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G. W. CONE

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ELECTROSTATIC STENCIL APPARATUS FOR MATRIX PRINTERS

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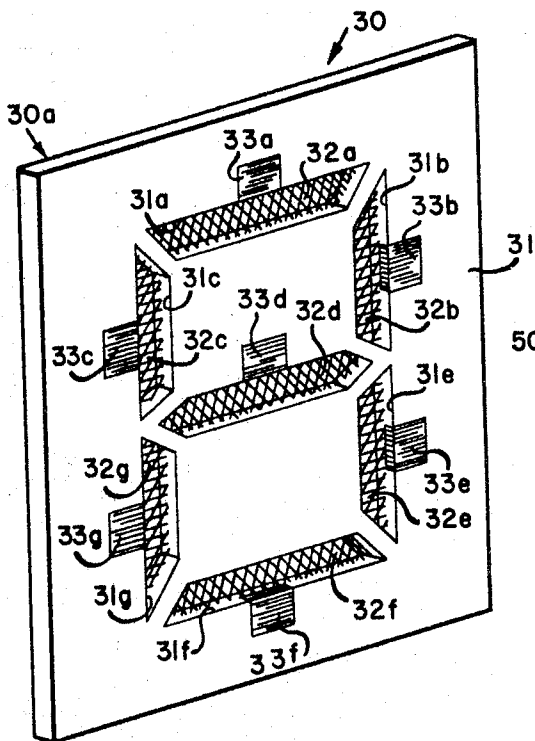


FIG. 2

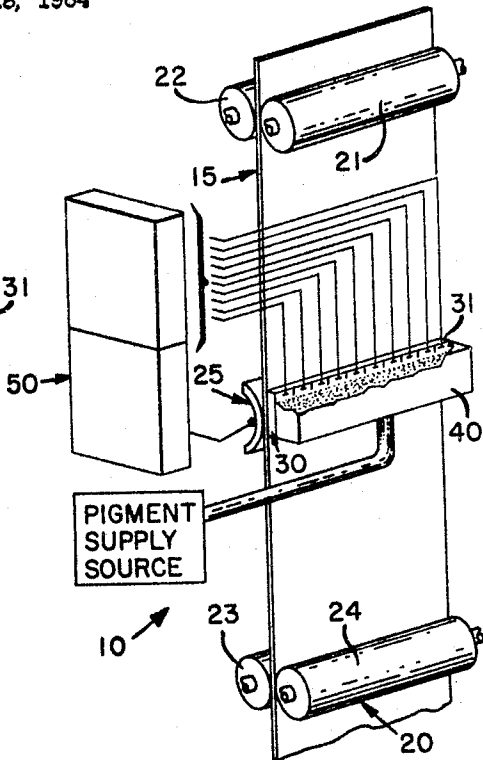


FIG. 1

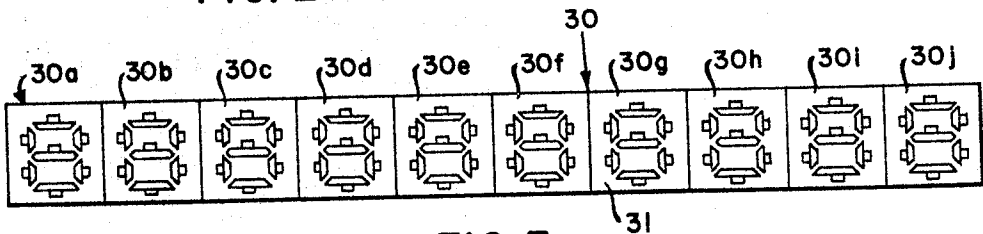


FIG. 3

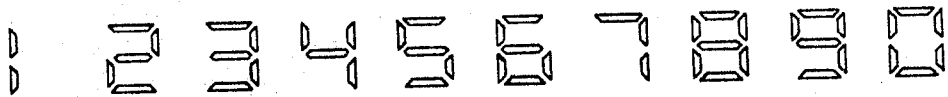


FIG. 4

GEORGE W. CONE
INVENTOR

BY *Jack M. Wiseman*
ATTORNEY

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ELECTROSTATIC STENCIL APPARATUS FOR MATRIX PRINTERS

George W. Cone, Cupertino, Calif., assignor to General Micro-Electronics Inc., Santa Clara, Calif., a corporation of Delaware

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1 Claim. (Cl. 101-92)

The present invention relates in general to electronic printing apparatus, and more particularly to an electronic printing apparatus adaptable for use with business machines and the like.

