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Carbonneau

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[54] **BRAILLE COMMUNICATIONS TERMINAL**

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[73] Assignee: **Triformation Systems, Inc.**, Stuart, Fla.

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[52] **U.S. Cl.** **197/6.1**; 197/6.2

[51] **Int. Cl.** **B41j 3/32**

[58] **Field of Search** 197/6, 6.1, 6.2, 58; 101/401.5, 18-20; 178/92

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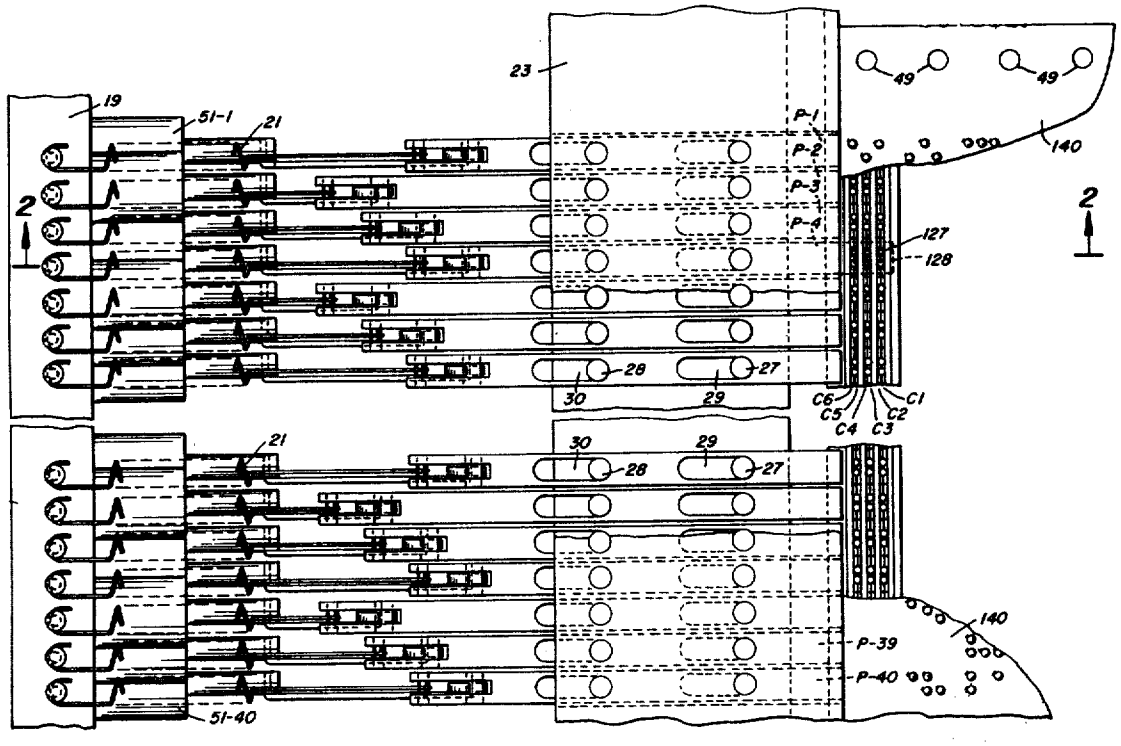
Primary Examiner—Edgar S. Burr
Assistant Examiner—R. T. Rader
Attorney, Agent, or Firm—Martin Lukacher

[57] **ABSTRACT**

A braille communications terminal described herein includes a plurality of platens disposed in a row with each of the platens actuable to move forward to an extended position against the back of an embossable sheet on which braille codes may be formed, a predetermined number of individually actuable parallelly and adjacently disposed code bars, each bar having a plurality of protruding embossing tips, and a circuitry having means responsive to a series train of binary coded braille signal characters, means for actuating the plurality of platens, one at a time, in succession in response to the counts of the braille signal characters, and means actuating a combination of the braille bars simultaneously in response to each of the characters in synchronization with the actuation of each of the platens, thereby forming a row of the braille codes. The typewriter includes means for advancing automatically the embossable sheet upon completion of a row of braille codes. The typewriter may also include means enabling it to receive other types of binary coded signals such as ASCII coded signals from a remote station and in response print out corresponding braille codes.

