# United States Patent [19]

**Metcalfe et al.**

[11] **3,739,087**

[45] **June 12, 1973**


[54] **MULTI-POINT DISTRIBUTOR HEAD FOR SIGNAL RECORDING OR THE LIKE**


[75] Inventors: **Kenneth A. Metcalfe**, Lockleys; **William H. Lowe**, Beaumont, both of Australia

[73] Assignee: **The Commonwealth of Australia, care of The Secretary, Department of Supply, Parks**, Canberra, Australia



[22] Filed: **Oct. 26, 1971**

[21] Appl. No.: **192,386**

[30] **Foreign Application Priority Data**

Oct. 26, 1970 Australia ..... 2956/70

[52] **U.S. Cl.** ..... **178/6.6 A**, 178/7.6, 346/74 E, 346/74 ES, 346/74 S

[51] **Int. Cl.** ..... **G11b 11/16**

[58] **Field of Search** ..... 346/74 E, 74 ES, 346/74 S, 74 SB, 74 SC; 178/18, 19, 20, 30, 6.6 A, 7.6, 7.13, 6.6 R; 340/337



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 2,486,985 | 11/1949 | Ruderfer | 101/93 |
| 3,576,585 | 4/1971 | Ohno et al. | 346/74 ES |
| 3,128,458 | 4/1964 | Romero | 340/337 |
| 2,832,820 | 4/1958 | Blackstone | 178/6.6 A |
| 3,348,232 | 10/1967 | King | 346/74 ES |



*Primary Examiner*—Terrell W. Fears

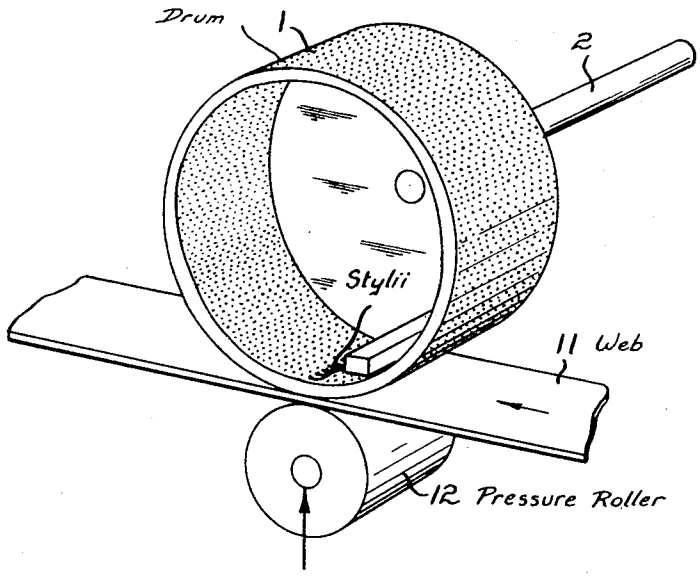
*Attorney*—Eric H. Waters, John G. Schwartz and J. Harold Nissen



[57] **ABSTRACT**

The method of signal transfer by multi-point distributor heads using a multiplicity of individually insulated conductive members and applying an electrical signal to the conductive members selectively from one side of the head by means of stylii adapted to impress or receive a signal, the other side of the head being in contact with a web either adapted to receive a signal or containing a signal.


