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METHOD AND APPARATUS FOR ELECTRICAL PRINTING

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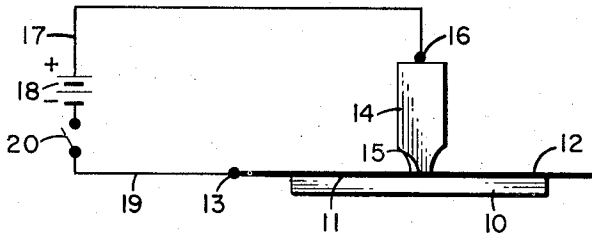


FIG. 1

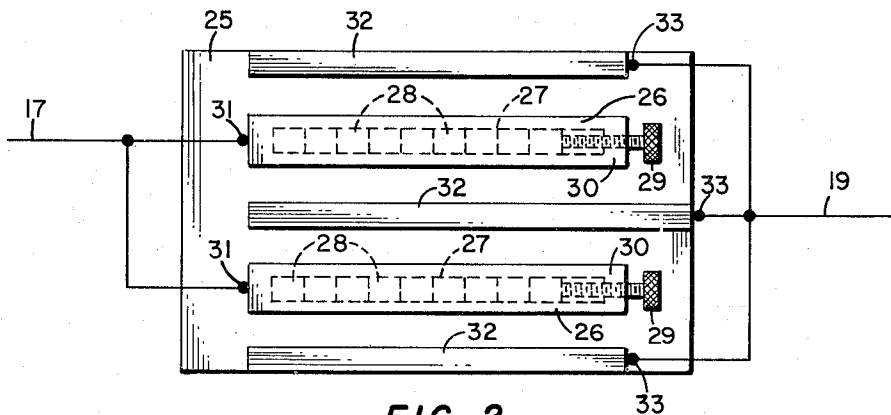


FIG. 2

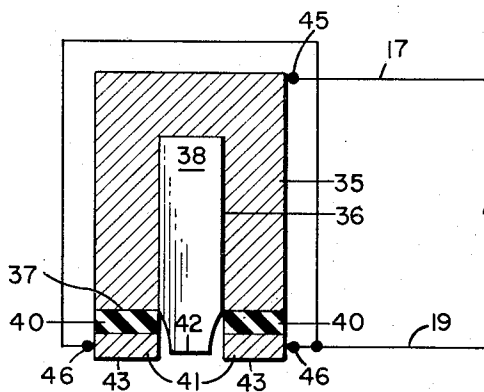


FIG. 3

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**METHOD AND APPARATUS FOR ELECTRICAL PRINTING**

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9 Claims. (Cl. 41—37)

(Granted under Title 35, U. S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

The present invention relates to a method and apparatus for electrical printing and more particularly to a method and apparatus for electrical printing utilizing an arrangement wherein a type member is pressed against a metal foil which is in engagement with a surface upon which it is desired to print, and an electrical current of short time duration is passed through the type member and the foil.

The invention method and apparatus is especially adapted for use in engraving where it is desired to impress certain characters in a surface. In such operations, heat is ordinarily utilized to soften the material of the surface upon which it is desired to engrave such that the characters formed on the face of suitable type members may be pressed into the surface. Prior art devices utilize heated platens and various arrangements of heating coils and the like for heating the type members employed therewith such that suitable heat is transferred to the material upon which it is desired to print. Such devices are complicated and expensive in construction and printing operations therewith are delayed due to the time required to heat up the platens or the type members. The use of known devices is also inconvenient in cases where it is desired to change the type members frequently since the type members and platen must be allowed time to cool after printing before the type may be changed.

In the present invention, an electrical current of short time duration is passed through a type member and a metal foil which is in engagement with a surface upon which it is desired to print, the current generating sufficient heat to soften the surface and permit the face of the type member to be pressed therein. Since the heat is generated very rapidly, the engraving operation may be carried out without the necessity of waiting for the platens or the type members to be preheated as in prior art devices. Furthermore, since the heat is generated so rapidly, the platens and the type members employed in the present invention do not have an opportunity to heat up to any great extent, and the type members may be changed immediately without waiting for them to cool to a lower temperature.

