ABSTRACT

Ink jet printer shiftable along a sheet recorder. The printer has conventional deflection plates or electrodes which, when energized, create an electromagnetic field corresponding to the shape of the indicia to be recorded and cause the spray of ink issuing from the head to be deflected to assume the configuration of the magnetic field. The head is moved along a record sheet traveling about a roll and is connected to its carrier by plug in connections, to enable cleaning or exchanging of the head and to avoid all solder connections. The plug-in connections are so arranged to prevent the plugging forces from being transmitted to the recording head.

12 Claims, 6 Drawing Figures
FIELD OF THE INVENTION

This invention relates to interchangeable ink jet recording heads and plug-in connections therefor.

PRIOR ART

Ink jet printing in place of contact printing is known to the art. In such printing, predetermined indicia are applied to a record sheet by means of a jet spray of dyed liquid, which may be in the form of ink. In these printers, an electromagnetic field corresponding to the form of the indicia to be recorded, causes the spray of ink to be magnetically deflected by the electromagnetic field set up, to assume the configuration of the resultant electromagnet field.

In prior ink jet recorders, in which the recording head is shifted along a line perpendicular to travel of the sheet, it has been difficult to clean or interchange the recording heads in case the inner recorder head may become dirty or may otherwise function improperly. This is particularly true where the electrical connections are solder connections, since the heat of releasing the solder connections is apt to deform the deflection plates of the recorder, which usually are made of a plastic material coated with a conducting material, such as gold, and the heat of soldering is liable to change the geometry of the recording head.

SUMMARY OF THE INVENTION

The present invention avoids the foregoing difficulties in that it provides a recording head which can be coupled to its carrier through a plug-in connection mechanically connecting the head to its carrier and making the electrical connections during the connecting process. In addition, the ink supply line is connected to the recording head through a plug-in connection which can be made while pluging in the recording head.

A further advantage and development of the invention is that the recording head carrier carries at least one rigid ink hose which can be connected with an ink supply hose and tightly coupled through a leak-proof connection with a connection nipple leading to the ink jet nozzle while the recording head is being plugged in.

A further advantage of the present invention is that a simple plug-in connection to the ink line is provided including two rigid aligned ink lines so arranged that transmitting of the plug-in connecting forces to the recording head is avoided.

A further advantage in the invention is that the recording head is slidable supported on a pair of parallel guide rods or wires to be shifted across a recording sheet, which serve to guide the carriage, and are associated with guide wires under tension on opposite sides of the plug-in part of the carriage adapted, to have the recording head plugged in from above, in which the guide rods support the carriage on opposite sides of the guide wires to relieve the guide wires from the plug-in forces occurring during the connecting process.

Other objects, features and advantages of the invention will be readily apparent from the following description of certain preferred embodiments thereof, taken in conjunction with the accompanying drawings, although variations and modifications may be effected without departing from the spirit and scope of the novel concepts of the disclosure.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic perspective view illustrating one form in which our invention may be embodied. FIG. 2 is an end view of the recording head shown in FIG. 1, with part of the head removed.

FIG. 3 is a view in side elevation of the recording head shown in FIGS. 1 and 2 with parts of the supports and guides for the carriage shown in transverse section.

FIG. 4 is a diagrammatic perspective view illustrating another form in which our invention may be embodied and showing the carrier head lifted from its carriage.

FIG. 5 is a fragmentary side view of the carrier head and part of the carriage with certain parts broken away and other parts shown in transverse section, and showing the association of the recording head with a record sheet; and

FIG. 6 is a front end view of the recording head and carriage with certain parts broken away and certain other parts shown in transverse section.

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

In FIG. 1 of the drawings, we have diagrammatically shown a recording device 1 of the jet ink printer type, guided and moved across a sheet (not shown) trained about a roll, which may be a driven roll, as shown in FIG. 5, for recording indicia thereon. The recording device includes a generally vertically extending carriage 1b having an enlarged generally rectangular housing portion and socket member 1a at its upper end, for receiving and supporting a recording head 3.

