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Langnickel

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[54] **CONTROL APPARATUS FOR THE RECORDING HEAD OF A PARALLEL PRINTER**

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[52] **U.S. Cl.** ..... **101/93.04;** 197/1 R

[51] **Int. Cl.²** **B41J 7/08**

[58] **Field of Search** ..... 101/93.04, 93.05, 93.08; 197/1 R

[56] **References Cited**

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Assistant Examiner—R. T. Rader
Attorney, Agent, or Firm—Spencer & Kaye

[57] **ABSTRACT**

An improved control arrangement for a multi-position printer having a recording head which extends over the entire width of a print line. The control arrangement includes a print position selection unit, having a plurality of outputs for selectively supplying printing current to the printing elements of a printing position; and a character selection circuit which is common to all printing positions and has a plurality of outputs, each corresponding to a particular character, for controlling the flow of printing current to the individual printing elements in dependence on the character to be printed. Each output of the position selection unit is connected via respective series connected resistors with the individual printing elements of the associated printing position. The character selection unit is provided with a plurality of normally open short circuit switches, each connected in series between a respective output of the character selection unit and a point reference potential. Each output of the character selection unit is connected to its associated printing element of each printing position via a respective decoupling diode so that closure of the one of the switches will short circuit the current flowing to the associated printing element.

