

**Option Printer**

**PK-512**

**PK-513**

**THEORY OF OPERATION**

Code Y108431-7

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# Revision history

After publication of this service manual, the parts and mechanism may be subject to change for improvement of their performance.

Therefore, the descriptions given in this service manual may not coincide with the actual machine.

When any change has been made to the descriptions in the service manual, a revised version will be issued with a revision mark added as required.

Revision mark:

- To indicate clearly a section revised,  is shown at the left margin of the revised section.  
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## NOTE

Revision marks shown in a page are restricted only to the latest ones with the old ones deleted.

- When a page revised in Ver. 2.0 has been changed in Ver. 3.0:  
The revision marks for Ver. 3.0 only are shown with those for Ver. 2.0 deleted.
- When a page revised in Ver. 2.0 has not been changed in Ver. 3.0:  
The revision marks for Ver. 2.0 are left as they are.

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Outline

Composition/Operation

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# Outline

## 1. Product specifications

### A. Type

Name	Punch unit
Type	FS-integrated type punching operation device

### B. Functions

Punching method	Stops and punches every paper
No. of holes	PK-512    2-3 holes / 2-4 holes
	PK-513    4 holes
Hole diameter	φ 8.0 mm (2-3 holes), φ 6.5 mm (2-4 holes)
Supported mode	Punch mode, through mode
Applicable post processing mode	Sort, group, staple

### C. Paper type

Size	2 hole punch setting: A3, B4, A4/A4S, B5/B5S, A5/A5S 8 x 13, 8 1/4 x 13, 8 1/2 x 13, 8 1/8 x 13 1/4, 11 x 17, 8 1/2 x 14, 8 1/2 x 11/8 1/2 x 11S, 5 1/2 x 8 1/2S, 8K, 16K/16KS 7 1/4 x 10 1/2, 7 1/4 x 10 1/2S  3 hole/4 hole punch setting: A3, B4, A4, B5 11 x 17, 8 1/2 x 11, 7 1/4 x 10 1/2, 8K, 16K
Supported paper	Plain paper, bond paper, colored paper, coated paper (Main unit specifications prioritized)
Weight	64 to 128 g/m <sup>2</sup>
Punch prohibited paper	Label paper, tab paper, transparency film, 2nd base paper, holed paper, and the other paper that may interfere with the operation of the punch unit or the punch blade.

### D. Machine specifications

Power requirements	DC 24 V (supplied from the main body)
	DC 5 V (supplied from the main body)
Max. power consumption	40 W or less
Dimensions	130 mm (W) x 470 mm (D) x 115 mm (H) 5 inch (W) x 18.5 inch (D) x 4.5 inch (H)
Weight	3.0 kg (6.5 lb)

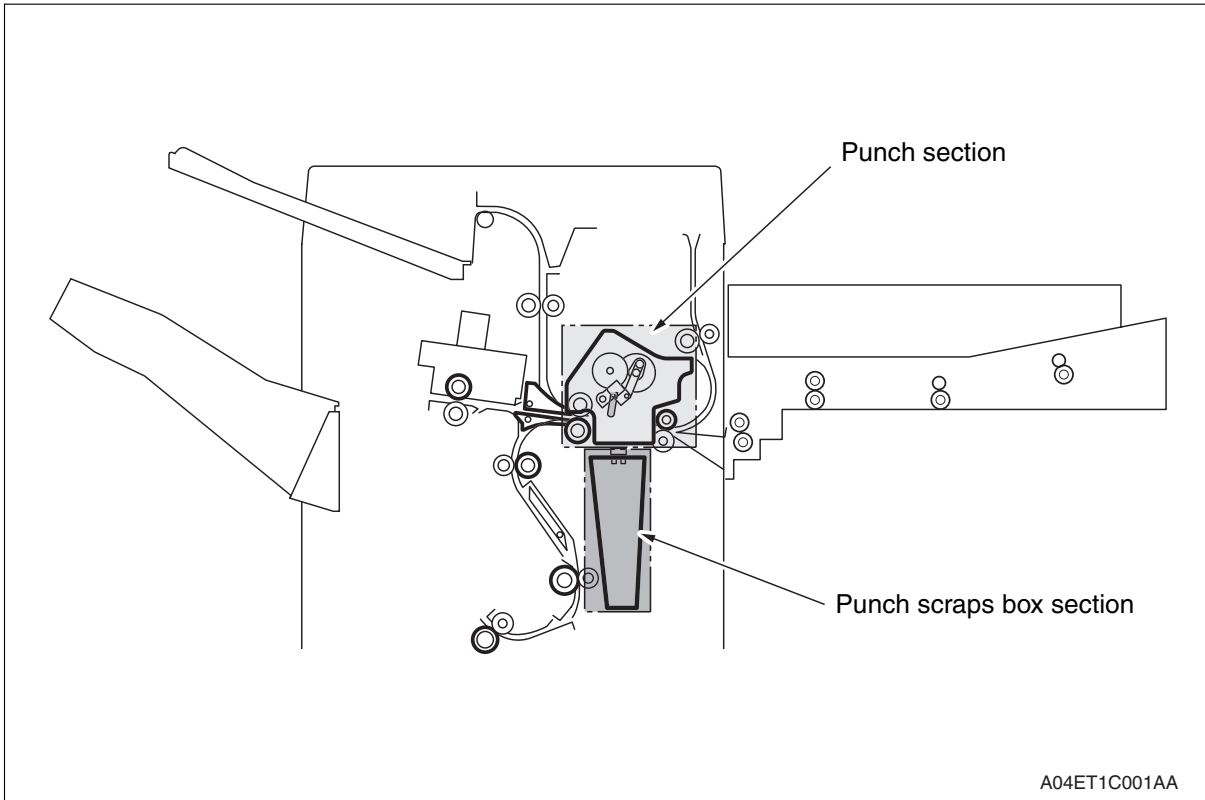
### E. Operating environment

- Conforms to the operating environment of the main body.

