inches. For many uses a wider strip is desirable; for example, tissue paper used for wrapping gifts at Christmas time is always more than twelve inches wide. In order to get a wider wound strip either a longer core and longer package must be used or the strip must be folded before winding. It would be simple enough to wind a wider strip, but a roll, substantially longer, say twenty-four inches long would be awkward to handle both for the merchant and for the user. The alternative, to wind a folded web, presents difficulties. The inner ply invariably buckles and when unwound is found to be badly wrinkled. Such a product is unattractive and is not commercially desirable. Another difficulty inherent in the winding of folded webs is this: The thickness at the fold is always more than twice the thickness of the single ply unless the fold be so sharp as to rupture the fibers—thus as the winding proceeds the diameter of the roll at the fold increases faster than elsewhere, complicating the winding and producing a misshapen wrinkled roll. It is, therefore, my object to produce a tightly wound roll of folded material free from wrinkles and of uniform diameter.

Now the reason the inner ply of a folded web buckles and wrinkles when wound is that in winding, the outer ply must travel farther than the inner, being wound in effect upon a core larger, by the thickness of the web itself, than the core upon which the inner ply is being wound. And yet both plies are of the same length and being of one piece must travel together without relative slippage. Thus either the outer ply must tear or the inner ply must wrinkle. Because of the tensile strength of the paper the inner ply

usually wrinkles. In accordance with the present invention I elongate the outer ply relative to the inner before winding just enough to compensate for the difference in winding length between the two plies. This relative elongation may be effected by stretching the outer ply, causing an actual shift in the fibers themselves, or by crimping the web transversely so that a differential elongation of the two plies is automatically effected during winding. In order to wind a smooth roll of uniform diameter despite the increased thickness of the material at the fold, I cause the core to traverse longitudinally during the winding so that the folded edge does not wind upon itself, each convolution being slightly displaced axially with reference to its predecessor.

In my copending application above-preferred to I have described and claimed a web winding machine adapted to crimp, fold and wind a web of paper into a roll. The present application is directed to the roll of folded paper.

In the accompanying drawings I have illustrated a preferred embodiment of my invention. In these drawings Figure 1 is a side elevation of the paper roll; Figure 2 is a horizontal section through the roll; Figure 3 is an enlarged detail showing the structure of the web at the fold; Figure 4 is a diagrammatic illustration of a folded web wound in accordance with the present invention; Figure 5 is a similar view showing the buckling of the inner ply on a folded web wound under ordinary conditions; Figure 6 illustrates the condition of the web of Fig. 5 when unrolled and opened out flat; Figure 7 is a sectional detail showing mechanism which may be employed for folding the web and winding it upon a core to form a folded paper roll; Figure 8 is a diagrammatic view showing the crimping rollers; and Figure 9 is a detail, very much enlarged and exaggerated showing the relation between inner and outer crimped plies on a wound roll.

I shall first refer to Figs. 4 and 5 and describe in some detail just what happens when a folded web is wound. In these figures, 20

represents a web folded at 21 to form an inner ply 22 and outer ply 23.

Let R =the radius of curvature of the inner ply at any given point,
 T =the thickness of the web, and
 S =the space between the two plies.

Although for any given convolution the cross section of each ply is spiral rather than truly circular, the error involved in considering the form as circular is small and can be disregarded. For any given convolution, therefore:

Length of outer ply= $2\pi(R+T+S)$
 Length of inner ply= $2\pi R$
 Difference in length= $2\pi(T+S)$

It is clear, therefore, that for every convolution the length of the outer ply must exceed the length of the inner ply by 6.28 times the thickness of the web plus the space between the two plies—a constant for any given paper and tightness of winding.

As a result of this disparity, a loosely wound folded web will assume roughly the form illustrated in Figure 5 with the inner ply buckling at points 24. When the roll is tightly wound, as it must be in commercial practice, these bulges 24 are flattened out and form creases or wrinkles 25 which remain as such in the paper when it is unwound and flattened, as illustrated in Figure 6. I avoid this by elongating the outer ply before winding an amount substantially equal to the difference in length.