11 Claims, 12 Drawing Figures



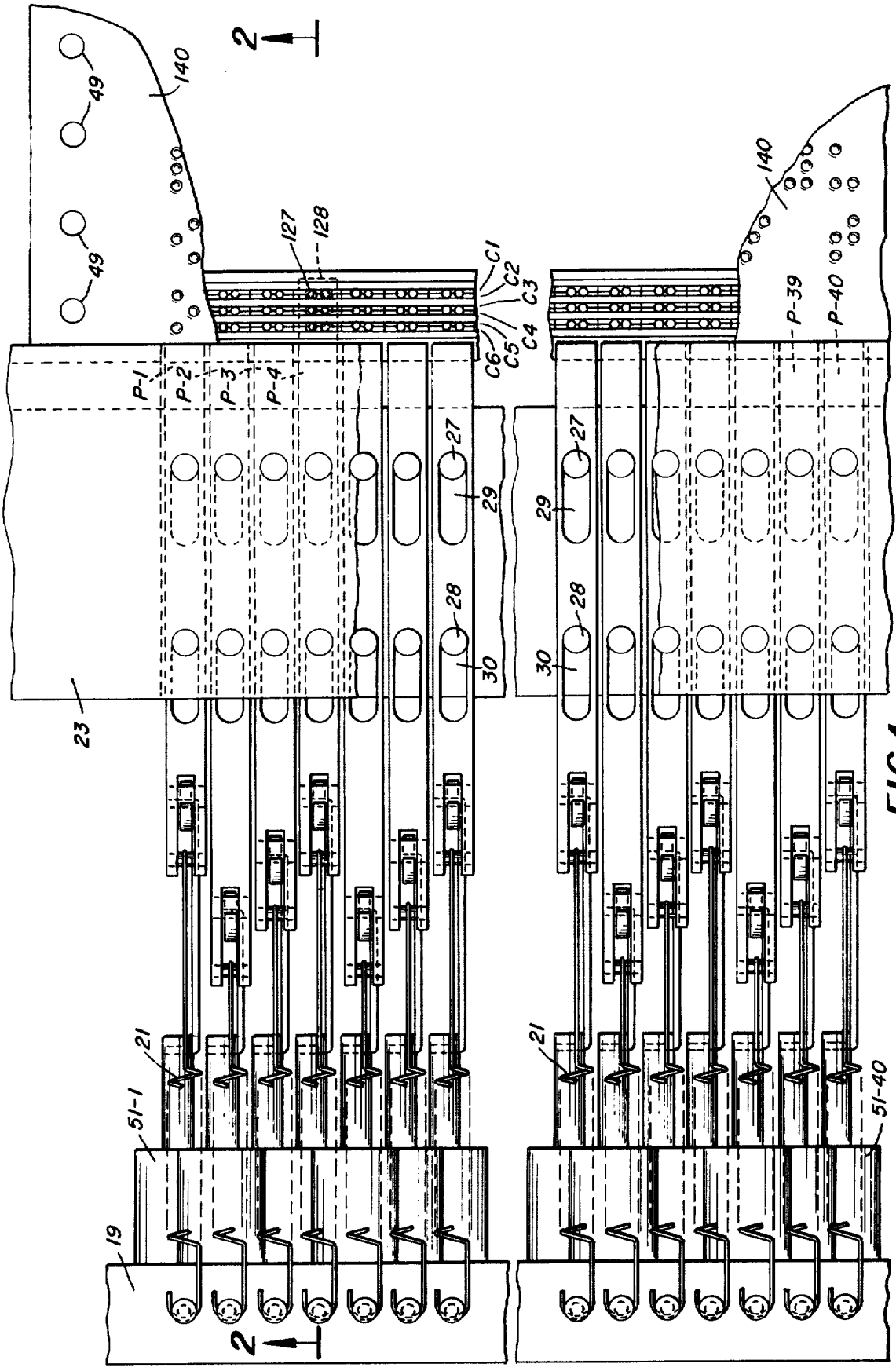

2
140
49
49
127
128
C1
C2
C3
C4
C5
C6
P-1
P-2
P-3
P-4
P-39
P-40
27
29
28
30
23
21
51-1
51-40
19
2

FIG.1.

