

- [54] **THERMAL RECORDER HAVING ANALOGUE STYLUS AND PRINT HEAD**
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- [52] U.S. Cl. **346/76 R, 346/61, 219/216**
 [51] Int. Cl. **G01d 15/10**
 [58] Field of Search **346/76 R, 62, 61; 219/216**

[56] **References Cited**
UNITED STATES PATENTS

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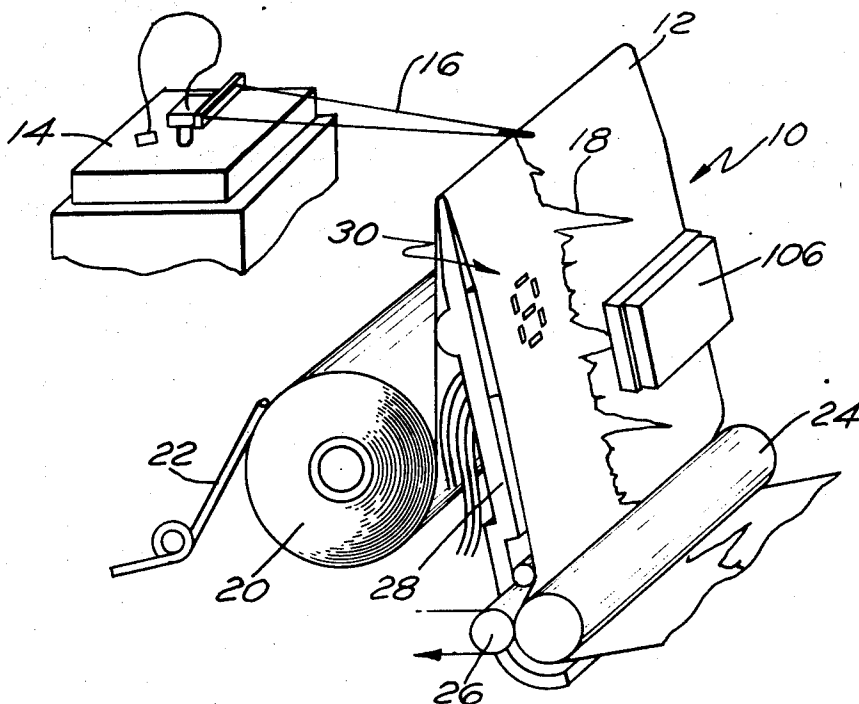
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Primary Examiner—Joseph W. Hartary
Attorney—Elliot A. Salter et al.

[57] **ABSTRACT**

A recording device for recording numeric information on a continuously moving thermo-responsive sheet material and including a print head having a plurality of heat conducting segments that are in contact with the sheet material and that are selectively energized for thermographically producing a numeric character at intervals on the continuously moving sheet material.

