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PRINTER HAVING TYPE DISK ROTATABLE IN A PLANE PARALLEL TO THE PRINTING LINE

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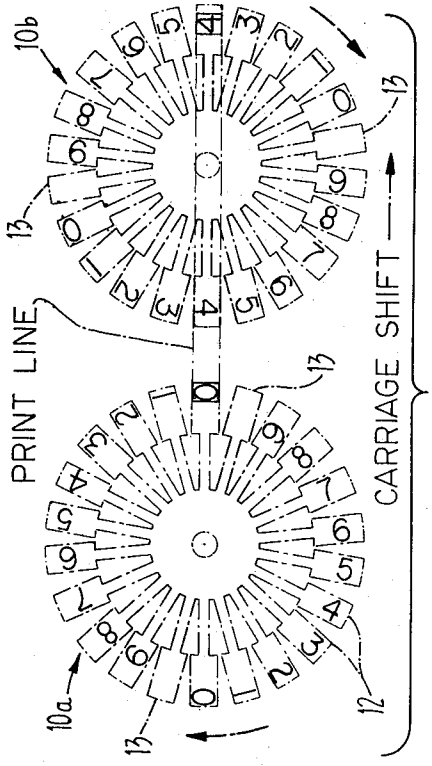

FIG. 3

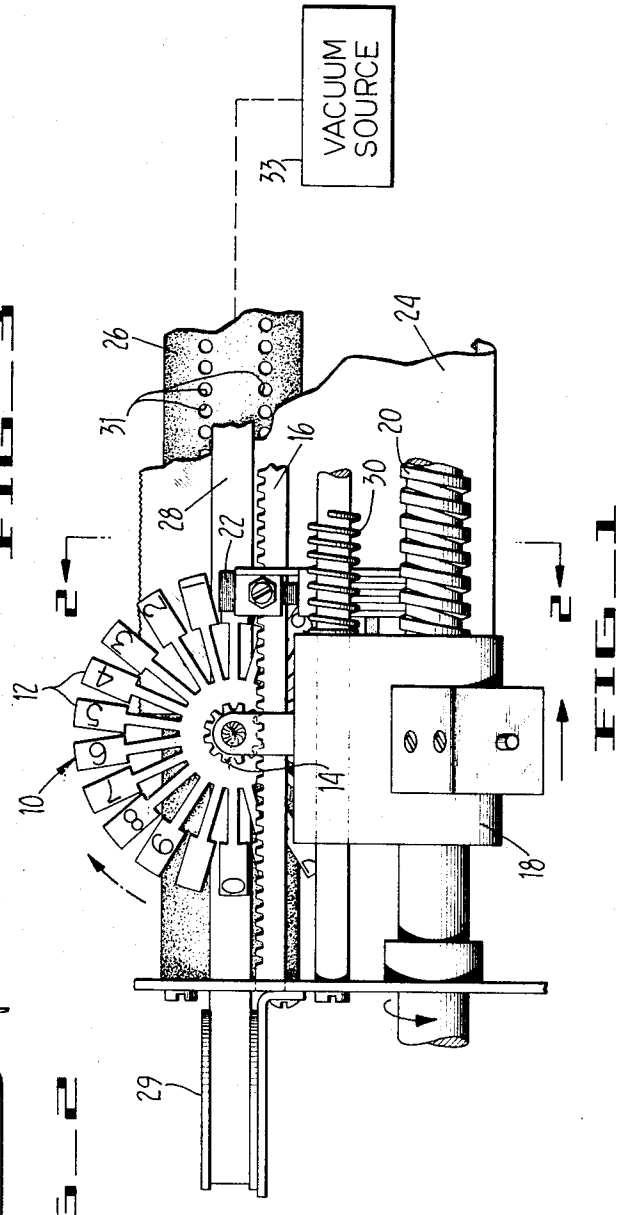

FIG. 1

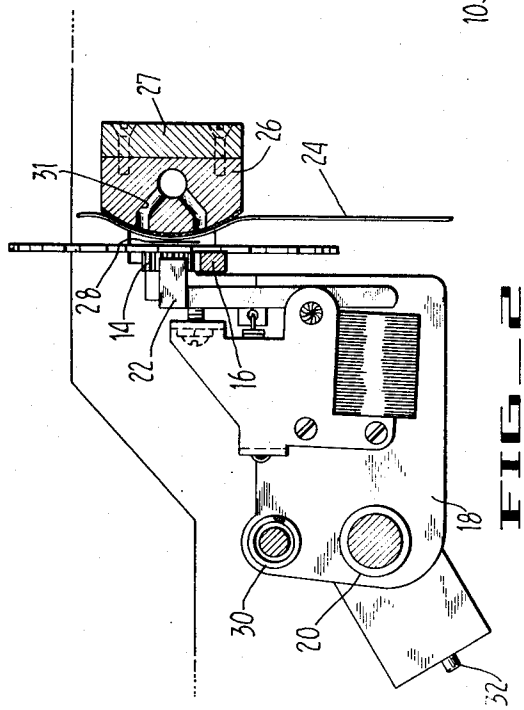

FIG. 2

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PRINTER HAVING TYPE DISK ROTATABLE IN A PLANE PARALLEL TO THE PRINTING LINE

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ABSTRACT OF THE DISCLOSURE

A high-speed printer utilizing a continuously rotating type wheel having at least one group of type characters on its face. Preferably, a plurality of similar groups of type characters are provided. Each group is arranged spirally relative to the center of the wheel and each type character is preferably supported on the face of a corresponding spoke or radial extension. During the continuous rotation of the type wheel, the wheel is moved continuously in a plane parallel to the path of line printing. With each predetermined angular rotation of the wheel, a desired character of a group may be printed in a columnar print position of the printing line due to the spiral arrangement of the type characters.

This invention relates to high-speed printers capable of printing information received from data handling apparatus, such as computers or calculators by way of example.

With the advent of computer technology and advances in the art of data processing, requirements for increased speed of handling information have become more stringent. One known type of rapid readout with permanent recordation incorporates a high-speed printer that employs a character type wheel bearing the characters to be printed at the outer periphery of respective spokes forming the wheel. In such prior art apparatus, the character wheel is advanced intermittently from one print position to the next, while it rotates continuously. However, such stop and start operation tends to reduce the speed of the system, and also causes undue wear and tear on the mechanical parts.

