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FINISHERS – LET'S "FINISH" THE COPY/PRINT JOB

By **VLADIMIR KAMENOV**

This series of articles is dedicated to rather exotic and mechanically complicated devices called *finishers*. They are attached to the exit side of a copier and, like in a sorter, copies are stored there. Sorters were discussed in our previous articles *(RechargEast Magazine, August, September 2008)*. The purpose of finishers is an upgrade of the capabilities of the sorters. The latter simply sort and optionally staple the finished jobs in one fixed position. The finishers can do much more than that.
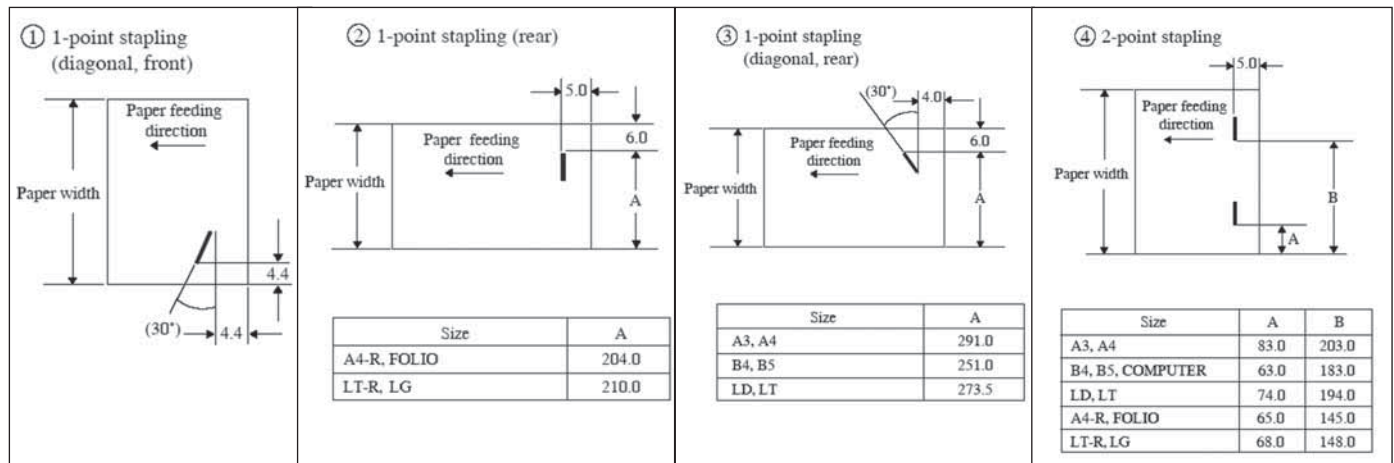
The finishers are a product of the development of new generation of multifunctional digital copiers. These copiers are not simply copiers. These are also printers, scanners, internet faxes and so on. Often, they have the capability of A3 format handling and duplexing. This means that operators would want to perform much more various jobs on their multifunctional copier other than copying. These can include offset sorting, stapling at various positions, creating of booklets and even punching the finished jobs.

In the present article we will go through the principles of operation of a finisher device. In order to understand the construction of mechanical devices, what the finisher consists of,; it is useful to get familiar with the capabilities and features of the device.

FEATURES

1. Accommodates large quantities of sheets - normally, the finisher holds a stack of sheets 147 mm in height in its two bins (small-size paper: equivalent to 1000 sheets)/74 mm in height (large-size paper: equivalent to 500 sheets);

2. Has high paper transportation performance - the finisher is capable of handling paper between 60 and 200 g/m2 ;

3. Offers a job offset function - the finisher has a job offset function for sorting non-stapled stacks of copies;

4. Offers four types of auto stapling - the finisher offers a choice of four stapling modes (1-point stapling at rear, diagonal stapling at front, diagonal stapling at rear, 2-point stapling);

5. Uses a buffer roller - The use of a buffer roller enables the finisher to accept copies without interruption from the host machine even during stapling or offset operation;

6. Has a saddle stitch function (Saddle Finisher) - the finisher can staple along the center of paper and fold it in two (up to 15 sheets);

7. Offers a punch function (option) - the use of the puncher unit enables the finisher to punch sheets for binders before they are output. (The puncher unit is capable of handling papers between 64 and 200 g/m2. It cannot handle special paper, postcards and transparencies).

