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Bäuerlen

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[54] **RECORDING APPARATUS FOR ELECTROGRAPHIC IMAGING**

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Related U.S. Application Data

[62] Division of Ser. No. 256,976, May 25, 1972, Pat. No. 3,798,756.

[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** ..... **346/74 ES; 346/139 C**

[51] **Int. Cl.²** **G03G 15/00**

[58] **Field of Search** ..... 346/74 E, 74 ES, 74 S, 346/74 SB, 74 SC, 74 CH, 139 A, 139 C

[56] **References Cited**

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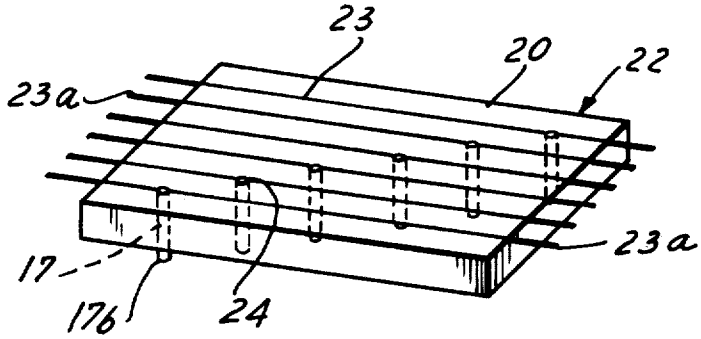
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[57] **ABSTRACT**

A recording head comprising a plurality of wires embedded uniformly spaced from each other in parallel relationship in insulating material with at least one end of each wire projecting beyond the insulating material and serving as a writing electrode. Connector means are connected to each of the wires for applying electrical signals thereto. These connecting means are preferably in the form of contact pins, extending normal to the wires, and each connected at one end to the respective wire and projecting with the other end beyond the insulating material.

6 Claims, 2 Drawing Figures



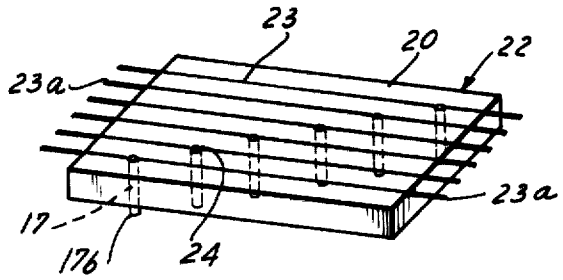


FIG. 1

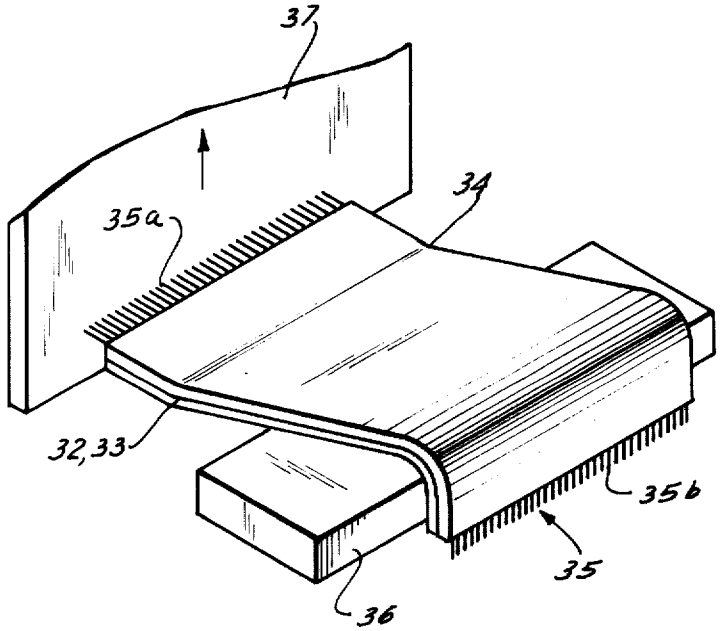


FIG. 2

RECORDING APPARATUS FOR ELECTROGRAPHIC IMAGING

CROSS REFERENCE TO RELATED APPLICATIONS

The present application is a divisional application of the copending application Ser. No. 256,976, filed May 25, 1972 now U.S. Pat. No. 3,798,756.

