High Speed Kanji Printer

JITSURO HASEGAWA*

1. *Introduction*

Our research of I/O equipment for Japanese sentences which are composed of many kinds of characters including chinese characters has achieved the prototype of a series of totally electronic high-speed character display and printer.

We deal with the out-lines of the hardware and the design problems on our chinese character printer JEM-3800.

A character printer JEM-3800 has been installed at the JICST (Japan Information Center of Science and Technologie) where Information processing and printing for abstract journals of science and technologie, and other three are also in service. Fig. 1 is a picture of the printer.

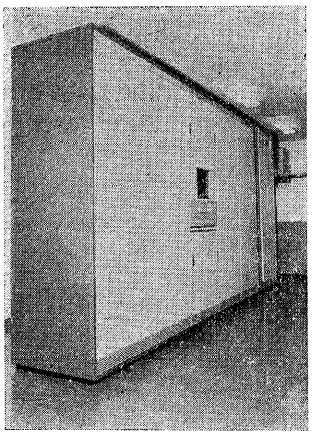

Fig. 1. External Appearance of JEM-3800.

2. *Features on the structure of the printer*

The composition of the system is shown in Fig. 2. It is capable of printing out instantaneously as on-line printer of electronic computer as well as off-line printer of magnetic tape or photo tape-readers.

Input informations as much as a whole line are stored in buffer memory at a time, and then, are changed into character video signals through character generator with the aid of flying spot. The video signals generate characters to

This paper first appeared in Japanese in Joho-Shori (the Journal of the Information Processing Society of Japan), Vol. 10, No. 5 (1969), pp. 279–284.

* The Japan Electronic Mfg. Co., Ltd.

be printed on the CRT upon which recording medium is exposed.

This system is characteristic of adopting beam control method such as flying spot on character generator and CRT display on printing, which can generate characters easily and rapidly.

Other features are as follows:

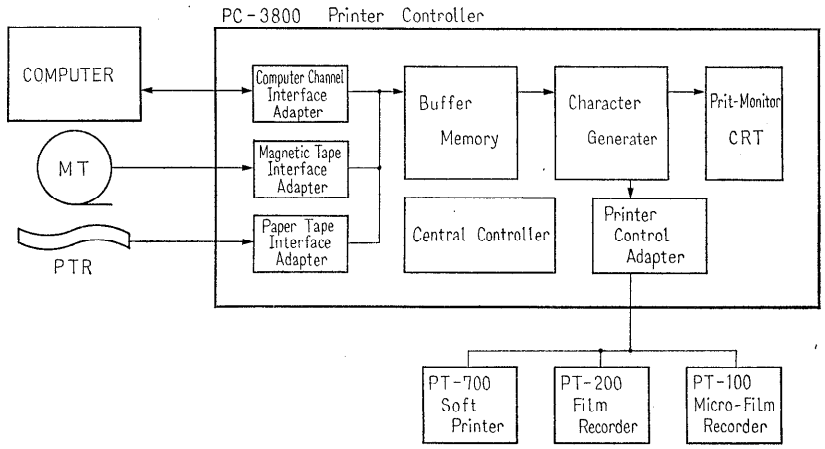

Fig. 2. Block Diagram of JEM-3800 Printer System.

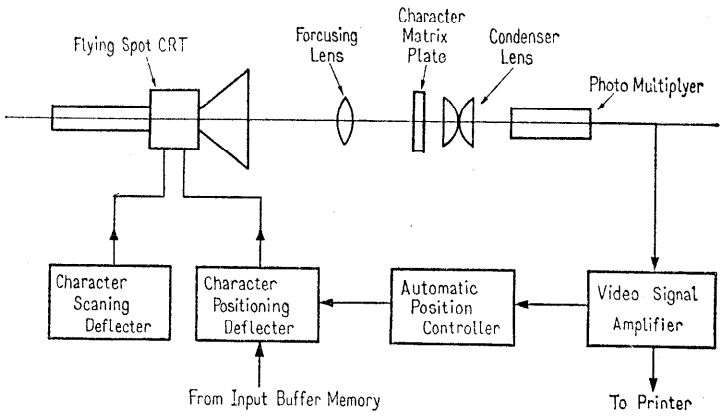

Fig. 3. Principle of Flying Spot Character Generator.

1) 2688 characters are standard with the easy unitary increase of 400 to 600 characters.

2) Printing speed is so high as 200 to 600 characters/sec for the chinese, and 400 to 1,200 characters/sec for the alphabetic at the speed of 5 to 10 lines/sec.

3) Beam control of CG can generate characters of 4 to 24 point.

4) Alpha-chinese typesetting is possible, as well as subindex such as X^2, H_2O.

5) Composed print as characters with signs, or characters and characters is

possible which can make specific characters.