4 Claims, 4 Drawing Figures



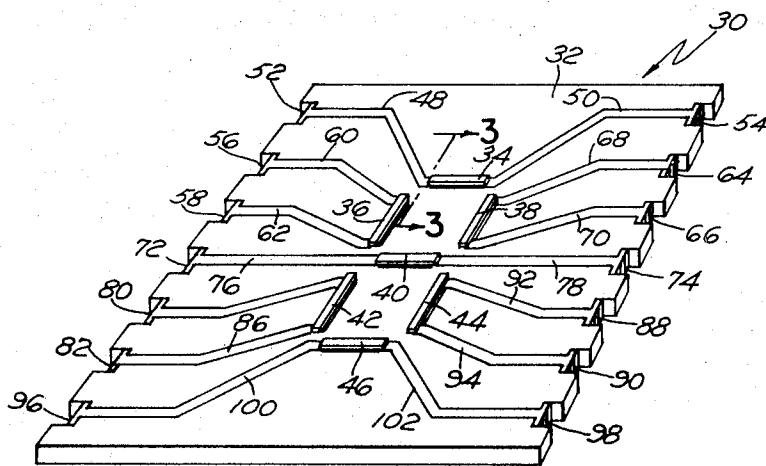


FIG. 2

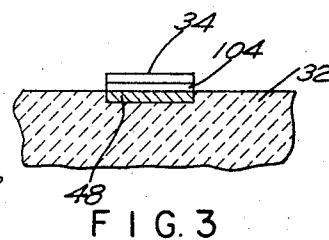


FIG. 3

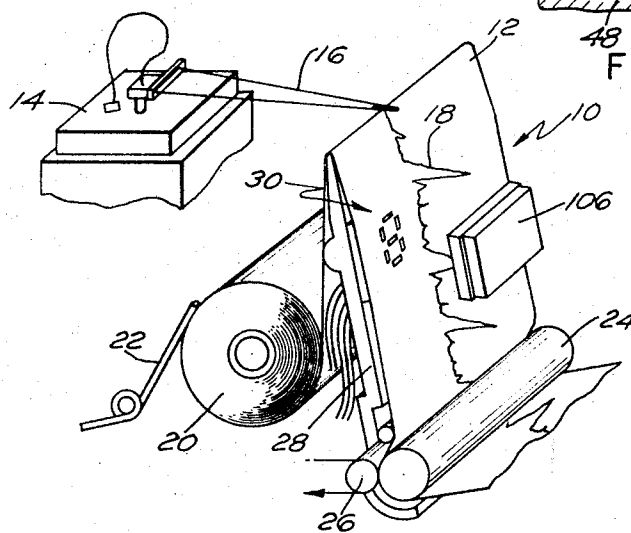


FIG. 1

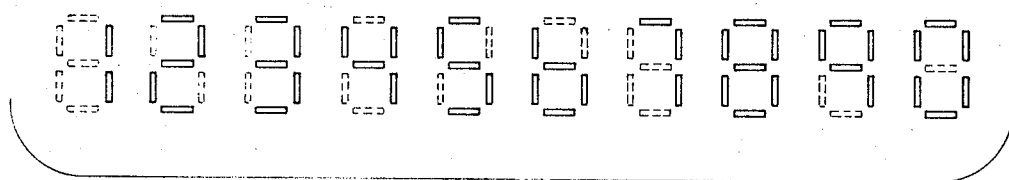


FIG. 4

THERMAL RECORDER HAVING ANALOGUE STYLUS AND PRINT HEAD

BACKGROUND OF THE INVENTION

The present invention relates to a recording device that incorporates a continuously moving thermo-responsive sheet material therein, wherein selected information is produced on the sheet material thermographically.

The present invention has particular application in analog recorders used for continuously recording information on a thermo-responsive paper. Prior to the instant invention, analog recorders have been used in hospitals for remotely recording tracings from electrocardiograph units that monitor patients that are located in intensive care areas so that an instantaneous observation of the units could at any time determine the status of an individual patient. Heretofore, it has been a problem to immediately identify a particular electrocardiograph tracing at the recording station with the specific patient being monitored. Thus, if a tracing at the recording station was observed by hospital personnel that indicated that a patient was having a reaction from normal, the patient could not always be immediately identified from the information on the recorder. This problem was particularly present when the electro-cardiograph unit was frequently shifted from one location to another. Usually the patient's name was written on the continuously moving sheet material at the recording station, or some other identifying means was written thereon. However, this kind of identification was not always satisfactory because the information relating to the patient, if located on the paper, would not be always visible; and at times the nursing staff would even neglect to identify a particular chart with a patient.

In addition to the problems resulting from identifying information at a remote station, as received from an electro-cardiograph unit, continuous analog trace recordings of various kinds often needed positive identification; and unless some system were provided for identifying the source of the analog information on the continuously moving sheet material, the source was not always immediately known, particularly if several recording devices were located at a recording station and if the source was frequently moved from one location to another.

SUMMARY OF THE INVENTION

The recording device as embodied in the present invention may include an analog recording stylus; but in order to provide an identifying symbol for the source of the analog information, a print head is incorporated in the device that includes a plurality of resistor heating segments that are in contact with a continuously moving thermo-responsive sheet material. The segments are arranged such that when selectively energized they produce a mark on the sheet material that corresponds to a numeric character from 1 through 9 and 0. The print head as located at the print station assures that the segments are in sufficient contact with the continuously moving thermo-responsive sheet material so that upon selective energizing of the heat conducting segments, the thermo-responsive paper reacts to the contact by the segments to intermittently produce the selected numeric character on the sheet material.