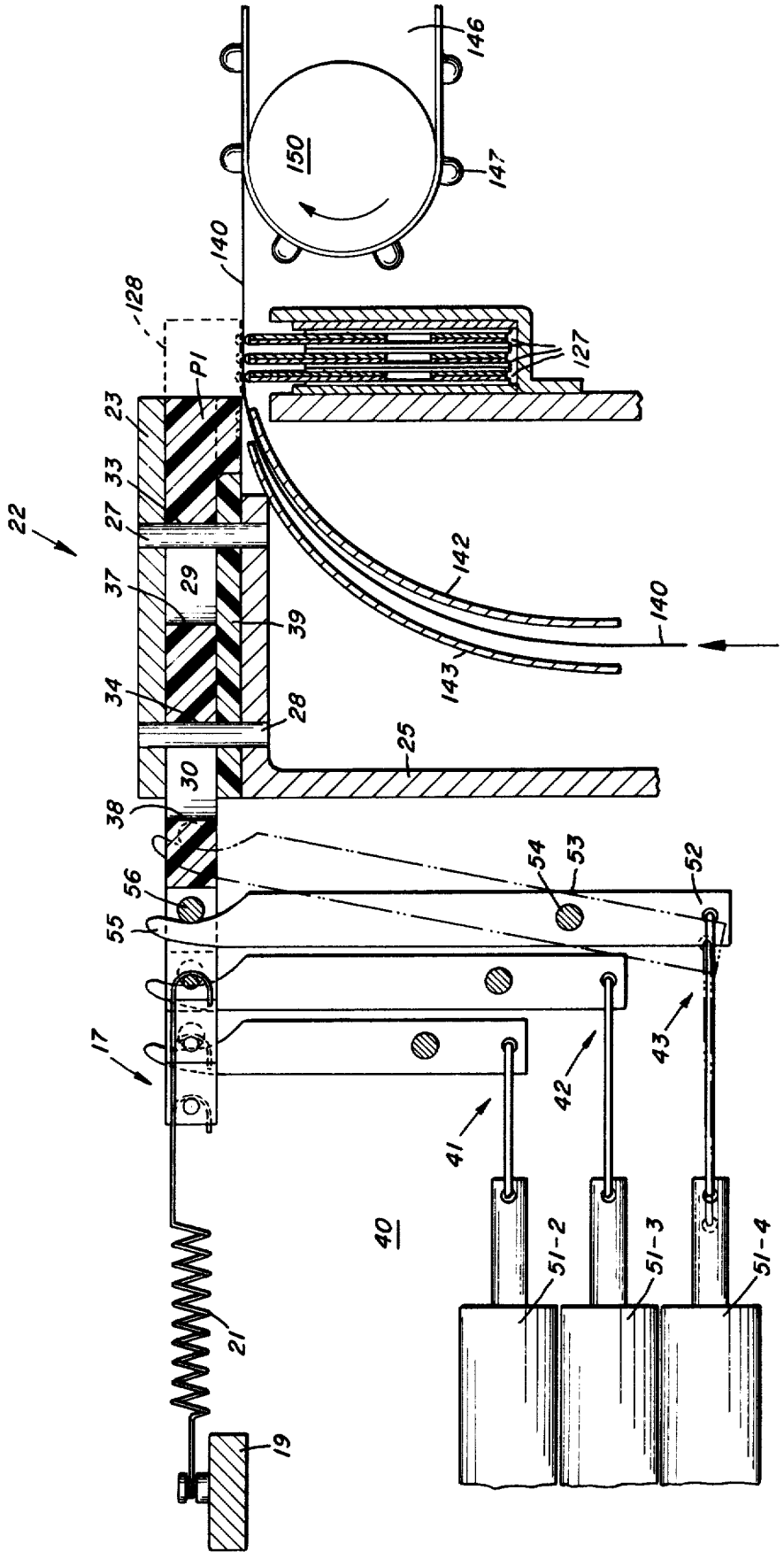

146
150
147
140
128
P1
127
23
33
27
22
142
37
29
39
140
143
34
28
25
30
38
54
53
52
56
55
17
43
42
41
40
51-2
51-3
51-4
21
19

FIG. 2.