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STAPLING POSITIONS
(unit: mm, allowance: ±4mm)

Size	A
A4-R, FOLIO	204.0
LT-R, LG	210.0

Size	A
A3, A4	291.0
B4, B5	251.0
LD, LT	273.5

Size	A	B
A3, A4	83.0	203.0
B4, B5, COMPUTER	63.0	183.0
LD, LT	74.0	194.0
A4-R, FOLIO	65.0	145.0
LT-R, LG	68.0	148.0

SADDLE STITCHER UNIT SPECIFICATIONS

Item	Description	
Stapling method	Center binding (double folding)	
Folding position	See Figure 1-202.	
Paper size	A3, B4, A4-R, LD, LT-R	
Capacity	Without binding: 1 sheet With binding: 2 to 15 sheets (including single cover page)	
Paper weight	64 to 80 g/m2(cover page up to 200 g/m2) (Note 1)	
Stacking capacity	10 sets (stack of 11 to 15 sheets), 20 sets (stack of 6 to 10 sheets),	
	25 sets (stack of 5 sheets or less)	
Stapling	Stapling position	2 points (center distribution; fixed interval)
	Staple accommodation	2000 staples
	Staple supply	Special cartridge
	Staples	Special staples (STAPLE-600)
	Staple detection	Provided
	Manual stapling	Not provided
Folding	Folding method	Roller contact
	Folding mode	Double folding
	Folding position	Paper center
	Position adjustment	Provided
Power supply	From finisher unit	
	(24 VDC, 5 VDC)	
Power consumption	160 W or less	

STAPLE AND FOLDING POSITION
(saddle finisher unit)

Unit: mm, allowance: ±2.5mm

Size	A	B
A3	83.0	203.0
B4	63.0	183.0
A4-R	39.5	159.5
LD	74.0	194.0
LT-R	42.0	162.0
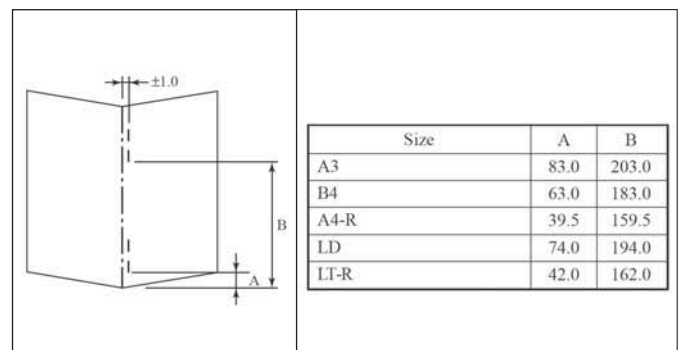
PUNCHER UNIT (OPTION) SPECIFICATIONS

Item	Description		
Punching method	Sequential punching		
Paper size	See the figures below		
Paper weight	64 to 200 g/m2 (Note 1)		
Punched hole diameter	See the figures below		
Punched scrap capacity	2 holes:	5,000 sheets	
	2 or 3 hole	s:3,000 sheets	(80 g/m2 or equivalent)
	4 holes:	5,000 sheets	
Power supply	From the finisher unit (24 VDC, 5 VDC)		
Power consumption	120 W or less		