Accordingly, it is an object of the present invention to provide a recording device that continuously prints an identifying number on a continuously moving sheet material.

Another object of the invention is to provide a recording device that includes a print head having an array of heat conducting segments located thereon that are in contact with a continuously moving thermo-responsive sheet material and that, when selectively energized, thermographically produce a numeric character on the sheet material at intervals thereon.

Still another object is to provide a recording device that thermographically produces a selected numeric character on a continuously moving sheet while analog information is simultaneously being produced on the same continuously moving sheet by an analog recorder.

Still another object is to provide a print head for use in a recording device that includes an array of heat conducting segments that are arranged to form a selected numeric character, the heat conducting segments being insulated from the base of the print head and being selectively energized so as to thermographically produce the selected numeric character on a continuously moving thermo-responsive sheet material that is in engagement therewith.

Other objects, features and advantages of the invention shall become apparent as the description thereof proceeds when considered in connection with the accompanying illustrative drawings.

DESCRIPTION OF THE DRAWINGS

In the drawings which illustrate the best mode presently contemplated for carrying out the present invention:

FIG. 1 is a perspective view of a print station of an analog recorder as embodied in the present invention showing the simultaneous printing of a selected numeric character and analog information on a continuously moving thermo-responsive sheet material;

FIG. 2 is a perspective view of a print head for thermographically producing the selected numeric character on the thermo-responsive sheet material;

FIG. 3 is a sectional view taken along line 3-3 in FIG. 2; and

FIG. 4 is a diagrammatic illustration showing the various combinations of print head segments that are energized to thermographically produce the numeric characters from 1 to 9 and 0 on a thermo-responsive sheet material.

DESCRIPTION OF THE INVENTION

Referring now to the drawing and particularly to FIG. 1, a remote recording device is illustrated and is generally indicated at 10. As shown, the remote recording device 10 is of the type generally referred to as an analog recorder and includes a specialized continuously moving recording sheet 12 that is formed of a thermo-responsive material of the type illustrated and described in U.S. Pat. No. 3539375. It is contemplated that one side of the sheet 12 will be sensitized; although, applying heat to the unsensitized surface will result in a marking thereon. Although the recording device 10 has general application as an analog recorder for recording information from a remote source, for purposes of the description herein reference will be made to a special use of the device wherein the recording sheet 12 continuously records tracings from an

electro-cardiograph unit that is responsive to the output of a patient located in a hospital facility. In this connection, a galvanometer 14 is located at a recording or print station and is responsive to the electro-cardiograph unit to cause a heated stylus 16 to produce a continuous tracing 18 on the thermo-responsive sheet material 12. Spaced from the galvanometer 14 and conveniently mounted in a suitable cabinet or the like (not shown) along with the galvanometer 14 is a chart paper supply 20 with which a friction arm 22 makes contact for imposing appropriate tension on the sheet material 12 as it is moved through the print station. A drive roller 24 is located at the discharge side of the print station and a drive member 26 which engages the drive roller 24, provides for movement of the roller 24 to produce the appropriate movement of the sheet material at a controlled speed. Also located at the print station is a fixed support 28 that is disposed in substantially vertical relation and over which the thermo-responsive sheet material 12 moves. As previously described, the heated stylus 16 that is responsive to the galvanometer 14 to produce a recording on the continuously moving thermo-responsive sheet material is located at the print station and produces a continuous record of the patient's electro-cardiograph tracing.

Usually the recording device 10 is located at a station remote from the patient so that observation by hospital personnel of the patient's condition may be made at any time by reading the recording device. Heretofore, there has been some problem in identifying a particular patient with the remote analog recorder as used with an electro-cardiograph, particularly when a plurality of electrograph tracings are being recorded simultaneously at the remote station on a continuous basis. If one of the recording devices indicated that a patient was having difficulty, it was not always immediately determined which patient was having the problem since the recording device could not always be instantly identified with the patient from which it was receiving the tracing.