**14 Claims, 6 Drawing Figures**



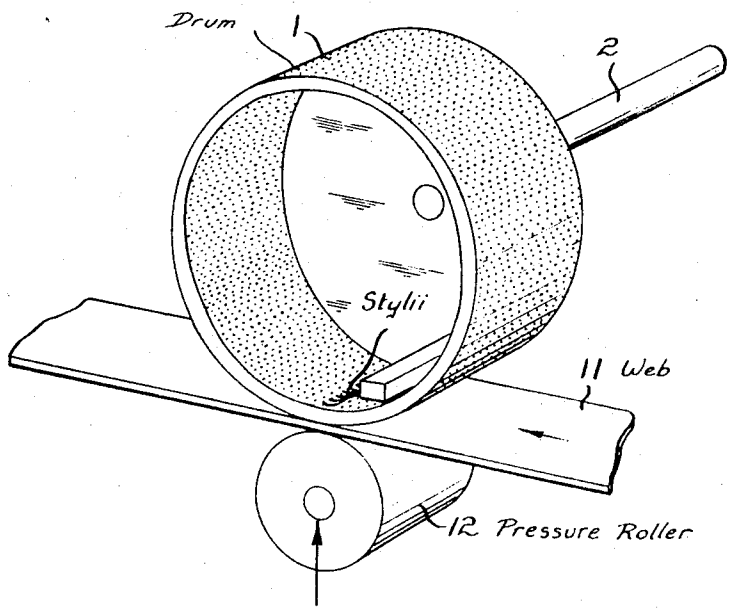



FIG 1

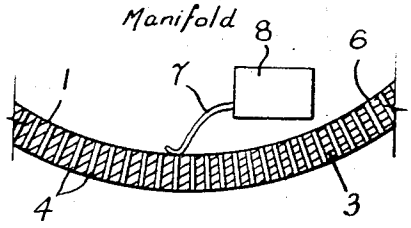



FIG 2

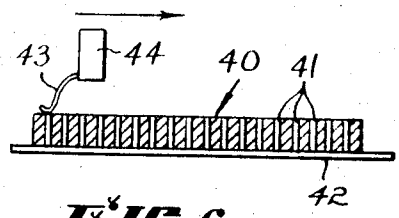



FIG 6

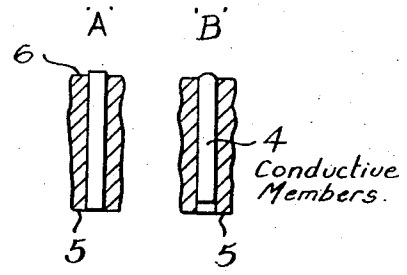



FIG 3

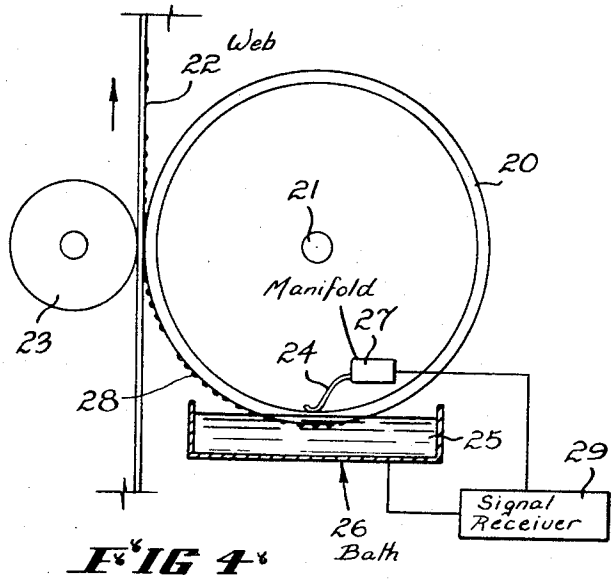

Web
22
20
21
Manifold
27
24
23
28
25
29
Signal Receiver
26
Bath

FIG 4

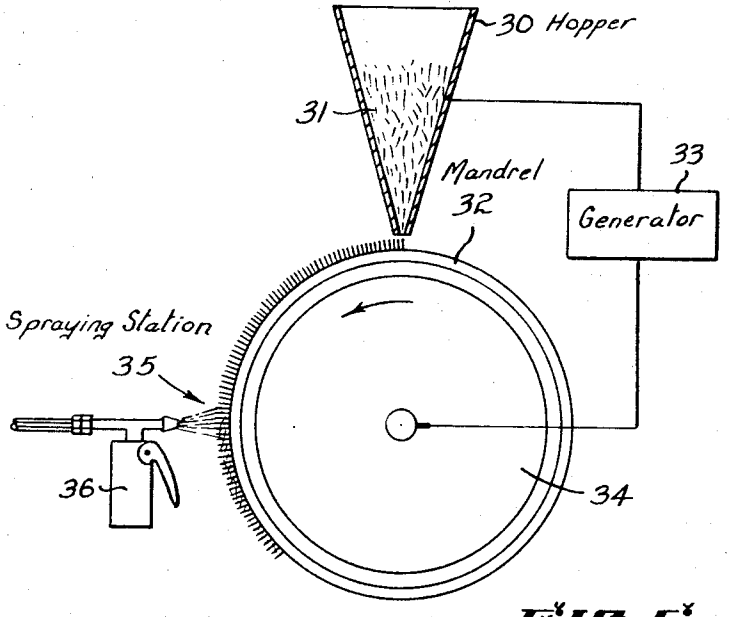

30 Hopper
31
Mandrel
32
33
Generator
Spraying Station
35
36
34

FIG 5

# MULTI-POINT DISTRIBUTOR HEAD FOR SIGNAL RECORDING OR THE LIKE

## BACKGROUND OF INVENTION

This invention relates to a multi-point distributor head for signal recording or the like.

