Dec. 31, 1968 P. BETTS ET AL 3,419,884

ELECTROGRAPHIC PRINTER

Filed June 29, 1964 Sheet 1 of 2

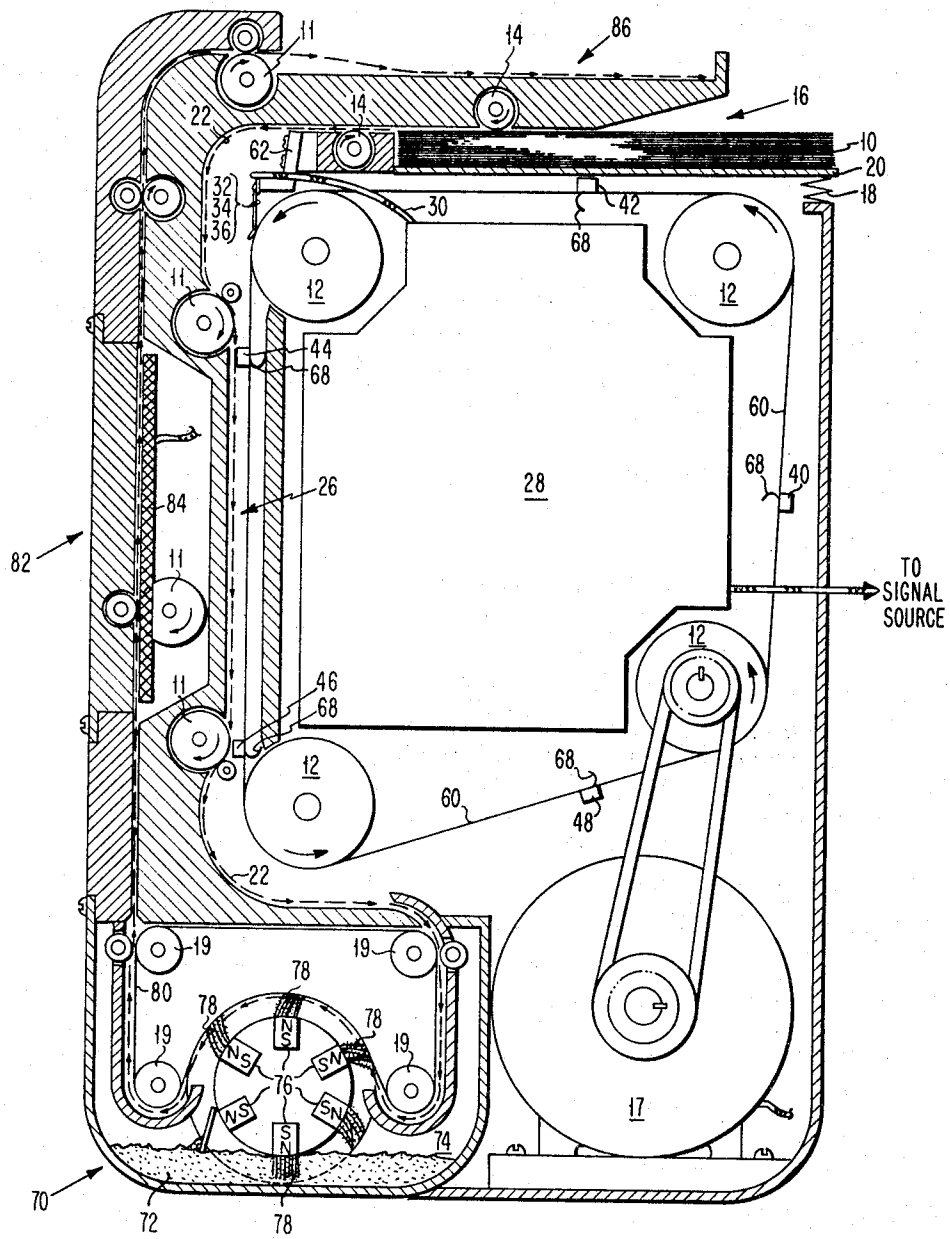

FIG. 1

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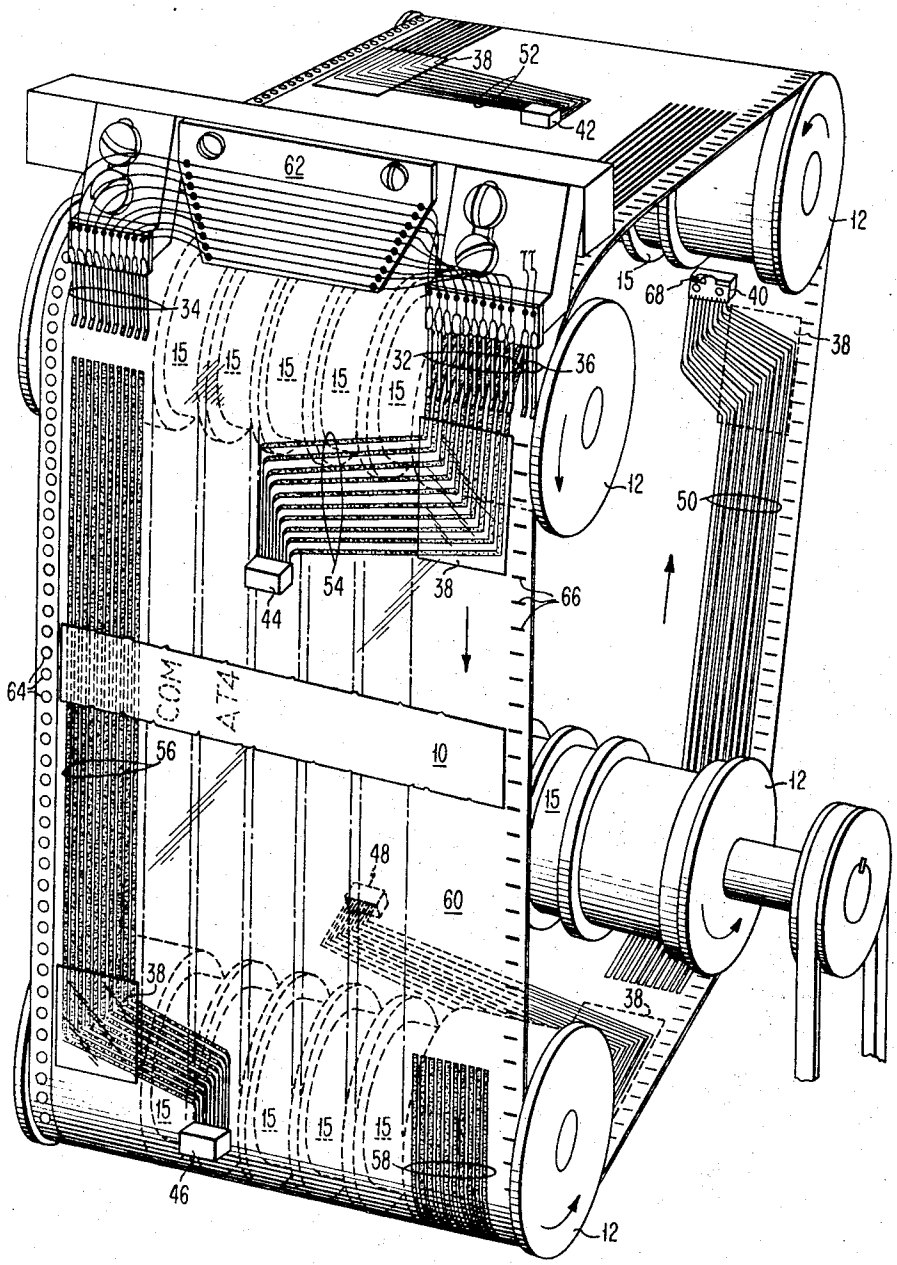
38
52
42
62
12
34
15
68
40
32
36
50
54
44
66
64
COM
AT4
10
56
48
60
46
58

FIG. 2

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ELECTROGRAPHIC PRINTER

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ABSTRACT OF THE DISCLOSURE

An electrographic printer for impressing an image on paper wherein a plurality of heads held on an endless belt are moved into proximity with the paper and energized in response to an incoming signal to print an image thereon. Thereafter the paper is pasesd through toning and fixing stations for developing the image.

This invention relates to printing devices and, more particularly, to an electrographic printer capable of receiving electrical impulses representing binary-coded alpha-numeric characters and imprinting them upon a surface in readable form.