In order to positively identify the recording device 10 with a particular patient, the present invention provides that an identifying number corresponding to the patient's room or the like be periodically recorded on the thermo-responsive sheet material 12; and for this purpose, a print head generally indicated at 30 is provided and is also located at the print station in contact with the unsensitized surface of the thermo-responsive sheet material 12. As illustrated in FIGS. 2 and 3, the print head 30 comprises a base 32 that is formed of a non-conductive ceramic material or the like such as alumina. As will be described, the print head is used simultaneously with the analog recorder and includes a thick film hybrid circuit of conventional construction having a seven-segment matrix, wherein selected segments are energized for heating and, as will be described, make contact with the continuously moving sheet material 12 to produce a selected numeric character from numbers 1 through 9 and 0 at intervals on the sheet material 12.

The print head 30 is located in a substantially vertical position on the support 28 and is positioned such that the continuously moving thermo-responsive sheet material 12 is located in intimate contact therewith. As will be described, heated segments fixed in the print head 30 make brush contact with the sheet material; and upon the energization of selected segments, a corresponding numeric character will be thermographi-

cally produced on the specialized thermo-responsive sheet material 12.

Referring again to FIG. 2, the print head 30 is shown including seven heat conducting segments 34, 36, 38, 40, 42, 44 and 46 that are arranged in an array for selected energizing to form a numeric character from 1 through 9 and 0. Appropriate grooving is formed in the base 32 of the print head 30 for receiving electrical conducting elements that are electrically connected to the segments, wherein the elements are selectively energized to heat the segments to the temperature required for forming a character on the sheet material 12. In this connection the segment 34 is electrically connected to conducting elements 48 and 50 to provide a complete circuit therethrough. Terminals 52 and 54 are electrically interconnected to appropriate wiring that in turn electrically communicate with a control station. Segment 36 is electrically connected to terminals 56 and 58 through conducting elements 60 and 62, respectively; while segment 38 is electrically connected to terminals 64 and 66 through conducting elements 68 and 70, respectively. The central segment 40 electrically communicates with terminals 72 and 74 through conducting elements 76 and 78, respectively. Terminals 80 and 82 communicate with the segment 42 through conducting elements 84 and 86, respectively; while terminals 88 and 90 are electrically connected to the segment 44 through conducting elements 92 and 94. The segment 46 is connected to terminals 96 and 98 through conducting elements 100 and 102, respectively. It is understood that all of the terminals that are electrically connected to the segments 34 through 46 are electrically interconnected to the control station through appropriate wiring so that any of the segments may be selectively and periodically energized for thermographically producing the necessary numeric character at intervals on the thermo-responsive sheet material 12. Although not illustrated, it is understood that one or more additional sets of segments may be fixed in the base 32, the appropriate conducting elements, terminals and wiring being electrically interconnected thereto.

In order to insure that sufficient heat is transferred to the sheet material from the print head segments and to minimize the heat transferred to the substrate of the segments, each of the segments is fixed on a glass base or mesa, an example of which is illustrated at 104 in FIG. 3. The glass mesas are built up of layers of glass material that are fired to serve as an underlay to the segments that are formed of resistor material. As shown in FIG. 3, the glass mesa 104 projects above the upper surface of the base 32; and since the segment 34 overlays the glass mesa 104, it also projects outwardly of the base 32 for insuring intimate contact with the sheet material 12. It is seen that the glass mesas as fixed beneath the segments serve a dual purpose, the first being as insulators for the segments, thereby thermally isolating the segments from the underlying substrate. By thermally isolating the segments from the substrate, the maximum heat is transferred to the sheet material from the segments during printing. Further, a minimum amount of heat is transferred to the substrate, which if allowed to have heat concentrated therein, could cause the substrate temperature to rise to the paper threshold temperature, thereby causing the printed character to be blurred or obliterated. The second purpose of the glass mesas is to physically elevate the resistor segment

above the substrate, thereby enhancing contact of the segments with the sheet material 12 as the sheet material passes over the print head 30.