In the art of signal recording it is desirable with certain types of recording to provide a visible or translatable signal on a tape or drum or the like and various forms of such devices have been proposed in the past such as multi-stylii devices to which signals were applied and which recorded these signals on a paper or plastic film or the like by for instance burning the signal into the surface or by leaving a series of traces which could be developed, or alternatively by utilizing a multi-point unit it is possible to scan written matter or illustrations or the like and to produce at a remote point a facsimile of the original.

Thus for instance by using an assembly comprising a series of points or members which scan spaced intervals of an original, a facsimile recorder at the other end can reproduce the original, allowing messages to be readily transmitted over wire or by any other means, including illustrations or the like.

The advantages of such a system will readily be appreciated when it is considered that a map could be transmitted by apparatus of this type by having sufficient scanning members and corresponding reproducing members at the other end, thus avoiding the lengthy process which is involved where single line scanning has to be resorted to.

With this type of recording however some quite serious difficulties occur in the inability to get the signal effectively applied to the reproducing apparatus, and the object of the present invention is to overcome the difficulties which have existed in the past and to provide a reliable and highly effective form of signal recording by means of a multi-stylii distributor head.

In prior art device which utilized multiple stylii, the stylii contacted a tape or other recording surface to apply a signal to such a recording surface, or to receive a signal from such a surface, which relative movement takes place between the stylii and the tape or member, but such a system, because of pressure applied by the stylii to the recording surface causes unwanted triboelectric markings due to pressure as the recording member moves beneath the stylii. Also effective contact is difficult to obtain.

An object of the present invention is to provide a system and apparatus for multiple stylus recording in which defects such as that referred to above will be eliminated.

## SUMMARY OF INVENTION

According to the present invention a drum or platten or other member is provided with a series of finely spaced conductive members which can have a spacing similar to the dot formation used in half tone reproduction, although this dimensioning is referred to merely for convenience and the invention is not limited to such proportions.

A signal is then applied by means of a plurality of stylii to one side of this drum or platten, or is received by the stylii, and the other side of the drum or platten is either in contact with a signal-receptive or signal-imparting paper or film or is provided with inking or developing means such that an image produced can be transferred to a suitable medium.



It could be mentioned at this stage that in recording, if a series of stylii were passed over a surface such as a photographic or xerographic paper, that the signals applied from the stylii would vary according to the contact with the surface, and because the surface is rarely perfect enough for this type of contact it is extremely difficult to reproduce the applied signals from the multiple stylii. Also the triboelectric effect referred to when stylii more over a surface adds to the problem. The same applies with stylii in signal reception.

In this invention however, where the surface is in contact with the multiplicity of conductive points or members in the insulating base, a signal can readily be transferred between multiple stylii and these conductive members and will then pass as a localised signal through the member to the other side thereof.

Transfer through such a medium can be better effected so that the conductive dot formation of the unit, which is in contact with the multiple point signal producing system, utilizes dots the spacing of which can be regular or random or can correspond for instance to the dots of a half tone reproduction, but any signal applied to a particular dot will pass through that conductive dot and will be exactly placed on the sheet or film on which the signal is reproduced, irrespective of whether there is a degree of roughness in this surface because firstly it would be possible to exert considerable pressure between the paper or film and the like and the medium which has the conductive dots or members in it, such for instance as by forming the one member as a cylinder of insulating material with the conductive dots through it, and this could be in contact with a further drum between which two drums the paper or film passes with the application of the necessary pressure.

There is only a pressure action and no sliding as both surfaces are pressed together without relative motion between them.

Another factor of extreme importance is that the brushes or contacts of the distributor head which would be spaced to contact the rows of conductive members in the transfer medium need not actually touch these conductive sections because it would be possible for instance to have a voltage which could be sufficient to produce a corona and there would then be a current flow from the corona-producing point to the nearest member which would thus localise the corona to an exact spot and a current so applied would have sufficient intensity to leave the conductive member on the other side and produce a localised dot on the paper or film or the like.