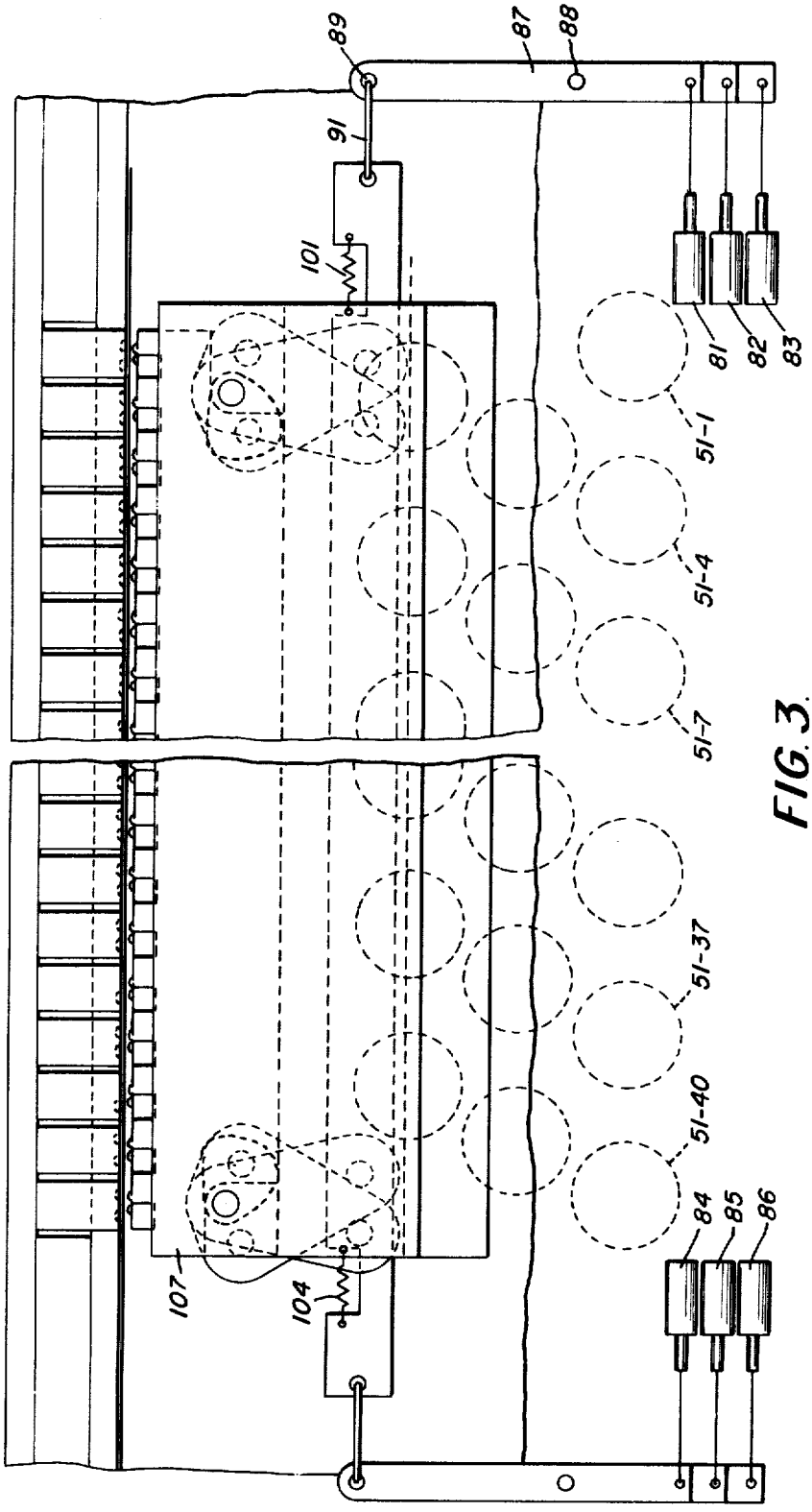


FIG. 3.