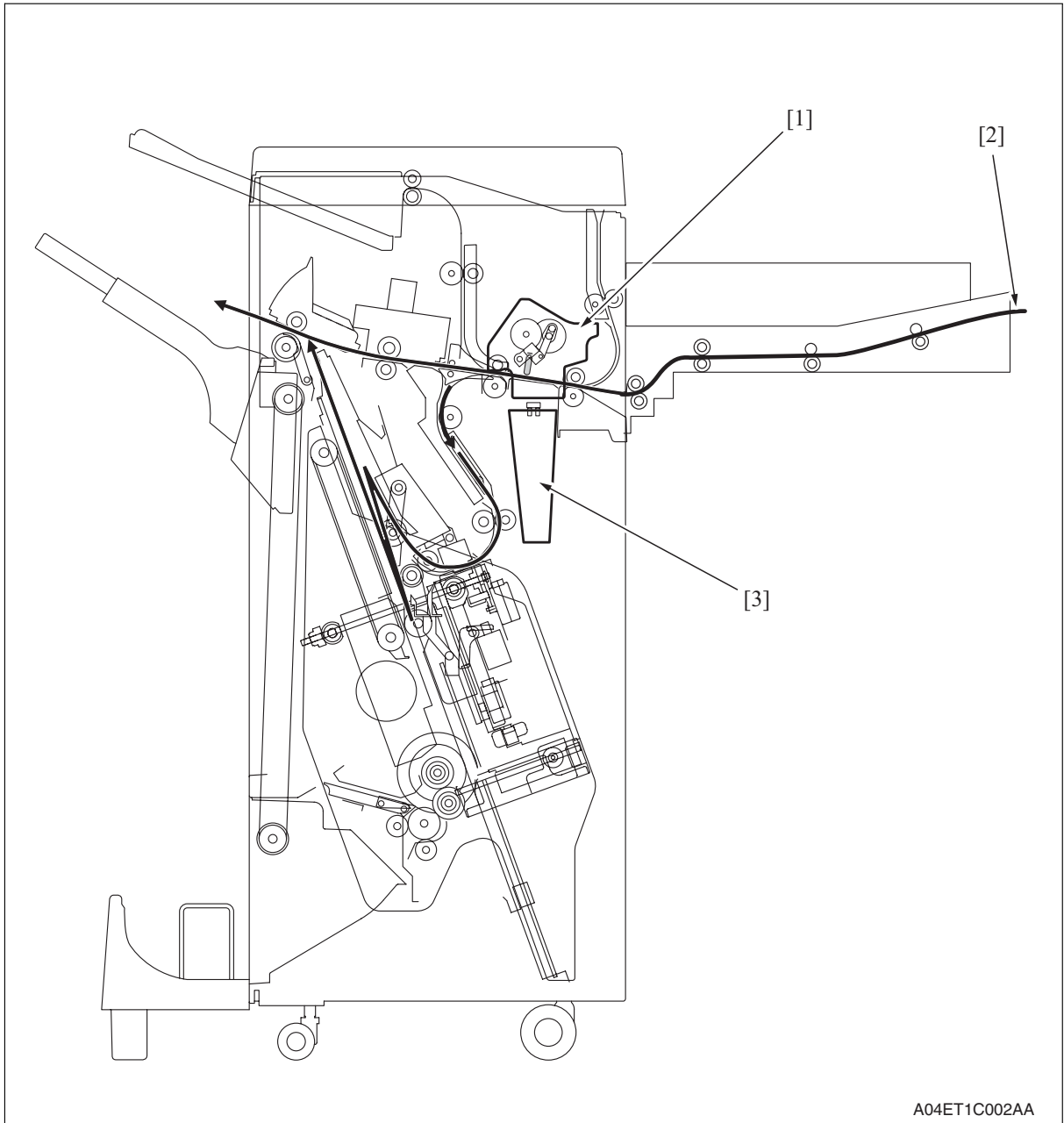
#### NOTE

- These specifications are subject to change without notice.

