United States Patent [19]

Rowe

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[45] **Oct. 23, 1973**

[54] **MANUALLY POSITIONABLE AUTOMATIC PRINTER**

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[73] Assignee: **International Business Machines Corporation,** Armonk, N.Y.

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[21] Appl. No.: **159,309**

[52] **U.S. Cl.** ..... **197/1 R,** 101/93 C

[51] **Int. Cl.** **B41j 3/02**

[58] **Field of Search** ..... 197/2, 1; 101/99, 101/93 C

[56] **References Cited**

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Primary Examiner—Edgar S. Burr

Attorney—Earl C. Hancock et al.

[57] **ABSTRACT**

A printing mechanism is mounted within a hand positionable housing. Relative motion between the printing mechanism and the medium on which printing is to be performed is sensed. A control device responds to these movement indicating signals to generate command signals for appropriately actuating the printing mechanism.

4 Claims, 6 Drawing Figures

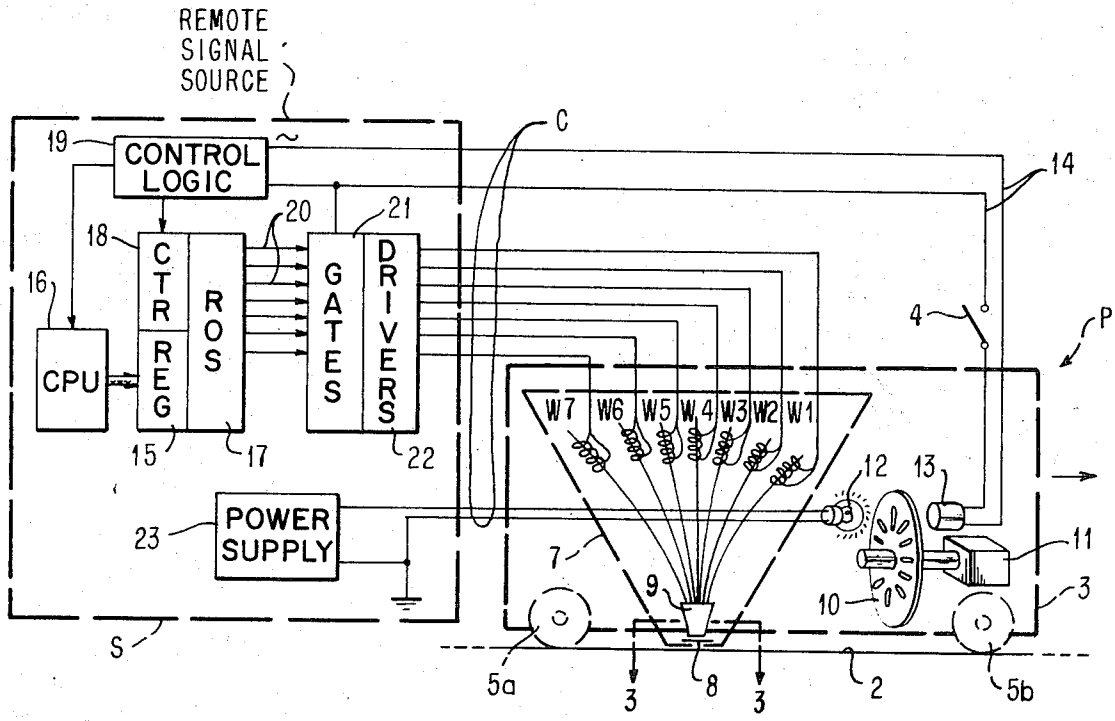
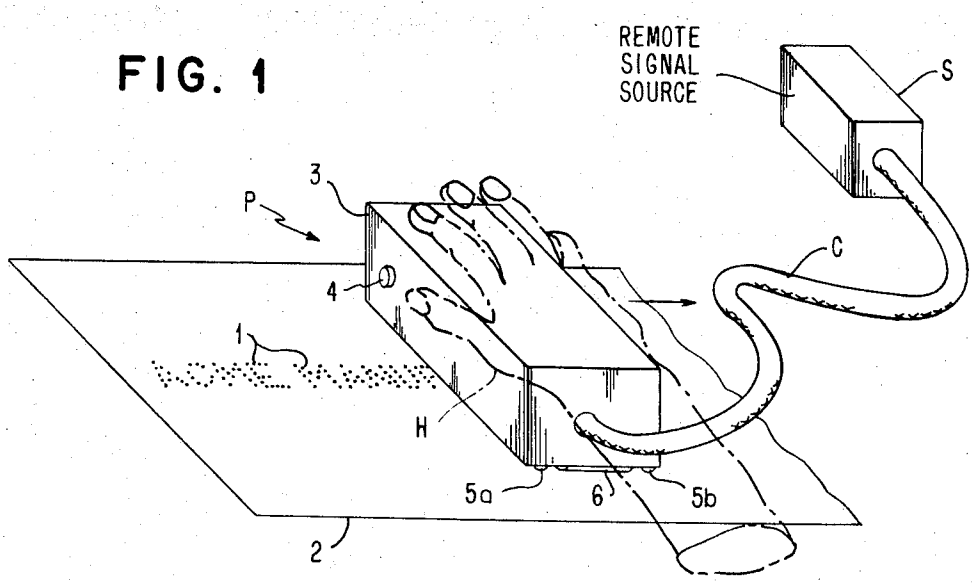