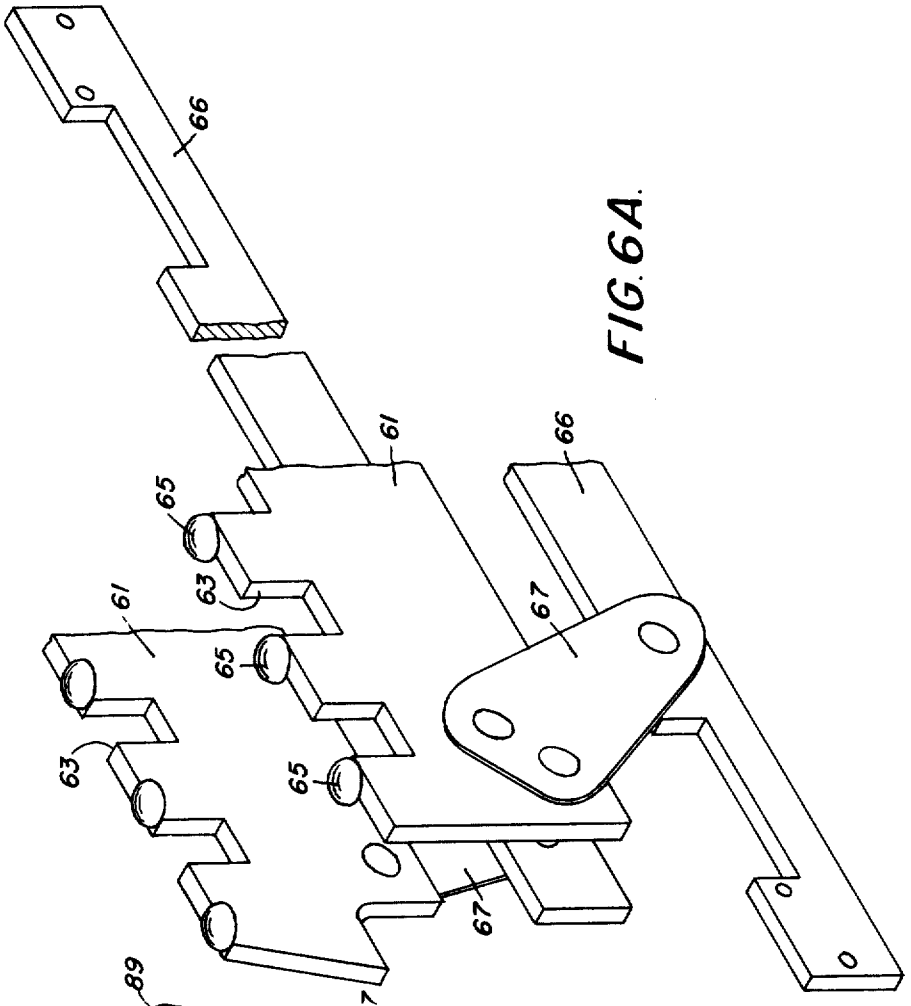


FIG. 6A.

