

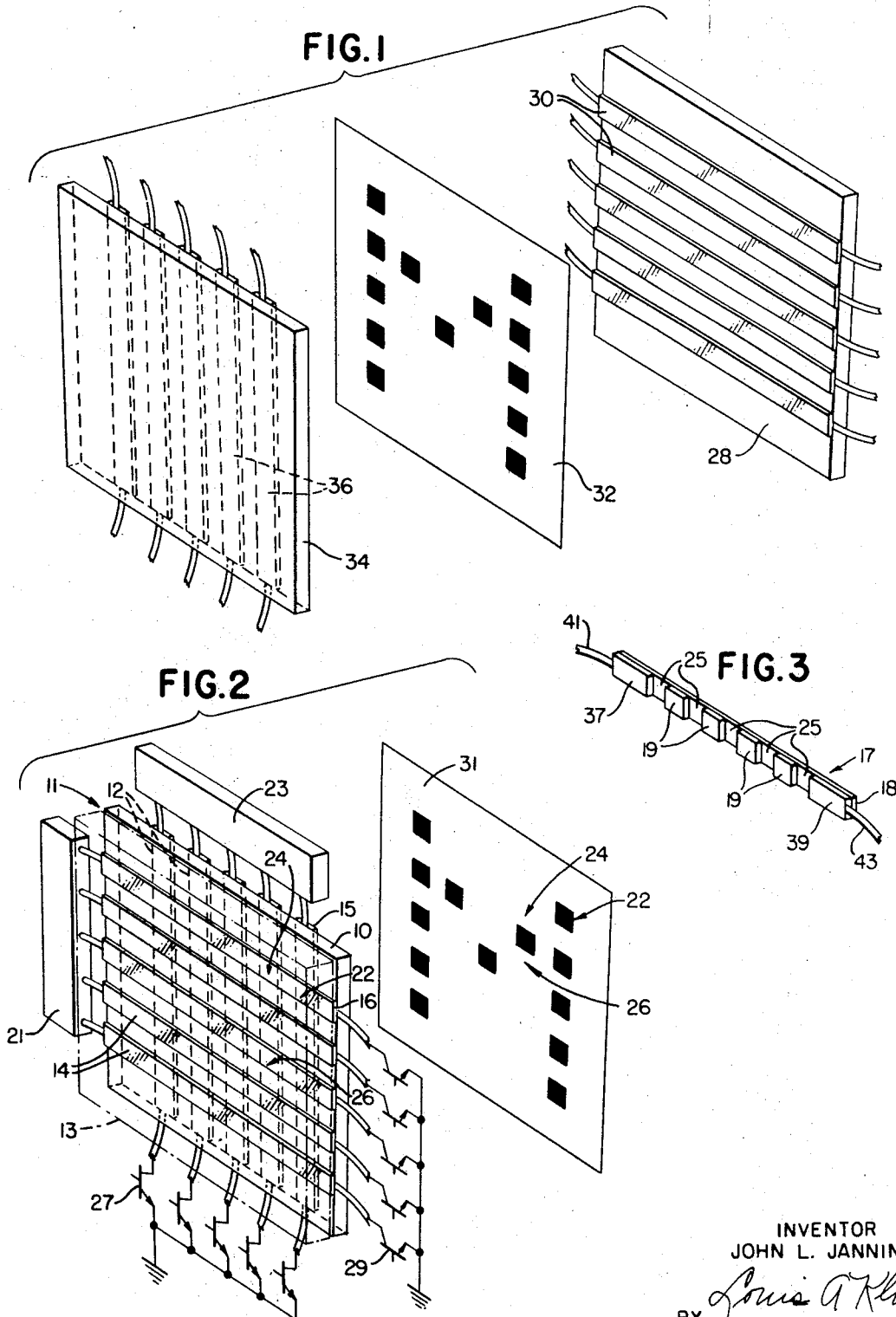
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THERMAL HALF-SELECT PRINTING MATRIX

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THERMAL HALF-SELECT PRINTING MATRIX

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2 Claims

ABSTRACT OF THE DISCLOSURE

Thermal half-select printing matrices in which printing on an adjacent heat-sensitive material occurs only at those matrix points which have coincident electrical current flowing through crossing electrically resistive thermal printing conductors which define those points are disclosed.

