United States Patent [19]

Vano

[11] **3,827,056**

[45] **July 30, 1974**

[54] **GRAPHIC ELECTRIC RECORDER SCANNING DEVICE WITH PRINTED RECORDING STRIPS**

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[73] Assignee: **Alden Research Foundation,** Westboro, Mass.

[22] Filed: **Oct. 4, 1972**

[21] Appl. No.: **294,814**

[52] **U.S. Cl.**..... **346/74 E,** 178/6.6 A, 317/101 F, 346/139 A

[51] **Int. Cl.**..... **G01d 15/06,** H05k 3/20

[58] **Field of Search**..... 346/74 E, 74 ES, 74 S, 346/74 SB, 74 CH, 74 SC; 317/101 F

[56] **References Cited**

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IBM Tech. Disc. Bulletin, Vol. 15, 3, pg. 775, Aug. 1972.

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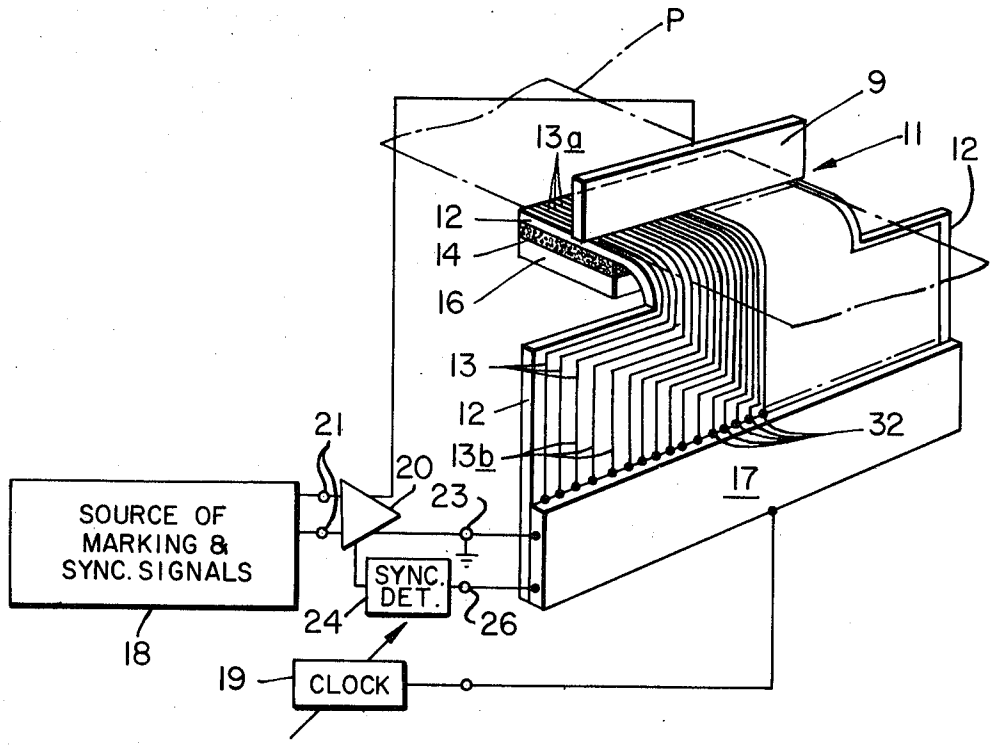
Assistant Examiner—Jay P. Lucas
Attorney, Agent, or Firm—James H. Grover, Esq.

[57] **ABSTRACT**

For use in a facsimile recorder with a linear marking electrode blade for marking on a recording web, an array of flexible parallel conductive strips is carried on a flexible insulating sheet backed by a foam rubber body which yieldingly presses the strips against the paper and the paper against the blade with uniform pressure. A solid state integrated circuit commutator, physically co-extensive with terminal portions of the conductive strips, distributes graphic signals to the strips.