The carriage 1b is supported intermediate its ends for slidable movement along a rod 15 supported at its opposite ends on support blocks 15a and 15b forming a part of the frame (not shown) of the recording device. A tensioning wire 2 is secured at one end to the block 15z in a suitable manner and extends parallel to the rod 15 through a guide bushing 2a (FIGS. 2 and 3) extending across the carriage and above the guide rod 15 about a rounded outer end portion of the block 15b and toward the block 15a through a guide bushing 2b carried at the lower end of the carriage on a widened base therefor and forming an elongated guide for the carriage on the lower wire 2, to maintain the recording device in an upright position. The guide wire 2 is suitably secured at its adjacent ends to the block 15a to place said wire under tension in a manner well known to those skilled in the art so not herein shown or described further. A flexible drive member 2c may be suitably connected to the bottom of the carriage 1b and be trained about a direction changing pulley 2d, shown as being disposed adjacent the block 15b and around direction changing members 2e spaced outwardly of the block 15a, to a suitable means for driving said flexible drive member, and moving the carriage 1b along the rod 15 at a controlled rate of speed, controlled by the rate of travel of the recording sheet about its roll. The means for moving the carriage and driving the flexible drive member 2c is no part of the present invention, so need not herein be shown or described further.

The rectangular enlarged housing portion and socket member 1a of the carriage 1b is shown in FIG. 2 as being of a generally rectangular form, having a socket 1e generally cylindrical in form, extending there-
through and opening into contact chambers 8a, 10a and 11a for contacts 8, 9, 10 and 11 spaced outwardly of those designated in FIG. 2. The recording head 3 has a generally cylindrical head portion 3a, shown as being hollow and forming a plug slidably fitting or adapted to be plugged within socket 1e in the housing portion and socket member 1a. FIG. 3 shows the recording head 3 as extending entirely through the socket 1e and as having a closed rear end portion 3b. The cylindrical wall 3a or plug portion of the recording head closely engages the internal wall 1e of the socket of the housing portion an socket member 1a, to accommodate the recording head to be slidably moved within the housing portion and socket member with its nozzle end projecting beyond the front of said housing and socket member 1a and to be readily removed therefrom by a sliding or unplugging operation, when it is desired to clean or interchange the recording head with another recording head. The recording head 3 is hollow and has a series of chordally extending slots therein for receiving deflection plates 4, 5, 6 and 7 extending thereacross, with one end of each deflection plate projecting into an associated contact chamber. As for example, the deflection plates 4 and 5 are shown as extending into the contact chamber 8a into contacting engagement with the respective contacts 8 and 9. The deflection plate 6 extends into the contact chamber 10a into engagement with the contact 11 and the deflection plate 7 extends into contact chamber 11a into engagement with the contact 11, as the recording head is plugged into the receptacle 1e.

The deflection plates may be plastic plates covered with gold, in order to obtain good contact with the contacts 8, 9, 10 and 11, which also may be gilded. The contacts 8, 9, 10 and 11 may be electrically connected to a suitable electric control circuit programmed to energize said contacts to produce electromagnetic fields between the deflection plates 4, 5, 6 and 7 in accordance with the ink jet pattern required to print the preselected indicia on the recording sheet in a manner well known to those skilled in the art so not herein shown or described further.

When the recording head 3 is plugged into the receptacle 1e, it may be held in the required position as by a spring-like bale 12 forming a locating and locking member extending within or suitably secured to the housing and socket portion 1a adjacent opposite sides thereof, and biased into engagement with a projecting nozzle portion 3d of the recording head 3, to hold said recording head in the proper position. The spring-like locating and locking member 12 may fit along a flattened surface (not shown) of the recording head to hold the recording head in position, or may fit into a suitable notch (not shown) to hold the recording head in position, but to enable ready removal or the recording head from its socket.

The recording head 3 has a nipple 3c for an ink hose 13 depending therefrom. The ink hose 13 may be supplied hose and may supply ink to the recording head at a preselected pressure. The closed end portion 3b of said recording head also has a nipple 3d depending therefrom, for an ink hose 14. The hose 14 may be a drain hose. The ink hoses 13 and 14 may readily be disconnected from said nipples prior to removal of the recording head from the socket 1e and may be connected to said nipples as the recording head is plugged into its socket. A guide bracket 14a extends rearwardly from the carriage to hold the ink hoses 13 and 14 in spaced relation with respect to each other.

It may be seen from the foregoing description that the recording head may readily be plugged into its receptacle and that the contacts to the deflection plates are made during the plugging operation with no soldering or other connection, other than bearing engaging connections between the deflection plates and their contacts.