An object of the present invention is to provide a novel and improved "on-the-fly" high-speed printer, wherein the character supporting assembly is rotated continuously while being transported continually along the path of line printing, without interruption during each cycle of line printing.

According to this invention, a high-speed printer comprises a rotary means having type faces representing characters to be printed, the type faces being disposed in at least one group defining a spiral path. The rotary type means, which may be a wheel with separate spokes supporting type symbols or characters, is continuously rotated and is urged along the path or line of print conjointly with a striking hammer to effectuate printing on a record medium or paper. The type wheel traverses the print line in a continuous and noninterrupted motion, precluding those problems that arise from intermittent operation such as found in prior art devices.

The spiral arrangement of the characters or symbols compensates for lateral displacement of the rotating type faces resulting from the continuous linear motion of the type wheel along the path of the line of printing. As a result of such compensation, each character of the group appears at substantially the same spot for each particular print position.

In a particular embodiment, each half or semicircular portion of the type wheel carries a separate group of spirally disposed characters from which one character

may be selected for printing while the wheel is on-the-fly. The groups are identical and like characters are substantially diametrically opposed.

The invention will be described in greater detail with reference to the drawing in which:

FIG. 1 is a front elevational view, partly broken away, of the printer apparatus of this invention;

FIG. 2 is a side elevational view of the novel printer, taken along a plane indicated by the line 2—2 of FIG. 1; and

FIG. 3 depicts the novel character wheel in two different printing positions along the same print line.

Similar numerals refer to similar elements throughout the drawing.