FIG. 1



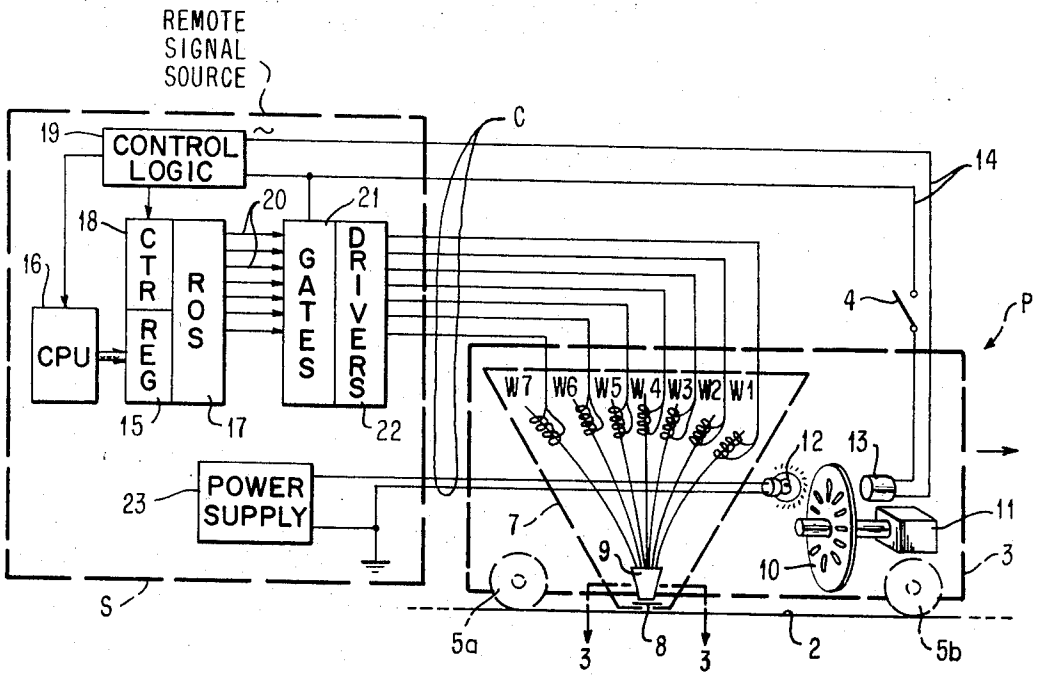


FIG. 2

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FIG. 2A

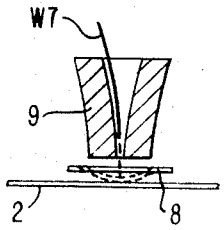


FIG. 3

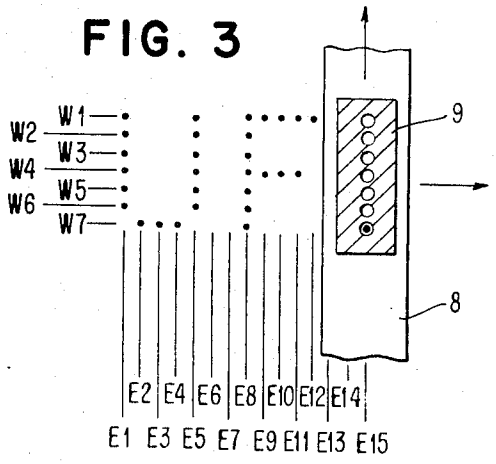


FIG. 4

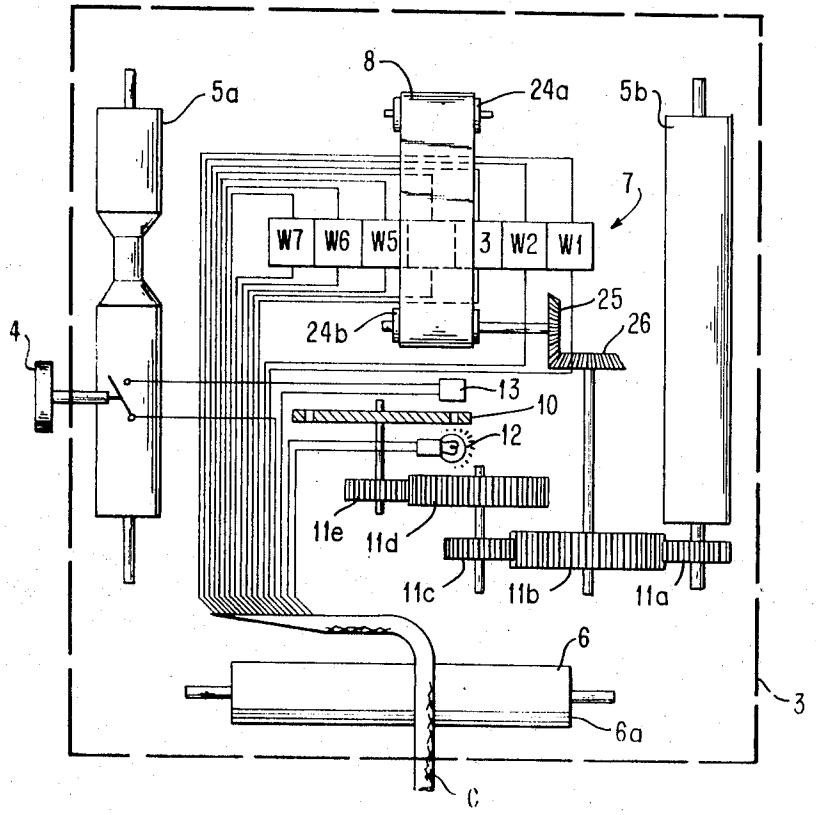
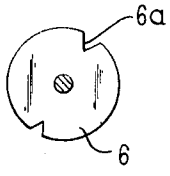


FIG. 4A



MANUALLY POSITIONABLE AUTOMATIC PRINTER

CROSS REFERENCE TO RELATED APPLICATION

Application Ser. No. 84,026 entitled "Printer Control with Monodirectional and Bidirectional Printing Compatibility" by J. H. McCarthy filed Oct. 26, 1970, now U.S. Pat. No. 3,708,050, and assigned to the same assignee as this application describes data processing equipment adaptable for use as a control device in conjunction with the present invention.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a hand positionable printer for printing upon a recording medium in response to print command signals from a remote signal source. More particularly, this invention relates to a manually positionable printer adaptable to provide a printout from a computer, data processing equipment or signal producing device wherein printing can be performed upon a wide variety of mediums. Wire matrix print mechanisms are particularly well suited for use as the printing element for printers in accordance with this invention.

2. Description of the Prior Art

Commonly available printers generate printing either by actuating an entire line of print elements at a time in the so-called line-printing operation or compose lines by serially printing one or some portion of a character at a time in a manner somewhat similar to the operation of a typewriter. The novel printer of the invention is particularly well suited for use as a serial wire matrix printer, but the scope of application of the invention is not so limited.

Serial printers are printers which have either a single print element or a lesser number of print elements than is necessary to print an entire line simultaneously. Typically, a suitable print element is moved a specified distance in a horizontal direction across the surface of a paper sheet or web of other recording medium and is actuated periodically to effect printing at a plurality of locations during its travel. Serial printers generally either print an entire character at a time for each actuation of a controllably movable print element or effect printing by composing a character through the selective actuation of a multiplicity of wires so that each character is formed by a composition of dots, bars, or the like.