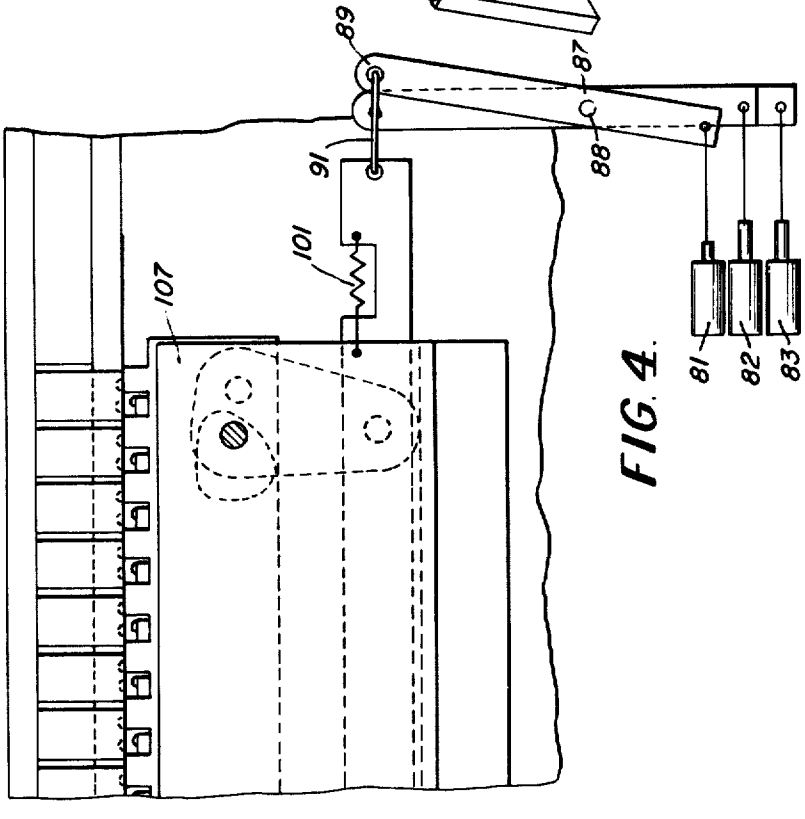


FIG. 4.

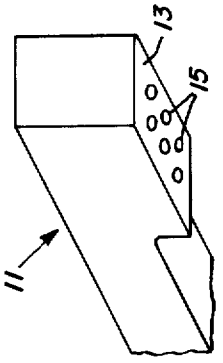


FIG. 5.