BACKGROUND OF THE INVENTION

The present invention relates to recording heads with a plurality of insulating writing electrodes which are placed adjacent to one another for use in an apparatus to record information on a recording medium.

In connection with high-speed printers or the like, it is necessary to utilize a plurality of writing electrodes which are uniformly spaced adjacent to one another so that characters or letters and numerals can be recorded on a recording surface. In such apparatus, the letters and numbers are produced by the formation of a plurality of markings which, when used as a whole make up the letters or numerals. More particularly, the known apparatus records the information by producing a raster wherein the simultaneous production over the width of the record carrier of dots or short lines, when recorded selectively by the plurality of recording electrodes, and while the recording medium is moving, can produce or generate the outlines of the letters or numerals.

It is already known, in connection with recording heads of this type, to place a plurality of writing electrodes adjacent to one another and to separate the same by insulating plates, which act as spacers therebetween, and then to package the entire assembly to produce a recording head. Such a construction is disclosed in the U.S. Pat. No. 1,524,340. However, this type of construction of recording heads is not economical and the required tolerances of the insulating spaces add to the cost, so that not only the construction becomes very expensive, but also of large width.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a recording head which does not have the disadvantages of such recording heads known in the art.

It is a further object of the present invention to provide a recording head wherein the plurality of electrode wires can be spaced as close as desired without running the risk of producing shorts therebetween.

It is a further object of the present invention to provide a recording head which is either rigid or flexible so that the recording head may be built in to recording apparatus without interfering with other components of the recording apparatus.

With these and other objects in view, which will become apparent as the description proceeds, the recording head according to the present invention mainly comprises a plurality of conductors, embedding means for embedding the plurality of conductors in closely spaced parallel relationship with at least one of the ends of each conductor projecting beyond the embedding means, and connector means connected to each of the conductors for applying electrical signals thereto.

According to a preferred embodiment of the apparatus, the connector means comprise a plurality of electrical contact pins, one for each conductor, and each connected at one end to the respective conductor,

while projecting with the opposite end beyond the embedding means.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and the method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a perspective view of a recording head according to the present invention: and

FIG. **2** is a perspective view of another embodiment of a recording head according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS:

Referring now to the drawing, and more specifically to FIG. **1** of the same, it will be seen that the recording head **22** according to the present invention may comprise a substantially plate-shaped member **20** of plastic insulating material in which a plurality of conductors in the form of blank wires **23** are embedded in closely spaced parallel relationship so as to be insulated from each other by the plastic insulating material. In the construction of the recording head **22**, as shown in FIG. **1**, the opposite ends **23***a* of the conductors **23** project beyond opposite end faces of the plate-shaped block **20** of insulating material to serve as writing electrodes. The recording head **22** includes further a plurality of connector means, one for each of the wires **23**, which are shown in FIG. **1** as contact pins **17**, each connected at **24** to a respective one of the wires **23** by welding or soldering and projecting from the connected end in substantially normal direction to the respective wire through and beyond the body **20** of insulating material to be connected at its outer end **17***b* projecting beyond the insulating body **20** to a female connector, not shown in the drawing, so that each of the wires may be supplied with electrical signals. As shown in FIG. **1**, the connecting points **24** between each of the connector pins **17** and the corresponding wire **23** are displaced from each other in the longitudinal direction of the wires so that the outer ends **17***b* of the contact pins will be spaced from each other a distance greater than the transverse spacing of the wires **23**.

With the recording head as illustrated in FIG. **1** in which the wires **23** project with opposite ends **23***a*, forming writing electrodes, beyond opposite ends of the insulating body **20**, the recording head **22** may be utilized on one side or the other, or on both sides simultaneously. Thus, by providing recording material at opposite ends of the insulating body **20** and by applying suitable electrical signals to the contact pins **17**, two records may be simultaneously imprinted on two recording surfaces in contact with the free ends of the writing electrodes **23***a*, while the recording surfaces move in a direction substantially normal to the longitudinal direction of the recording head. On the other hand, the recording head shown in FIG. **1** may be used with only one recording surface in contact with the free ends of the writing electrodes **23***a* projecting beyond one end of the recording head, and after the projecting ends **23***a* of the wires **23** are worn after extended use of the recording head, the recording head may be reversed so

that the unused projecting ends 23*a* may then contact the recording surface.