Both line and serial printers presently require paper storage and transport mechanisms to store and feed paper through the printer and to accurately position the paper web relative to the path of the print element, defined by its print carriage. Furthermore, transport and carriage controls are in turn made necessary for determining margins and otherwise coordinating paper and print element movements.

As a result, present day printers are restricted as to format, size, and thickness of the paper or other medium upon which printing can take place under control of a data processor or other remote print signal source. For example, such prior art printers could not be used for printing information under processor control upon shipping cartons, mailing envelopes, manufactured articles, bank passbooks, inventory control cards, travel tickets or on the surface of other media which fail to conform to the rigid format requirements associated

with the paper feed and control mechanisms of the available printers. Moreover, such paper feed and control mechanisms in turn necessitate complex control circuitry and render such prior art printers both bulky and expensive.

Prior art hand printers have generally been manually controlled devices which are not adaptable for use for printout purposes with data processor type equipment. However, one hand-held marking device of the type used in supermarkets or the like is shown in U.S. Pat. No. 3,504,622 by Morrison wherein the marking wheels of the device are rotatably set under computer control before the device is applied to the surface of a medium. Although possibly well suited for its intended usage, such a device is too inflexible for many of the printing applications contemplated herein since, inter alia, the marking wheels do not print immediately on receiving signals from the computer nor can the device print a new selection of symbols while it remains in operative registration or contact with the surface of the medium. For instance, any attempt to use such a device with a five-wheel printing element for a serial printer ro print a 30-character line would involve six successive and repeated operating sequences of raising the device from the medium surface, resetting the wheels under computer control, and then manually realigning and applying the device to the medium surface. Such printing would be discontinuous and disadvantageously time-consuming thus rendering it unacceptable for data processing printout purposes.

SUMMARY OF THE INVENTION

The present invention recognizes that there are numerous applications where printing under processor control is desirable, but where web transport mechanisms and carriage controls are either unnecessary or even wholly incompatible with the recording medium upon which printing is desired. It is therefore a realization of the present invention that adequate positioning of a printing element relative to the surface of a recording medium of unrestricted format can be accomplished by hand.

The present invention seeks broadly and generally to provide a printer which can be hand-guided and manually positioned to print upon the surface of almost any desired medium, free of any paper handling mechanisms and their associated controls, in response to signals from a remote signal source.

It is an object of the invention to provide a hand-positionable serial printer capable of printing one or more lines of desirably spaced characters while in continuous operative contact with the medium surface during continuous relative motion between the printer and the medium surface.

A further object of the invention is to provide a hand-held printer which resists skew thereof relative to the surface of the recording medium during printing of a line of any desired length.

These and other objects can be attained by utilizing the present invention. In its broadest present comprehended scope, the present invention provides a hand positionable printer for printing symbols upon a surface of a recording medium employing a housing adapted for hand-positioning and relative movement thereof with respect to a surface of the medium, a printing means carried by that housing and actuable by print command signals from a remote signal source to imme-

diately print upon the medium surface while the printer is in proximity therewith, and control means carried by the housing for selectively enabling the signal source to transmit a print command signal upon manual displacement between the printer and medium surface.

According to a preferred aspect of the invention, the control means comprises sensing means for sensing the displacement of the printer relative to the surface of the medium, and emitter means responsive to the sensing means for generating enabling signals timed in synchronism with predetermined displacements of the printer over the surface of the medium, these enabling signals being transmitted to a remote signal source for enabling the signal source as aforesaid. Expediently, the sensing means may comprise a roller adapted to frictionally engage the surface of the medium, while the emitter means may comprise a rotatable disk having apertures therein with the disk being driven by the roller, a light source positioned to transmit light through each of the apertures sequentially during rotation of the disc, a photoelectric device positioned for exposure to light passing through the apertures as aforesaid and to transmit the enabling signals on exposure to the light.

According to a further aspect of the invention, the hand-held printer is provided with alignment means for preventing skew of the printer during hand-guiding movement thereof along a selected linear path over the surface of the medium. Where the sensing means comprises a frictional roller, such a roller may serve both for sensing displacement and as a suitable alignment means as well.