## HOLE POSITION (Paper trailing edge) Unit:mm
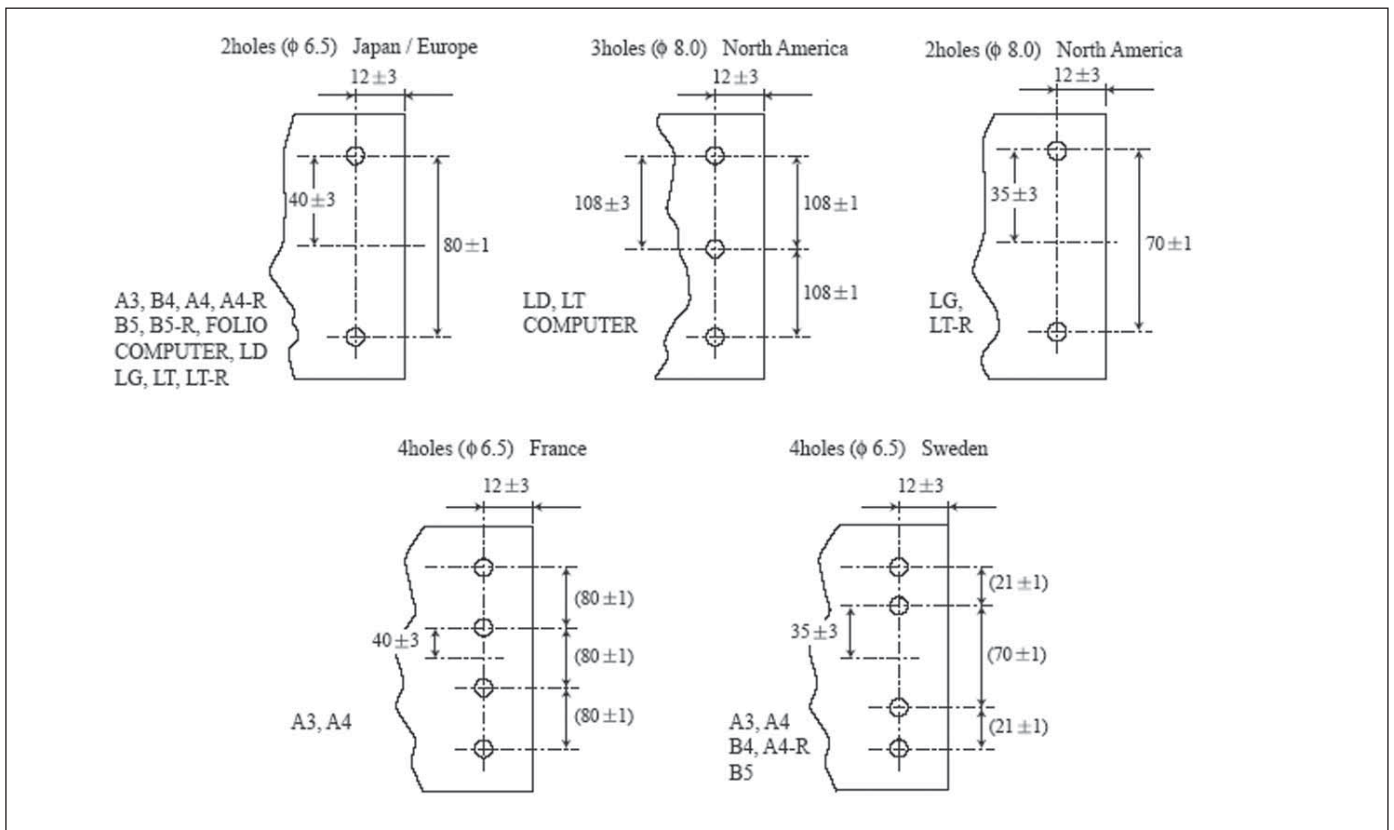
Beneath are given the cross sections of the units of the finisher. Knowing the names of various components on the figure is essential to understanding the repair procedures explained in the service documentation. It is also important to study these names in order to understand the operation principles of the finisher, given below.

