

April 14, 1964

F. V. THIEMANN
HIGH SPEED PRINTER DRUM

3,128,693

Filed June 9, 1961

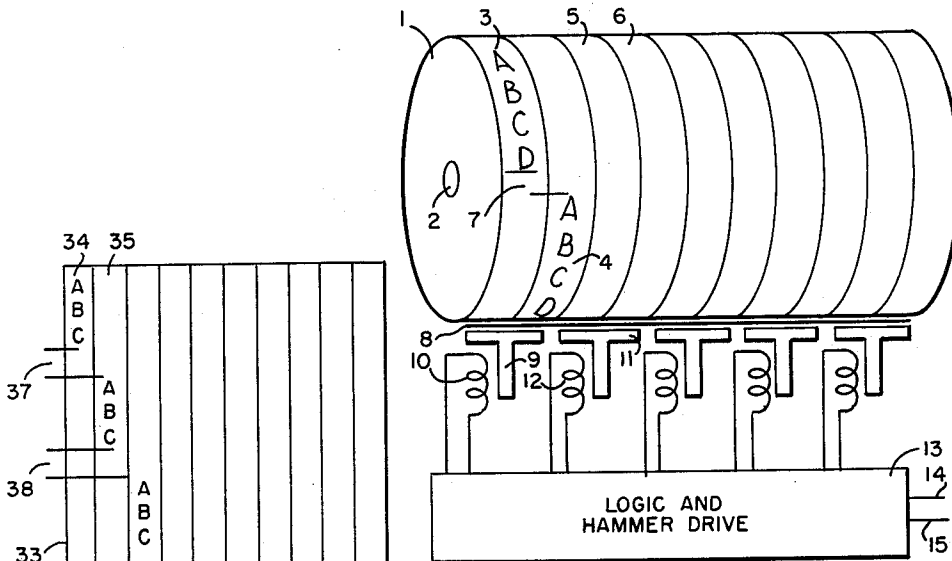


FIG. 1

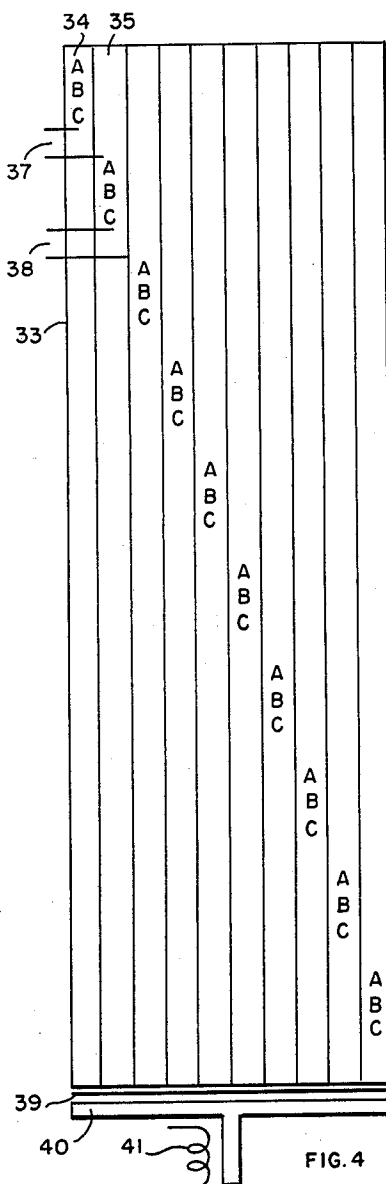


FIG. 4

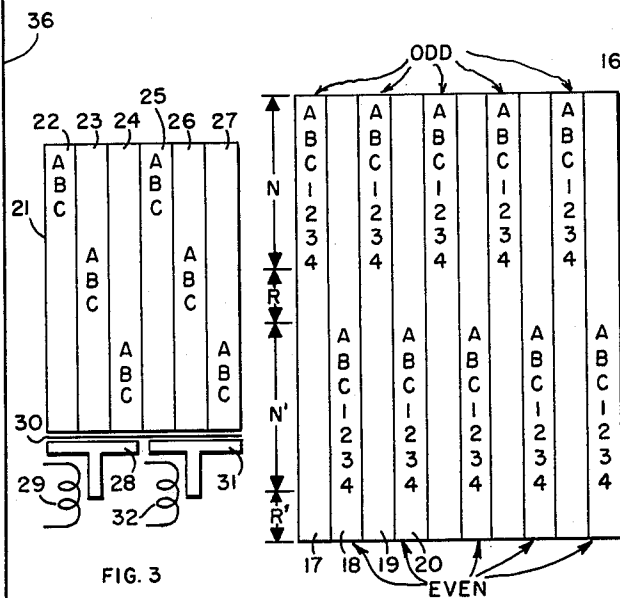


FIG. 3

FIG. 2

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3,128,693

HIGH SPEED PRINTER DRUM

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Filed June 9, 1961, Ser. No. 115,956
4 Claims. (Cl. 101-93)

The present invention concerns high speed printer drums and, in particular, drums which are used with column spanning hammers.