## 2. Unit composition



### 3. Paper path



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[1] Punch unit

[3] Punch scraps box

[2] Paper path from the main body

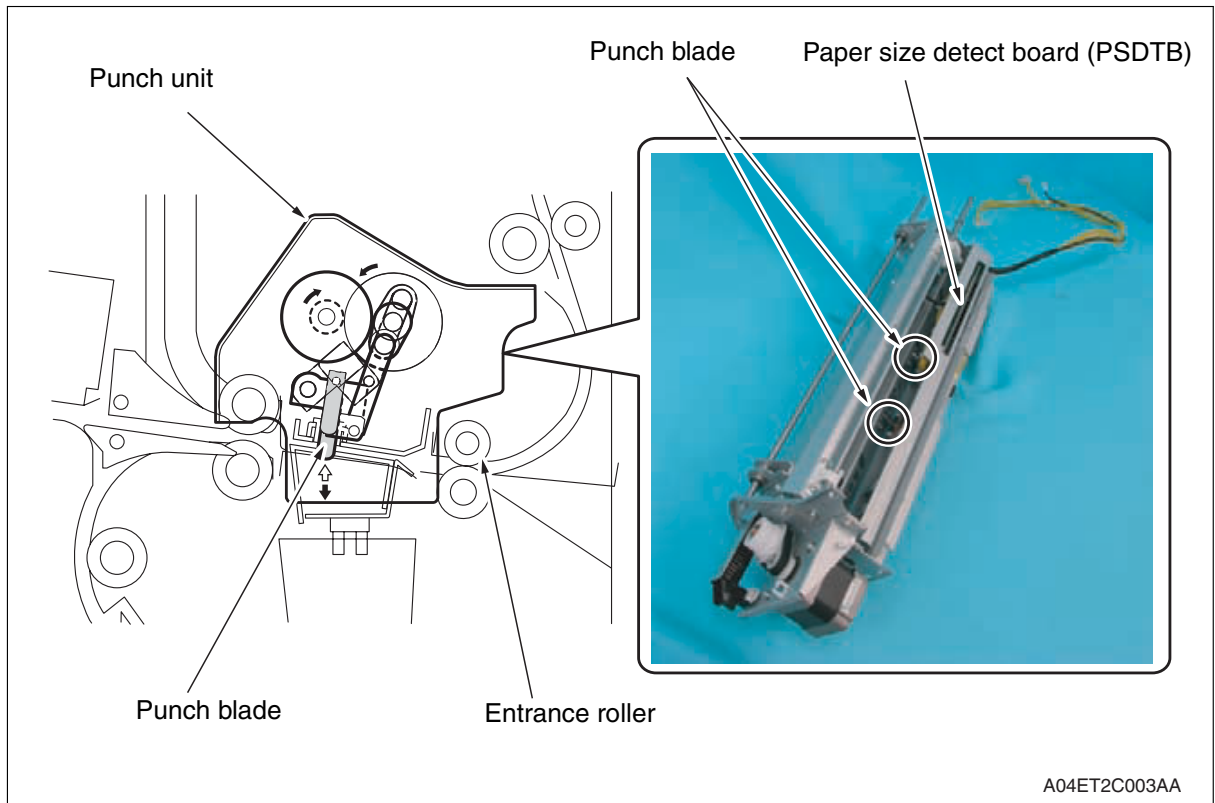


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# Composition/Operation

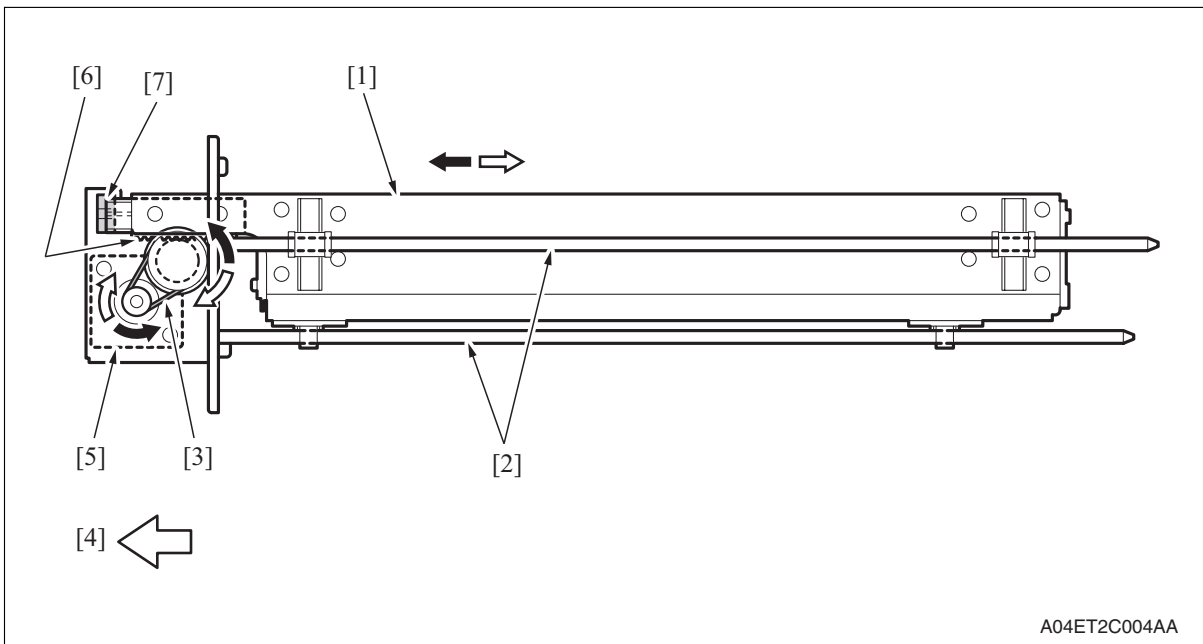
## 4. Punch section

### 4.1 Composition



## 4.2 Drive

### 4.2.1 Punch shift drive

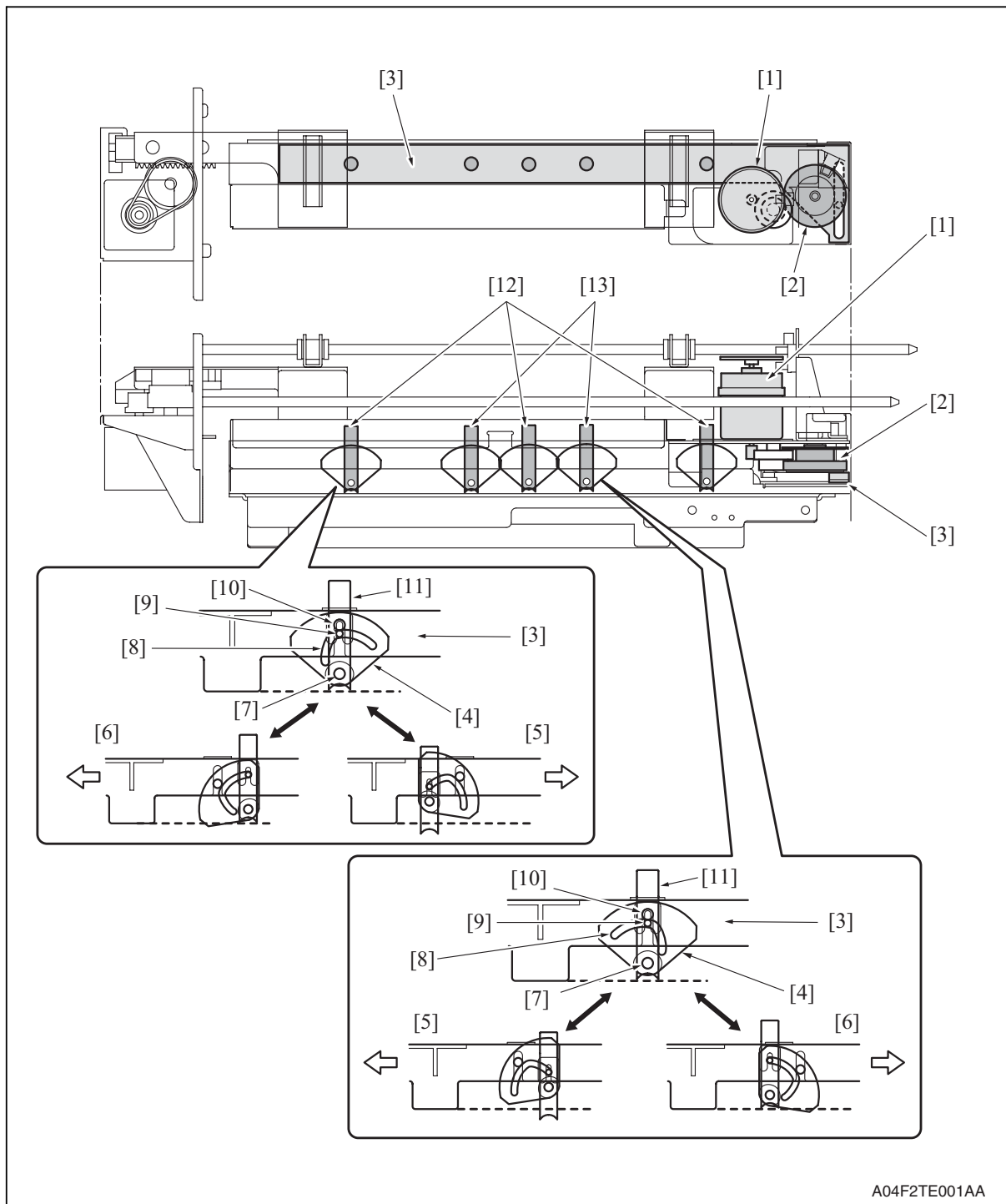


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- |                 |                                     |
|-----------------|-------------------------------------|
| [1] Punch unit  | [5] Punch shift motor (M302)        |
| [2] Guide shaft | [6] Rack                            |
| [3] Belt        | [7] Punch shift home sensor (PS303) |
| [4] Front       |                                     |