Heretofore, the electrostatic printing apparatus printed the prescribed pattern formed on the stencil. Hence, the opportunity to select the information to be printed while the apparatus was in operation was not available.

An object of the present invention is to provide an electronic printing apparatus in which the information to be printed thereby is selected while the apparatus is in operation.

Another object of the present invention is to provide an electronic printing apparatus in which the electrical charge on selected portions of a stencil thereof is controlled to produce printed material with selected information thereon.

Another object of the present invention is to provide an electronic printing apparatus wherein the stencil is divided into segments forming a figure eight and wherein the segments are selectively charged to produce printed material with Arabic numerals selected in accordance with the charge on the segments.

Other and further objects and advantages of the present invention will be apparent to one skilled in the art from the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a diagrammatic illustration of the electronic printing apparatus of the present invention.

FIG. 2 is an enlarged diagrammatic illustration of a stencil section employed in the electronic printing apparatus shown in FIG. 1.

FIG. 3 is a diagrammatic illustration of a stencil with horizontally aligned sections, each section containing segments forming a figure eight.

FIG. 4 is a diagrammatic illustration of the Arabic numerals printed by the electronic printing apparatus of the present invention.

In the electronic printing apparatus of the present invention, a stencil comprises a plurality of figure eight sections, each of which comprises a group of screen segments. Spaced from the stencil is a conductor member. When a screen segment and the conductor member are oppositely charged, an electrostatic field is created therebetween.

Pigment particles are exposed to the screen segments. When pigment particles engage a charged screen segment, the pigment particles are drawn through the charged screen segment and advance through the electrostatic field toward the conductor member. Interposed between the stencil and the conductor member within the electrostatic field is a sheet of paper. As the pigment particles are drawn toward the conducting member, they impinge on the sheet of paper disposed in their path of travel to cause a character to be printed thereon having a con-

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figuration similar to the shape of the charged screen segment.

A print control circuit selectively charges the screen segments of each stencil section and oppositely charges the conducting member. As a consequence thereof, each stencil section with a plurality of charged screen segments will cause the printing of selected numerals on the sheet of paper as the electronic printing apparatus is in operation.

Illustrated in FIG. 1 is the electronic printing apparatus 10 of the present invention, which comprises a sheet of paper 15 or other suitable material for printing information thereon. The sheet of paper 15 may be intermittently advanced by any suitable drive mechanism 20 employed in business machines or the like and has incorporated therein drive rollers 21-24 that engage the sheet of paper to advance the same.

Disposed on one side of the sheet of paper 15 and spaced therefrom is a conductor member 25 that is charged for establishing an electrostatic field. In the exemplary embodiment, the conductor member 25 has a semicylindrical configuration with the semicylindrical surface thereof confronting the sheet of paper 15. By virtue of the curved surface, space is provided for mounting the print heater or means for making the print permanent. Positioned on the other side of the sheet of paper 15 and spaced therefrom is a stencil 30. Thus, the sheet of paper 15 is interposed between the stencil 30 and the conductor member 25 in spaced relation therewith.

According to the present invention, the stencil 30 (FIGS. 2 and 3) comprises a non-conducting rigid base 31, which in the preferred embodiment is made from Mylar or a suitable plastic material. The base 31 comprises a plurality of stencil sections, such as stencil sections 30a-30j. For purpose of clarity only the stencil section 30a will be described in detail.