In the high speed printer field one useful printer utilizes a drum carrying a plurality of columns of type faces around its periphery. Each column passes substantially completely around the drum and includes one of each of all the characters to be printed and in a predetermined order. The characters might, for example, include the alphabet from A to Z, numerals from 0 to 9 and a number of signs and symbols all adding up to 64 different designations. A drum will carry as many of these columns as there are columns to be printed. The drum is rotated continuously at constant speed so that the characters pass repeatedly and in order past a so-called printing line where a row of printing hammers is located. The paper to be printed on is moved step-wise a line width at a time past the hammers and between them and the type faces on the drum. This may be pressure sensitive paper which is printed out merely by the hammer pressing the paper against the type face. The timing of the hammers is controlled by timing and firing circuits which sense matches between character designating information received by the system and the instantaneous character positions for each hammer and column.

One of the problems with the system described above is due to the fact that a separate hammer is required for each column on the type drum. A considerable savings in cost and operating power can be provided if each hammer can be made to serve two or more columns of characters on the drum. If the characters are staggered on the drum, as shown in the application for Letters Patent of Carl I. Wasserman entitled "High Speed Printer with Column Spanning Hammers," filed on Nov. 22, 1960 and bearing Serial No. 71,640 this saving in cost and power can be realized. However, the character pattern shown in the above designated application requires a substantial reduction in printing speed for a given peripheral velocity of the type drum.

It has been found according to the present invention that if the characters on the drum are grouped, the printing speed may be increased by a factor which may approach two to one for the same drum peripheral speed. According to the present invention, the characters comprising a complete complement of characters to be printed are arranged contiguously in one column, a space at least equal to the hammer recovery time is left blank and another complete complement of characters is provided contiguously in the adjacent column. In a system where each hammer spans two columns, these alternate columns are repeated along the length of the drum until the total required number of columns is provided. With the first described stagger system, the drum must be made to rotate twice for each printing line whereas for the system of the present invention, one revolution of the drum per line printed is sufficient. An extension of the present invention provides for hammers spanning columns in groups of three or more up to a single hammer which spans the entire drum with columns repeated accordingly. Thus, a ten column drum utilizing a single hammer would have ten off-set repeated sequences of characters.

Accordingly one object of the present invention is to provide an improved character pattern on a type drum for a high speed printer.

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Another object is to provide a type character pattern on a high speed printer drum for use with column spanning hammers which provides for the highest possible line printing rate for a given drum peripheral speed.

Still another object is to provide an optimum character distribution on a high speed printer drum for use with hammers spanning two, three or more columns.

A still further object is to provide a high speed printer drum character pattern which permits one hammer to print all columns on a drum.

These and other objects will be apparent from the detailed description of the invention given below in connection with the various figures of the drawing.

In the drawing:

FIGURE 1 is a diagrammatic representation of the preferred form of the present invention.

FIGURE 2 is a development of a typical drum surface showing character patterns in accordance with the present invention.

FIGURE 3 is a diagrammatic representation of a modified character drum in accordance with the present invention.

FIGURE 4 is a diagrammatic representation of a further modified character drum in accordance with the present invention.

FIG. 1 shows a high speed printer drum 1 carried on shaft 2 and rotated by suitable means not shown. The surface of the drum carries a plurality of columns of printing characters, usually raised type faces, in pairs 3-4, 5-6, etc. along the length of the drum. Each column consists in a contiguous group containing a plurality of characters as column 3 and following a space interval 7 a second similar group of contiguous characters 4. The two columns comprising a pair are blank adjacent to the characters in the complementary column. Columns 3 and 4 are printed out by hammer 9 spanning both columns and printing is accomplished by firing the hammer by means of a suitable magnetic coil 10 energized from a hammer drive power source 13 to print on paper or other suitable medium 8. The logic circuits contained in the logic and hammer drive unit 13 receive information to be printed over input wires 14 and 15 and actuate hammers 9 through coil 10, 11 through coil 12, etc. Details of suitable logic and hammer drive circuits are set forth in detail in the above referred to application.