CROSS SECTION

1. Finisher Unit

[1] Tray 1/2
[2] Shutter
[3] Delivery roller
[4] Swing guide
[5] Feed roller 2
[6] Height sensor
[7] Wrap flapper
[8] Buffer roller
[9] Buffer inlet flapper
[10] Saddle stitcher flapper
[11] Inlet feed roller
[12] Feed roller 1
[13] Vertical path
[14] Stapler
[15] Knurled belt
[16] Tray lift motor
[17] Saddle stitcher unit
(Saddle Finisher)
[18] Latch unit
[19] Inlet feed section
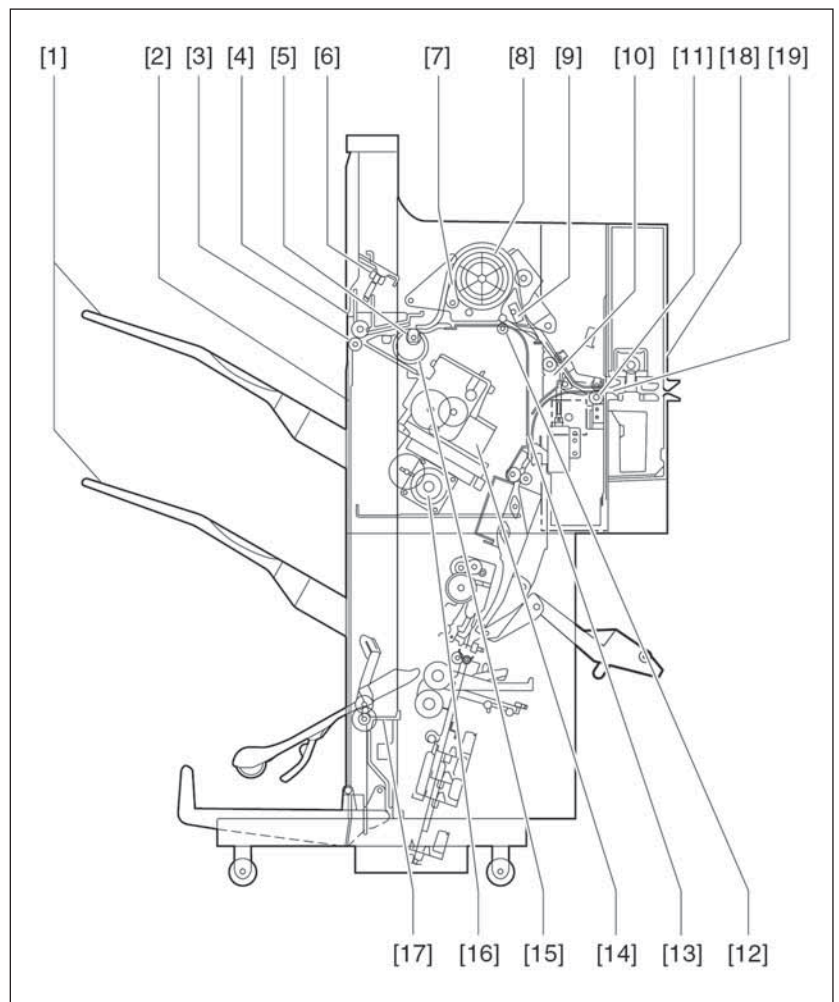
2. Saddle Stitcher Unit
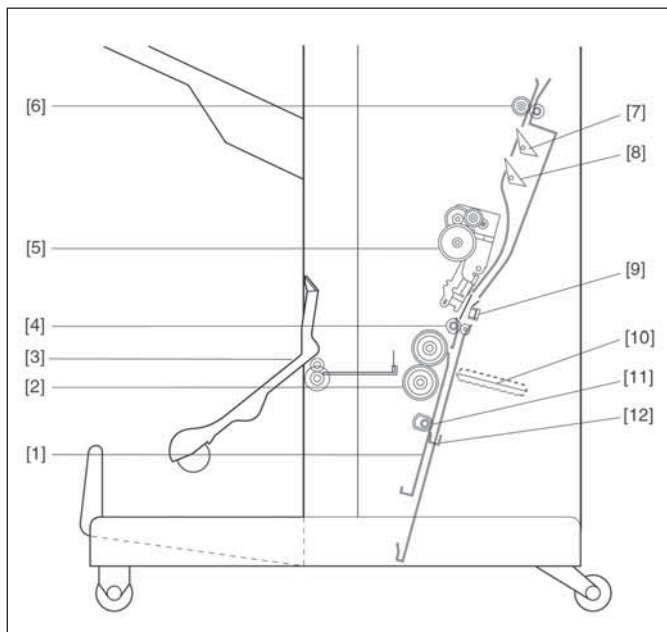
[1] Guide plate
[2] Folding roller
[3] Delivery guide plate
[4] Holding roller
[5] Stitcher (front, rear)
[6] Inlet roller

[7] No. 1 flapper
[8] No. 2 flapper
[9] Stitcher plate (front, rear)
[10] Butting plate
[11] Crescent roller
[12] Paper positioning plate

3. Puncher Unit (option)
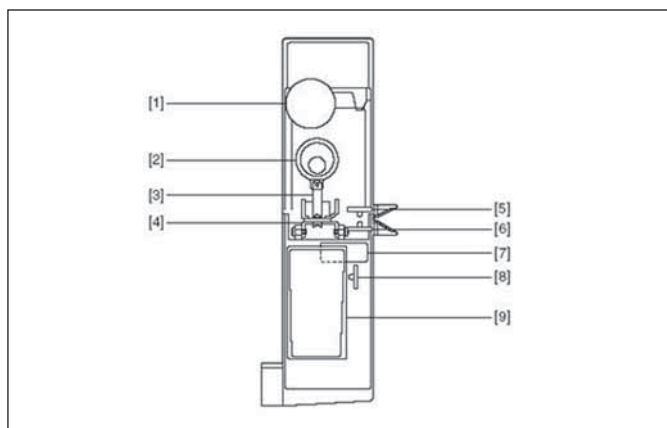
[1] Punch motor
[2] Cam
[3] Hole puncher (Punch blade)
[4] Die
[5] Photosensor PCB
[6] LED PCB
[7] Horizontal registration motor
[8] Scrap-full detector PCB unit
[9] Punched scrap container