9 Claims, 5 Drawing Figures

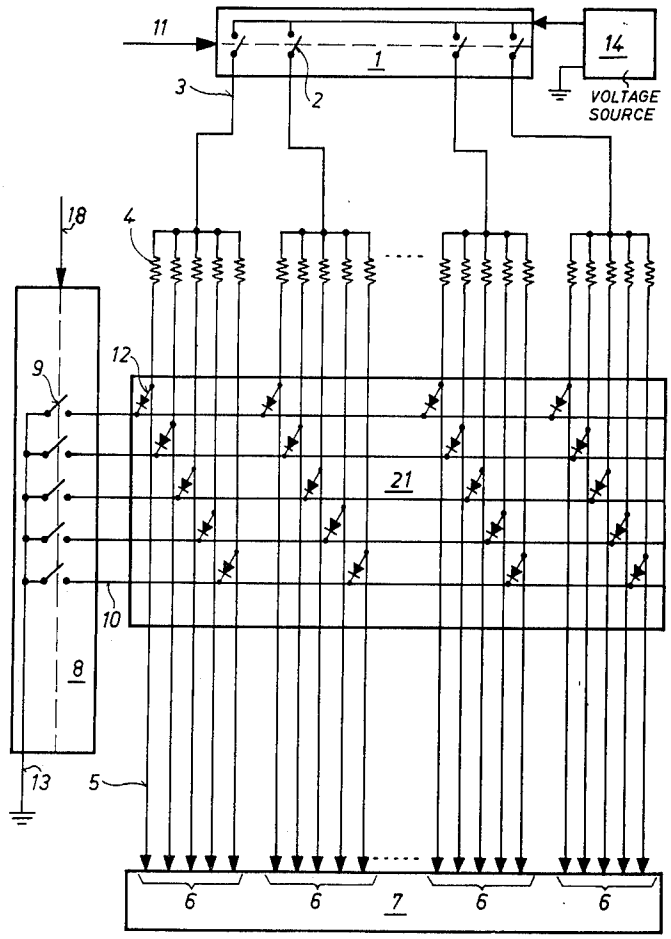


FIG.1