FIG. 2 shows a surface development of a drum of the type shown in FIG. 1 wherein the type faces are provided in contiguous groups of characters arranged in complementary pairs of columns. Columns 17 and 18 provide one pair, 19 and 20 another pair and so on along the length of the drum 16. With two complementary columns, one may be designated as the "even" column and the other the "odd" column in each pair. If the complement of contiguous type faces occupies a peripheral distance N the complement in the adjacent column occupies the same distance N' and a separation from first to second of R is provided and an equal space from second back to first of R'. The distance R is chosen to be at least as great in terms of peripheral travel time as the time required for a printing hammer to recover and be actuated to print again. Thus the "4" in the first column may be printed and the "A" in the second column during a single revolution of the drum. (The prior type drums were required to make two revolutions to print out two columns of type.) While FIG. 2 may be taken to represent a complete drum surface or it may be taken to represent one-half, one-third, one-quarter, etc. of a complete drum with the complements of characters alternately repeated two, three, four, etc. times.

FIG. 3 shows what may be taken as one side of a drum or a complete drum surface developed as 21 including triple repeated columns 22-23-24 and 25-26-27. Each

column of a group of three carries a contiguous character complement and complements are spaced to allow for hammer recovery time. Each group of three columns is printed out on a sheet 30 by a common hammer as 28 actuated by coil 29 or 31 actuated by coil 32. This concept may be extended to one hammer for four columns, one hammer for five columns, etc.

FIG. 4 shows what may be taken as one side of a drum or a complete drum surface development 33 carrying N columns of repeated character complements 34, 35 etc. each complement separated by an equal hammer recovery time space 37, 38, etc. and to be printed out on a sheet 39 by a single hammer 40 actuated by coil 41.

Thus several arrangements have been shown and described for arrangements of type on a high speed printer drum which provide for faster printing at a given drum speed. Whereas prior drums required two revolutions or more to complete a printed line, the present drum configurations provide a line of printing at every drum revolution. Further modifications will be apparent to those skilled in the art within the spirit and scope of the invention as set forth, in particular, in the appended claims.

What is claimed is:

1. In a high speed printer, a type carrier assembly including:
 - a movable type carrier adapted to support a plurality of printing type arranged in rows in the direction of movement,
 - a plurality of printing hammers supported in positions to strike the printing type,
 - each of the printing hammers including a head portion arranged to span at least two rows of the printing type,
 - circuit means to actuate the printing hammers in accordance with a predetermined logic,
 - the two rows spanned by a head portion comprising:
 - a first plurality of printing type positioned in one row,
 - a second plurality of printing type positioned in the other of the two rows, and
 - one printing type in the first plurality being displaced relative to the corresponding printing type in the second plurality by a distance at least equal to the length of one plurality of printing type,
 - so that the head portion of the printing hammer can strike all of the printing type in the first plurality before striking the printing type in the second plurality.
2. In a high speed printer, a type carrier assembly including:
 - a moveable carrier means adapted to support a plurality of printing type arranged in rows extending in the direction of movement of the carrier means,
 - a plurality of printing hammers supported in positions to strike the printing type,
 - each of the printing hammers including a head portion arranged to span at least two rows of the printing type,
 - a circuit means to actuate the printing hammers in accordance with a predetermined logic,
 - the two rows spanned by a head portion comprising:
 - all the printing type in one of the two rows being arranged sequentially in a linear group with a space after the end of the group at least equal to the length of the group,

all the printing type in the other of the two rows being arranged sequentially in a linear group similar to the arrangement in the one of the two rows, and the two groups of printing type being displaced in the direction of movement of the carrier means so that the second mentioned group is positioned adjacent the space after the first mentioned group, so that the head portion of the printing hammer can strike each printing type in the first-mentioned group before striking any printing type in the second mentioned group.

3. In a high speed printer, a type carrier assembly including:

- a movable carrier means adapted to support a plurality of printing type arranged in rows extending in the direction of movement of the carrier means,
- a plurality of printing hammers supported in positions to strike the printing type,
- each of the printing hammers including a head portion arranged to span at least three rows of the printing type,

circuit means to actuate the printing hammers in accordance with a predetermined logic,

the three rows spanned by a head portion comprising:

- all the printing type in each respective row being arranged sequentially in a linear group with a space after each group at least equal to twice the length of the group, and
- each group being displaced relative to the other groups in the direction of movement of the carrier means, so that the head portion of the printing hammer can strike the printing type in only one group during any one stroke.

4. In a high speed printer, a type carrier assembly including:

- a movable carrier means adapted to support a plurality of printing type arranged sequentially in rows extending in the direction of movement of the carrier means,

- a single printing hammer supported in a position to strike the printing type,

- the printing hammer including a head portion arranged to span all of the rows of printing type,

- circuit means to actuate the printing hammer in accordance with a predetermined logic,

the rows spanned by the head portion comprising:

- printing type in each respective row being arranged sequentially in a linear group with a space after each group at least equal in length to the sum of the lengths of corresponding groups in the other rows,

- so that the head portion can strike each printing type in any one group before striking the printing type in another group.

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