With reference to the figures of the drawing, an embodiment of a high-speed printer, in accordance with this invention, comprises a type wheel **10** formed with resilient, flexible spokes **12**, each spoke supporting a character or symbol near the periphery of the wheel. In this particular embodiment, two identical groups of characters are disposed in diametric relation, each group occupying a semicircular portion of the wheel **10**. At the end of each group of characters there is one spoke **13** that is blank to provide a gap hiatus (see FIG. 3), whereby a suitable interval is provided for retraction and resetting of a print hammer **22** used in the printing operation.

To achieve rotary motion, the type wheel **10** is driven by a pinion gear **14** that is actuated by a rack **16** in a well-known manner, the axis of the gear and type wheel being at a right angle to the printing line. It should be understood that the gear configuration and gear ratios depicted herein are merely illustrative, and should not be interpreted as exclusionary. The characters, shown as numerals in the wheel **10**, rotate clockwise in the illustrated embodiment, and are disposed so as to form a spiral configuration for each character group, each group spiral characterized by a decreasing radius of curvature in the direction of rotation of the wheel.

The wheel **10** is coupled to a carriage **18** that is transported linearly along a rotatable drive screw or threaded shaft **20**, which is fixed with its axis substantially parallel to the proposed paths of line printing. Also mounted to the carriage **18** is the print hammer assembly **22** utilized for striking a selected character at each print position, whereby printing on a record medium or paper **24** is effectuated. The paper **24** is located between a fixed platen **26** and an ink ribbon **28** which is fed from a supply spool **29**. Self-inked papers or the like may be used to eliminate the need for the ribbon.

The platen **26**, which is secured to a rigid frame **27**, has two axial rows of apertures **31** that provide suction for firm adherence of the paper **24** to the platen. Pressure supply or a vacuum source **33** maintains the necessary suction during the print cycle. During the interval between each line of printing, the suction is removed by valve means, for example, to allow facile advance of the paper to the next line position.

A return spring **30** is provided to urge the carriage **18** back to Home or start position at the end of each cycle of line printing. A detent pin **32** is provided for coupling the carriage **18** to the drive screw **20** during print operation, and for decoupling the carriage to allow spring retraction between print cycles, as disclosed in copending application Ser. No. 528,501, filed Feb. 18, 1966, in behalf of Leland Chamness et al., and assigned to the same assignee. The source of power drive for the carriage and type wheel, as well as other conventional parts commonly used in printer apparatus, are not shown for the purposes of convenience and clarity.

In operation, the carriage **18** is moved with the rotating wheel **10** and print hammer **22** in a longitudinal path defining the direction of serial printing of the line char-

acters. As depicted in FIG. 3, at a first position of a given print line, the wheel **10***a* is in position for printing the "0" numeral. Any numeral in the semicircular group "0" to "9" will appear in substantially the same print position or spot, delineated by the rectangle encompassing the "0." Similarly, at a second print position further along the print line, the wheel **10***b* is represented with the numeral "4" in position for selection for imprinting. The print hammer **22** is made sufficiently wide, preferably two column widths, so as to be capable of printing at a selected column, regardless of where the selected character appears.

Each character of a group is positioned at successively shorter distances from the center of curvature of the spiral defined by the characters. The difference in such distance between adjacent characters is substantially equal to the amount of linear displacement of the carriage and print wheel along the print line, which occurs during the interval that the wheel is rotated from one numeral to the next in the same group. Also, when the last numeral "9" in a group has passed print position, the succeeding "0" of the next group which is positioned a predetermined distance further from the center of curvature than the preceding "9," traverses the next print position. It is evident that the difference in length between the radius of curvature of the "9" character and that of the "0" character of the succeeding group substantially represents the distance between adjacent print positions. The angular velocity of the print wheel **10** is such that for every 180° of rotation of the wheel **10**, the carriage is translated axially from one print position to the next; and thus, for each complete revolution of the print wheel, the carriage and print wheel traverses two print positions.