Ex. $\bar{A}$, $\ddot{a}$, ⒤, $\sqrt{A^2+B^2}$

3. *Character generator*

Fig. 3 represents the principle of CG employed in our flying spot system. The characters to be printed are stored in a sheet of matrix board of which size is about 800×800 mm. The character is as large as about 2 mm.

The access time of a character throgh the flying spot CRT is so rapid as in several microseconds, and fineness of the printed characters depends on the largeness of the scanning beam.

Two or more flying spots working in parallel can 'generate 2,688 kinds of standard characters at a time.

In the flying spot CG, the storage of character patterns is analogic and in natural form, and recording on films with higher density and easier handling can be possible comparing with other systems. Therefore, this system is adopted for generating various point-size of many characters at high speed with high quality. In general, linear arrangement of characters printed by flying spot system is not so good as that of digital system on account of the beam deflection which is analogic quantity. However, our system meets 3% precision by means of automatic control of the scanning beam positions with reference to the character-position signal.

4. *Printing performances*

4.1. *Variety of characters*

About 2,500 characters are enough to handle informations in most newspaper offices in Japan, while prints including names of persons or places require 5,000 to 6,000 characters as a font.

Our printer TEM-3800 meets the large capacity of characters up to 8,000 by means of parallel operation of the flying spot.

4.2. *Quality of printing*

Quality of printed characters generally depends upon density, resolution

Table 1. Target Value of Printed Quality.

	Density	Resolution	Linearity
Moritor Print	>1.8, ±0.2	>8 line/mm	<0.2 mm
Light Print	>2.0, ±0.2	>15 line/mm	<0.15 mm
Commercial Print	>2.0, ±0.1	>20 line/mm	<0.1 mm

(lines/mm), linear arrangement etc. and Table 1 represents the requirements. As for chinese characters, since the width of the finest line is about 1/50 of a type, the resolution of CG should be better than that.

On our system JEM-3800, total resolution, depending on the CG and the

printing CRT, can be settled by the required CG resolution which is obtainable of adjusting number of characters generated in a line on the CRT, as long as the resolution of the CRT is invariable.

The printing CRT, on the other hand, as will be discussed further, is high resolution CRT with 130 mm in diameter and about 30 lines/mm which is made in the U. S. For example, a chinese character of 12 point can be scanned with 100 scanning lines.

5. *Recording equipment*

As shown in a block diagram of Fig. 2, we have three types of output recording equipments tailored to the printer JEM-3800, that is, PT-100 for 16 mm microfilm printing, PT-700 for monitor print of proof-recording, and PT-200 for blockcopy printing.

5.1. *Film recorder PT-200*

Film recorder PT-200 is designed for block-copy printing, where a line of informations is displayed on the high-resolution CRT and printed on a film or a printing paper through the lens.

The images on the printing flat-face CRT of 130 mm in diameter with 30 lines/mm resolution as described before, is magnified by 1, 3 time through the lens and is printed. The film or the printing paper is a roll of 100 m long of which width is 70, 105 and 150 mm, and the successive processes of fixing and developing are done externally.

5.2. *Soft printer PT-700*

The soft-printer PT-700 designed for monitor printer of proof-reading uses fibre-plate CRT for printing CRT, and a printing paper, attached on the fibre-plate and exposed, is processed for developing and fixing, and then, the output goes out on it.

The stabilization-processed printing paper is used in PF-700, of which fibre-plate is 210 mm×6 mm. The paper is rolled in 100 meters long whose width is equal to B4, A4, and B5.

Of the soft-printer, the printing paper is attached tightly on the fibre-plate CRT, which results in photo-sensitivity as high as 20 times of expose-through-lens system PT-200. Therefore, the less sensitive paper can be used.

6. *Software*

Since our printers JEM-3800 are one-line-printing system as described, software system is same as line-printers in electronic computers, with the exception that 16 bits (2 bytes) represent a chinese character which is different from code system of alphabet. 64,000 characters can be represented by this code system.

Our printer JEM-3800 allows to edit Japanese sentences and foreign language sentences together, both of which require editing software of typesetting.

The software can process composition, graph, picture, and illustration for page-edit, and vertical and horizontal edits, variation of height of a chinese characters, justification in European characters, supression of head and tail in Japanese sentence, hyphenation in European sentence, and even phonetical sign addition which is of Japanese's own.

7. *Conclution*

We outlined our high-speed chinese character printers we have developed, which allow to edit and publish not only in Japanese but also in any foreign language with rapid computer-processing.

Our further studies are being continued on,

——low expense of printing paper as in mechanical printer, because the expense of print for proof-reading is not little in our electro-optical printer.

——multiple hard-copying system, i.e., many sheet of the copied at a time.