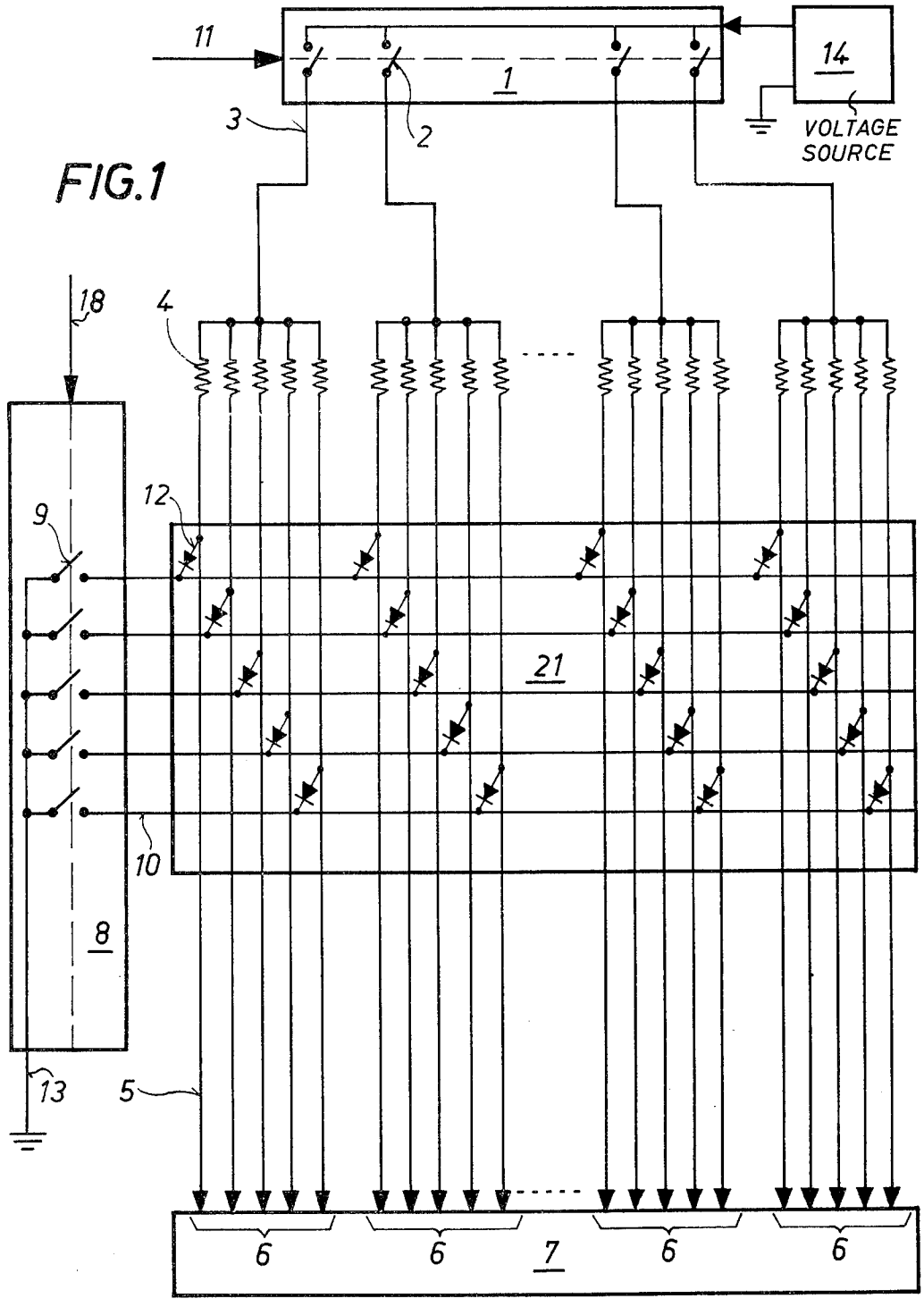
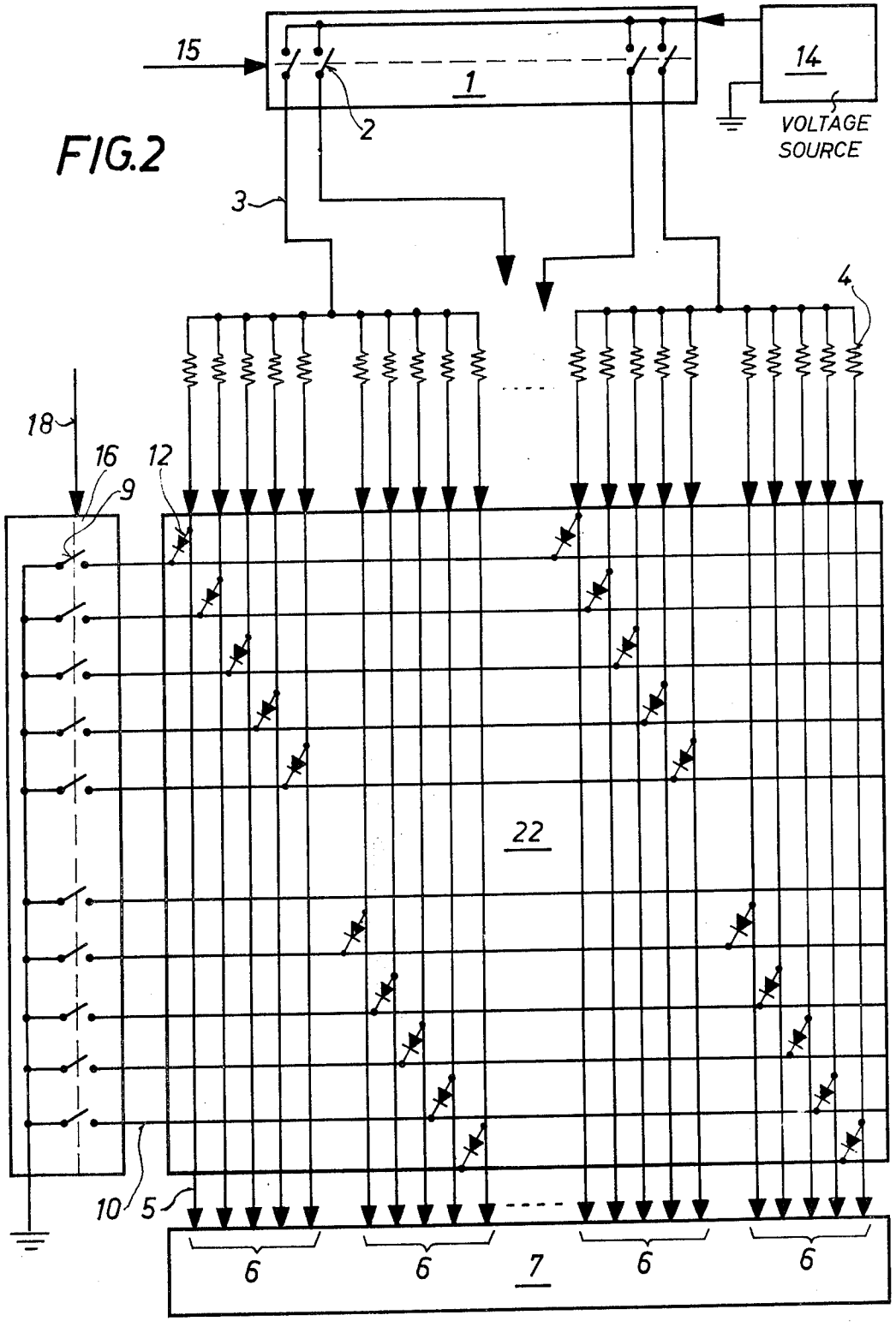