Formed in each stencil section, such as stencil section 30a, are openings 31a-31g. Seated within the openings 31a-31g are mesh screen segments 32a-32g, respectively. Each of the screen segments 32a-32g is made of suitable electrical conducting material, such as nickel or stainless steel or the like, and constitutes a separate conductor member. Together the screen segments 32a-32g form a figure eight. In the exemplary embodiment, the mesh screen includes 100 x 100 wires per square inch. Integrally formed with each screen segment 32a-32g is a solid tab or terminal for the application of the electrical charge to the associated screen segment. Thus, terminals 33a-33g may be integrally formed with the screen segments 32a-32g, respectively.

Pigment particles are exposed to the screen segments 32a-32g. For this purpose, a housing 40 (FIG. 1) containing pigment particles is disposed in communication with the screen segments 32a-32g of the stencil section 30a to form a closed chamber. Suitable means, not shown, may be provided in the housing 40 to blow a mixture of air and the pigment particles toward the screen segments 32a-32g of the stencil section 30a. Other feeding systems, such as a magnetic feed arrangement, may be employed equally as well.

When one or more of the screen segments 32a-32g of the stencil is charged oppositely from the conductor member 25, a separate and distinct electrostatic field is created between each of the charged screen segments and

the conductor member 25. This action causes the pigment particles which contact a charged screen segment to be drawn through the openings of the charged screen segment and travel in the electrostatic field toward the oppositely charged conductor member 25. Thus, by virtue of the electrostatic field created between a charged screen segment and the oppositely charged conducting member, the pigment particles are drawn through the screen segment toward the conducting member 25. However, the sheet of paper 15 is disposed in the path of travel of the advancing pigment particles, which causes the pigment particles advancing in the electrostatic field to impinge on the sheet of paper 15, thereby printing on the sheet of paper 15 a mark or a character having a configuration similar to the shape of the charged screen segment.

The character or number printed on the sheet of paper 15 is determined by the screen segments 32a-32g selectively charged. By selectively charging the screen segments 32a-32g, numbers 1-9 and 0 can be produced on the sheet of paper 15. Of course, the placement of a plurality of stencil sections in horizontal alignment enables numbers to be printed on the sheet of paper 15 with more than one digit. If a configuration other than a figure eight is used for the conductor screen segments, letters or other characters may be printed on the sheet of paper 15.

By selectively charging the screen segments 32a-32g and oppositely charging the conductor member 25 to produce electrostatic fields therebetween, predetermined numbers can be produced on the sheet of paper 15. For this purpose, a conventional or well-known print control circuit 50 of the type known in the calculator art may be employed which may include a plurality of digital control circuits for transmitting a plurality of pulse signals of prescribed polarity and magnitude. The output conductors of the print control circuit 50 are connected to the terminals 33a-33g, respectively, whereby the print control circuit 50 selectively controls the charge on each of the screen segments 32a-32g individually. The print control circuit 50 can also be connected to the terminal of the other stencil sections.

In the operation of the electronic printing apparatus 10, pigment particles in the housing 40 are continuously blown toward the stencil 30. For purpose of clarity, only the operation of the stencil section 30a will be described in detail. To print the numeral 1 on the sheet of paper 15, the print control circuit 50 charges the screen segment 32c negatively and simultaneously charges the conductor member 25 positively. Thereupon, an electrostatic field is created between the conductor member 25 and the screen segment 32c. This action causes the pigment particles contacting the screen segment 32c to be drawn through the openings in the screen segment 32c and to travel in the created electrostatic field toward the conductor member 25. Since the sheet of paper 15 is interposed between the conductor member 25 and the stencil 30, the pigment particles advancing in the electrostatic field toward the conductor member 25 impinge on the sheet of paper 15 to print thereon a character having a configuration similar to the shape of the screen segment 32c.

Now, the print control circuit 50 charges the screen segment 32g positively and simultaneously charges the conductor member 25 negatively. An electrostatic field is therefore produced between the conductor member 25 and the screen segment 32g. The pigment particles contacting the screen segment 32g are drawn through the openings in the screen segment 32g and travel in the created electrostatic field toward the conductor member 25. With the sheet of paper 15 interposed between the conductor member 25 and the stencil 30 the pigment particles advancing in the electrostatic field toward the conductor member 25 impinge on the sheet of paper 15 to print thereon a character having a configuration simi-

lar to the shape of the screen segment 32g. Thus, the numeral 1 (FIG. 4) is printed on the sheet of paper 15.