An object of the present invention is the provision of a new and novel method and apparatus for electrical printing wherein it is not necessary to preheat the platens or type members utilized therein.

Another object is to provide a new and novel method and apparatus for electrical printing wherein the platens and type members utilized therein are not heated to any great extent during printing operations.

A further object of the invention is the provision of a new and novel method and apparatus for electrical

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printing which is simple and inexpensive, yet efficient and reliable in operation.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing wherein:

Fig. 1 is a schematic view of a printing apparatus according to the invention;

Fig. 2 is a somewhat schematic plan view of a printing arrangement according to the invention, and

Fig. 3 is a cross-sectional view of a modification of the type holders shown in Fig. 2.

Referring now to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in Fig. 1 a member 10 having an upper surface 11 upon which it is desired to print. Member 10 may be formed preferably of a flexible material such as leather or a thermoplastic and the like and is held in place by a suitable clamping means (not shown).

A metal foil 12 is disposed in frictional engagement with surface 11 and may be formed of any suitable metal such as aluminum, copper and the like, the foil being on the order of .001 to .005 inch in thickness. A terminal 13 is secured to the outer periphery of the foil and the contacting surface between the terminal and the foil is preferably of fairly large area to prevent excessive heat from being generated in the foil adjacent the terminal.

A type member 14 formed of brass or type metal and the like has a face portion 15 upon which a suitable character is formed. Any suitable means (not shown) may be provided for applying pressure to member 14 as for example utilizing a conventional press arrangement or by mounting the type member in a manually operated stamp assembly and the like. The amount of pressure required will vary according to the size of the type member and the type of material of which member 10 is composed. If member 10 is formed of a material the softening temperature of which decreases with pressure, it may be desirable to increase the pressure on member 14, thereby decreasing the amount of heat which it is necessary to develop and consequently decrease the amount of current or the time duration of the current which passes through members 11 and 14. However, if the pressure applied to member 14 is increased to a sufficient degree, the contact resistance between the face portion of the type member and the metal foil may be decreased to a point where the metal foil will melt at the edges of the face portion before sufficient heat is generated to soften surface 11 and permit the character formed on the type member to be impressed therein. Such melting of the foil is undesirable, and may be avoided either by applying less pressure to the type member or by coating the upper surface of the foil with an electrical semi-conductor such as graphite or the like, thereby increasing the contact resistance between the type and the foil.

A terminal 16 is suitably secured to member 14 and the terminal is connected by a lead 17 to one pole of a source of electrical energy such as battery 18 or the like. Terminal 13 is connected to the opposite pole of the battery through the intermediary of lead 19 and switch 20. It is apparent that by actuating switch 20, the flow of current through members 11 and 14 may be selectively controlled.

The operation of the apparatus shown in Fig. 1 is as follows:

Foil 12 is initially placed in frictional engagement with surface 11 of member 10 and member 14 is pressed downwardly against foil 12 by suitable means as pre-

viously described. The foil and the type member are connected in the electrical circuit as shown, and switch 20 is closed for a predetermined short time duration. The current which flows through members 14 and 11 immediately under face portion 15 and the material of member 10 softens at that point sufficiently to allow portion 15 to be pressed into surface 11, thereby engraving the character which is formed on portion 15 into surface 11. However, since the current flows for only a short period of time, the type member and the foil do not heat up to any appreciable extent except immediately adjacent the portions of members 11 and 14 which are in contact with one another. The remaining portions of members 11 and 14 remain relatively cool and therefore these members may be changed immediately without allowing them time to cool after a printing operation.