Referring now to Figure 3 it will be noted that where the paper is folded at 21, a loop is formed having a greater thickness than twice the thickness of the plies. To make a sharper fold would rupture the fibres and weaken the paper along the fold when it is unfolded for use. If a folded web is wound in the ordinary fashion, the diameter of the roll, at the fold, will increase more rapidly than throughout the body of the roll. In order to avoid this, I wind the folded web helically, as illustrated in Figures 1 and 2 in which 26 indicates the cardboard core on which the web is wound. As illustrated in these views the web is displaced relative to the core as the winding proceeds so that successive convolutions of the fold do not overlap. This machine and method forms the subject matter of my copending application Serial No. 476,428 above referred to.

In my copending application above referred to there is described in detail a machine for folding and winding a web of paper upon a core. According to the machine therein described the web is unwound from a parent roll, is drawn over a folding former which folds the web to make a two-ply strip and then winds the folded strip upon a cardboard core. The folding former 42, feed rollers 43,

44 and winding rollers 45, 46 and 47 of such a machine are shown in Fig. 7.

The folding former 42 is provided along its paper-contacting edges with bars 49 and 50 over which the web passes during the folding operation. In order to stretch half of the web, that half which is to form the outer ply during winding, I provide means for adjusting the bar 49 so that it may be raised above the bar 50 and thus increase the path which that half of the web passing it must travel, thus causing a slight elongation of that half of the web. This adjustment of the bar 49 is effected by means of a series of set screws 51. In order to facilitate the stretching operation steam may be discharged upon the portion of the web to be stretched as for example by means of a steam chamber which has one of its sides closed by the web itself as described in my copending application. Only that half of the web which is to be stretched is subjected to this dampening treatment. The folded web then passes downward through feed rollers 43 and 44 to the core 26 which is held by three winding rollers 45, 46 and 47. These winding rollers wind the folded web upon the core by surface contact. Winding roller 47 is swingingly mounted to move outward as the diameter of the wound roll increases. During winding the core is given a continual longitudinal displacement so that the core of each roll is moved longitudinally away from the fold of the winding web thus producing the set back construction illustrated in Figs. 1 and 2.

Another means for varying the relative lengths of the inner and outer piles is illustrated in Figure 8. The rollers 40 and 41 are replaced by longitudinally corrugated rollers 40' and 41' so that the web is crimped transversely as it passes between them. A crimped web can be elongated slightly, even when under winding tension, without deformation of the fibers; thus when a crimped web is folded and wound the outer ply automatically elongates just sufficient to compensate for its greater length of travel, and wrinkling is avoided. The relation of the two plies is illustrated in Figure 9 from which it will be observed that the outer ply has been flattened slightly more than the inner. No special stretching mechanism is required and the relative elongation automatically decreases with increase in the diameter of the roll. Despite the fact that the two piles of a double-wound crimp roll are of slightly different lengths and that a residual crimp remains, a relatively tight roll can be wound by this method.

The product of my invention is a tightly wound folded strip free from creases and wrinkles and of uniform diameter. The outer stretched ply may be longer than the inner so that if the entire strip were unwound and unfolded it would curve slightly toward the

inner ply. However, when relatively short sections are torn from the roll this difference in length is imperceptible. My invention is particularly useful in connection with rolls of wrapping paper, especially the tissue used for wrapping gifts. A wide full sheet may be unwound from a short, easily handled roll.

I claim:

1. A tightly wound roll of paper, said roll consisting of convolutions, each convolution comprising two plies integrally joined by a longitudinally folded area or line, the web constituting the outer ply being constructed of greater length than the inner ply of the same convolution, and each convolution being in a substantially smooth and unwrinkled condition.

2. A tightly wound roll of paper, said roll consisting of convolutions, each convolution comprising two plies integrally joined by a longitudinally folded area or line, the web constituting the outer ply being constructed of greater length than the inner ply of the same convolution, each convolution being in a substantially smooth and unwrinkled condition, and the folded area or line present in the convolutions being axially displaced with respect to each other.

3. A tightly wound roll of substantially nonelastic paper, said roll consisting of convolutions, each convolution consisting of two plies integrally joined along a longitudinal fold line, the exterior ply of each convolution being greater in length than the interior ply and each convolution being in a substantially smooth and unwrinkled condition.

4. A tightly wound roll of substantially nonelastic paper, said roll consisting of convolutions, each convolution consisting of two plies integrally joined along a longitudinal fold line, the exterior ply of each convolution being greater in length than the interior ply, each convolution being in a substantially smooth and unwrinkled condition and the fold lines present in the convolutions being axially displaced with respect to each other.

In testimony whereof I affix my signature.

NICHOLAS MARCALUS.