FIG.2



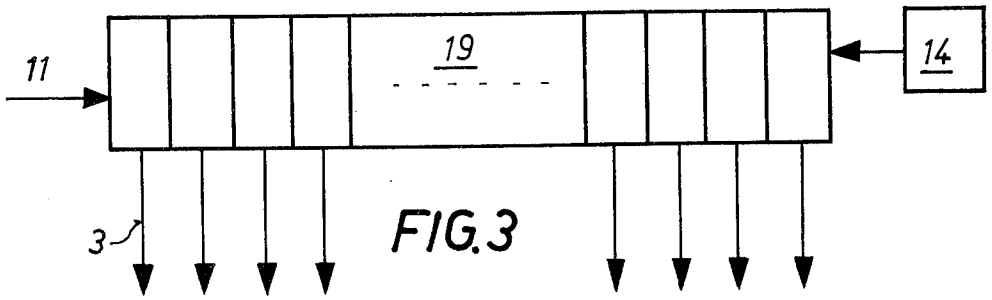


FIG.3

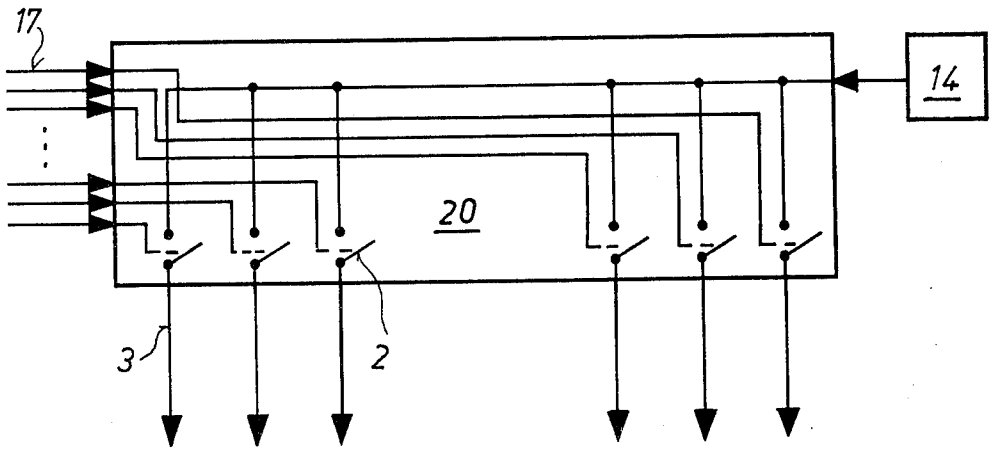


FIG.4

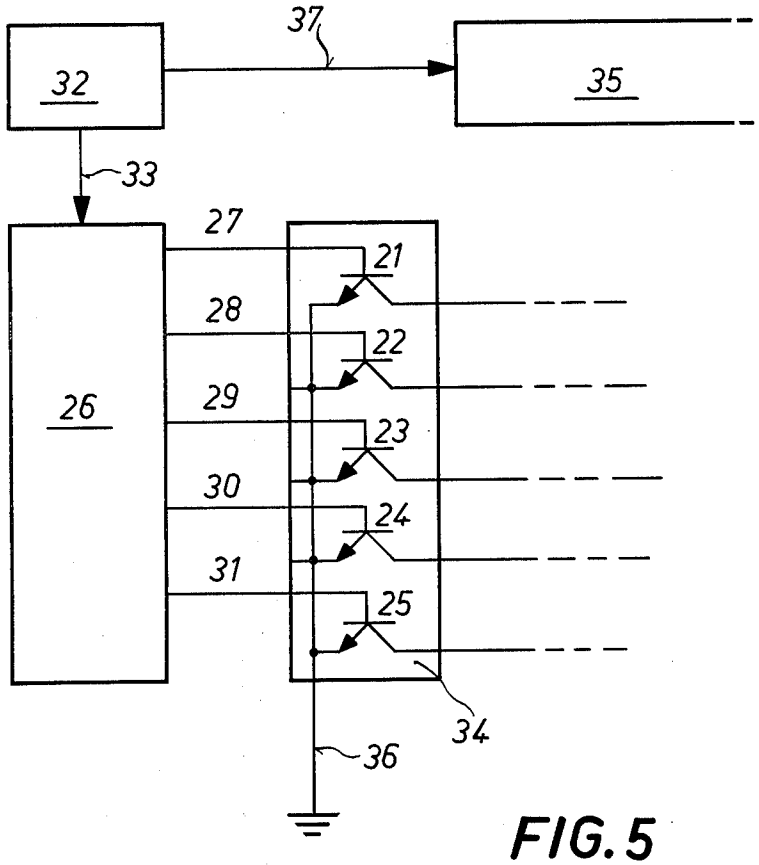


FIG. 5

CONTROL APPARATUS FOR THE RECORDING HEAD OF A PARALLEL PRINTER

BACKGROUND OF THE INVENTION

The present invention relates to an improved control arrangement for a multi-position printer, particularly a mosaic or raster printer, with a stationary printing head which extends over the entire width of the printing line. More particularly, the present invention relates to an improved control arrangement for a printer of the above-mentioned type wherein the switching of the printing currents from a position selection unit to the printing elements representing the desired character are effected in dependence on the output of a character selection unit which is common to all printing positions.