It should be noted that with two separate groups of numerals, selection of a numeral for printing will be made alternately from each group. That is, each alternate print position is accommodated by one group of numerals, while the second group provides the other interspaced print positions with a selected numeral to be printed. Thus, if N groups of numerals are used, each group would provide a character for every Nth print position.

Selection of a character for printing may be accomplished by any one of several known means, such as by an optical system employing a radiation source and photosensing means cooperating with a timing disk having a reference aperture and a series of holes, each hole corresponding to a different character position. Input data received from a keyboard, punched tape, or recorded magnetic tape, for example, serves to actuate the print hammer when a selected character is in print position.

By employing a plurality of character groups, the hammer is allowed ample time to strike a selected spoke of one character group at one print position. As described heretofore, a blank spoke or space is provided at the end of each character group to allow recovery time for the hammer. Thus, while the type wheel advances to the next character group, the hammer is able to retract and recover to ready position, so that it can be triggered to strike a character from the succeeding group at the next print position.

It should be understood that various modifications and alternatives of the embodiment described above are possible within the scope of this invention. For example, a plurality of wheels of different diameters may be employed with associated hammers for the simultaneous printing of a plurality of characters along a line, or in some other predetermined configuration. Also, the arrangement of the paper and ribbon relative to the type wheel and hammer may be changed, and the drive system may be modified accordingly.

What is claimed is:

1. A high-speed printer apparatus comprising:
a rotary wheel supporting a plurality of type characters on one side surface, said characters being disposed in a spiral curve receding toward the axis of said wheel;
means for rotating said wheel continuously during each cycle of line printing and in a plane parallel to the printing line;
a print hammer for striking selected characters to print a line during each of such print cycles; and
means for transporting said wheel and said hammer relative to a record medium, continuously and without interrupted travel along a predetermined line of printing.

2. A high-speed printer apparatus as in claim **1** wherein said type characters are disposed in a plurality of separate groups on said wheel, each group of characters defining a separate spiral path toward the axis of said wheel.

3. A high-speed printer apparatus as in claim **2** wherein said separate groups are substantially identical.

4. A high-speed printer apparatus as in claim **2** wherein such plurality comprises two groups, each group positioned within a semicircular portion of a side surface of said wheel.

5. A high-speed printer apparatus as in claim **4** wherein the two groups consist of like characters, similar characters of each group being substantially dimetrically opposed.

6. A high-speed printer apparatus as in claim **1** including power means for returning said hammer and wheel to home position at the end of each cycle of line printing, and means for disabling said transporting means and enabling said power means.

7. A high-speed printer apparatus as in claim **2** wherein said wheel comprises a multiplicity of separate spokes, each said spoke supporting a type character and the characters being disposed spirally on the respective spokes receding from the periphery of the wheel.

8. A high-speed printer apparatus as in claim **7** wherein said spokes are grouped in different portions of the wheel, and the characters of each group define a spiral having a decreasing radius of curvature.

9. A high-speed printer apparatus as in claim **8** wherein the difference in length of the radius of curvature of the last character of a group, and that of the first character of the succeeding group is substantially equivalent to the distance between adjacent print positions in a printing line.

References Cited

UNITED STATES PATENTS

438,430	10/1890	Clerk	197—53
1,189,449	7/1916	Highley	197—54
2,060,082	11/1936	Johnson et al.	101—382 X
2,236,663	4/1941	Adams	197—53
2,484,671	10/1949	Bauman	101
2,590,044	3/1952	Schaller	101—382 X
2,831,424	4/1958	MacDonald	197—1 X
2,843,243	7/1958	Masterson	101—93 X
2,926,602	3/1960	MacDonald et al.	101—93
3,023,731	3/1962	Schwertz.	
3,128,693	4/1964	Thiemann	101—93
3,151,547	10/1964	Hornmaner et al.	197—49 X
3,220,343	11/1965	Wasserman	101—93
3,247,788	4/1966	Wilkins et al.	101—93

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