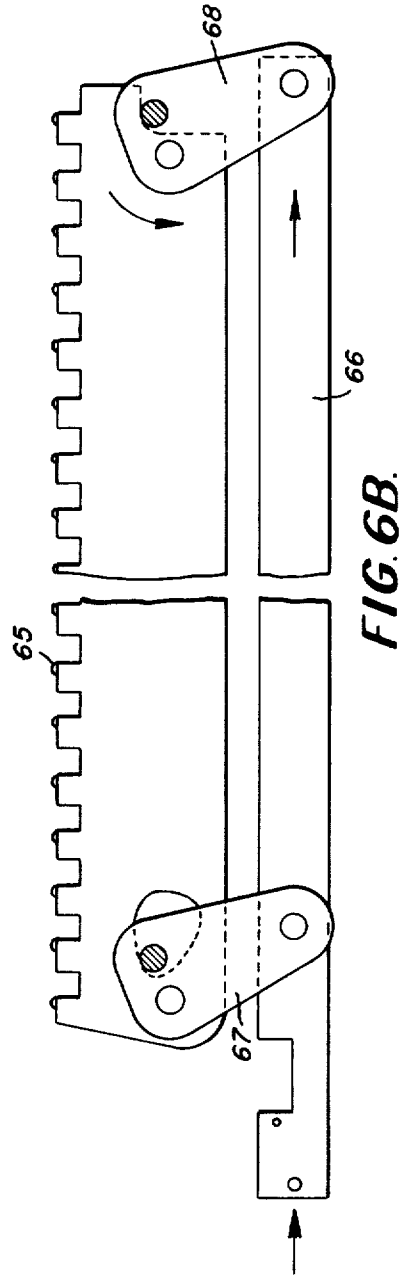


FIG. 6B.

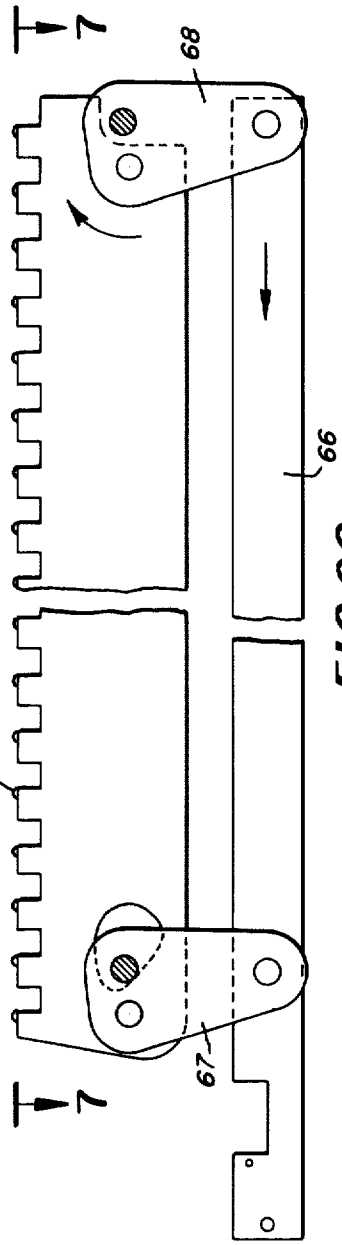


FIG. 6C.

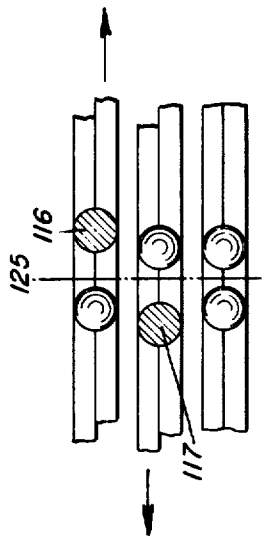


FIG. 7B.

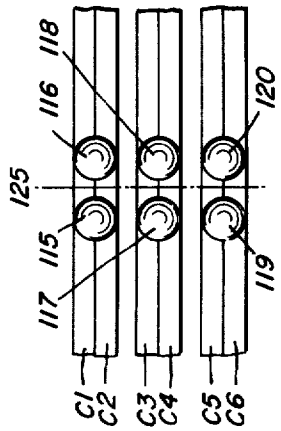


FIG. 7A.