According to another aspect of the invention, the hand-held printer is provided with switch means for selectively preventing transmission of enabling signals to the remote signal source.

For a better understanding of these and other aspects of the present invention, as well as its operation and other advantages, objects and features, reference may be made to the following detailed description of preferred embodiments of the invention, taken in conjunction with the appended drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a simplified perspective view of the exterior of one embodiment of the invention;

FIG. 2 is an elevation, partly schematic, partly diagrammatic, and partly in section, of the interior of the embodiment of FIG. 1.

FIG. 2*a* is an enlarged view of a portion of FIG. 2, showing in greater detail the cooperation of one wire with the inking ribbon and recording medium.

FIG. 3 is an enlarged fragmentary plan view, partly in section, of a portion of the hand-held printer of FIG. 2 taken along section line III—III thereof;

FIG. 4 is a plan view, partly diagrammatic and partly in horizontal section, showing elements of the hand-positionable printer of FIG. 2 in somewhat greater structural detail;

FIG. 4*a* shows a vertical section of roller 6 in FIG. 4 taken along a line intermediate the ends of the roller.

Throughout the aforesaid figures of the drawings, like reference characters are employed to indicate similar elements.

DETAILED DESCRIPTION

In the embodiment of FIG. 1, a novel hand positionable printer, generally indicated at P, is shown in a typical operation of printing symbols 1 upon a surface of a recording medium 2 in accordance with print command signals transmitted from remote signal source S via flexible cable C to printing means described hereinafter carried by housing 3 of printer P. Printer P and its housing 3 are preferably of small size and weight to permit ease of manipulation by operator's hand H and are shown as adapted for hand-guided movement over the surface of medium 2 during printing thereon. It should be noted, however, that printer P could likewise be held in position and medium 2 moves to cause appropriate relative motion as will be understood by those having normal skill in the art.

To operate printer P, housing 3 is gripped by hand H, located and aligned upon the surface of medium 2 at the left end of a selected linear print path, and is then moved to the right. During this motion, control means (not shown in FIG. 1) carried within the housing regulate the timing of print command signal transmissions from source S in accordance with the displacement of printer P, to thereby ensure that symbols 1 are printed with uniform spacing despite variations in speed of printer movement across medium 2.

To prevent printing during positioning of printer P, a switch 4 located on the exterior of housing 3 may be used to selectively permit transmission of print command signals by remote signal source S. Alignment means in the form of rollers 5*a*, 5*b*, which have surfaces for frictionally engaging the surface of medium 2, may be employed to prevent skew of printer P away from the selected linear print path during printing.

Roller 6, whose lower surface is spaced above those of rollers 5*a* and 5*b* and beyond their ends, is used as an alignment means for preventing skew during movement of printer P from a first selected linear print path to a second path in spaced parallel relationship with the first path. For example, roller 6 may be utilized in moving from the addressee line to an address line by tilting housing 3 into contact of roller 6 and medium 2, then rolling the printer upward or downward on roller 6 to a position corresponding to the address line, and finally rolling printer P to the left on rollers 5*a*, 5*b* in preparation for another printing operation.

While recording medium 2 is illustrated as a paper mailing envelope, it should be understood that the novel printer P imposes almost no requirements as to the dimensions, physical disposition, or properties of medium 2. It may, for example, be a page of a bank passbook, a surface of a manufactured article or of a shipping carton, an airline ticket, or any other medium whose surface is capable of receiving the mark of the printing means of printer P.

FIGS. 2 and 3 illustrate an embodiment of the functional elements of the system in FIG. 1 and the manner of their cooperation.

The printing element 7 enclosed by a dotted line in FIG. 2 includes an inking ribbon 8 and a wire matrix print head having a plurality (e.g. seven in this illustration) of electromagnetically driven wires W1–W7. The lower ends of wires W1–W7 are collinearly aligned by guide 9 to form a line perpendicular to the intended printing path. When a selected coil is energized, the lower end of its corresponding wire is driven against a portion of ribbon 8 which is disposed between the lower ends of the wires and the surface of medium 2 to thereby leave an ink dot imprint upon medium 2. Such

action of wire W7 in printing the single dot of the first column (E15) for the start of the symbol A is shown in FIGS. 2*a* and 3. By driving selected combinations of wires W1 to W7 five times in succession, a character can be composed within a 5 × 7 ink dot matrix as shown in FIG. 3. That is, the U is printed by W1–W7 dot selection as columns E1–E5 are passed while the F is formed while passing columns E8– E12. A typical wire matrix print head which could be adapted for use in this invention is shown in U.S. Pat. No. 3,108,534 issued on Oct. 28, 1963, to Preisinger. It should be understood, however, that ink-spray, needle punches and other types of printing means than the illustrated wire matrix print head can be adapted for use in the present invention.