From this moment on, we will divide the finisher into three functional units – **finisher, saddle stitch** and **punch unit** and each will be discussed separately. We start with the operation principles of the finishing unit of the Finisher:

# FINISHER UNIT BASIC OPERATION

FEED/DRIVE SYSTEM

A. Outline

The finisher is designed to operate according to the commands from its host machine to deliver arriving copies to trays in the appropriate mode: simple stacking, job offset, stapling. The figure and the diagram show the three modes of delivery (four for the Saddle Finisher):
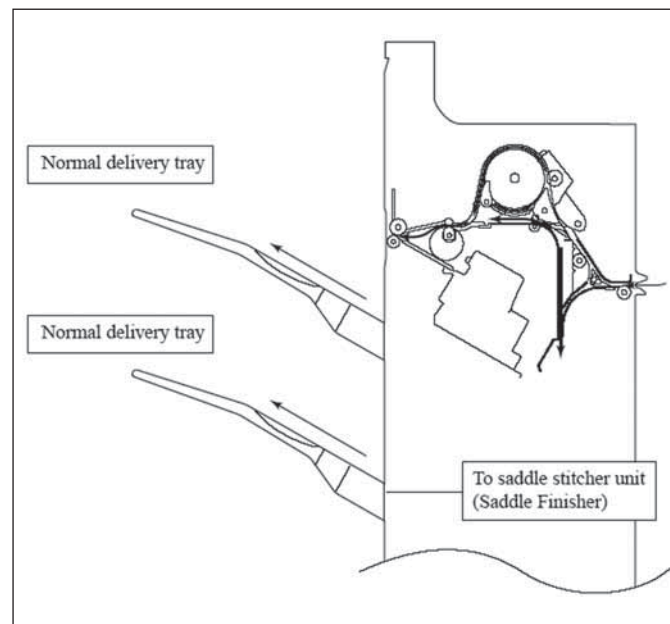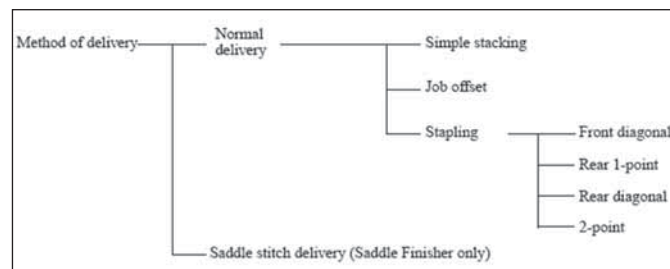

1. Normal Delivery

a. Simple Stacking – the finisher delivers copies directly to the tray:
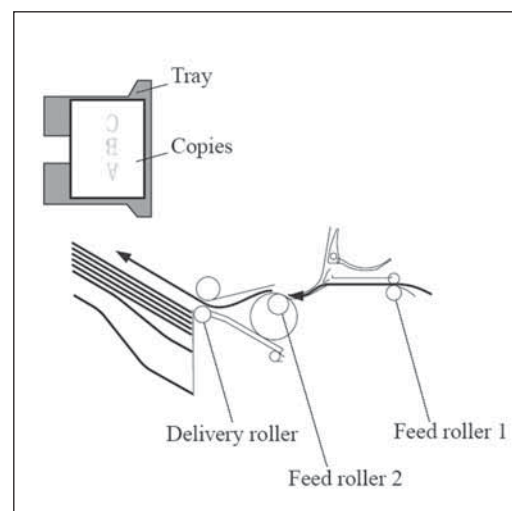
b. Job Offset - the finisher forwards all copies of each sort job to the stapling tray.