4.2.2 Punch drive

A. PK-512 (2 to 3 holes)



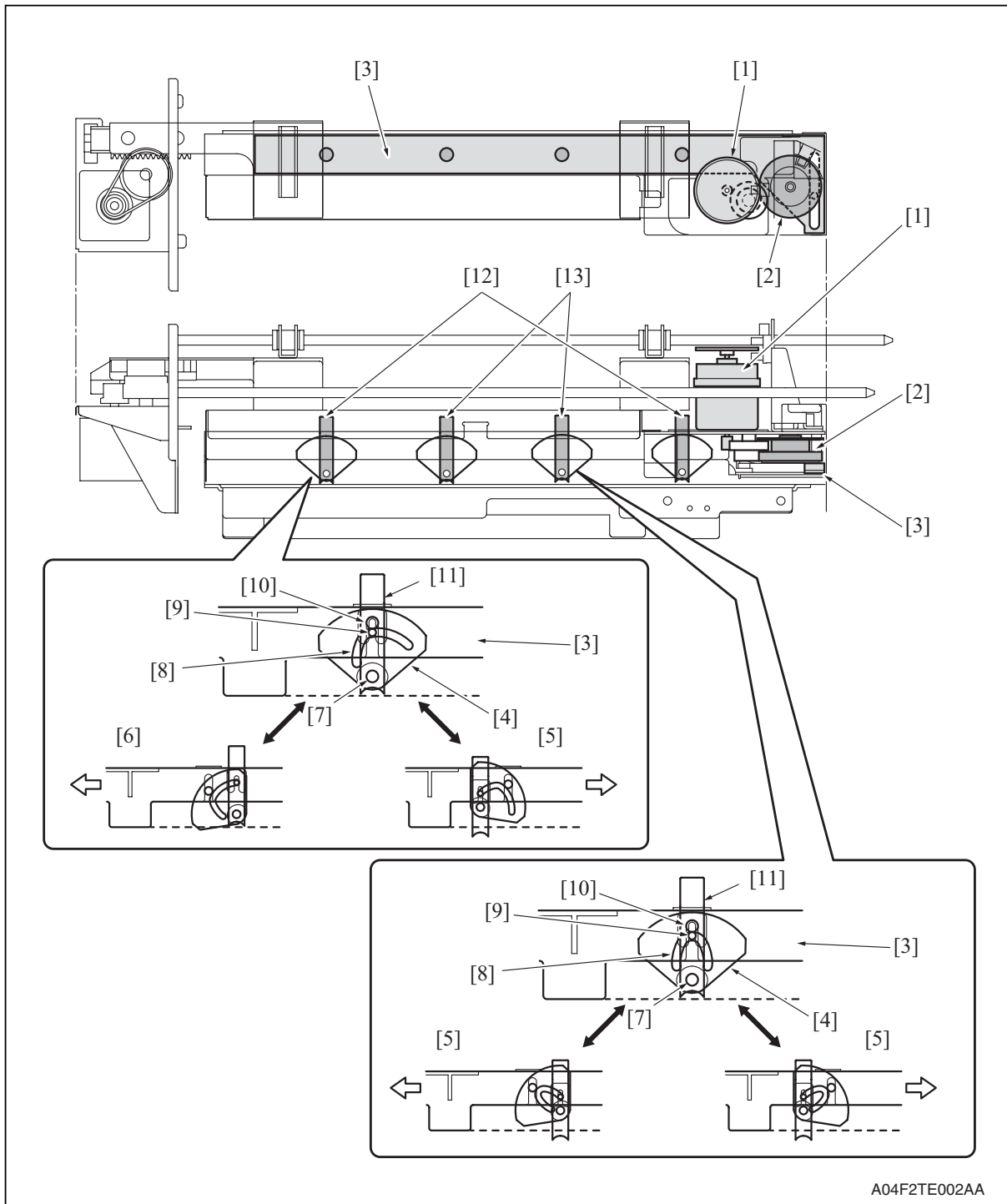
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- |  |                                      |
|--|--------------------------------------|
| [1] Punch motor (M301)                 | [8] Groove of the switching cam      |
| [2] Eccentric cam                      | [9] Projection of the punch blade    |
| [3] Slide link                         | [10] Projection of the switching cam |
| [4] Switching cam                      | [11] Punch blade                     |
| [5] When the punch blade is driven     | [12] Punch blade of the 3-hole punch |
| [6] When the punch blade is not driven | [13] Punch blade of the 2-hole punch |
| [7] Switching cam shaft                |                                      |