FIG. 2 shows another embodiment of a recording head according to the present invention. While the body 20 of the recording head 22 shown in FIG. 1 is made of substantially rigid, for instance transparent plastic material, in the recording head 34 shown in FIG. 2 the parallel wires 35 are embedded between two plastic foils 32 and 33 which are fused together on abutting surfaces thereof and these foils are made from flexible plastic material so that the resulting recording head is in the form of a flat cable which may be bent around intervening components, such as a bar 36 which may form part of the recording apparatus. Such a recording head is suitable for apparatus for picture transmission as well as for so-called numerical writers, in which the entire width of the recording head is utilized. In the recording head 34 illustrated in FIG. 2, the opposite ends 35*a* and 35*b* of the wires 35 which are embedded in close and parallel relationship between the fused plastic foils 32 and 33, likewise project beyond the embedding material so that for instance the ends 35*a* which lie in a straight line, may make contact with a record carrier 37, travelling in the direction as indicated by the arrow with respect to the recording head 34 and which may be formed by a metallized web capable of being oxidized or burned by application of a voltage thereto by the ends 35*a*. In this manner, by selectively applying voltages to the ends 35*a*, while the record carrier 37 is moving, letters, numerals as well as picture recordings can be made. The connections to the wires 35, forming with their projecting ends 35*a* writing electrodes, can be made either at the ends 35*b* or connector means in the form of connecting pins, as described in a connection with FIG. 1 may also be included in the second embodiment. In this case, the connecting pins (not shown in FIG. 2) may be embedded in the plastic foil 32 projecting with the outer ends therefrom. In such an arrangement the foil 32 should preferably be made less flexible to properly hold the connecting wires in correct position. Contact pins or connecting wires may also be used which are held spaced from each other in a rigid plate of insulating material and connected to the free ends 35*b* of the wires 35, whereafter the connecting portions are surrounded with plastic material. It is also possible to roll the free rear end of the recording head 34 substantially to a circle so that the ends 35*b* of the wires 35 which project beyond the fused plastic layers 32 and 33 form a connector which may be used in conjunction with a connector having suitable mating surfaces for applying electrical signals to the wires 35.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of recording apparatus differing from the types described above.

While the invention has been illustrated and described as embodied in recording heads, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended:

1. A recording head for recording on a recording medium, comprising a carrier; a plurality of one-piece electrically conductive wires embedded in said carrier in closely spaced parallel relationship, each of said wires having opposite end portions projecting beyond said carrier and adapted to serve as writing electrodes; and a plurality of electrically conductive contact pins, each partially embedded in said carrier in a direction substantially perpendicular to said wires and having a first end connected to said wires intermediate said end portions thereof and a second end projecting outwardly beyond said carrier, one of said end portions of the respective wire being adapted to conduct electrical signals to the other of said end portions of the same wire so that said other end portion serves as a writing electrode and, at the option of a user, said second end of each pin being adapted to conduct electrical signals to the associated wire so that either or both of said end portions of the wire serve as writing electrodes for interchangeably or simultaneously writing on the recording medium.

2. A recording head as defined in claim **1**, wherein said carrier is a a supporting plate formed of electrically insulating material supporting all of said electrical contact pins.

3. A recording head as defined in claim **1**, wherein said carrier comprises two layers of flexible plastic material connected in abutting relationship to each other with said plurality of one-piece conductive wires sandwiched therebetween.

4. A recording head as defined in claim **1**, wherein said embedding means comprises substantially rigid insulating material.

5. A recording head as defined in claim **1**, wherein said contact pins are respectively connected to adjacent one-piece conductive wires at points displaced from each other in the direction of said one-piece conductive wires.

6. A recording head as defined in claim **5**, wherein the connecting points between the one-piece conductive wires and the contact pins of the plurality of one-piece conductive wires are displaced from each other through equal distances.

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