CROSS-REFERENCE TO RELATED APPLICATION

U.S. patent application Ser. No. 646,888, filed June 19, 1967, now Pat. No. 3,466,423, issued Sept. 9, 1969, in the name of John L. Janning, inventor, of which this is a division.

BACKGROUND OF THE INVENTION

Full-select thermal printing matrices employed in the prior art must have an isolation diode for each electrical selection conductor that is employed in order to prevent "sneak" currents and to isolate one matrix element from another. The thermal half-select printing matrices of the present invention eliminate the necessity of supplying an isolation diode for each electrically resistive thermal printing conductor of a thermal printing matrix.

SUMMARY

Thermal half-select printing is accomplished by coincident current energization of electrically resistive thermal printing elements.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of one embodiment of the present invention, in which row and column electrically resistive thermal printing conductors are located on separate substrates.

FIG. 2 is a perspective view of another embodiment of the present invention, in which row and column electrically resistive thermal printing conductors are located on a common substrate.

FIG. 3 is a perspective view of an alternate electrically resistive thermal printing conductor.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The thermal half-select printing matrices of the present invention are constructed for use with thermally sensitive record material. In the embodiment of FIG. 2, a thin electrically insulating substrate 10, which may be of any electrically insulating material, such as silicon dioxide, which is not subject to rapid heat diffusion from a heated point on the substrate, is employed. The thin electrically insulating substrate 10 should be on the order of one thousandth of an inch thick. The complete thermal printing member 11 is then mounted on a rigid support board 13.

Electrically resistive thermal printing conductors which are on the order of 16 thousandths to 70 thousandths of an inch wide and on the order of 4 millionths of an inch thick, and which are composed of an electrically resistive

material such as tin oxide, Nichrome, rhenium, tantalum, or other such materials, are aligned into columns 12 on one side of the substrate 10 and into rows 14 on the other side of the substrate 10. When the heat-sensitive side of a thermally sensitive record material 31 is brought near the substrate 10, printing may be accomplished at a matrix location, such as 22, by coincident current energization of the crossing row and column conductors that are associated with that location. Coincident electrical current is supplied by the current supply means 21 and 23 and the selection grounding transistors 27 and 29, which are selectively saturated when supplied with positive voltage selection signals on their bases. For example, if an electrical current is passed through the column conductor 15 coincidentally with an electrical current through the row conductor 16, the radiated energy at the matrix location 22 due to the current in each of the conductors 15 and 16 will add, and, consequently, printing will occur on the thermally sensitive paper 31 at this location if the thermal threshold of the thermally sensitive paper is exceeded. Energization of only one conductor will not produce sufficient energy at a matrix location to exceed the thermal threshold of the thermally sensitive paper 31. At other points of the matrix, such as the matrix points 24 and 26, where only the current through either a row conductor or a column conductor generates energy, the thermal printing threshold of the heat-sensitive paper is not exceeded, and, therefore, printing does not occur at these points.

The thermal printing paper 31 may be placed in proximity with the exposed side of the electrically insulating film substrate 10. The optimum operating characteristics are found to exist when the heat-sensitive paper 31 is positioned in its thermal printing position and the current through a column conductor is increased until printing occurs as the result of energy through the column conductor only. The current through the column conductor is then reduced by approximately 10%. The same procedure is then followed for determining the optimum operating point of a row conductor.

