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THE “RIPPLE” EFFECT IN THE ROUNDER & BACKER

By Jack Bendror
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In using the semi-automatic, self-adjusting Rounder & Backer, the question is often asked why certain books, such as Oversewn theses and hot-melt bound paperbacks with pulpy paper, especially thin ones, when processed by the Rounding and Backing machine, develop what is commonly described as a ***“pinch” "wave"*** or ***"ripple".***

Below is a brief technical analysis of the Rounding & Backing process describing some of the design considerations that had to be made with the hope that it will explain and highlight the various elements that contribute to, what will be called in this study, the ***"ripple"*** effect.

By way of information, as the designer and manufacturer of the only standalone, self-adjusting hydraulic Rounder & Backers used by binders world-wide, this "ripple" effect is a common occurrence when three factors, namely, paper characteristics, leaf-attachment method and spine thickness, described later on, interact in an unfavorable manner.

Rounding & Backing, as the name implies, is a process involving two separate but successive operations that take place in one machine.

Rounding is the process of shaping the text block so as to form a concave shape in the fore-edge or front and an equal but opposite convex shape in the spine or back.

Backing follows rounding and in this process the back of the book is "tooled" so as to form the "joints" that act as supports for the cover to hinge upon. Backing plays a minor role as it only accentuates further the "ripple" which was first caused by the rounding operation. Consequently, we shall closely examine below what happens in the rounding process by referring to the accompanying illustrations.

In the rounding process, the volume is placed on a support platform between a pair of rollers known as the "rounding rollers". When the cycle begins, the moveable roller advances towards the fixed roller and grips the volume. Once properly gripped with sufficient force, the support platform disappears and the rounding rollers are allowed to rotate and deliver the volume for subsequent clamping by the jaw blades for the ensuing backing operation.

Referring to figure 1, the shaping of the front and back respectively into a concave and convex shape is governed by the following physical principles:

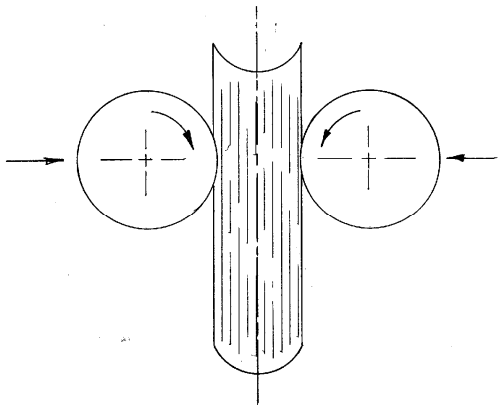

FIG. 1

1. The centerline of the volume is the point furthest from the center of rotation of each roller.

2. Upon rotation, there is zero displacement at the center of rotation of each roller and maximum displacement will occur at the centerline of the volume.

3. With the rollers applying the proper force on the volume and with a certain adjustable rotational displacement (which establishes the size of the joint) the rounding process has been performed.

4. The degree of form for the concave/convex shape will depend on both the paper characteristics as well as thickness of the spine.

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One of the most important things to remember is that the design of a self-adjusting rounding and backing machine is, at best, a compromise. That is to say, that because of the wide range of books with a variety of papers, and especially because of the wide range of spine thicknesses being processed daily in the bindery, in reality two separate machines would have to be used in order to optimize the results. While possible, as you know, it is not cost/benefit justifiable.

Figures 2 & 3 illustrate what the design requirements would be were one to consider making a machine for two separate ranges of spine thicknesses.

Had the rounding rollers been made with a very small diameter, shown in exaggeration in figure 2, upon rotation, with a volume gripped between them, there would be no rounding or displacement as the rollers would be slipping in place due to the fact that they do not have enough surface area to positively grip the volume.

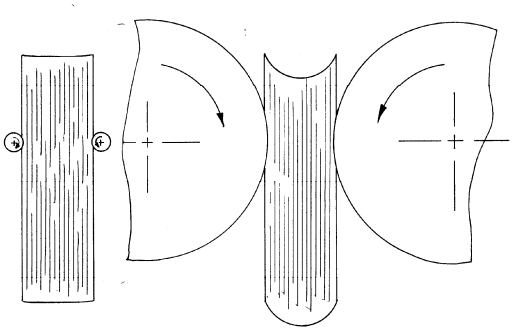

FIG. 2 FIG. 3

If, on the other hand, the rollers were to have a very large diameter, such as shown in exaggeration in figure 3, then the surface area for the rollers gripping the volume is large, displacement will be positive and a true concave/convex shape would result. However, having a very large diameter-rounding roller presents severe design limitations. The result is a roller with a compromised diameter that would be suitable for a great percentage of the work in the bindery, but not for 100%.