In this embodiment, the control means comprises sensing means, in the form of roller 5*b*, for sensing displacement of printer P over the surface of medium 2, and emitter means responsive to the sensing means 5*b* for generating enabling signals timed in synchronism with predetermined displacements of the printer P over the surface of the medium 2. In this illustration, the emitter means comprises an apertured rotatable disk 10 driven by roller 5*b* via a suitable drive linkage 11, a light source 12 (powered by power supply 23) positioned to transmit light through each disk aperture in turn, and a photoelectric device 13 positioned for exposure to light passing through each aperture in turn. On exposure to such light signals, photoelectric device 13 (e.g. a photocell) generates timing pulses or enabling signals E1, E2, . . . E15 which are transmitted to remote signal source S via lines 14 of cable C.

FIG. 2 shows one exemplary well known arrangement of remote signal source S in simplified block-schematic form to show how it is actuated by enabling signals E_1, E_2, . . . to transmit print command signals to the coils of printing means 7. The illustrated structure of source S includes only those components necessary to cooperate with the illustrated preferred embodiment of this invention. A more detailed exposition of such a prior art remote signal source may be found in an International Business Machines Corporation publication entitled "5213 Printer Models 1, 2 and 3, Theory-Maintenance" Form Number SY 24–3549–0. A bidirectional control arrangement which permits both left-to-right and right-to-left printing by modifying the order of retrieval of print command signal data from CPU storage relating to the particular character sequence so that the completed line will read properly even though printed backwards (right-to-left) is taught by J. H. McCarthy, Jr. in the previously referenced application Ser. No. 84,026. The manner of generating sequential print command signals for a typical processor-controlled printer via an ROS (read-only store) is shown in IBM Technical Disclosure Bulletin of July, 1970 (Vo. 13, No. 2) at pages 343–344 in the article entitled, "Read Only Storage Computer Code to Dot Matrix Translator", by Onwiler et al.

To print a character such as F (as shown in FIG. 3), bits in computer code defining the character are transmitted from storage in central processing unit CPU 16 and are stored in register REG 15, where these bits form part of the address for that character in read-only store ROS 17; the address of that character within ROS 17 is completed by counter 18, which is reset on loading of REG 15. As noted hereinabove, on moving printer P over medium 2, enabling signals E1, E2, . . . are generated in synchronism with predetermined displacements (e.g. one fifth of character width) of printr P over the surface of medium 2. When logic 19 has enabled CTR 18, the next enabling signal E8 which is received from the control means of printer P will result in incrementing of counter 18 so that the address for ROS 17 formed by the combination of register 15 and counter 18 will be translated by ROS 17 into print command signal code for the first column of character F, thereby selecting all seven output lines 20 for energization. After and appropriate but brief delay to allow the signals on lines 20 to settle, this same enabling signal E8 will open gates 21 (which may comprise seven parallel AND gates each having an input commoned to line 14) to permit amplification by drivers 22 of the signals on lines 20 to the level required for driving wires W1–W7 by their associated coils. When the next enabling signal E9 is generated upon a predetermined displacement of printer P to the right, the counter 18 is incremented to complete the ROS address for the second column of character F, whereby ROS 17 selects the first and fourth lines 20 for energization; after gating and amplification, wires W1 and W4 of printing means 7 will be fired to form two printed dots in the second column (E9) for character F (see FIG. 3). Similarly, the E10 enabling signal causes energization of only two of lines 20 when printer P has been moved to the next column print location, whereupon the corresponding two wires (again W1 and W4) of printing means 7 will immediately print two dots in the third column of the F being printed. This sequence continues until counter 18 has been incremented five times (for 5 × 7 matrix printing), which logic 19 interprets as the end of printing of character F and therefore orders CPU 16 to reload register 15 with the next character byte in computer code. Logic 19 also delays resetting of counter 18 to provide the desired inter-character spacing by controlling the resetting of counter 18 (e.g. until two more enabling pulses such as E6, E7 or E13, E14 are received by logic 19).