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Composition/Operation

**B. PK-512 (2 to 4 holes)**

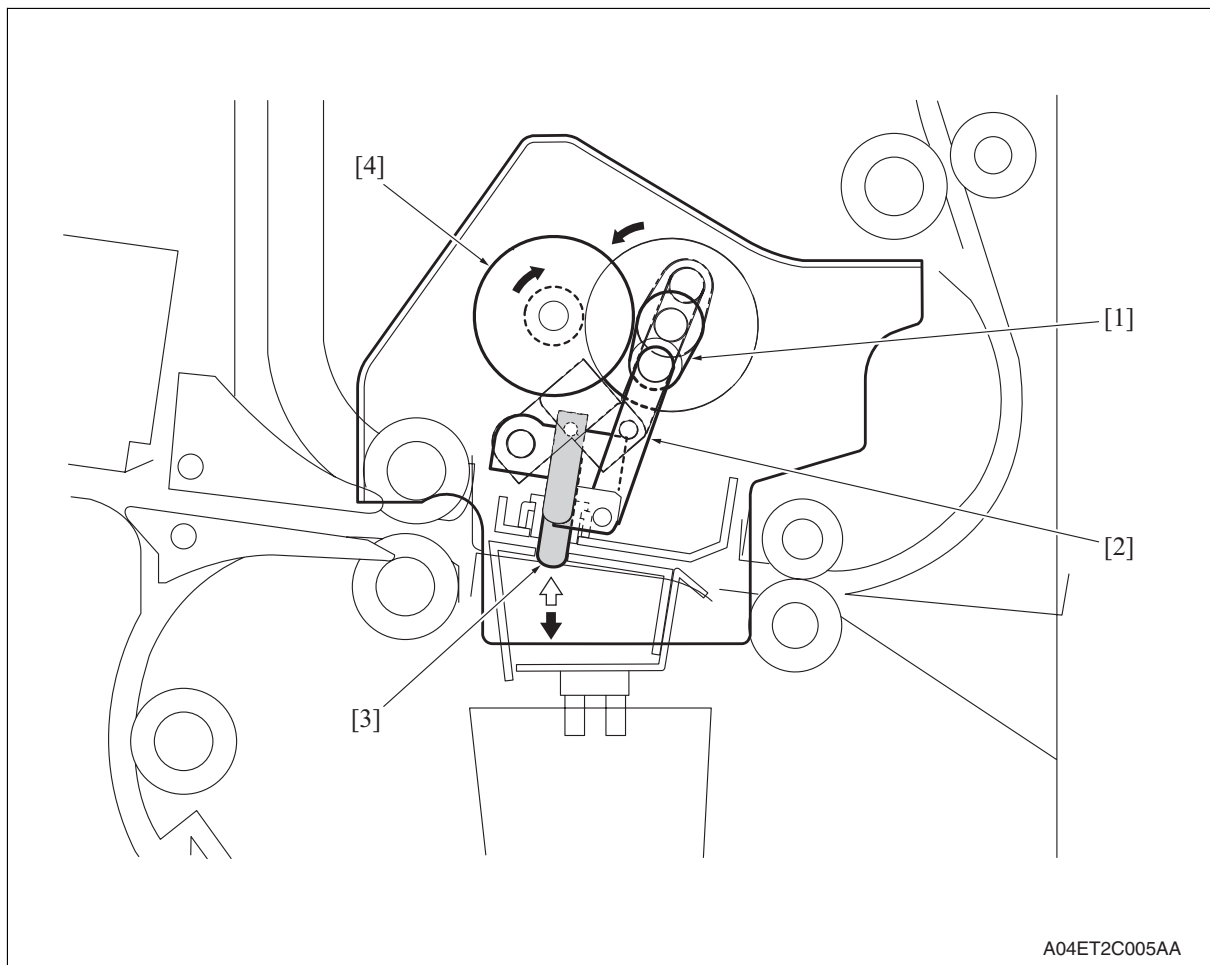


- |  |                                      |
|--|--------------------------------------|
| [1] Punch motor (M301)                 | [8] Groove of the switching cam      |
| [2] Eccentric cam                      | [9] Projection of the punch blade    |
| [3] Slide link                         | [10] Projection of the switching cam |
| [4] Switching cam                      | [11] Punch blade                     |
| [5] When the punch blade is driven     | [12] Punch blade of the 4-hole punch |
| [6] When the punch blade is not driven | [13] Punch blade of the 2-hole punch |
| [7] Switching cam shaft                |                                      |

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Composition/Operation

## 4.2.3 PK-513



[1] Eccentric cam

[2] Drive arm

[3] Punch blade

[4] Punch motor (M301)

## 4.3 Operation

### 4.3.1 Punch standby position movement control

Turning ON the device, the punch shift motor rotates to move the punch unit [6] to the home position until the punch shift home sensor turns ON.

Selecting the punch mode, the punch shift motor rotates to move the punch unit [6] so that the paper size detect board [1] of the punch unit [6] is positioned 5 mm inward [2] from the side edge of the paper.

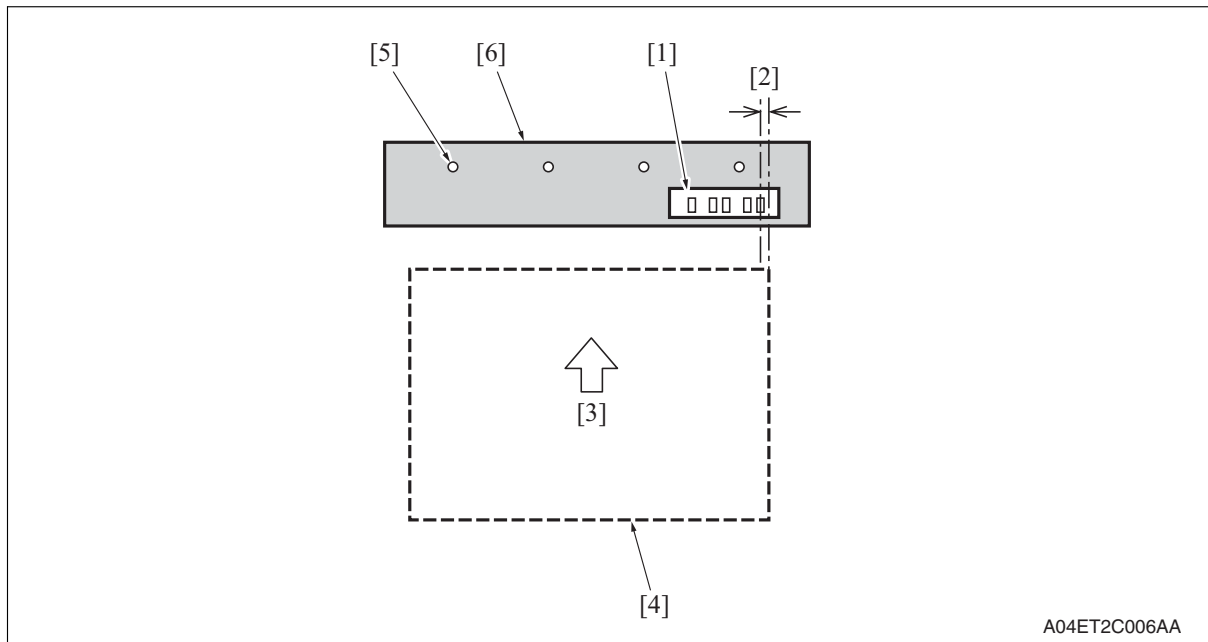
The paper size detect board consists of five sensors. Each sensor detects the following paper.

Sensor	Paper size
1	A5S, 5 1/2 x 8 1/2S
2	B5S, 16KS
3	A4S, A5, 8 1/2 x 11S, 8 1/2 x 14S, 5 1/2 x 8 1/2, 8 1/2 x 13, 8 1/4 x 13, 8 1/8 x 13 1/4, 8 x 13
4	B4, B5, 8K, 16K
5	A3, A4, 11 x 17, 8 1/2 x 11

\* The sensors are numbered 1 to 5 from the front side

And, when the stand-by position is 5 mm for B5 and B4 paper sizes, the corner of the paper passes through below the punch hole and the stand-by position is changed to 1.5 mm to prevent the hitching of the paper.

The punch unit returns to the home position at the end of the job.



- |   |                 |
|---|-----------------|
| [1] Paper size detect board (PSDTB)     | [4] Paper       |
| [2] Moving distance from the paper edge | [5] Punch blade |
| [3] Paper transfer direction            | [6] Punch unit  |

#### NOTE

- In the model PK-512, the paper size detect board is positioned on the front side and its operation is contrary to that in the above illustration on the right and left sides.