Printers and indicator units are known in which the symbols to be printed or displayed are shown in a mosaic pattern by recording heads each comprising a plurality of individual printing elements. The printing elements of the recording head are arranged so as to constitute a line or a column in a matrix, and a certain combination of printing elements is actuated in succession for each symbol in order to either print or display the corresponding symbol on a moving record carrier. The recording head or heads are controlled in the known devices by a special arrangement of a network, possibly in the form of a matrix, which then actuates the respective printing elements of the recording head or heads.

It is also known to effect the display of characters by means of nonmechanical printing methods. In particular, thermal or electrographic recording processes are known which employ specially prepared paper as the record carrier.

German Auslegeschrift (Laid Open Patent Application) No. 1,127,644 published April 12th, 1962, discloses that it is advisable in raster printers in parallel operation to produce the special pattern for each individual symbol, corresponding to the characters of one line of the symbol, in succession by means of a suitable distributing arrangement associated with the individual printing positions. That is, a parallel printing process is linked with a serial control. In the disclosed configuration this requires substantial amounts of switching and control circuitry.

German Auslegeschrift No. 1,127,644 published April 12th, 1962, discloses a network including AND circuits which are controlled by an electrical distributor, the serially fed-in information and the position information being fed to the AND circuit network which then switches the particular group of printing elements which is associated with the individual printing positions in succession to the next-following group of printing elements. A ring counter in communication with the AND circuit network switches from one group to the next in dependence on the switching state of the ring counter. Thus a parallel printing process is supplemented by a serial control process.

SUMMARY OF THE INVENTION

It is therefore the object of the present invention to provide an improved control arrangement for a parallel printer which reduces the requirement for the number of lines and the material costs for such a printer.

This is accomplished in that in a control arrangement for a parallel printer of the above-mentioned type, each

output of the position selection unit is connected, via series resistors, with the individual printing elements of the associated printing position, the character selection unit is provided with a short-circuit switch in series with each one of its character output lines, and each character output line is connected, via a decoupling diode, with the printing elements associated with this character output of all printing positions.

According to the preferred embodiment of the present invention each output of the position selection unit is connected with a group of printing elements and the number of the individual printing elements in the group is equal to the number of short-circuit switches in the character selection unit. In a special case the printing elements of two printing positions are combined into a group and corresponding number of short-circuit switches are provided in the character selection unit and connected with these printing elements. In a printer having five printing elements per printing position, a group of ten printing elements are connected to each output of the position selection unit.

According to a further feature of the present invention the short-circuit switches included in the character selection unit can be selectively actuated via a control line as required by the character to be printed. Additionally, the position selection unit may be a continuous counter which connects one output line after the other in succession with an operating voltage source or the position selection unit may be a multiple access switch which connects those position outputs at which the presently available character is to be printed with the operating voltage source.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG **1** shows one embodiment of control circuit according to the invention in which each output of the position selection unit is connected with a group of printing elements corresponding to one printing position.

FIG **2** shows a further embodiment of a control circuit according to the invention in which each output of the position selection unit is connected with a group of printing elements corresponding to two printing positions.

FIG **3** illustrates a counter which may be used as the position selection unit of the embodiments of FIGS. **1** and **2.**

FIG **4** illustrates a multiple access switch which may be used as the position selection unit of FIGS. **1** and **2.**

FIG. **5** shows a short-circuit switch arrangement which may be used as the character selection unit of FIG. **1.**

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** shows a control device for the recording head **7,** including a plurality of printing positions **6,** of a parallel printer of otherwise conventional design. The printing elements **5** of the respective printing positions **6** are controlled by a position selection unit **1** and a character selection unit **8.**

The position selection unit **1** includes a plurality of normally open switches **2,** each of which can selectively connect a respective output line **3** of the position selection unit **1** to the output of a source of operating voltage **14.** The particular switch **2** which is closed in any given time interval is determined by a signal supplied via input **11** in a well known manner. Depending on the

specific configuration of the position selection unit **1**, the switches **2** can be actuated either in succession or randomly by means of the signal at input **11**.