In the case of printing by means of a liquid developer or the like the drum or platten with the conductive members in it could actually pass through a developing bath so that as each of the conductive member has a charge applied to it, it will hold this charge because of the fact that the member is insulated from the surrounding members by being embedded in the insulator and therefore the outer side of this conductive member will attract developer and will hold it and carry it to a transfer locality such as where a sheet of paper or the like presses against this drum or medium and lifts the dots of developer from the drum and transfers them to the paper or the like.

It would of course be possible to effect this transfer by use of a suitable field which would urge the developed image away from the drum or platten on to the paper or other receiving medium and in this regard again it would be possible to utilize contact means on the inside of the drum or the like which would apply the necessary transferring force for the developer to the conductive members.

Thus it will be seen that in the case of a transducer the received signal is applied by means of a multiplicity of stylii to a series of individual conductive members embedded in an insulating drum or platten, thus localising the signal in these conductive members, from which the signal is then transferred to the receiving element either by utilizing an element having a photoconductive surface or an insulating surface or a surface which can be dielectrically modified, but which can subsequently be developed, or can have developer applied to the drum or platten which developer is then transferred to the receiving surface.

Because of the fact that the reproduction is in the nature of a half tone image it will be realised that very effective gradations of the signal are possible and this allows highly effective reproduction of images such as printed matter or drawings or the like in a rapid manner because a large number of stylii which may be linearly arranged across a drum or the like form lines of signals which are translated to read-out means by means of the conductive dot structure of the intermediate drum or platten.

As stated earlier the fact that contact may be poor is not of very great importance in the structure of this invention because substantial voltages can be used which do not spread but are localised by the insulating drum or platten to act only through the conductive members.

So far as production of such a drum or platten is concerned this can be effected in many ways such as by embedding uniformly spaced conductors in an insulating medium and grinding or otherwise giving a high finish to the two sides of the medium, or the insulating medium could be pierced at regular intervals such as by use of a penetrating laser beam of the required minute dimensions and the aperture so formed then filled with a conductive medium and the faces again ground off or otherwise treated to leave a series of insulated conductive needles in the structure through which the necessary signals can then be applied from the row of stylii to the other side of the drum or platten where translation of the signal takes place whether by development of the charges held on the conductive dot structure or by transfer of the field to a photoconductive surface and subsequent development of this surface. As stated, a transmitter can have a similarly formed scanning drum.

Thus a highly effective form of device is provided which will allow rapid signal transmission including illustrations and the like and which instead of having to use helical scanning or the like with consequent time consuming factors, can be reproduced for instance by a single rotation of a drum, thus allowing almost instantaneous reproduction without the attendant problems previously existing.

## BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings which illustrate general principals of the invention the following figures will be referred to;

FIG. **1** is a perspective view of a drum used as a reproducer according to one system as defined in this invention, in which the drum has a series of conductive members extending through it which are contacted on the inside of the drum by stylii, the drum being in contact with a tape onto which the signal or image is to be transferred and being held in contact with the drum by a pressure roller.

FIG. **2** is an enlarged fragmentary section of the drum showing the relative position of the stylii.

FIG. **3** shows two forms of conductive members which can be used in the drum.

FIG. **4** shows a drum similar to that used in the device of FIG. **1** but illustrates how the conductive members can pick up developer and transfer them to a web or tape with the aid of a pressure roller,

FIG. **5** demonstrates schematically how the conductive members can be electrostatically deposited on a surface and fixed to the surface to provide the assembly of conductive members which can then be machined and further treated to produce the final drum, and

FIG. **6** shows a platten-type head in which the stylii move over the head.

Referring now to the form of the invention shown in FIGS. **1**, **2** and **3**, a drum **1** is provided with a shaft **2** which can be supported in any suitable bearings.

The drum is formed of an insulating medium which is indicated by the numeral **3**, and has embedded in it a multiplicity of conductive members, which can finish flush with the outer surface **5** of the drum **1** as shown in A of FIG. **3** but preferably project from the inner surface **6** of the drum so that they can be physically contacted by the stylii **7** which are supported in a row on a manifold **8** passing through the drum **1**, the individual stylii **7** being insulated from each other and connected to leads not shown which leave the distributor box and have the necessary signals applied thereto. In B of FIG. **3** the conductive members do not extend to the surface **5**. In this case the stylii transfer signals through the head but without continuous contact between the stylii and means on the other side of the head to which the signal is applied.

The outer surface of the drum **1** is in contact with the web **11** which is in this case is in the form of a tape and which may have its one surface photoconductive so that the photoconductive surface is in contact with the drum **1**, or the web may be formed on an insulating medium capable of receiving a charge and holding it.