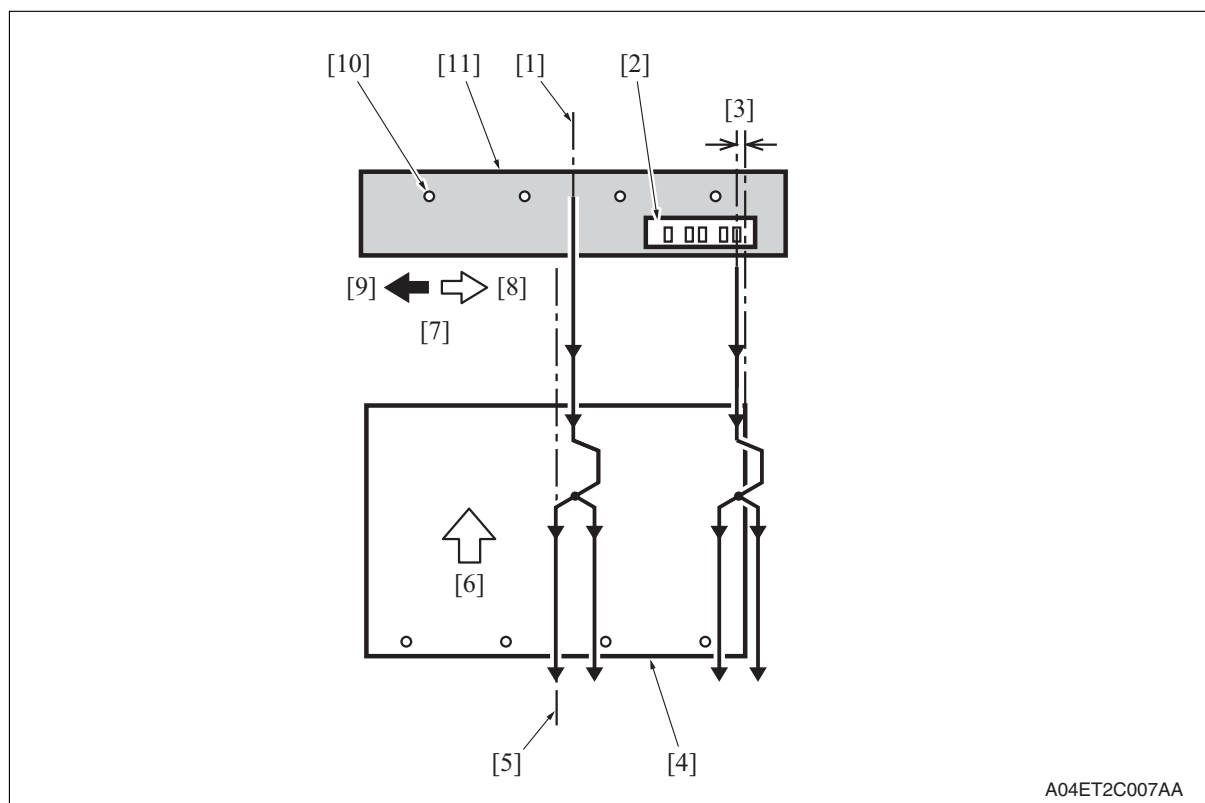
### 4.3.2 Punch position correction control

For the punch unit positioned from the side edge of the paper to the inside, the punch position is adjusted in the following procedure so that punching is made symmetrically to the center of paper at all times. The punch position correction is operated by moving the punch unit back and forth while conveying the paper.

- When the FNS entrance sensor detects the leading edge of the paper, the punch unit [11] is moved to the rear side until the paper size detect board [2] detects the side edge of the paper.

Then, the punch unit [11] is moved to the front side until the paper size detect board [2] detects the side edge of the paper (the side edge reference position detection).

- Once it detects the side edge reference position [3], the punch unit is moved further [11] so that the center of the punch blade [1] is positioned to the center of the paper [5]. The moving distance and its direction are depending on the paper size. It is stopped temporarily at the side edge reference position if it is moved to the rear side.



- |                                     |                                 |
|-------------------------------------|---------------------------------|
| [1] Center of the punch blade       | [7] Punch unit moving direction |
| [2] Paper size detect board (PSDTB) | [8] Rear side                   |
| [3] Side edge reference position    | [9] Front side                  |
| [4] Paper                           | [10] Punch blade                |
| [5] Center of the paper             | [11] Punch unit                 |
| [6] Paper transfer direction        |                                 |

#### NOTE

- In the model PK-512, the paper size detect board is positioned on the front side and its operation is contrary to that in the above illustration on the right and left sides.

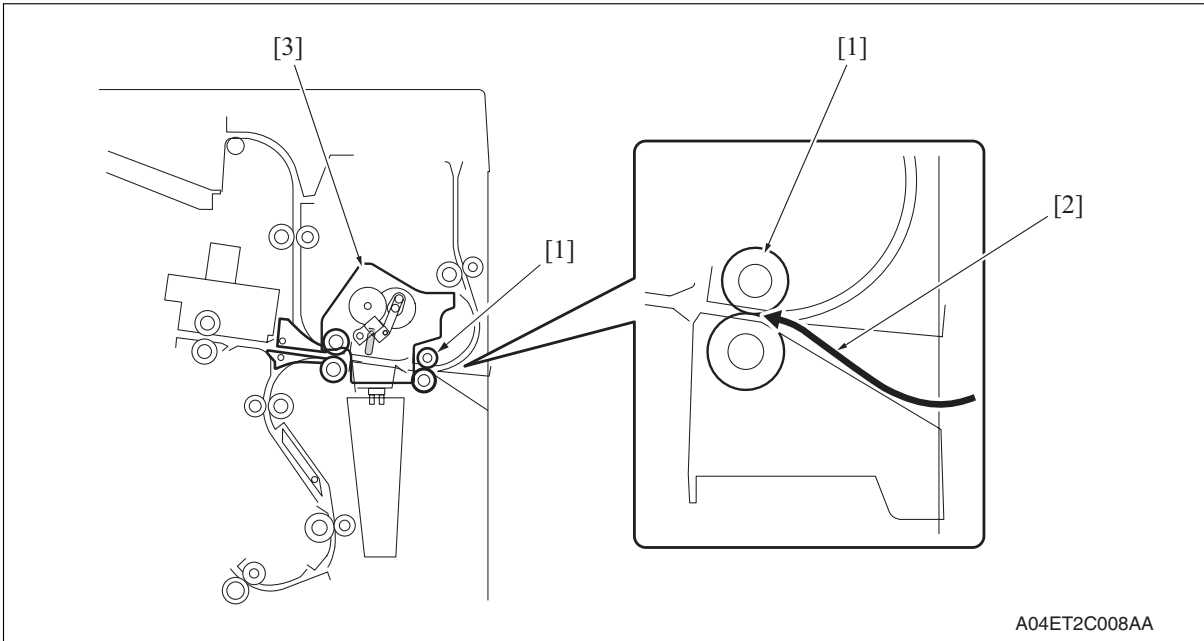


### 4.3.3 Punch control

#### A. Registration loop control

The FNS conveyance motor turns OFF temporarily to stop conveyance of paper when the specified time has passed since paper exit sensor detected the leading edge of the paper. Thus the paper is pressed against the entrance roller forming a loop to correct the bend. When the specified time has passed, FNS transfer motor turns ON to restart conveying the paper.

The above operation is not performed when conveying a large paper (220 mm and longer in the sub scan direction) and in the non-punching mode.