Where communication between, for instance, an electronic computer and a human operator is desired, means may be provided to translate the computer signal into coded electronic binaries representing alpha-numeric information. These are then used to activate an output device, such as a printer, capable of making them visible in proper sequence. In electrographic printing, special paper is prepared by treating ordinary paper with a humectant to make it somewhat conductive and adding a thin (approximately 0.0001 inch) dielectric coating of a high-resistivity material. In the printer, the paper is imaged at an exposure station by electrostatically charging the dielectric by means of high voltage pulses (representing the characters) fed to print wires in printing heads when they are in contact with the dielectric surface; a typical electrostatic head and its association with cooperative printer structure is shown in co-pending patent application, Ser. No. 345,912, filed Feb. 19, 1964 now Patent No. 3,380,070. The imaged paper then passes through a toning (i.e., developing) station where fine (8 to 10 microns), colored, oppositely-charged particles are attached to the image with for instance, magnetic brushes, thereby making the image visible. The particles, being of thermoplastic composition, are fixed to the paper by heating at a fixing station and then the paper may be passed to a viewing station where its message may be read or it may be removed from the printer.

Since, in such an application, the task of the printer is a formidable one, typical structures have been large, heavy, unwieldly, critical in operation, and generally unsuitable in special installations. Typical is in asociation with airborne communicatons equpment where the need is for reliable printout of high image quality under extreme conditions, to produce short, easily-readable messages at high speeds. This is one object of the printer of the present invention.

Another object of this invention is to provide an electrostatic printer construction which is simple and easy to repair because of ready accessibility of parts and the use of the latest of methods of structural fabrication for this type of equipment.

Another object of this invention is to provide a printer capable of serving as high speed output equipment for electronic computers, facsimile image conversion devices, microimage scanners and similar equipment.

These objects are accomplished in the present electrographic printer by structure which functions to convey

prepared paper from a supply station through an exposure station, a toning station and a fixing station, and into a deposit station. At the exposure station, an endless belt, to which a plurality of electrostatic recording heads are attached, sweeps the heads over the paper as the heads are sequentially pulsed in accordance with incoming coded signals decoded by the printer electronic circuitry. Each head, in the preferred embodiment, records a line on the paper, which is stationary during the recording process. The heads are energized from conductive strips depoisted on the belt, to which commutation is made by brushes mounted on the printer frame and connected to the electronic circuitry. The arrangement of conductive strips is offset in two channels around the belt in order to permit sequential energization of the heads (avoid simultaneous energization). Also provided on the belt are sprocket holes to prevent its slippage on the drive pulley and a clocking channel having conductive strips one character space apart to control the rate of data being fed to the printer.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings.

FIGURE 1 is a diagrammatic side view of a printer embodying the invention; and ,

FIGURE 2 is a diagrammatic view of salient features of the exposure station of the printer of FIGURE 1.

Referring now to FIGURE 1, a side view of the printer, presensitized paper **10**, preferably in the form of individual sheets, is conveyed through the printer stations along dashed path **22** by means of a feed-roll system, including rollers **11**, **12**, **14** and **19**, belt-driven by motor **17** as shown. The paper feed is intermittent through control of rollers **11** and **14** by a timed clutch (not shown).

The arrangement at supply station **16**, through utilization of pressure from spring **18** against platform **20**, causes the top sheet of paper **10** to be presented to rollers **14** which, due to their indicated opposite rotation, separate the top sheet for transmission to exposure station **26**, where it is stationary for the period of time required for sensitization by signals from electronic circuitry **28**. The signals are conveyed via cable **30** to brush set **32**, **34** and **36**.

Further detail of exposure station **26** is shown in FIGURE 2. In the preferred embodiment, five electrostatic heads **40**, **42**, **44**, **46** and **48** are used, conforming to those described in the aforementioned patent application. Briefly, the heads are composed of ten stylii, one corresponding to each row of a character spot matrix, and as the head moves over (downward in FIGURE 2) the portion of the exposure station devoted to the character, each stylus is pulsed separately in accordance with whether or not the character configuration requires a recording in the corresponding column of the matrix. In this way, a latent image of the character configuraton is laid down on the surface of paper **10**. Heads **40**, **42**, **44**, **46** and **48** are fixed to belt **60** at the terminations of conductive-strip sets **50**, **52**, **54**, **56** and **58**, respectively, one strip connecting to each stylus of a head and to which commutation of drive signals from electronic circuitry **28** (FIGURE 1) is made through brush sets **32** and **34**. The conductive strips may be of copper and are deposited, by electroplating or otherwise, on belt **60**. The material of belt **60** may be thin, tough plastic, such as polyethylene glycol terephthalate in the form of a closed loop sufficiently wide to extend beyond the edges of paper **10**.