For rendering permanent the numeral printed on the sheet of paper 15, any suitable heat treating process may be employed.

The sheet of paper 15 is now advanced by the paper drive mechanism 20 in a vertical direction. To print the numeral 2 on the sheet of paper 15, the above-described operations are repeated. However, initially the screen segments 32a and 32d are charged negatively, while the conductor member 25 is charged positively. Then, the screen segments 32b and 32g are charged positively, while the conductor member 25 is charged negatively. This results in the printing on the sheet of paper 15 the numeral 2 as shown in FIG. 4.

For printing the numeral 3, the screen segments 32a, 32d, 32e and 32f are charged negatively, while the conductor member 25 is charged positively. Then, the conductor segment 32b is charged positively, while the conductor member 25 is charged negatively. To print the numeral 4, the screen segments 32c, 32d, and 32e are charged negatively, while the conductor member 25 is charged positively. Subsequently, the screen segment 32b is charged positively, while the conductor member 25 is charged negatively.

In printing the numeral 5, the screen segments, 32a, 32c, 32d, 32e and 32f are charged negatively and simultaneously the conductor member 25 is charged positively. Printing the numeral 6 is similar to printing the numeral 5 with the difference that subsequently the screen segment 32g is charged positively, while the conductor member 25 is charged negatively.

As for the numeral 7, the screen segments 32a and 32e are charged negatively, while the conductor member 25 is charged positively. Thereupon, the screen segment 32b is charged positively, while the conductor member 25 is charged negatively. In printing the numeral 8, all the screen segments 32a-32g are charged by the print control circuit 50. First, the screen segments 32a and 32c-32f are charged negatively, while the conductor member 25 is charged positively. Then, the screen segments 32b and 32g are charged positively, while the conductor member 25 is charged negatively.

For the printing of the numeral 9, the screen segments 32d, 32c, 32a and 32e are charged negatively, while the conductor member 25 is charged positively. Subsequently, the screen segment 32b is charged positively, while the conductor member 25 is charged negatively. For printing the zero, the screen segments 32a, 32e, 32f and 32c are charged negatively, while the conducting member 25 is charged positively. Then, the screen segments 32b and 32g are charged positively, while the conductor member 25 is charged negatively.

While the foregoing has been described with one digit, it is apparent that the plurality of stencil sections, such as the stencil sections 30a-30j (FIG. 3) are aligned horizontally and the screen segments thereof may be charged simultaneously. The print control circuit 50 can be employed for charging the screen segments of a plurality of stencil sections in a manner similar to that described for charging the screen segments of the stencil section 30a. In this way, multi-digit numbers may be printed simultaneously on the sheet of paper 15 in horizontal alignment. However, the corresponding screen segments of adjacent stencil sections will be charged, when selected, with opposite polarities.

It is to be understood that modifications and variations of the invention disclosed herein may be resorted to without departing from the spirit of the invention and the scope of the appended claim.

Having thus described my invention, what I claim as new and desire to protect by Letters Patent is:

An electronic printing apparatus comprising character forming means, said character forming means being formed with a plurality of conductor screen segments,

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means for exposing said conductor screen segments to pigment particles, conductor means spaced from said character forming means, means to be printed on interposed between said character forming means and said conductor means, and a print control circuit connected to said conductor means and said conductor screen segments for selectively charging said conductor screen segments and oppositely charging said conductor means to create an electrostatic field between each charged conductor screen segments and said conductor means for drawing pigment particles through said charged conductor screen segments and toward said conductor means for impinging on said means to be printed on characters having a configuration similar to the shape of the charged conductor screen segments, certain of said conductor

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screen segments being charged with an opposite polarity than other of said conductor screen segments.

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WILLIAM B. PENN, *Primary Examiner.*