17 Claims, 9 Drawing Figures



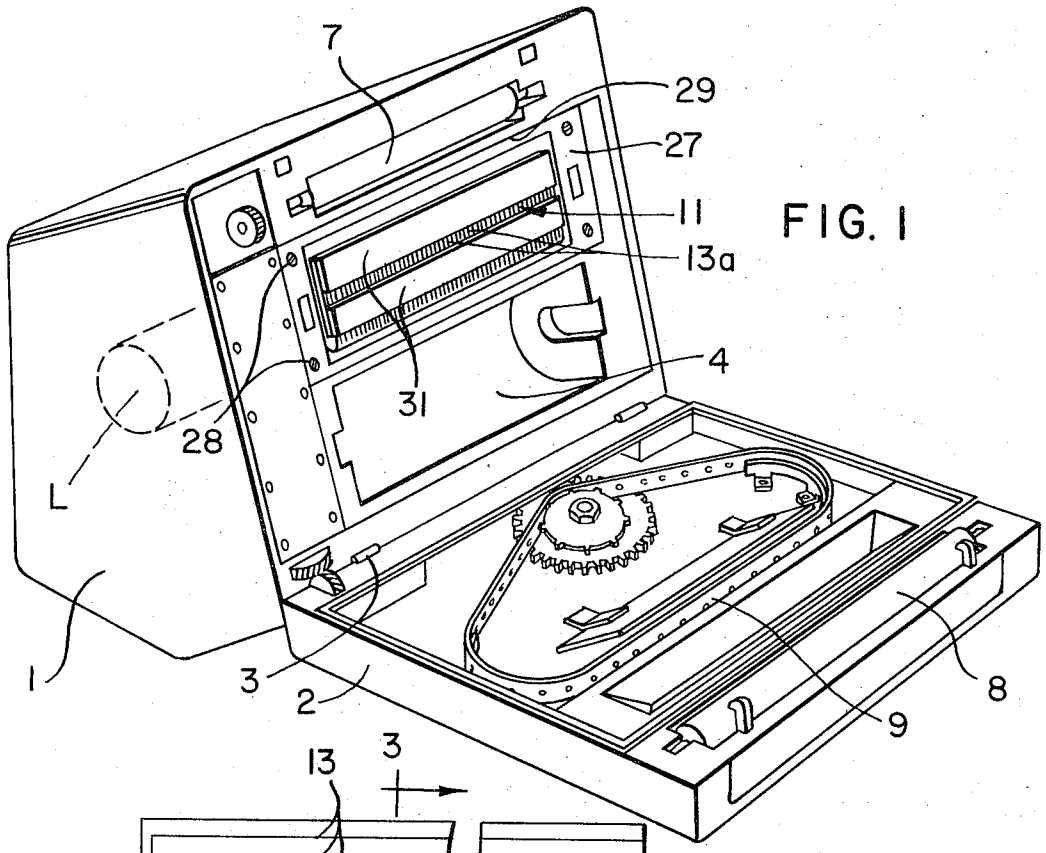


FIG. 1

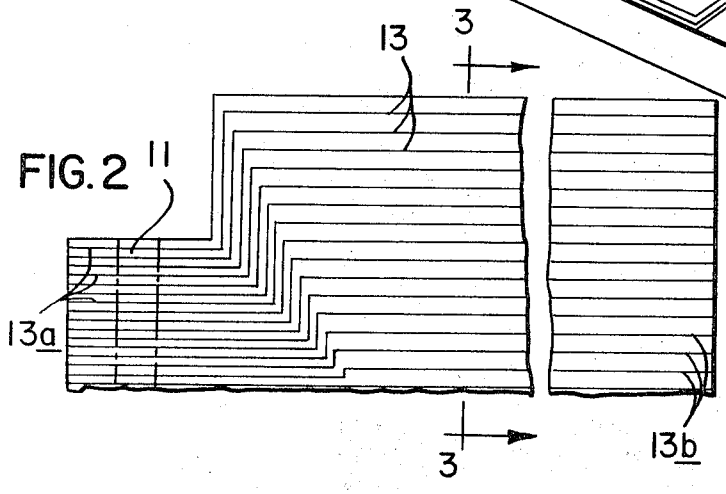


FIG. 2

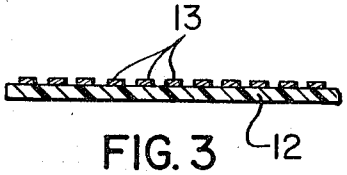


FIG. 3

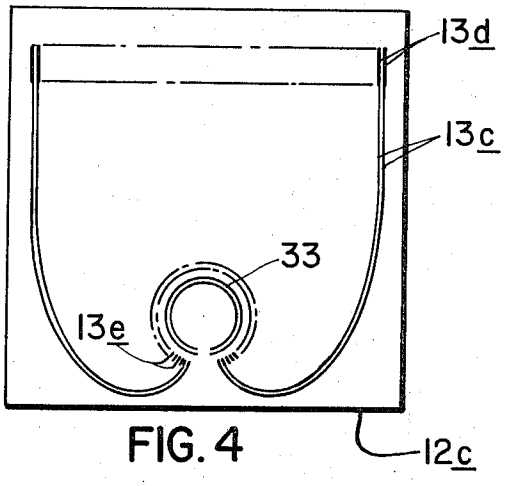


FIG. 4

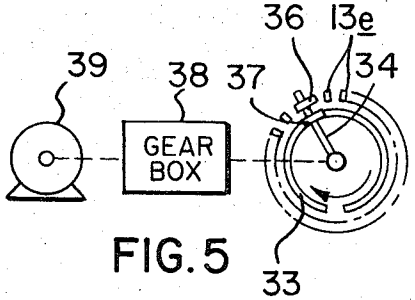


FIG. 5

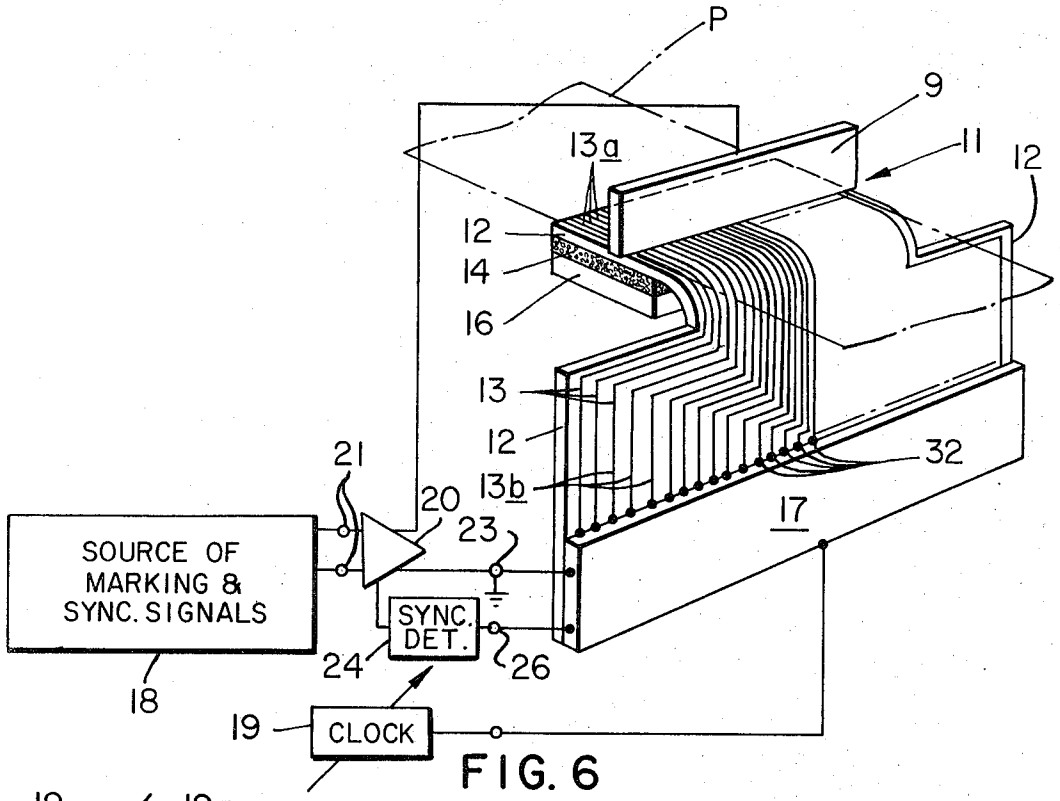

P
9
11
12
13a
12
14
16
13
12
32
13b
17
21
20
23
SOURCE OF MARKING & SYNC. SIGNALS
SYNC. DET.
24
26
18
19
CLOCK

FIG. 6

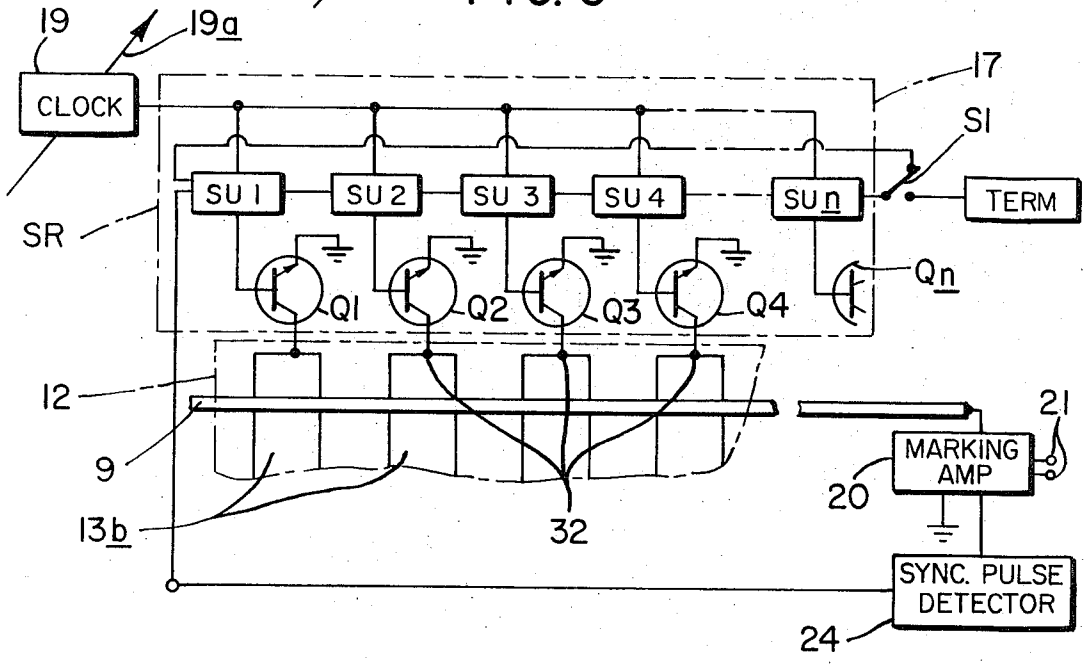

19
19a
CLOCK
17
SI
SU 1
SU 2
SU 3
SU 4
SU n
TERM
SR
Q1
Q2
Q3
Q4
Qn
12
9
13b
32
21
MARKING AMP
20
SYNC. PULSE DETECTOR
24

FIG. 7

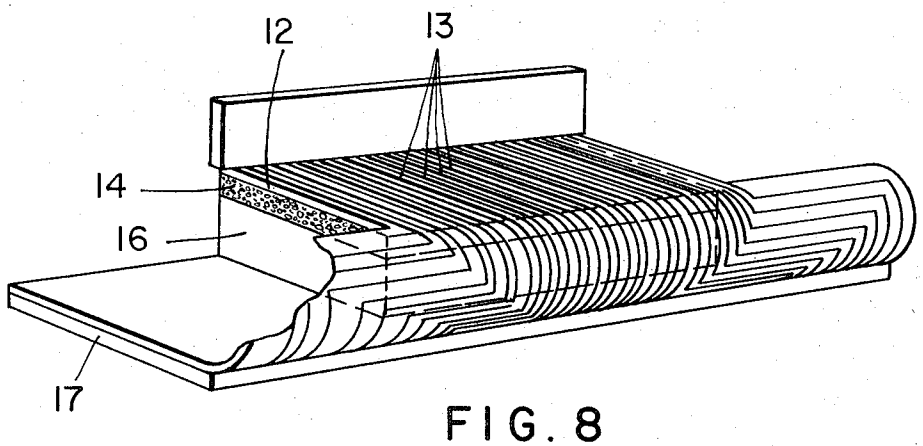


FIG. 8

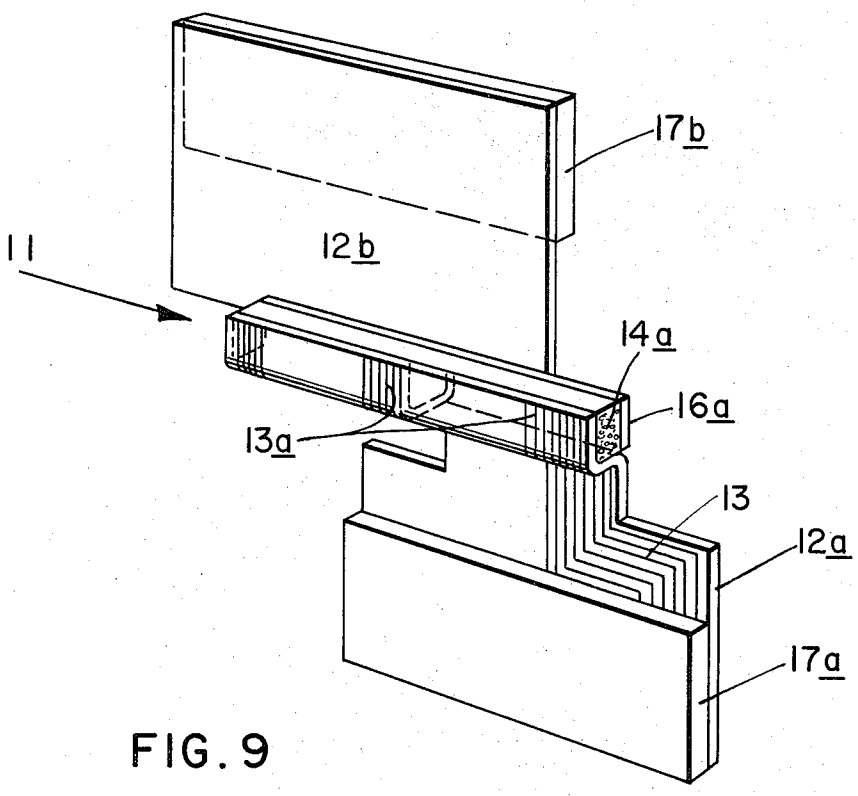


FIG. 9

GRAPHIC ELECTRIC RECORDER SCANNING DEVICE WITH PRINTED RECORDING STRIPS

BACKGROUND OF THE INVENTION

This invention relates to facsimile recorders for marking a conductive electrosensitive web such as electrolytic or heat sensitive recording paper in which current flows through the paper, as in U.S. Pat. Nos. 3,430,254 or 