In use of the recording device 10, it will be assumed that the analog information being received by the galvanometer 14 and transmitted to the thermo-responsive sheet material 12 is transmitted from an electro-cardiograph unit that is recording pulses from a patient. This information as illustrated in FIG. 1 is being traced on the sheet material 12 by the heated stylus 16. In order to identify the patient from whom the information is received, the control for the print head is activated to energize selected heat conducting segments 34 through 46. As previously described, any numeric character from 1 to 9 and 0 can be reproduced on the sheet material 12 by energizing the appropriate segments. If it is desired to produce the numeric character "8" on the sheet material, all of the segments are energized and the heat produced therefrom as the sheet material 12 makes contact therewith would result in the numeric character "8" appearing on the sheet material as illustrated in FIG. 1. The control for the print head 30 is also operated to cause the appropriate segments to be periodically energized so as to produce the numeric character on the sheet material 12 at intervals. It is seen that any selected numeric character can be produced as indicated in FIG. 4 by energizing the required segments so that only the selected segments are heated, wherein the heat therefrom is transferred to the sheet material 12 upon contact therewith to periodically produce the selected numeric character on the continuously moving sheet material.

On occasion it may be desirable to have the sheet material 12 make firm positive contact with the print head 30, and for this purpose a pressure pad 106 is provided. The pressure pad 106 is suitably mounted on a support that is periodically movable into brush contact with the sheet material 12 and into overlying relation with respect to the print head 30. It is seen that contact of the pressure pad 106 with the sheet material over the print head 30 will enhance the contact of the heated segments with the sheet material to positively produce the selected numeric character.

Although the print head 30 has been described for use herein with an analog recorder for recording electro-cardiograph information transmitted from a remote station and as described produces the numeric character on the sheet material simultaneously with the electro-cardiograph tracing as transmitted, it is understood that the concept of the invention embodied herein need not necessarily be incorporated in an analog recording device as described. In this connection, the present invention may be utilized with any thermo-responsive sheet material with which a print head of the type illustrated in FIG. 2 is associated. It would be essential, of course, that the print head makes contact with a continuously moving thermo-responsive sheet material and that preferably the selected segments in the print head 30 are periodically energized to cause

the print head to produce the selected numeric character at predetermined intervals on the moving sheet 12.

While there is shown and described herein certain specific structure embodying the invention, it will be manifest to those skilled in the art that various modifications and rearrangements of the parts may be made without departing from the spirit and scope of the underlying inventive concept and that the same is not limited to the particular forms herein shown and described except insofar as indicated by the scope of the appended claims.

What is claimed is:

1. A recorder for recording information from a remote source on a continuously moving thermo-responsive sheet material, comprising a print station, means for continuously moving said thermo-responsive sheet material through said print station, an analog recording stylus engaging said sheet material at the print station for continuously and thermographically recording analog information on said continuously moving sheet material, a print head located at said print station and including a plurality of heat conducting segments that are arranged to selectively form a plurality of identifying characters, said print head including a base of non-conducting material in which said heat conducting segments are located, a plurality of conductor elements fixed in said base and electrically communicating with said heat conducting segments, wherein said heat conducting segments are individually and selectively energized by the conductor elements in intermittent relation for inducing heat therein, the heated segments in contact with said continuously moving sheet material thermographically producing a selected identifying character at intervals thereon and simultaneously with the continuous recording of the analog information on said sheet material.

2. A recorder as set forth in claim 1, a support located at said print station and said print head mounted on said support in fixed relation with respect to the continuously moving thermo-responsive sheet material.

3. A recorder as set forth in claim 1, a non-conducting element disposed beneath each of said heat conducting segments for thermally insulating each heat conducting segment from the underlying base, wherein maximum heat is transferred to said sheet material by the heat conducting segments, said non-conducting element further elevating each heat conducting segment sufficiently above the base to provide for intimate contact of the sheet material with said heat conducting segments as the sheet material is moved over said printing head.

4. A recorder as set forth in claim 3, said sheet material having a sensitized surface and an unsensitized surface, the energized selected heating segments engaging the unsensitized surface for thermographically producing the selected numeric character on the sensitized surface.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,754,279 Dated August 21, 1973

Inventor(s) Leo F. Valenti and Paul S. Follett

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Abstract, line 1, change "numeric" to --identifying--;

line 6, change "a numeric" to --an identifying--;

Claim 4, line 5 (column 6, line 57), change "numeric" to
--identifying--.

Signed and sealed this 25th day of December 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents

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