Each of the output lines **3** of the position selection unit **1** is connected via a respective series connected resistor **4** to the individual printing elements **5** of an associated print position **6**. In the illustrated embodiment of FIG. **1**, the printing elements **5** of each print position **6** are combined into a group and connected to one output line **3** of the position selection unit **1**. The particular one of the output lines **3** which is connected to and controls the respective printing elements **5** is determined by the design of the position selection unit **1**.

With the control arrangement thus far described, whenever one of the switches **2** of the position selection unit **1** is closed in response to a signal at input **11**, the operating voltage from source **14** is applied to the respective output **3**. Since in the illustrated embodiment each output **3** is connected to the five printing elements **5** of a printing position **6** via the respective resistors **4**, this would normally cause a current to simultaneously flow to each of the connected group of printing elements **5**. However, since in order to print a desired symbol only one or a certain combination of the printing elements **5** of a printing position are to be supplied with current during any given time interval, the character selection unit **8** is provided.

The character selection unit **8** includes a plurality of normally open short circuit switches **9**, each of which is connected in series between a respective output **10** of the character selection unit **8** and a point of reference potential **13**. Each of the outputs **10** is connected to an associated printing element **5** of each printing position **6** via a respective decoupling diode **12**. The selective actuation of the short circuit switches **9** is controlled via a signal input **18** of the character selection unit **8**. In this arrangement the number of short circuit switches **9**, and hence the number of outputs **10** of the character selection unit, is equal to the number of printing elements **5** in each group, i.e. in the illustrated case, five switches **9** are provided.

The embodiment shown in FIG. **1** shows the position control of five printing elements **5** during any particular time interval. That is, whenever one of the switches **2** is closed the five printing elements **5** of a printing position **6** are simultaneously controlled. In the embodiment illustrated, the five printing elements **5** represent one line of the mosaic pattern of a 5×7 matrix and consequently by closing a switch **2** of the position selection unit **1** exactly one line of a printing position **6** is actuated.

With the illustrated mosaic or raster dot printer, in order to print one line of the matrix at a selected printing position **6**, the desired number of short-circuit switches **9** are closed via the signal at input **18** of the character selection unit **8**, the information present at input **18** being identical with the information to be printed, and the associated one of the switches **2** of the position selection unit **1** is closed. As a result of the closed short-circuit switches **9**, the current present at output **3** is short-circuited, via the associated decoupling diodes **12**, around the associated individual printing elements **5** of the selected printing position **6**. Thus the only printing elements **5** of the selected printing position **6** which receive current, and thus produce an indication, are those for which the corresponding short-circuit switch **9** has not been closed. With the disclosed arrangement only one group of printing elements **5** is provided with current through one output **3** during any one time interval with the number of short-circuit switches **9** closed determining the printed information. The process is then repeated for the other printing positions of the entire printing line, after which the recording medium is moved to present a new print line to the recording head **7** and the process is repeated.

FIG **2** shows a control device for the recording head **7** including a plurality of printing positions **6**, in a parallel printer similar to that of FIG **1**, in which a group of ten printing elements **5** is provided with current through a single output **3** of the position selection unit **1** during one time interval. Corresponding to the number of printing elements **5** in a group the character selection unit **8** contains ten short-circuit switches **9** which can be selectively actuated via input **18**. In this case two printing positions **6** are printed at the same time. It should be noted however, that the printing positions **6** which are printed simultaneously do not have to be in a direct sequence. For example, the first and the third printing positions can be printed in one time interval, etc. This simultaneous actuation of two printing positions has been found to be the optimum mode of operation for a twenty position printer.

FIG **3** shows a counter **19** which may perform the function of a position selection unit **1**. A counting pulse is given through input **11** to counter **19** so that each output **3** is connected with operating voltage source **14** in succession. With this counter every printing position **6** is successively actuated, independent of the fact whether a character is to be printed at the respective printing position or not. For those printing positions **6** where no character is to be printed, all of the short-circuit switches **9** in the character selection unit **8** are closed.