3,553,178, and to recorders which capacitatively apply an electrostatic charge to the paper, as in U.S. Pat. No. 3,576,585. In these patents multiple wire or deposited styli are disposed in contact with and across the recording for scanning the paper and effecting marking of the paper when electrical signals are distributed to them by commutator circuits.

The objects of the present invention are to provide an improved stylus assembly, which is greatly simplified in structure and economical to manufacture, which makes better contact with the recording paper and which cooperates with improved means for distributing signals to the styli.

STATEMENT OF INVENTION

According to the invention a signal marking device comprises a flexible supporting sheet carrying a plurality of mutually insulated flexible conducting strips along one surface, the strips having recording portions, and a resilient body at the other surface of the support sheet for yieldingly backing the sheet and the recording portions of the strips, the body, sheet and strips being jointly flexible to conform to the paper.

DRAWINGS

FIG. 1 is an isometric view of a facsimile recorder having one form of multiple styli signal marking device according to the invention;

FIG. 2 is a plan view of the marking device of FIG. 1; partly assembled;

FIG. 3 is a section on line 3—3 of FIG. 2.

FIG. 4 is a plan view of an alternate form of marking device;

FIG. 5 shows schematically mechanical apparatus for distributing signals to the marking device of FIG. 4;

FIG. 6 is an isometric assembly view of the marking device of FIGS. 1 to 3 and an electronic signal distribution;

FIG. 7 is a schematic view of the marking device and circuit of FIG. 6;

FIG. 8 is the assembled marking device of FIG. 1; and

FIG. 9 is a modified form of the device of FIG. 8.

DESCRIPTION

FIGS. 1 to 3

The facsimile recorder of FIG. 1 comprises a base 1 with a cover 2 hinged thereto at 3. A well 4 receives a roll of recording paper (not shown). A motor L within the base drives a paper feed roll 7. As fully described in U.S. Pat. No. 3,417,405 to Milton Alden, when the cover is closed in operation, the feed roll 7 and an opposed idler roll 8 on the cover grip the paper and draw it from the well through a recording zone 11 between a blade electrode 9 and the multiple styli marking assembly which is the subject of the present invention.

The unassembled multiple styli marking device of FIGS. 2 and 3 comprises a thin, flexible insulating sheet 12, for example, an 0.003 inch Mylar film, on which is formed by photoetching or deposition an array of stainless steel, copper or the like conducting strips 13. The conducting strips are thin enough, e.g., 0.002 inch, to flex with their supporting sheet 12. The strips have recording portions 13*a* approximately 0.008 to 0.016 inch wide and insulatively spaced 0.002 to 0.004 of an inch providing a density of 50 to 100 strips per inch along the recording zone 11. The strips converge to an equal or lower density at their terminal ends 13*b* where they are connected to the terminals of a solid state signal distributing circuit.