[1] Entrance roller

[3] PK

[2] Loop

## B. Punch control (PK-512)

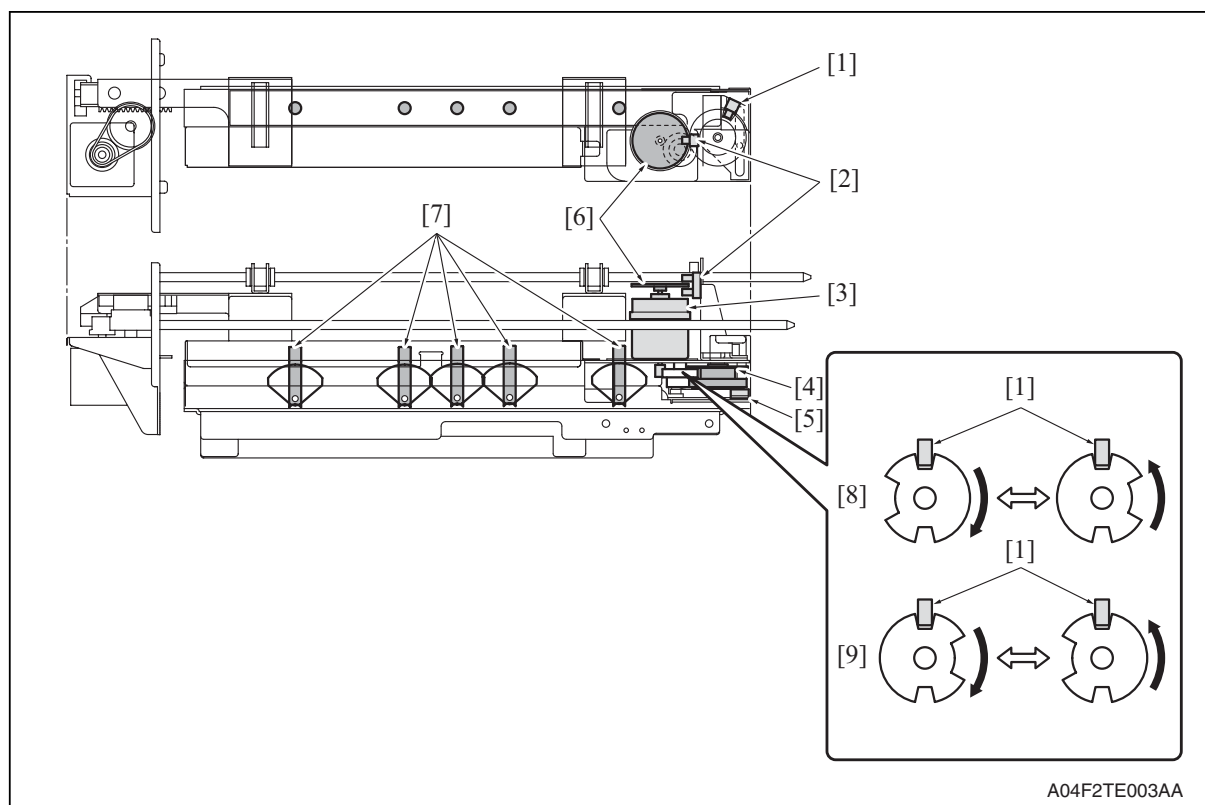
The FNS transfer motor is driven by the main body start signal.

In the punching mode, the motor the FNS transfer motor stops temporarily after the FNS entrance sensor detects the rear edge of paper. At the same time, the punch motor [3] rotates in the direction according to the number of punched holes. Number of punched holes of PK-512 is switched between 2 to 4 and 2 to 3 holes depending on the country. The motor the punch motor drives the slide link in the main scanning direction through the eccentric cam. As a result, the projection of the switching cam is pushed in the slide link moving direction and the switching cam is rotated around its axis. And then the punching blade [7] lowers to punch a hole. The projection of the punch blade is fitted into the groove of the switching cam.

Moving distance of the slide link [5] is controlled by detecting the eccentric cam actuator [4] with the punch home sensor [1]. When the actuator rotates 180 degrees, first punching is completed. In the second punching, the punch motor is reversed. When the actuator reverses 180 degrees, punching is completed. Forward and reverse rotations are repeated alternately.

The rotating speed of the punch motor is controlled by detecting the rotation of the punch encoder plate [6] fixed to the axis of the punch motor with the punch encoder sensor [2]. Then, the punch motor reverses and the punch home sensor [1] returns to ON and the The punch motor stops finally.

When a specified time elapsed after the FNS transfer motor stops temporarily, the FNS transfer motor resumes rotating and paper is transferred.



- |                                  |  |
|----------------------------------|--|
| [1] Punch home sensor (PS301)    | [7] Punching blade   |
| [2] Punch encoder sensor (PS306) | [8] Operation of 3-hole punching in the 2 to 3 hole mode and 4-hole punching in the 2 to 4 hole mode |
| [3] Punch motor (M301)           | [9] Operation of 2-hole punching in the 2 to 3 hole mode and 2-hole punching in the 2 to 4 hole mode |
| [4] Actuator                     |  |
| [5] Slide link                   |  |
| [6] Punch encoder plate          |  |

**(1) 2 to 3 holes mode**

In the 2 to 3 punched hole mode, the groove of the switching cam of the 3-hole punching blade is shaped so that the rear side is concentric with the rotating axis and the front side is curved toward the rotating axis. For this reason, when the switching cam is rotated clockwise, the punching blade is driven downward and when the cam is rotated counterclockwise, the punching blade is not driven. The shape of the groove of the punching blade for 2 holes is contrary to it on the right and left sides. When the switching cam is rotated counterclockwise, the punching blade is driven.