In the arrangement shown in Fig. 2, a sheet of metal foil 25 is positioned in frictional engagement with a surface upon which it is desired to print, the surface being immediately below the foil and hidden thereby. Two elongated type holders 26 each have cavities 27 formed therein, and a plurality of type members 28 are positioned in the cavities, the type members being rigidly clamped in place by means of adjustable clamping screws 29 threaded in end walls 30 of members 26. The face portions of the type members are in contact with foil 25 and a suitable means (not shown) is provided for applying pressure to the type members as described in connection with the apparatus shown in Fig. 1. Terminals 31 are secured to the type holders, and lead 17 corresponds to lead 17 shown in Fig. 1.

A plurality of elongated electrodes 32 are secured to member 25, these electrodes being substantially coextensive with members 26 and equally spaced from the lateral portions thereof. Each of members 32 is connected through terminals 33 to lead 19 which corresponds with lead 19 in Fig. 1, whereby a current may be selectively passed through members 26 and 32 in a manner similar to that described in connection with the apparatus shown in Fig. 1. Elongated electrodes 32 provide a means whereby the current flowing through the foil from the type members is distributed, thereby preventing the foil from heating up as would be the case if an electrode of small area were utilized with a consequent concentration of current flow in a limited area of the foil.

Fig. 3 illustrates a modified type holder 35 similar to members 26 of Fig. 2 which may be employed for the purposes of the invention. Member 35 has a rectangularly shaped cavity 36 formed in the lower surface 37 thereof, the cavity extending longitudinally through member 35 and being closed at opposite ends thereof by wall portions (not shown) similar to wall portions 30 of members 26 shown in Fig. 2. A plurality of type members 38, only one of which is shown, are positioned within cavity 36 and are clamped in place by a clamping screw similar to screws 29 shown in Fig. 2. The type members fit snugly within cavity 36 such that the outer surfaces of the type members are in engagement with the inner surfaces of the cavity, thereby providing a good electrical contact therebetween.

Insulating members 40 are secured to surface 37 as by bonding or the like and are longitudinally coextensive with cavity 36, being positioned adjacent thereto on either side thereof, as shown. Members 40 are formed of an electrically nonconductive material which is also resilient such as rubber or the like. Electrodes 41 of the same size and configuration as members 40 are secured thereto as by bonding or the like, the electrodes being formed of electrically conductive material such as copper or the like. It should be noted that when type members 38 are clamped in place as shown, the lower surfaces 42 of the face portions thereof are slightly higher than the lower surfaces 43 of electrodes 41. The difference in

height of surfaces 42 and 43 may be on the order of .01 to .1 inch, provided that when pressure is applied to the device, members 40 will yield sufficiently to enable surfaces 43 to be urged upwardly above surface 42. When the device is utilized for printing, pressure is applied in a downward direction, causing members 40 to be compressed and allowing surfaces 43 to move upwardly sufficiently such that surface 42 may be pressed into the surface upon which it is desired to print.

A terminal 45 is secured to member 35 and is connected to lead 17 which corresponds to lead 17 shown in Fig. 2. Terminals 46 which correspond to terminals 33 in Fig. 2 are secured to electrodes 41 which correspond to electrodes 32 in Fig. 2, terminals 46 being connected to lead 19 which corresponds to lead 19 in Fig. 2.

It is apparent that when the device shown in Fig. 3 is connected in a suitable electrical circuit and the switch closed, current will flow through member 35, type members 38, the foil in engagement therewith, and through electrodes 41 which are also in engagement with the foil.

It should be noted that in the apparatus shown in each of Figs. 1-3, a metal foil is placed in frictional engagement with a surface upon which it is desired to print and the face portion of a type member pressed against the foil by a suitable means. An electrical current of short time duration is thereupon passed through the type member and the foil such that the character formed on the type face is impressed into said surface.

It is apparent from the foregoing that there is provided a method and apparatus wherein it is not necessary to preheat the components utilized therein and the components are not heated to any great extent during printing operations. The method and apparatus is simple and inexpensive, yet efficient and reliable in operation.