The first sort job on the stapling tray is delivered with a shift to the front of about 30 mm, and the second sort job is delivered without being shifted. Whether the first copy or the last copy of a sort job should be shifted is determined by the host machine:
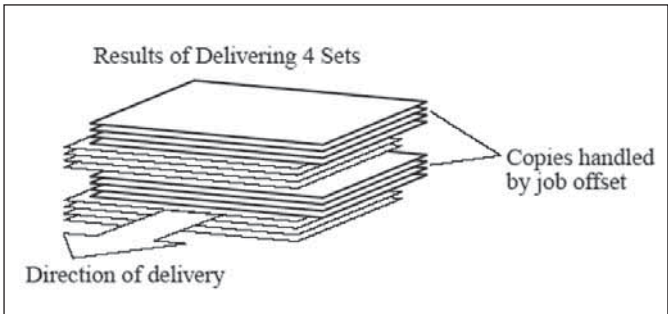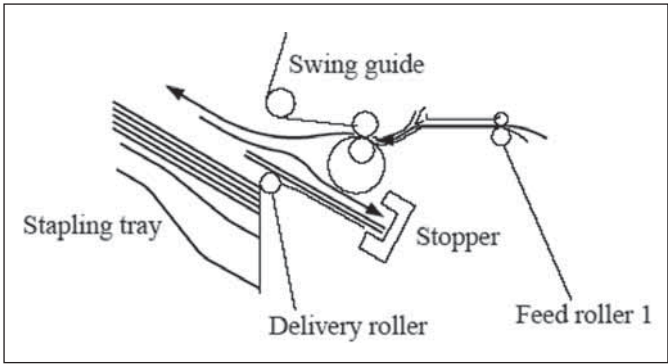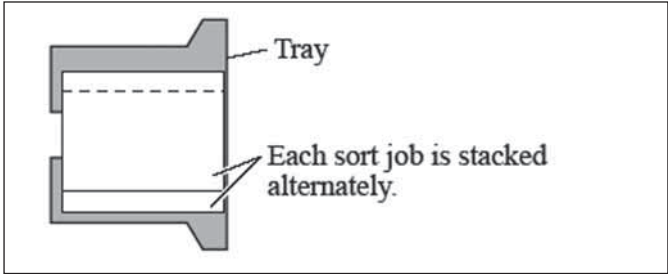

c. Stapling - the finisher stacks copies arriving from its host machine on the stapling tray. Then it staples and delivers the copies to the appropriate tray:
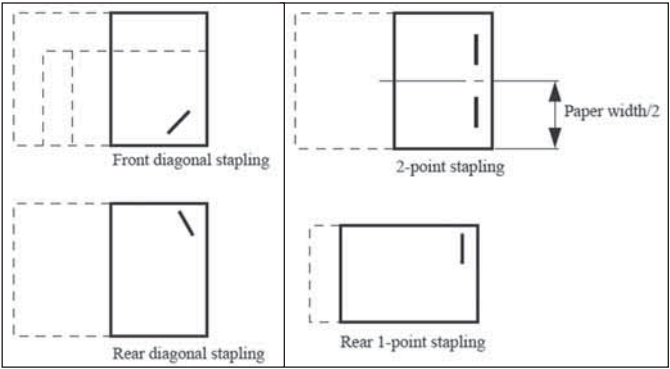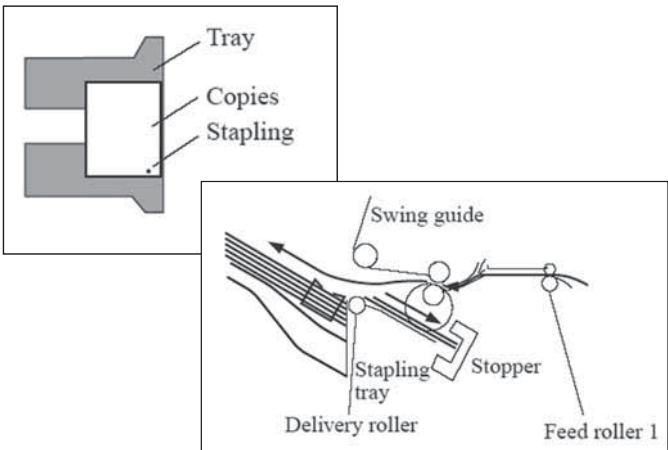
2. Saddle Stitch Delivery (Saddle Finisher)