The web **11** is pressed to the drum **1** by a pressure roller **12** which maintains rolling contact between the drum **1** and the web **11** so that there is no sliding contact which could give rise to defects caused through triboelectric effects.

From the illustrations it will be realised that as the drum rotates in contact with the web **11**, there is merely rolling contact between the drum and the web **11**, and as the conductive members **4** extend through the drum as for instance shown at A of FIG. **3**, these members contact the web **11** and if a signal is applied to such conductive members by the stylii **7**, that signal will be transmitted through the conductive member contacted by that particular stylii, to the web **11** and will leave an electrical impression on the web which can then be developed by xerographic means or by any other form of electrostatic development.

As the web **11** is pressed firmly to the drum **1** both the web and drum move at the same linear speed, and

it will be realised that rolling contact will be maintained and defects which could be present if the stylii contacted the surface of the web **11** and required to drag on the surface, are non-existent in the present invention. It will also be realised that a very precise transfer of the signal can take place because there is no spread or other similar problem as transmission through the drum is by the conductive members and thus a dot pattern is transmitted in exactly the relationship of the signal transmitted to and by the stylii.

It will be realised that a reverse effect could also be obtained by using a modified image such as an image developed by a conductive devloper on a web of suitable material in that when contact is made with the conductive or non conductive section of the web by the conductive members, current flow can be instituted to the stylii in accordance with this effect. The device then acts as a reader of information to be transmitted.

Thus for instance by using a pair of units similar to those described with reference to FIGS. **1** and **3**, the stylii of which are coupled together by intermediate wiring, or transmission means a pattern on a web which influences the flow of current between the pressure roller **12** and the stylii **7**, can be transmitted to a remote locality where a similar device, but operating in reverse, transfers the exact pattern to the web **11** at the area, which web can then have the pattern developed in any suitable manner to give a facsimile of the original transmitting web.

In the embodiment shown in FIG. **4** the drum **20** is again provided with a shaft **21** so that it can be rotated and this drum has conductive members positioned through it in the same way as that described with the first embodiment, but in this case the drum **20** is in contact with a web **22** which is urged on to the drum **20** by the pressure roller **23**, but it will be noted that the stylii **24** are now remote from the position at which the pressure roller **23** is located, and the drum **20** dips into developer **25** in a bath **26** so that as signals are transmitted from the manifold **27** to the stylii **24** it will cause a pattern to be formed on the drum of developer **25** corresponding to the impulse as applied to the respective stylii, the pattern so produced in the form of dots of developer being indicated by **28.**

Thus as the drum rotates, a dot pattern of developer can be held on the conductive members which will correspond to the data being transmitted, and this data will then be immediately applied to the web **22** at the point of contact with the drum **20.**

A signal receiver **29** is indicated which connects with the stylii **24** and the bath **26.**

It will be obvious as already explained in this specification that a drum with conductive members through it at required intervals can be formed in many ways, but a convenient method is illustrated in FIG. **5** where a hopper **30** carries short lengths of chopped enamelled wire **31,** the lengths of enamelled wire being allowed to move from the hopper **30** on to the periphery of an adhesively coated mandrel **32,** the chopped wires being orientated in their deposition on to the surface of the mandrel **32** by the application of a field from the generator **33,** which field is applied between the hopper **30** and the drum **34** on which the mandrel **32** is carried, so that the wires are stood on end on the mandrel **32** as it rotates, and the wires can then be permanently bonded together by spraying with a plastic material at the spraying station **35** where a gun **36** is shown.

When the mandrel has been completely coated it is removed from the drum **34** and the surface of the orientated wires can be machined or otherwise treated after which the matrix formed by the wires and the bonding medium which was injected at the spraying station is removed from the mandrel so that a drum is then formed which after treating, such as machining of both faces, can then serve the purpose of this invention.

Obviously if the conductive members are to project from the drum as on the stylii side as in A and B of FIG. **3,** it is a simple matter to use a solvent for the insulating medium to allow the wires to project beyond the surface by removing a required amount of the insulator surface through solution on the face of the insulator. Similarly the wire could be etched to terminate it below the surface **5** as at the bottom of B of FIG. **3.**

It will be realised that if enamelled wire is used, the wires can contact without transfer of electrical currents to adjacent wires, and as the whole assembly is held in a matrix of insulating material, a highly effective result is achieved.