FIG **4** shows a switch **20** with multiple access which may perform the function of the position selection unit **1**. in this multiple access switch **20**, each of the switches **2** is controlled via a separate signal input **17**. Via the inputs **17** certain of the switches **2** can be selectively closed so that then only the printing positions **6** for which a character is to be printed need be controlled by switch **20**.

Although the character selection unit **8** has been illustrated as a plurality of selectively actuatable mechanical switches **9**, it is to be understood that this is by way of example only and electronic switching circuits may be used if desired.

FIG **5** shows an embodiment of electronic short-circuit switches **21 – 25**, which are controlled by the output signals of a character generator **26**, well known in the art. The signals are applied to the switches **21 – 25** via output lines **27 – 30**. A clock pulse generator **32** is connected via lines **33** and **37** to the character generator **26** and the position selector unit **35** respectively and synchronizes the output of character signals from generator **66** to character selection unit **34**, and thus the actuation of respective switches **21 – 25**, with the actuation of the position selection unit **35**, e.g. of the kind shown in FIG **3**. The electronic switches **21 – 25** of character selection unit **34** are represented by transistors which are connected with their bases to respective output lines **27 – 31** of the character generator **26**, with their collectors to associated printing elements as described before and with their emitters to a common reference potential **36**.

It will be understood that the above description of the present invention is susceptible to various modifica-

tions, changes and adaptations, and the same are intended to be comprehended within the meaning and range of equivalents of the appended claims.

I claim:

1. In a control circuit for a multiple printing position printer having a stationary printing head which extends over the entire width of a printing line and has a plurality of individual printing elements for each printing position, said circuit including a printing position selection means for selectively applying printing current to the printing elements of a selected printing position, and a character selection means, which is common to all printing positions, for controlling the flow of printing current to the printing elements of the selected printing position in dependance on the particular character to be printed at said selected printing position, the improvement wherein: said position selection means has a plurality of outputs each of which is connected via respective series resistors with all of said individual printing elements of the associated printing position; and character selection means has a plurality of output leads each associated with only one printing element of each of a plurality of said printing positions, and a plurality of controllable normally open short circuit switches each of which is connected in series between one of said character outputs and a point of reference potential; and, each of said printing elements is connected to the associated one of said character output leads only via a separate decoupling diode whereby the selective closing of one or more of said switches will short circuit the printing current flowing from said position selection means around the printing element of the selected printing position associated with the closed switch and only the printing elements of the selected printing position which are associated with open ones of said switches will be supplied with printing current.

2. The apparatus as defined in claim **1** wherein each of said outputs of said position selection means is connected with a group of said printing elements including the individual printing elements of a plurality of said printing positions, and wherein the number of said individual printing elements per group corresponds to the number of said short-circuit switches in said character selection means.

3. The apparatus as defined in claim **2** wherein each of said groups includes the individual printing elements of two of said printing positions, whereby printing may occur simultaneously in said two of said printing positions.

4. The apparatus as defined in claim **3** wherein each of said printing positions contains five of said individual printing elements, each of said groups includes ten individual printing elements, and said character selection means has ten short circuit switches and ten character output leads, each connected to a respective one of said ten printing elements of each group.

5. The apparatus as defined in claim **1** including means for selectively controlling said short-circuit switches in said character selection means to correspond to the character to be printed.

6. The apparatus as defined in claim **1** further including a source of operating voltage; and wherein said position selection means comprises a continuous counter means for consecutively connecting its outputs, one after the other with said source of operating voltage.

7. The apparatus as defined in claim **1,** further including a source of operating voltage; and wherein said position selection means comprises a multiple access switch which selectively connects those of its said outputs for which there is a character to be printed with said source of operating voltage.

8. The apparatus as defined in claim **1** wherein said plurality of individual printing elements at each printing position comprise one line of said mosaic.

9. The apparatus as defined in claim **1** wherein each of said printing positions has a like plurality of said individual printing elements and each of said character output leads is connected to the same printing element of all printing positions.

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