In the embodiment of the invention diagrammatically illustrated in FIGS. 4 through 6, we have shown a modified form in which our invention may be carried out. In this form of the invention, a translationally movable carriage 21 is provided with guide slots opening to opposite sides thereof and slidably supported on guide rods 22 and 23. The guide rods 22 and 23 are mounted at their ends on frame members 22a and 23a, forming a part of the main frame of the machine. The rods 22 and 23 will absorb relatively high plugging forces, in each position of the carriage with little, if any, bending of said rods and a guide wire 24.

The carriage 21 is shown as being of a generally rectangular blocklike form having a central rectangular recessed portion 21a to receive a base 26 for a recording head 25. The guide wire 24 under tension extends about a direction changing sheave 24a on the inside of the bracket member 22a, through apertured guide portions extending through the carriage 21 and equally spaced from opposite sides of the recessed portion 21a, to the bracket member 23a, and is secured thereto at its ends in such a manner as to place said guide wires 24 under tension. A flexible drive member 23b is provided to drive the carriage 21 along the guide rods 22 and 23. The flexible drive member 23b is diagrammatically shown as trained along the rod 23 about a direction changing sheave 23d on an arm 23f of the bracket member 22a, to the opposite end of the guide rod 23, and about sheaves 23e rotatable about coaxial vertical axes. Suitable means may be provided for driving the flexible drive member and moving the carriage 21 and recording head 25 back and forth along the support and guide rods 22 and 23 parallel to a roll 19, having a recording sheet 20 trained thereabout. The drive connection to the flexible drive member 23b may be of a conventional form and is not part of the present invention so need not herein be shown or described further.

The recording head 25 includes a housing 25a rigidly mounted on the upper part of the base 26 and extending upwardly therefrom. The base 26 extends downwardly of the recording head and has four plug-in contacts spaced diametrically apart and depending therefrom. Said contacts are plug-in contacts and have electrical connection with the deflection plates 4, 5, 6 and 7 of the recording head, which like the deflection plates shown in FIG. 2, are arranged at right angles with respect to each other chordally of the cylindrical surface of the housing for the recording head and may have direct bearing engagement with the conductors leading from the said plug-in contacts. The base 26 has a plug housing portion 26a conforming to the recess 21a an fitting therein.

A cross-piece 26b extending across the housing portion 26a has an opening therein for receiving a rubber grommet or sleeve 27 and accommodating said grommet to be snapped thereinto to hold said grommet in position. The cross-piece 26b is movable with the housing portion 26a along the recessed portion 21a when
plugged the recording head in or withdrawing the recording head from the recessed portion 21a. A nipple 32 depends from a carrier 32a for the recording head into sealing engagement with the sleeve 27, and has communication with the recording head, for supplying ink thereto. A fluid connector 32b is plugged into the resilient sleeve or grommet 27 in direct alignment with the nipple 32 with its discharge end out of contact with said nipple. Said fluid connector is hollow to accommodate the flow of ink therethrough from the ink pump (not shown) and has a head 32c on its lower end with a flanged bottom portion engaging the bottom of an internal bottom wall of the recessed portion 21a of the carriage 21, and secured thereto. A passageway 29a leads through the bottom wall of the recessed portion 21a in direct alignment with the flanged connector 29 and depends therefrom and has a reduced end portion for a hose 28. The flange of the connector 29 may be suitably secured to the bottom of the recessed portion of the carriage, to provide a continuous ink connection from the hose 28 through the conduit 29, fluid passageway 29a, fluid conduit 32b and nipple 32. The hose 28 and fluid conduit 32b thus have no contact with the nipple 32 so that connecting or plugging forces connecting the housing portion 26a for the recording head to the recessed portion 21a, are isolated from the recording head. Ink which may possibly drip, when the base 26 is removed or when 32b may be removed from the rubber sleeve or grommet is caught in a dish-shaped member 30 extending about the conduit 32b beneath the sleeve 27.

An insulator 31 is firmly connected with the lower carriage part 21 and forms a multiple receptacle bushing for the plug-in pins arranged at 90° with respect to each other. Plug-in pins 34 shown in FIG. 6 engage suitable receptacles in said multi-receptacle bushing. Other plug-in pins not shown at right angles to the pins 34 are plugged into said receptacle. The receptacles for the other plug-in pins are shown as having conductors 33 leading therefrom. The conductors 33 and plug-in pins 34 thus serve as electrical connection lines for establishing the required electromagnetic fields along the vertical and horizontal deflection plates 4, 5, 6 and 7.