FIGS. 6 and 7

As shown in FIG. 6 the conducting strips 13 and the supporting sheet 12 are flexed from the planar form of FIG. 2 so that their terminal ends 13*b* lie out of the plane of the recording portions 13*a* in the recording zone 11 through which the recording paper P is fed between the blade electrode 9 and the strips 13. On the opposite side of the supporting sheet 12 from the strips 13 a body 14 of foam rubber or similar resilient material is attached so as to yieldingly back the sheet and recording portions 13*b* of the strips. Behind the resilient body 14 is a rigid plate 16 joined integrally with the resilient body 14 and sheet 12, and serving as a mounting secured to the base 1 of FIG. 1.

At the terminal ends 13*b* of the conducting strips a signal distributor in the form of an integrated circuit module 17 is physically attached to the sheet 12 and electrically connected to the conducting strip terminal ends 13*b*. From a standard source 18 of marking and synchronization signals such as a transmission line or facsimile receiver a marking amplifier 20 connected through terminals 21 increases the power of the signals, applying them to the blade electrode 9 and to the graphic signal input terminal 23 of the module. The graphic signals occur as varying amplitude or frequency pulses and are also applied by the marking amplifier to a conventional facsimile synchronization pulse detector 24, which in turn detects the synchronization pulse only and applies it to the module 17 through terminal 26. A clock 19 also applies pulses to the module at a frequency described below.

As shown in FIG. 7 the integrated circuit module 17 consists of shift register units SU1 to SU*n* corresponding in number *n* to the conducting strips 13. The detected synchronization pulses occur once every line of graphic signals, corresponding approximately to the scan width of the paper P and the number *n* of shift units and conducting strips. The clock pulses occur *n* times during each scan. As in a conventional shift register coincidence of the sync pulse and a clock pulse causes the first shift unit SU1 to produce an output pulse which is applied to the base of a corresponding switching transistor Q1. The transistor then conducts, completing a circuit from the marking amplifier 20 through the blade 9, the recording paper P, the first conductive strip 13, and the transistor Q and thence through a ground return to the marking amplifier. If at the instant of coincidence of clock and sync pulses the marking amplifier is carrying a facsimile signal the paper will be marked by cooperation of the blade 9 and stylus 13. The shift register then shifts successively through units SU2 to SU*n* as one scan line of facsimile signals is received.

On completing one line the scan may be repeated unidirectionally beginning with the first step register unit SU1 or may be reversed to proceed bidirectionally from SU*n* to SU1 with the appropriate graphic signal. It is also possible to begin two or more scans simultaneously at different units in the register. Also the clock rate may be varied furing each scan to provide nonlinear sweeps. As shown in FIG. 7 the last shift unit SU*n* is connected through a manual switch S1 to the first unit SU1 to provide a feedback pulse which, when applied to the first unit S1, causes continued repetition of the scan until the switch S1 is transferred, for example. Alternatively, with the switch S1 transferred from the position shown in FIG. 7 the output of the last shift unit SU*n* is fed to a termination **26** and dissipated. Successive scans are then initiated by coincidence of a sync pulse and a clock pulse as previously described.

As shown in FIG. 7, the terminal end of the supporting sheet **12**, resilient backing body **14** and rigid substrate **16** are adhered together to form a unitary sandwich. As appears in FIG. 1 the sandwich is secured to a mounting plate **27** on the base **1** by screws **28**, the mounting plate having a window **29** through which the recording ends **13***a* of the conducting strips extend. The terminal ends are preferably masked by adhesive insulating tape **31** except in the recording zone **11** opposed to the blade **9** during recording. The IC module **17** in addition to being electrically connected to the terminal ends **13***b* of the conducting strips and physically adhered to the insulating sheet **12**, is physically coextensive with the sheet at its terminal end. A suitable module which is a seven inch span across the terminal ends **13***b* has **350** terminals **32** soldered directly to the conducting strips ends **13***b*.

Because the insulating support sheet **12** and the conducting strips **13** thereon are flexible, they can flex with the underlying foam pad to conform to the blade electrode **9** and insure uniform electrolytic marking across the width of the paper despite irregularities in the blade recording edge. Such uniform conformation is particularly important with minimum pressure on the moist electrolytic paper.