What are the consequences of having a machine with rounding rollers of a "compromised" diameter?

If the volume is very thick, near the maximum limit, and especially if it has soft, pulpy paper that offers resistance for the pages to slip relative to each other, the shape of the rounded volume would look something like that shown in figure 4. However, a volume with the same thickness having hard glossy paper will yield a more concave/convex

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shape, but still not a perfect one because the roller diameter is not large enough to offer enough surface to positively displace the pages.

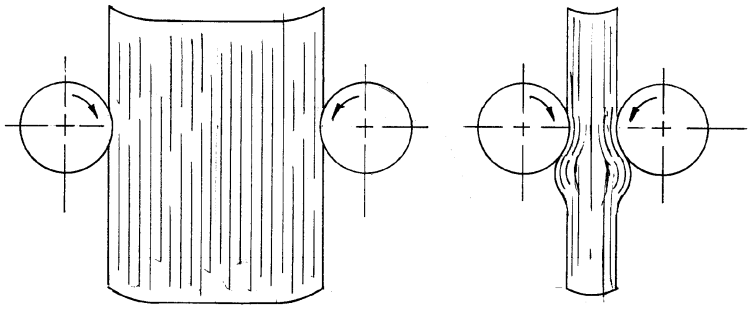

FIG. 4

If a volume is thin, depending again on the paper characteristics, the rounding rollers may "over-round" the volume and if the leaf attachment method is such that the volume is almost rigid at the spine, such as in Side sewing, bindings with hot-melts, Oversewing and bindings with PVA cold emulsions, in that order of difficulty; the "ripple" effect will appear.

As previously mentioned, paper characteristics, method of leaf attachment and spine thickness, all play a role in the "ripple" effect.

It is difficult to establish the magnitude of the role which each of the three factors play in the "ripple" effect. Any single one, or a combination of any two, or all may produce a "ripple".

1. **Paper characteristics**

Excluding for a moment the influence of the leaf attachment method or spine thickness, a volume having glossy paper with a low coefficient of friction, will allow the pages to easily slip relative to each other resulting in a better round than that produced in a volume having soft pulpy paper with a high resistance to motion between the pages.

2. Leaf Attachment method

Of the various methods of leaf attachment employed, Side sewing, bindings with hot-melts, Oversewing and bindings with PVA cold emulsions, in that order of difficulty; produce a relatively rigid spine when compared to sewing through the fold.

3. Spine flexibility

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Suffice here to say that, regardless of leaf attachment method, paper characteristics and thickness of volume, the more flexible the spine is, the less likely it is to resist movement of the pages while the volume is being rounded.

A volume being rounded and backed in which any of the above factors, singly or in combination are not favorable, the "ripple" effect will take place. A relatively thin volume in the range of 1/4 - 3/4 inches in thickness, with soft paper hot-melt bound or oversewn for strength and durability, such as a thesis for example, will be a definite candidate for the "ripple" effect.

What is actually happening in the machine can be clearly seen in figure 5.

The bound volume, with a relatively rigid back, to some extent, prevents the slippage of pages as the rounding rollers try to round and deliver the volume into the backing area. The pages, being resisted by the rigid spine, take the path of least resistance and "curl" into the gap between the rounding roller and the top of the clamping jaw blades.

A slight "ripple" is thus formed which is subsequently accentuated further by the vertical component of force created by the backing roller as it tries to shape the "joints". There is less likelihood for the "ripple" to occur in a thick oversewn volume with the same soft paper.

In general, the "ripple" problem is not considered to be serious since the "ripple" tends to disappear or be lessened once the volumes undergo the building-in process.

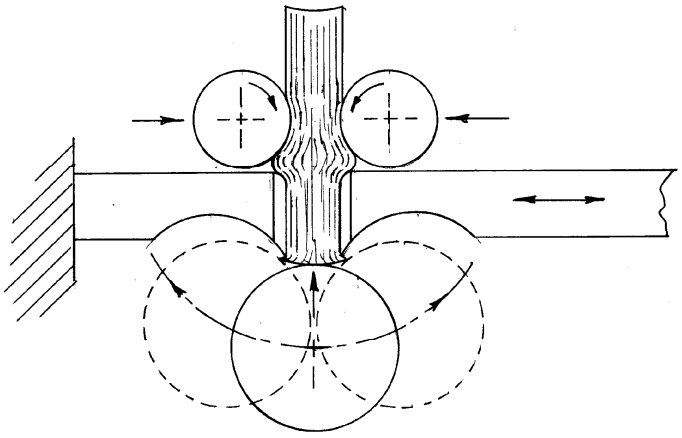

FIG. 5

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