**(2) 2 to 4 holes mode**

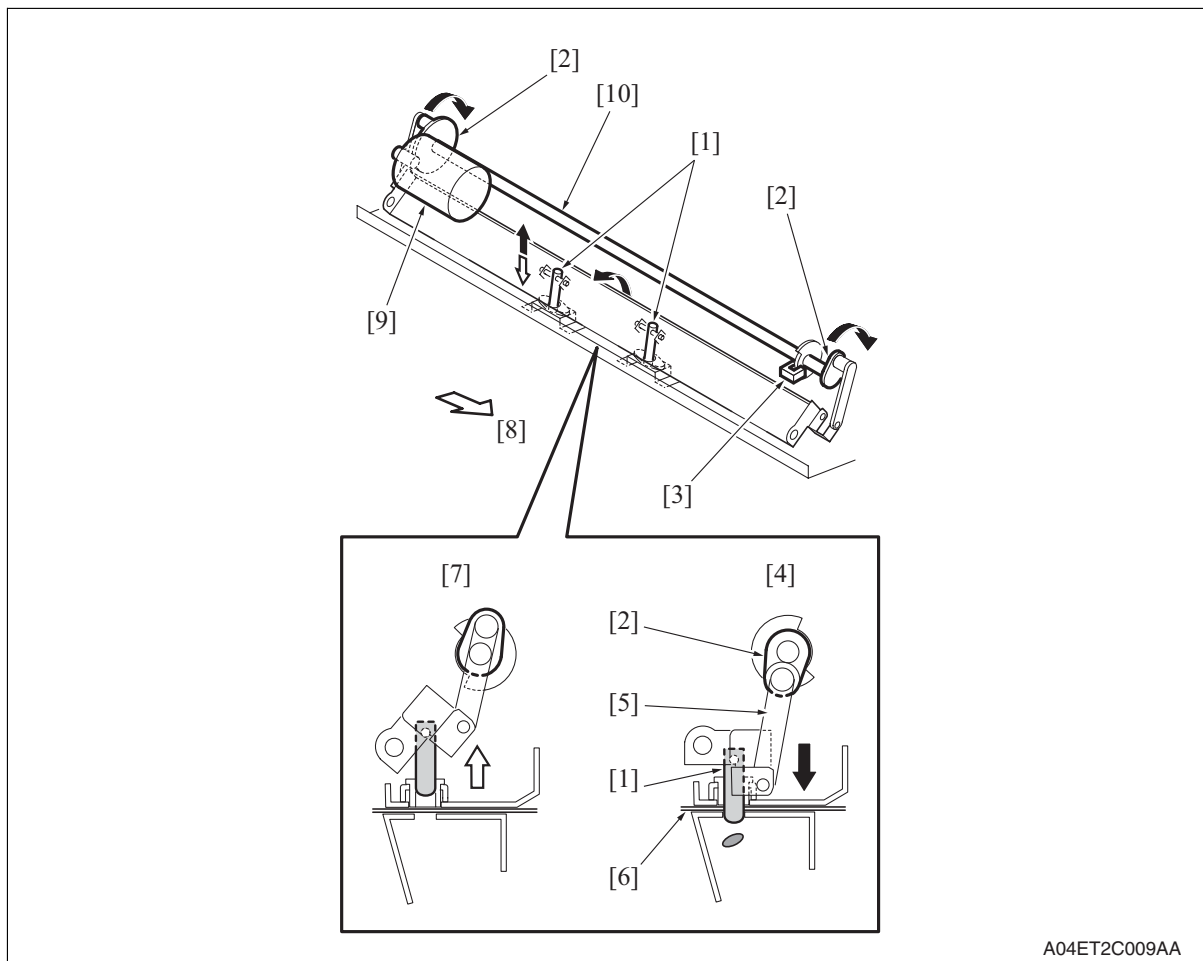
In the 2 to 4 holes mode, the 2 punching blades at both ends are driven only when the switching cam is rotated clockwise in the same way as in the 2 to 3 hole mode. As the 2 punching blades at the center should be driven in both cases of 2 or 4 hole punching, shape of the groove of the switching cam is symmetrical on the right and left sides and both the front and rear sides are curved in the rotating axis direction.

**C. Punch control (PK-513)**

Transmitting the start signal from the main body, the FNS conveyance motor rotates. In the punch mode, M1 stops temporarily a specified period of time after the FNS entrance sensor detects the trailing edge of the paper.

At the same time, the punch motor [9] drives the shaft [10] to rotate a full circle. The eccentric cams [2] rotate in sync with the shaft to move down the punch blade [1] to conduct the punch operation. The punch motor stops and the punch operation is completed when the punch home sensor [3] turns ON.

The punch motor rotates again to convey the paper a specified period of time after it stops temporarily.



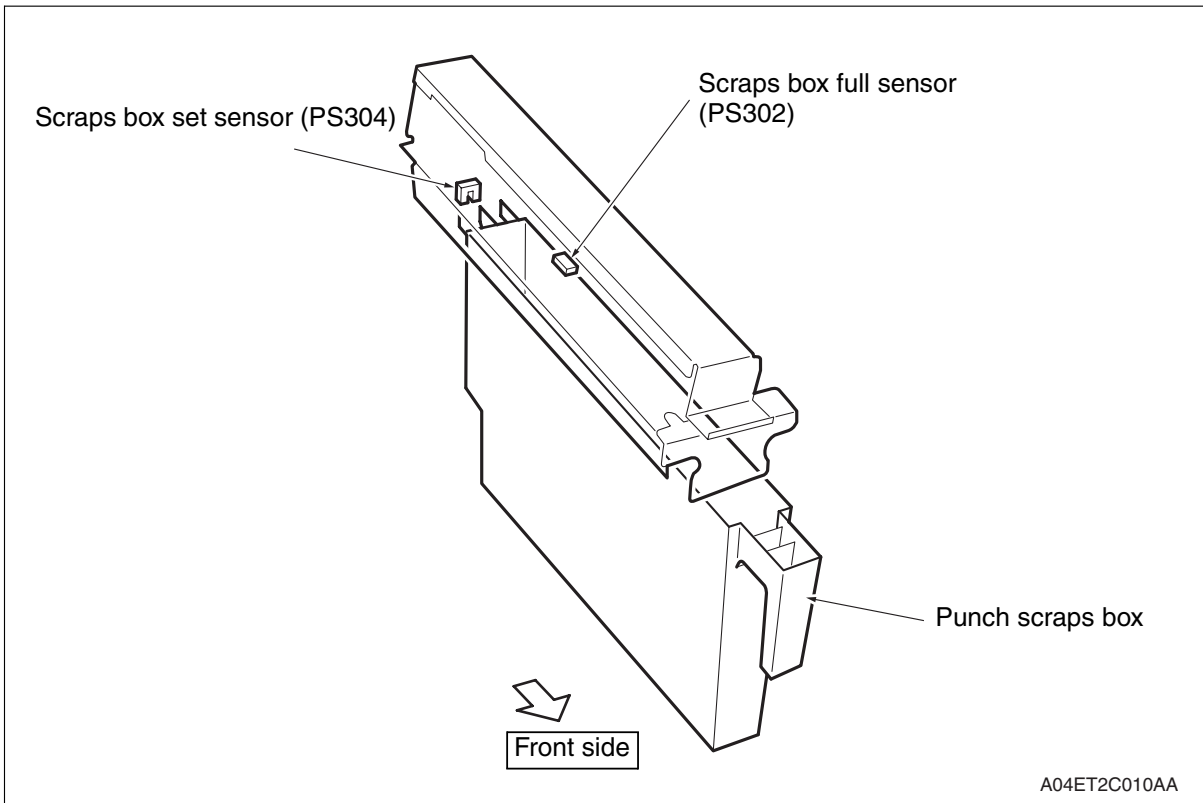
- |                                       |                                       |
|---------------------------------------|---------------------------------------|
| [1] Punch blade                       | [6] Paper                             |
| [2] Eccentric cam                     | [7] Punch blade at the upper position |
| [3] Punch home sensor (PS301)         | [8] Front side                        |
| [4] Punch blade at the lower position | [9] Punch motor (M301)                |
| [5] Drive arm                         | [10] Shaft                            |

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Composition/Operation

## 5. Punch scraps box section

### 5.1 Composition



### 5.2 Drive

- The punch scraps box section comprises no moving parts.

### 5.3 Operation

#### 5.3.1 Punch scraps box control

##### A. Punch scraps box full detection

The punch scraps generated by the punch operation falls in the punch scraps box [3]. The punch scraps box full sensor [1] turns ON and transmits the “no punch scraps box” information to the main body when the punch scraps box becomes full of punch scraps.

##### B. Punch scraps box detection

The punch scraps box set sensor detects whether the punch scraps box is set or not. The scraps box set sensor turns OFF and transmits the “no punch scraps box” information to the main body if the punch scraps box is not set.