The flexibility of the support sheet **12** and conducting strips **13** also permits the terminal end of the sheet to be folded out of the plane of the strip ends **13***a* in the recording zone, for example to allow housing the terminal ends **13***b* and IC module **17** in the base **1** behind the window **29** through which the recording ends **13***a* extend.

FIG. 8

The flexibility of the sheet **12** and its conducting strips **13** further permits the IC module **17** to be combined in the previously described sandwich by folding the sheet **12** and strips **13** 180° and adhering the backside of the IC module **17** to the underside of the rigid backing plate **16**. The sheet **12**, foam body **14**, plate **16** and module **17** are then adhered in one integral sandwich.

FIG. 9

To increase the number of conducting strips above the number of step units in a single IC module two or more support sheets **12***a* and **12***b* are folded in opposite directions with their recording ends **13***a* positioned edge to edge in one continuous recording zone **11**. The two recording ends of sheets **12***a* and **12***b* are backed by a common foam body **14***a* and rigid plate **16***a*. Their terminal ends to which two IC modules **17***a* and **17***b* are respectively attached are wider than the recording ends and are folded out of the plane of the recording zone to different spacial locations.

FIGS. 4 and 5

Instead of the integrated circuit signal distributing circuit a mechanical signal distributor may be used with a modified signal marking sheet **12***c*. The sheet **12***c* has conducting strips **13***c* whose recording ends **13***d* are arrayed across a recording zone **11** as in the device of FIGS. **1** to **3**. The terminal ends **13***e*, however, converge in a planar, circular array concentric with a split commutating ring conductor **33** deposited or adhered to the sheet **12***c*.

As shown in FIG. **5** a rotor **34** carries two conductive wipers **36** and **37** respectively sweeping the terminal ends **13***e* and the split ring **33**. The rotor **34** is driven through a gear box **38** by a motor **39** synchronized with the source of marking signals in a known way. The wipers replace the IC module **17** of FIG. **1** in completing a circuit from the marking amplifier **20** through the blade electrode **9**, recording paper P and a selected conductive strip **13***c*. The signal marking device of FIGS. **4** and **5** has the advantage of providing circular scan of the coplanar terminal ends **13***e*, while allowing the recording ends **13***d* to be resiliently backed as described with reference to FIGS. **1** to **3**, **6** and **7** and to be folded to another plane.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. In a graphical electric signal recorder for marking on a longitudinally moving recording web, a signal marking device comprising:

a recorder base,

a flexible supporting sheet on the base carrying a plurality of mutually insulated fleixble conducting strips along one surface, the strips having recording portions,

a soft resilient incrementally compressible elastomeric body at the other surface of the support sheet for yieldingly backing the sheet and the recording portions of the strips, and

a linear electrode on the base and extending in opposition to the recording portions, the linear electrode cooperating with the recording portions to mark a web drawn therebetween,

the body being incrementally compressible perpendicularly to the web, and the sheet and strips being jointly flexible therewith to conform to irregularities of the electrode across the width of the web.

2. A device according to claim **1** wherein said support sheet is of insulating material.

3. A device according to claim **1** wherein the body, sheet and strips are joined in a unitary sandwich.

4. A device according to claim **1** wherein said strip recording portions are planar disposed and said strips have terminal portions spaced from the recording portions.

5. A device according to claim **4** wherein the sheet is flexed to dispose the recording portions and terminal portions of the strip in different planes.

6. A device according to claim 4 in combination with means for distributing signals to the terminal portions.

7. A device according to claim 6 wherein the distributing means comprises a plurality of solid state switches.

8. A device according to claim 7 wherein said switches are unitarily contained in an integrated circuit chip.

9. A device according to claim 8 wherein the body, sheet, strips and chip are joined in a unitary sandwich.

10. A device according to claim 8 wherein said chip is co-extensive with the terminal portions of the conductive strips.

11. A device according to claim 8 wherein a plurality of supporting sheets are backed by a common body, the sheets and strips being folded away from the body.

12. A device according to claim 4 wherein the terminal portions of the strips are arrayed circularly.

13. A device according to claim 12 wherein the terminal portions are coplanar.

14. A device according to claim 4 wherein the terminal portions of the strips have a greater spacing than the recording portions.

15. A device according to claim 1 wherein a plurality of supporting sheets are backed by a common body.

16. A device according to claim 15 wherein the recording portions of the conducting strips on the plurality of sheets are disposed in a coplanar array.

17. A device according to claim 16 wherein the sheets and strips are folded away from the array.

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