A nipple 36 leads from the recording head in parallel spaced relation with respect to the nipple 32 and has a rubber hose 37 leading therefrom having a wick 39 extending therealong for allowing the return of ink to a suitable receptacle for waste ink.

It may be seen from the foregoing that the electrical connections, the leak-proof connection from the ink supply line to the recording head and the mechanically centering of the recording head are assured when the recording head 25 is plugged into the carriage 21, and that all disrupting or damaging forces to the recording head are avoided when plugging the recording head into or removing the recording head from its carriage.

We claim:
1. In an ink jet recording device, a carriage shiftable along a record sheet, support and guide means for said carriage, a recording head including an ink jet nozzle and a series of deflecting plates extending thereacross in horizontal and vertical directions, mechanical and electrical slidable plug-in connections between said recording head and carriage mechanically connecting said recording head to said carriage and electrically connecting said deflecting plates, said electrical connections being energizable to create electromagnetic fields along said deflecting plates in conformance to the form of the indicia to be recorded, and all of said plug-in connections being arranged to remove all damaging forces to said recording head when plugging said recording head in or removing said recording head for cleaning or replacing.
2. In an ink jet recording device, a carriage shiftable along a record sheet and having a socket at its upper end having an internal cylindrical wall, a recording head including an ink jet nozzle and a series of deflecting plates extending thereacross in horizontal and vertical directions, said internal cylindrical wall of said socket having spaced chambers leading therefrom for respective of said deflection plates and energizing contacts for said deflection plates, said socket and chambers forming slidable plug-in connections electrically connecting said deflecting plates to energize said deflecting plates to create electromagnetic fields along said deflecting plates in conformance to the form of the indicia to be recorded.
3. The ink jet recording device of claim 2, wherein ink supply and return nipples lead into and from said recording head and ink lines are provided to be pluggable along said nipples as the recording head is plugged in.
4. The ink jet recording device of claim 3, in which the ink supply line is plugged in when plugging in the recording head.
5. In an ink jet recording device, a carriage shiftable along a record sheet, a support and guide means for said carriage, a recording head including an ink jet nozzle and a series of deflecting plates extending thereacross in horizontal and vertical directions, slidable plug-in connections between said recording head and carriage providing electrical connections to said deflecting plates, energizable to create electromagnetic fields along said deflecting plates in conformance to the form of indicia to be recorded, said carriage having at least one rigid ink supply line, said recording head having an ink supply nipple in direct alignment with said ink supply line, and a resilient sleeve carried by said recording head on said nipple so arranged as to be plugged into said rigid ink supply line upon plugging in the recording head to provide a leak-proof connection between said supply line and the recording head.
6. The ink jet recording device of claim 5, including means shifting the carriage along the line of the record sheet, means supporting and guiding the carriage for movement in a rectilinear path, wherein the recording head has a base supporting said recording head in elevated relation with respect to said base, and the carriage has a recessed portion conforming to said base and forming a receptacle for plugging in the ink supply and energizing connections to said recording head from above.
7. The ink jet recording device of claim 6, wherein the recessed portion of the carriage forms a receptacle for a multi-contact electric plug and
bushing and forms a support for an ink supply line leading downwardly therefrom beneath said carriage adapted to have an ink hose plugged in from below, wherein a rigid fluid conduit leads upwardly from said fluid connection into said base, and wherein a connecting sleeve is provided for plugging in said fluid connection to said recording head upon plugging said recording head into said base.

8. The ink jet recording device of claim 6, wherein the means supporting said guiding the carriage for movement along a recording path comprises two parallel spaced rods slidably supporting said carriage and extending in a horizontal plane, two guide wires spaced inside of said guide rods, and wherein the multiple contact plug bushing is positioned between said guide rods.

9. The ink jet recorder of claim 8, wherein an ink supply nipple depends from the recording head, wherein a resilient sleeve extends into the lower end of said nipple, wherein an ink supply line extends upwardly from said carriage, and wherein said ink supply line is a rigid line plugged into said sleeve upon plugging of said head into said carriage.

10. The ink recorder of claim 9, wherein the rigid ink supply line leading upwardly from said carriage is surrounded by a dish-like component for catching ink which may emerge when the recording head is removed from said supply line.

11. The ink jet recorder of claim 10, wherein the carriage has a channel portion leading therefrom for draining dripping ink from the recording head.

12. The ink jet recorder of claim 11, wherein the recording head has a return ink nipple depending therefrom, and wherein a flexible hose leads from said nipple along said channel.