It will be understood that the foregoing is merely exemplary of an embodiment where a seven-wire matrix head is used with an inking ribbon S as a printing means 7 for 5 × 7 matrix dot printing. If, for example, a 35-wire printing means is used to print an entire character at a time, then ROS 17 should have 35 output lines 20, and since register 15 would then provide the full ROS address for a character, counter 18 need only be a one-bit counter (if 1 then full character print, if 0 then inter-character spacing); of course, the angular spacing of apertures in disc 10 would correspond to character spacing rather than column spacing (e.g. one-fifth of a character width). As will be readily apparent to those skilled in the art, the arrangement may also be appropriately modified where pneumatically driven, ink-spray, xerographic, thermographic, or the like printing means are to be employed in a hand-positionable printer in accordance with this invention. For example, where a pneumatically actuated printing means is used, thin fluid supply lines may be led via cable C from valves located at remote signal source S to a housing 3 having a suitable printing means of wires actuated by fluid pressure print command signals.

FIG. 4 shows another view of the components within housing 3 including detail of one form of drive gear arrangement. Rotation of lead roller 5*b* rotates gears 11*a* and 11*b* and thus bevel gears 25 and 26 to actuate roll-

ers 24*a* and 24*b* thus moving ink ribbon **8**. Note that ribbon **8** could be an endless loop arrangement or could be transferred from reel to reel. Further, electrical or mechanical means could be included to disengage the drive for ribbon **8** when printing is not being performed. This disengaging means could be associated with switch **4** if desired. For an endless loop ribbon **8**, the disengaging may not be needed at all.

Roller **6** can include detent slots **6***a* as shown in FIG. **4***a* to indicate vertical spacing between lines. Follower roller **5***a* is shown slotted in FIG. **4** to prevent smearing of the symbols by roller **5***a* as housing **3** is moved from left to right. If bidirectional printing is to be performed for which the aforementioned McCarthy application Ser. No. 84,026 could be readily adapted, a slot similar to that in roller **5***a* could be included in roller **5***b* and a sensing device would be included for indicating direction of movement.

While the invention has been particularly described and shown relative to the foregoing embodiment, it will be understood by those having normal skill in the art that various changes and modifications can be made therein without departing from the spirit of this invention.

What is claimed is:

1. A hand motivated printer for printing symbols upon a surface of a recording medium comprising:

a. a manually manipulatable housing for permitting relative motion between said housing and said medium,

b. printing means carried by said housing,

c. a signal source coupled for introducing print command signals to said printing means,

d. a roller means carried by said housing for frictionally engaging said medium, and

e. emitter means responsive to said roller means for generating enablng signals timed in synchronism with predetermined displacements of said printer over the surface of said medium, said enabling signals being transmitted for enabling said signal source, said emitter means including:

i. a rotatable disk having apertures therein, said disk being driven by said roller,

ii. a light source positioned to transmit light through each of said apertures sequentially during rotation of said disc, and

iii. a photoelectric device positioned for exposure to light passing through said apertures for generating said enabling signals on exposure to said light.

2. A manually motivated printer for printing symbols upon a surface of a recording medium in accordance with sequences of print command signals from a signal source comprising

a print head responsive to said print commands for impressing a matrix of print elements upon said medium into characters representing said symbols,

a manually manipulatable housing for permitting relative motion between said housing and said medium, said print head being carried by said housing,

roller means carried by said housing for frictionally engaging said medium,

an emitter device coupled to said roller means for generating signals indicative of relative motion between said housing and said medium,

means for coupling said emitter device signals to said signal source for controlling the generation of said print command signals in correlation with said relative motion, and

means for coupling said controlled print command signals to said print head.

3. A printer in accordance with claim **2** wherein said means for coupling said emitter device signals further includes switching means for selectively preventing coupling of said sensing means signals whenever printing is not to be performed.

4. A printer in accordance with claim **3** wherein said switching means is mounted on said housing for manual operation.

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