A copy arriving in the finisher from the host machine is routed to the saddle stitcher by the paper deflecting plate. The saddle stitcher executes stitching and saddling operations on the copy and then delivers it to the saddle stitcher tray.
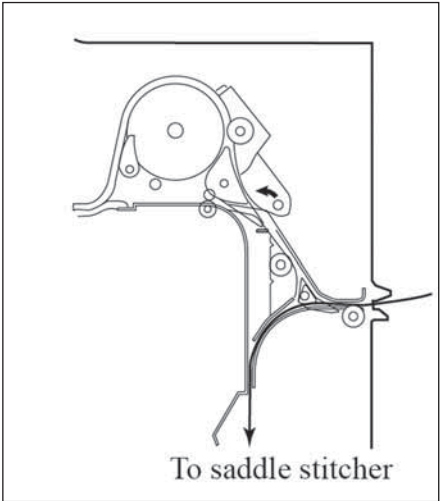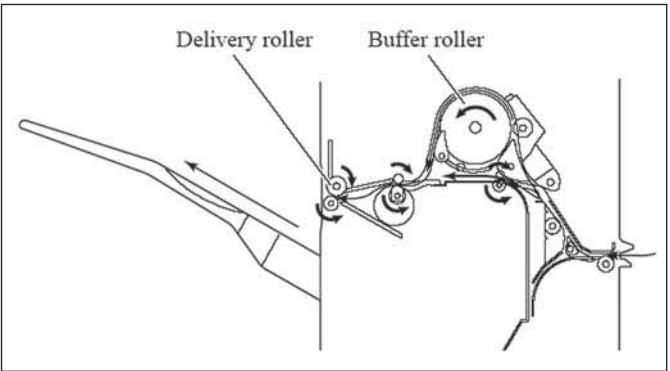

B. Type of Delivery Paths - the finisher has three different paper paths for delivery, each selected to suit paper size and delivery mode.

1. Straight Path
When stacking copies shown in Table bellow, the copies pass under the buffer roller:

Copy size	Length or width 182 mm or less
Typical copy examples	A5-R, ST-R, thick stock

2. Buffer Paper Path 1
When stacking copies shown in Table bellow, the copies pass over the buffer roller, increasing the distance between copies:

| Copy size	Length and width 182 mm or more
Typical copy examples	A3, B4, A4, A4-R, B5, B5-R, LD, LG, LT,
	LT-R, (excluding transparencies and thick stock)
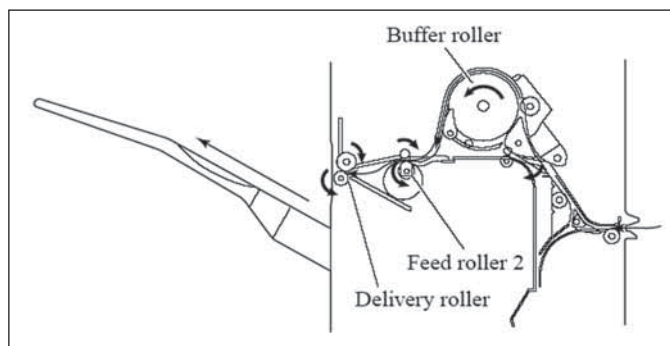
3. Buffer Paper Path 2

This is the paper path when copy sizes shown in the table are stacked. A maximum of three copies (three originals or more in the stapling mode) are wrapped round the buffer roller, during which job offset and stapling are performed on the stapling tray:

Copy size	Length 182 to 232mm, and width 182 to 297mm
Typical copy examples	A4, B5, LT, (excluding transparencies and thick stock)