FIG. 1 shows another embodiment of the present invention, in which row conductors 30 are secured on one side of an electrically insulating substrate 28. The substrate 28 is then placed behind the non-thermally-sensitive side of the thermally-sensitive paper 32. Column conductors 36 of an electrically resistive material are secured on one side of another electrically insulating substrate 34. The substrate 34 is positioned on the front, or heat-sensitive, side of the thermally sensitive paper 32. As in the embodiment of FIG. 2, the row and column conductors may be interchanged if desired. The row conductors 30 and the column conductors 36 are selectively supplied separate and coincidental electrical currents by a current supply means, such as the current supply means 21 and 23 shown in FIG. 1. Just as in FIG. 1, if an electrical current is passed through a column conductor 36 coincidentally with a separate electrical current through a row conductor 30, the thermal energy radiation from those portions of the electrically resistive printing elements that intersect at a matrix location, like the matrix location 22 of FIG. 1, will be greater than the thermal energy radiation from those portions of the electrically resistive printing elements that intersect but are not supplied with separate and coincidental electrical currents. The foregoing greater thermal energy radiation will be of a magnitude sufficient to exceed the thermal threshold of the thermally-sensitive record material 32, causing printing thereon in the same manner as in the FIG. 1 embodiment. In particular, printing will occur on the thermally-sensitive record material 32 in the vicinity of those thermal printing locations which are formed by an intersecting portion of a printing element 28 and an intersecting print-

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ing element 36 when both of the crossing printing elements 28 and 36 at a thermal printing location are supplied separate and coincidental electrical currents. The same procedure for obtaining the optimum operating characteristics which was described in conjunction with the embodiment of FIG. 2 may also be employed in connection with the embodiment of FIG. 1.

FIG. 3 shows an alternate electrically resistive conductor 17, which may replace the row conductors or the column conductors of the embodiments of FIGS. 1 and 2. This conductor 17 consists of alternate areas 19 of an electrically conductive material, such as copper or gold, which are deposited over an electrically resistive substrate material 18, such as tin oxide, etc. The deposited conductive material 19 reduces the resistance along portions of the conductor 17 in which no print is desired; therefore the total energy loss of the conductor 17 is reduced, and, in addition, printing is more accurately confined to the desired printing areas 25. External electrical connections are made to the conductive areas 37 and 39 by the conductive leads 41 and 43, respectively.

What is claimed is:

1. A thermal printing device for printing on a thermally-sensitive record material, comprising:

- (a) a first set of electrically resistive printing elements, crossing the first set of printing elements, to form a matrix of thermal printing locations at those portions of the printing elements which intersect, wherein the first set of electrically resistive printing elements is mounted on one side of a non-conductive substrate, and
- (b) a second set of electrically resistive printing elements is mounted on one side of a second non-conductive substrate and is positioned to face the first set of electrically resistive printing elements, the thermally-sensitive record material being placed intermediate the two substrates, and

(c) means to selectively supply a first electrical current through printing elements of the first set of electrically resistive printing elements and a second separate and coincidental electrical current through printing elements of the second set of electrically resistive printing elements to cause thermal energy radiation

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from those portions of the electrically resistive printing elements that intersect and are supplied with said first and second electrical currents to be greater than thermal energy radiation from those portions of the electrically resistive printing elements that intersect but are not supplied with both of said first and second electrical currents,

said greater thermal energy radiation being of a magnitude exceeding the thermal threshold of the thermally-sensitive record material and effecting printing thereon, said printing being effected on the thermally-sensitive record material, which is positioned adjacent the matrix of thermal printing locations,

in the vicinity of those thermal printing locations which are formed by an intersecting portion of a printing element of the first set and an intersecting portion of a printing element of the second set when both of the crossing printing elements at a thermal printing location are supplied said separate and coincidental currents.

2. A thermal printing device as in claim 1 wherein the electrically resistive printing elements of at least one of the sets of the printing elements each comprises an electrically conductive path of alternately arranged high-resistance portions and low-resistance portions, and the high-resistance portions define the thermal printing locations of the matrix.

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