It should be understood that the particular polarity of the electric circuit of the device described herein, e. g. the embodiment shown in Fig. 1, is not essential. Thus, if desired, the positive terminal of the battery in Fig. 1 can be connected to switch 20 with the negative terminal of the battery connected to type member 14, instead of as shown in Fig. 1. Further, either D. C. or A. C. electrical energy may be employed in the invention device.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

I claim:

1. A method of electrical printing which comprises positioning a sheet of metal foil adjacent a surface upon which it is desired to print, pressing the face of a type member against said foil and passing an electric current below arcing potential through said type face and said metal foil to heat the latter.

2. A method of electrical printing which comprises coating one surface of a sheet of metal foil with an electrical semi-conductor, positioning the opposite surface of said sheet adjacent a surface upon which it is desired to print, pressing the face of a type member against said foil and passing an electrical current below arcing potential through said type face and said metal foil to heat the latter.

3. A method of electrical printing which comprises positioning a sheet of metal foil in frictional engagement with a surface upon which it is desired to print, pressing the face of a type member against said foil and passing an electric current of short time duration and below arcing potential through said type face and said metal foil to heat the latter.

4. A method of electrical printing which comprises positioning a sheet of metal foil in frictional engagement with a surface upon which it is desired to print, pressing the face of a type member against said foil, passing an electric current of short time duration and below arcing potential through said type face and said

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metal foil to heat the latter, allowing said foil to cool and removing the excess foil from said surface.

5. Electrical printing apparatus which comprises a sheet of metal foil in engagement with a surface upon which it is desired to print, a type member having a face portion formed thereon, said face portion being in contact with said foil, an electrical network including said type member and said foil, a source of current below arcing potential for said network, and means for establishing a flow of current from said source in said network so that the surface of said foil which is in contact with the face portion of said type member may be selectively heated and thereby softened.

6. Electrical printing apparatus which comprises a sheet of metal foil in engagement with a surface upon which it is desired to print, a first electrical terminal secured to said foil, a type member composed of electrically conductive material and having a face portion formed thereon, said face portion being in frictional engagement with said foil, a second electrical terminal secured to said type member, an electrical circuit connected to said two terminals, a source of current below arcing potential for said circuit, and switch means for establishing a flow of current from said source in said circuit so that the surface of said foil which is in contact with the face portion of said type member may be selectively heated and thereby softened.

7. Electrical printing apparatus which comprises a sheet of metal foil in engagement with a surface upon which it is desired to print, a plurality of elongated electrical terminals connected to said foil, at least one elongated type support member positioned adjacent said plurality of electrical terminals and being substantially co-extensive therewith, a plurality of type members rigidly supported within said type support member and each having a face portion formed thereon, each of said face portions being in frictional engagement with said foil, an

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electrical terminal secured to said type support member, an electrical circuit connected to said terminals, a source of current below arcing potential for said circuit, and switch means for establishing a flow of current from said source in said circuit so that the surface of said foil which is in contact with the face portion of said type member may be selectively heated and thereby softened.

8. In an electrical printing apparatus, a type holder formed of electrically conductive material and having a cavity formed therein, at least one type member positioned within said cavity and in frictional engagement with said type holder, said type member having a face portion formed thereon, an electrically nonconductive member secured to said type holder adjacent the open end of said cavity, and an electrically conductive member secured to said nonconductive member.

9. In an electrical printing apparatus, an elongated type holder formed of electrically conductive material and having a cavity formed in one surface thereof, a first terminal secured to said type holder, a plurality of type members positioned within said cavity and in frictional engagement with said type holder, each of said type members having a face portion formed thereon, a plurality of electrically nonconductive members secured to said type holder adjacent the open end of said cavity, an electrically conductive member secured to each of said nonconductive members, and a second terminal secured to each of said electrically conductive members.

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