The following shows paper delivery operation in the case of three originals in the stapling mode:
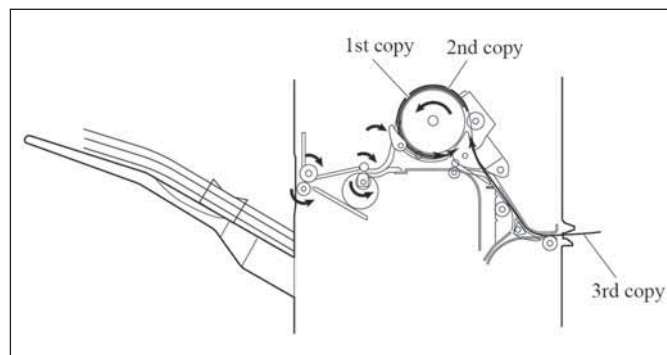
1) The first copy is moved in the direction of the buffer roller:
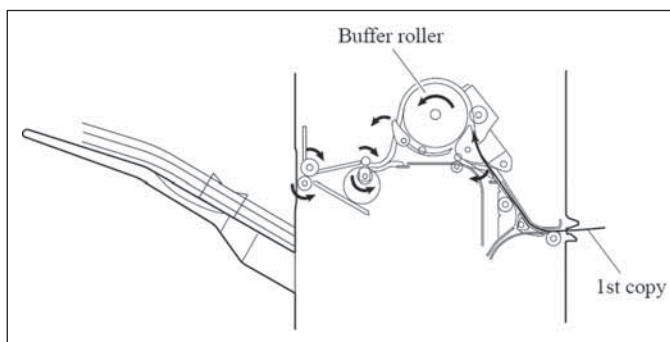
2) The first copy wraps around the buffer roller and, at the same time, the second copy arrives from the host machine:
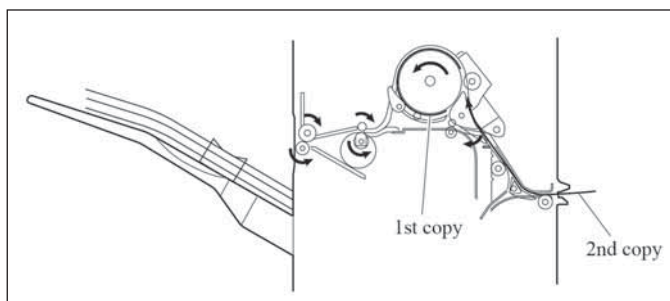
3) The second copy is laid over the first copy and, at the same time, the third copy arrives from the host machine:

4) The first, second and third copies are simultaneously pulled into the stapling tray:
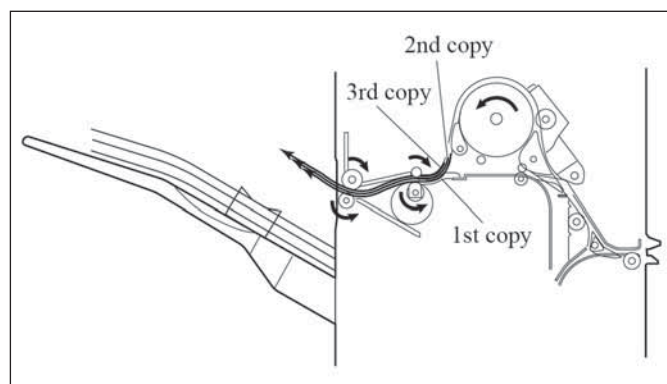
Note:
The third copy as explained here is moved through buffer paper path 1. This fact is omitted from the discussion to avoid interrupting the sequence of operations.

C. Feeding and Delivering

The paper paths are equipped with the following four sensors for detection of paper (arrival, passage):
• Inlet sensor (PI1)
• Delivery sensor (PI3)
• Stapling tray sensor (PI4)
• Buffer path paper sensor (PI14)
In addition, each delivery tray is equipped with a sensor designed to detect the presence/absence of paper on it:
• No.1 tray paper sensor (PI11)
• No.2 tray paper sensor (PI12)

Below are the locations and functions of all motors, solenoids and sensors of the finisher:

Finisher controller PCB

Escape solenoid drive signal ESCPSL
Alignment motor drive signal
Delivery motor drive signal
Delivery motor clock signal DELCLK
Swing motor drive signal
Swing motor clock signal SWGCLK
Shift motor clock detection signal 1 SFTCLK1
Shift motor clock detection signal 2 SFTCLK2
Tray lift motor drive signal
Paddle solenoid drive signal PDLSL
Second feed motor drive signal
First feed motor drive signal
Inlet feed motor drive signal
Buffer outlet solenoid drive signal EXITSL
Buffer inlet solenoid drive signal ENTSL
Flapper solenoid drive signal FLPSL
Belt escape solenoid drive signal BESCPSL
Stapler motor drive signal
Stapler shift motor drive signal

PI19
PI9
M5
M8
M1
M9
SL5
PI20
M7
SL3
SL2
SL1
M2
SL7
PI10
M6
M3
M4
SL6

Finisher controller PCB

No.2 tray paper detection signal SNDTRAY
No.1 tray paper detection signal FSTTRAY
Stapling tray paper detection signal STPTY
Buffer path paper detection signal BUFPASS
Delivery detection signal PDEL
Buffer path inlet paper detection signal BUFENTR
Inlet paper detection signal PENT

PI3
PI17
PI14
PI11
PI4
PI1
PI12

To Be Continued… RCE