It would of course also be possible to mechanically position the wires in rows in any form required and as stated earlier the method of forming the conductive members through an insulating drum can be widely varied.

Obviously also where the wires used are enamelled or otherwise coated with an insulating medium, the material applied at the spraying station may not require a high degree of electrical resistivity because the conductive members themselves carry insulation to isolate them electrically from each other.

In FIG. **6** a platen **40** has conductive members **41** through it and it is in contact with a sheet **42.** The stylii **43** are carried by a manifold **44** which moves to traverse the stylii over the platen type head.

In this specification the term "web" includes sheets, or flat surfaces of paper, metal insulators or the like and can have photoconductive surfaces or image surfaces.

From the forgoing it will be realised that a simple and effective method and apparatus for transmitting signals from or to stylii is achieved.

We claim:

**1.** The method of signal transfer by multi-point distributor heads comprising, forming a head of insulating material with a multiplicity of individually insulated conductive members extending therethrough, applying an electrical signal to the said conductive members selectively from one side of the head, receiving the signal on the said conductive members at the other side of the said head, one side of the said head being in contact with stylii to impress or receive a signal and the other side of the said head being in contact with a web either adapted to receive a signal or containing a signal and providing relative motion between said head and stylii to cause the head to be scanned by the stylii which successively contact said conductive members.

**2.** The method of claim **1** wherein the head is formed as a rotatable drum having the insulated conductive members projecting through its wall, the conductive members being contacted by stylii on a manifold within the drum, and rotating the drum while pressing the web against the outside of the drum to move the web and drum at the same linear speed.

**3.** The method of claim **2** wherein the web is an insulator or photoconductive member which receives elec-

trical signals impressed by the stylii on the web, and developing said signals on said web to render same translatable.

4. The method of claim 2 wherein the web contains a conductive image which is transmitted to said stylii by said conductive members.

5. The method of claim 1 wherein the head is formed as a rotatable drum having the insulated conductive members projecting through its wall, the conductive members being contacted by stylii on a manifold within the drum, rotating the drum, contacting the periphery of the drum with a developer, and transferring the developed signal from the drum to a web.

6. The method of claim 1 wherein the head is formed as a rotatable drum having the insulated conductive members projecting through its wall, the conductive members being contacted on one side of the platen by stylii on a manifold, moving the manifold and stylii across the platen, and pressing the web against the other side of the platen.

7. The method of claim 6 wherein the web receives signals transmitted from the stylii, and developing said signals on said web to render same translatable.

8. The method of claim 6 wherein the web contains a conductive image which is transmitted to said stylii by said conductive members.

9. A device for receiving or recording signals comprising, a head having a multiplicity of individually insulated conductive members extending therethrough, stylii positioned for contacting said head on one side thereof, means for providing relative movement between said head and said stylii and means to press a web against the other side of said head whereby signals are transmitted between said stylii and said web through said conductive members when relative movement exists between said head and stylii.

10. A device according to claim 9 wherein the head is a drum having the conductive members extending through its wall, said stylii contacting the inner surface of said drum, said web contacting the outer surface of said drum.

11. A device according to claim 9 wherein the head is a platen having the conductive members extending through it, the said stylii contacting the platten on one side, said web contacting the other side of said platten.

12. A device according to claim 9 wherein the head comprises a wall of insulating material, a multiplicity of said conductive members being set in said wall to extend substantially from one face of the wall to the other, said stylii being supported in a row extending across said head to effect signal exchange between said stylii and said conductive members, said means which effects relative movement between said stylii and said head being constructed to produce such relative movement in a direction substantially at right angles to said row of stylii.

13. A device according to claim 9 wherein the head comprises a wall of insulating material, a plurality of said conductive members being set in said wall to extend from one face of said wall through said other face, said stylii being supported in a row extending across said head on the side thereof where the conductive members extend, whereby said stylii contact said conductive members, said means which effects relative movement between said stylii and said head being constructed to produce such relative movement in a direction substantially at right angles to said row of stylii.

14. A device according to claim 9 wherein the head comprises a wall of insulating material, a plurality of said conductive members being set in said wall to extend from one face to near said other face of said wall, said stylii being supported in a row and extending across said head, whereby said stylii transfer signals through said head but without continuous contact between said stylii and the means on the other side of said head to which said signal is applied. sections because it would be possible for instance to have a voltage which could be sufficient to produce a similar problem as transmission through thedrum is by the

* * * * *