## PRINTING AND NUMBERING EXPLAINED

by Jerome Fourre #120

The Canadian Banknote Company (CBN) and The British American Banknote Company (BABN) have both printed Canadian Tire Money, depending on the contracts awarded to them by the CTC corporation. At present, series CTC S27 to CTC S30 is being printed by CBN.

CTC money is printed using 2 different types of printing presses. The first printing process is the offset method. This process is used to print the background and signatures on the front of the notes and the entire back except for the serial numbers.

Offset presses can print from 4 to 8 colors with just one print pass. This enables them to print "4 color process" jobs, which use 4 primary colors, cyan, magenta, yellow and black. By screening (half toning) these colors it is possible to make up most of the colors in the spectrum. Pick up any magazine and look at any color image with a 10X magnifying glass and you will see what I mean. These same presses can also print "spot" colors. A spot color is a solid color, which is not screened. Canadian Tire Money is printed using the Spot color method. If you wish to see the difference, use your magnifying glass to look at the red ink on the CTC triangle on the back of any note and you will not see the small dots as on the magazine image.

The second and principal printing process is known as intaglio printing. This process is used because of its ability to produce extremely fine detail that remains legible under repeated handling and is difficult to counterfeit. Stacks of paper sheets are loaded into a high-speed, rotary intaglio printing press. Each sheet is sized to allow 50 individual bills to be printed on the same sheet. A master printing plate of the proper denomination is secured around the master plate cylinder in the press. It is known that BABN was using three plates at once on their presses, because defects have been found on every third note. There is evidence that CBN has started doing this also. The rotating master printing plate is coated with ink. A wiper removes the ink from the surface of the plate, leaving only the ink that is trapped in the engraved recesses of the design. A sheet of paper is fed into the press where it passes between the master plate cylinder and a hard, smooth impression cylinder under pressures reaching 15,000 pounds per square inch. The impression cylinder forces the paper into the fine, engraved lines of the printing plate to pick up the ink, leaving a raised image about 0.02 mm above the paper. In the case of the latent image the ink is slightly higher, making for the raised image we can see when we slant the note toward a light source like the maple leaf on recent store coupons. This process is repeated at a rate of about 10,000 sheets per hour. The printed sheets are then stacked to dry.

From here it is off to the numbering machine. The sheets, up until now, do not have to be replaced, but once the numbers go on, they must have replacement sheets already printed, numbered and ready to replace defective sheets. These are known as "sheet replacements". Once the sheets have been cut into individual notes they need "single note replacements" ready to replace defective single notes. These single and sheet replacement notes are only used to replace notes that are inside a bundle of notes.

The top and bottom notes of a bundle are usually replaced using single replacement notes that have been printed and cut into individual notes, but, have not been through the numbering process and are known as "same number replacements". These notes are numbered, using a separate hand numbering machine, with the actual number of the note that they are replacing. The numbers can be printed on these notes, one at a time or simultaneously, making for a plethora of differences in their spacing and alignment. These notes are done this way so that the packaging department can keep track of the notes that go into each case of notes. The reason for this is that the cases have a label on the outside stating which notes (serial numbers) are in that particular case.



A Miller 4 color sheet printing press.



A 1015 Heidelberg press

To number a sheet of 50 notes you need 100 numbering heads mounted on a numbering machine. Different types of numbering machines exist. There are rotary numbering machines (numbering offset press) and flat or "crash" numbering machines (Heidelberg 1015 press).

The way that the numbering heads are mounted on a numbering machine can determine the type of numbering errors we collectors find. If the numbering heads are mounted vertically we find errors similar to this 5¢ note in figure 1 on the following page. If they are mounted horizontally we find errors similar to these 10¢ notes in figure 2. The normal tolerances in the numbering head spacing makes for the small differences in the spacing between the serial numbers on any given series.

When setting up the numbering machine to number a batch of notes, the numbering heads must be set individually so that when the sheets exit the machine, they pile up into stacks and when cut into individual notes, are consecutive. Numbering heads are made in two distinct versions - backward Numbering and forward numbering and can cost easily \$500.00 each.

BABN numbered their notes backwards for series CTC S18 through CTC S21. That means that the first note (sheet) out of the numbering machine was the lowest number in that particular batch and the last one out was the highest number. When you took a bundle of BABN CTC money and looked at the first note on the back of the bundle, that particular note would be .....1500 and the last note would be .....1001. CBN does the opposite, their first note on a bundle would also be .....1500 but the last note would be .....1999.



Making adjustments on a vertical "numbering apparatus" from "The Art and Design of Canadian Bank Notes" photograph by Martin Lipman sent in by Don Roebuck #848



A six digit numbering head with a "No" prefix. The "No" prefix is the mechanism that advances the number.



The cog on the outside of this GTO numbering head advances the number with every hit.



A numbering offset press.

When the setup is done and they are ready to roll the press to do the numbering, they will run a few trial sheets of paper to make sure that the numbering heads are all set properly and that the ink is being spread uniformly. Every sheet through the press would advance the numbering heads, so they have to turn a cog on each numbering head so that they will not advance during their test run. This cog leaves an impression, similar to the one shown in figure 3, on the trial sheets. These sheets are usually plain paper and are scrapped. When all is ready to roll, they disengage the cog and start numbering.



Three CTC S24-D 50¢ notes found in sequence, the first is a regular piece of Blue bond paper.

The numbering process must be watched closely because all sorts of things can go wrong with any one of the numbering heads. Partially rotated digits, missing digits and mismatched serial numbers are only a small portion of the errors that can possibly happen with the serial numbers. (see figure 4). Figure 5 shows six notes with the same serial number, this would be impossible to find once the bundle was opened and the notes dispersed.



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These two notes prove that this particular bundle of sheets were cut vertically before being cut horizontally, notice that the note on the left is cut slightly higher than the one on the right. This is evident when you line up the serial numbers.

Figure 2 - CTC S28-C07

Anything as important as money requires strict quality control standards. In addition to the many inspections that occur during the printing process, the raw materials are also subject to strict inspections before they are used. The paper used in the making of CTC money is presently produced by Rolland Papers of St. Jerome, Quebec. The inks are tested and the paper is tested for chemical composition, thickness, and other properties including the watermarks and planchets. The ink used for the serial numbers is fluorescent and is strictly controlled to prevent counterfeiting.

The finished notes are also tested periodically for durability. Some notes are put through a washing machine to determine the colorfastness of the inks. It is estimated that a bill can be folded and crumpled up to 2,000 times before it

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