Referring to belt **60** and the arrangement of conductive-strip sets **50**, **52**, **54**, **56** and **58** specifically, FIGURE 2 shows that the sets are laid down longitudinally with respect to belt **60** in two channels, one on each side of belt

60, and that the sets run laterally across belt 60 to their respective heads. Strip sets 50, 54 and 58 lie along the right side of belt 60 and extend from right to left to reach heads 40, 44 and 48 respectively, while strip sets 52 and 56 lie along the left side of belt 60 and extend from left to right to reach heads 42 and 46 respectively. In this way, only two sets 32 and 34 of commutation brushes are required to connect to the five heads. Brush sets 32 and 34 are connected in parallel through connector 62 and are pulsed by electronic circuitry 28 in accordance with the character coding; the line on paper 10 in which a character appears is dependent upon which head is being swept over paper 10. In the view of FIGURE 2, it can be seen that head 46 has just completed traversal of its line (the second, latent image "AT4") on paper 10 and its strip set 56 has just disconnected from brush set 34, and that head 44 has just started to record its line (the third) on paper 10 and its strip set 54 has just made contact with brush set 32. In this configuration, the first line (latent image "COM") has been recorded by head 48 through strip set 58 and brush set 32, the fourth line will be recorded by head 42 through strip set 52 and brush set 34 and the fifth line will be recorded by head 40 through strip set 50 and brush set 32. It will be noted that a thin layer of insulation, coating 38, preferably of cellulose acetate or the like, covers the strip sets in the vicinity of overlap, transverse on belt 60, to the end of another strip set; coating 38 insulates from brush sets 32 and 34 in order to preclude simultaneous recording by more than one head. It will also be noted that rollers 12 are provided with recesses 15 to clear backing springs 68 of the heads (FIGURE 1).

Also provided on belt 60 are sprocket holes 64 for engagement with a sprocketed drive roller (not shown) to prevent belt slippage, and a paralleled set of brushes 36 cooperating with evenly-spaced transverse conductive strips comprising a clock track 66, designating the character spacing to electronic circuitry 28. The strips of track 66 are applied on both surfaces of and through belt 60 so that brush set 36 makes contact through them with roller 12, which may be at ground potential.

Returning to FIGURE 1, after paper 10 has been exposed to recording at exposure station 26, it is again engaged by the roller feed and passed to toning station 70 for development. Here, magnetic toner 72, comprising small, colored, magnetic particles, is lifted from reservoir 74 by rotating magnets 76 in the form of magnetic brushes 78, and swept over paper 10 as it is conveyed through toning station 70 by rollers 19 and belt 80. The latent image, now visible, is fixed to paper 10 at fixing station 82, by heat from electrical plate 84, after which it is placed in deposit station 86 where it is available to the operator.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in the form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. Apparatus for recording electrical information pulses, comprising:

a plurality of heads capable of converting the information pulses to field discharges;

means capable of electrostatically retaining an image corresponding to the discharges from said heads;

an endless, insulating belt;

means to move said belt continuously;

means for moving said image retaining means into close proximity to a portion of said belt moving in the same direction as said image retaining means but with motion relative thereto in the direction of movement;

means to fix said heads to said belt such that they each traverse a separate line along said image retaining means;

a source for the information pulses;

means fixed to said belt and to said source to connect from said source to said heads, said means comprising:

a terminal connector for said source,

a conductive strip attached to said belt for each head, said conductive strips being disposed both longitudinally and transversely on said belt, and,

conductive means at said terminal connector operative to brush along said conductive strips;

said heads being positioned on said belt such that they traverse said image retaining means sequentially and are correspondingly connected to said source by said connecting means; and

means fixed to said belt to prevent simultaneous energization of said heads.

2. The combination of claim 1 wherein the longitudinal portion of said conductive strips are operatively brushed by said conductive means.

3. The combination of claim 2 wherein the longitudinal portions of said conductive strips for all of said heads are arranged in channels around said belt, the number of channels being less than the number of said heads

and wherein at least one said terminal connector and at least one said conductive means are provided for each channel.

4. The combination of claim 3 wherein all said terminal connectors are connected in parallel.

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U.S. Cl. X.R.

200—46; 346—139