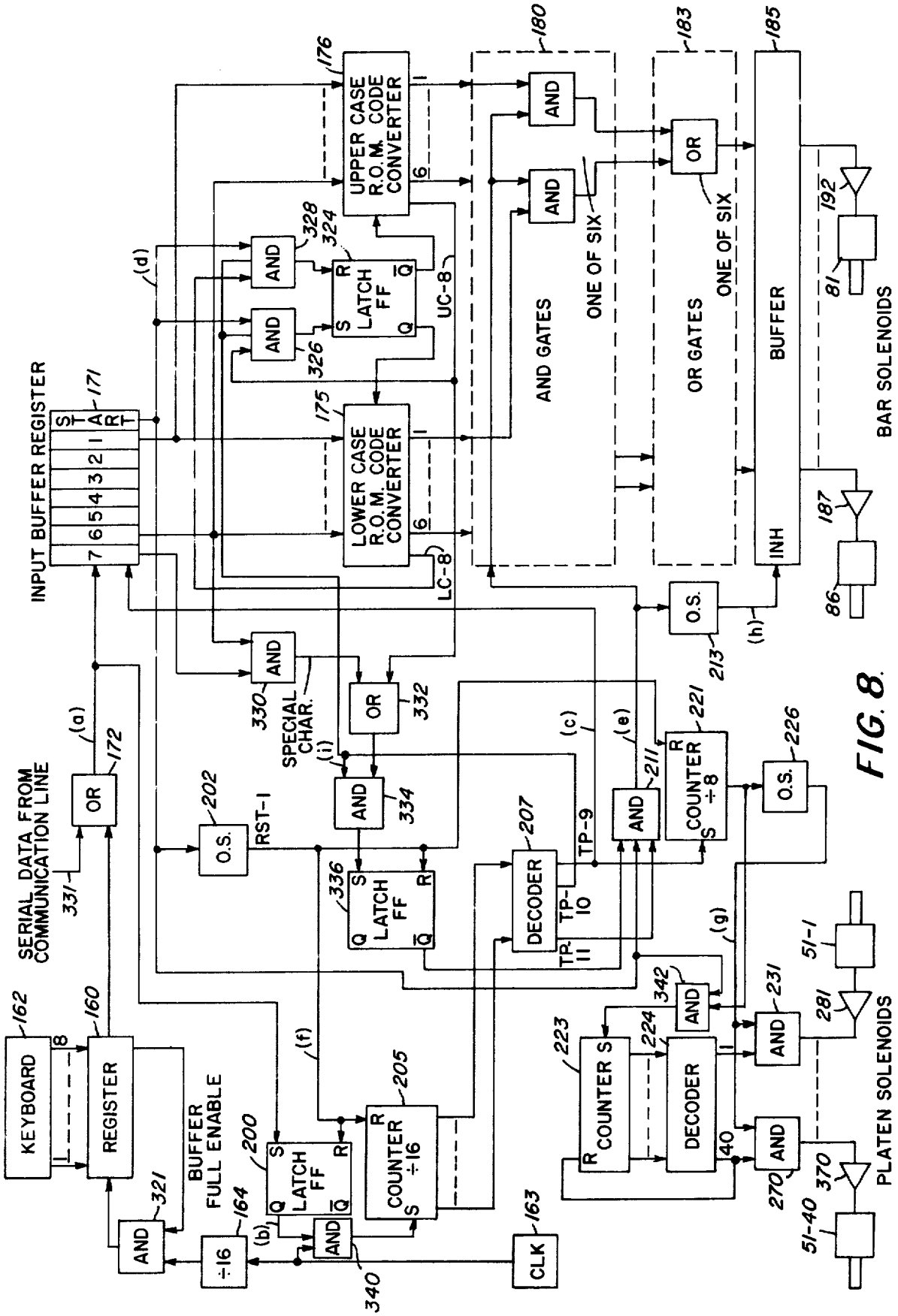

KEYBOARD
REGISTER
SERIAL DATA FROM COMMUNICATION LINE
INPUT BUFFER REGISTER
UPPER CASE R.O.M. CODE CONVERTER
LOWER CASE R.O.M. CODE CONVERTER
AND GATES
ONE OF SIX
OR GATES
ONE OF SIX
BUFFER
INH
BAR SOLENOIDS
PLATEN SOLENOIDS
BUFFER FULL ENABLE
LATCH FF
COUNTER ÷16
COUNTER ÷8
DECODER
COUNTER S
O.S.
SPECIAL CHAR.
RST-1
TP-9
TP-10
TP-11
CLK
÷16
AND
OR

FIG. 8

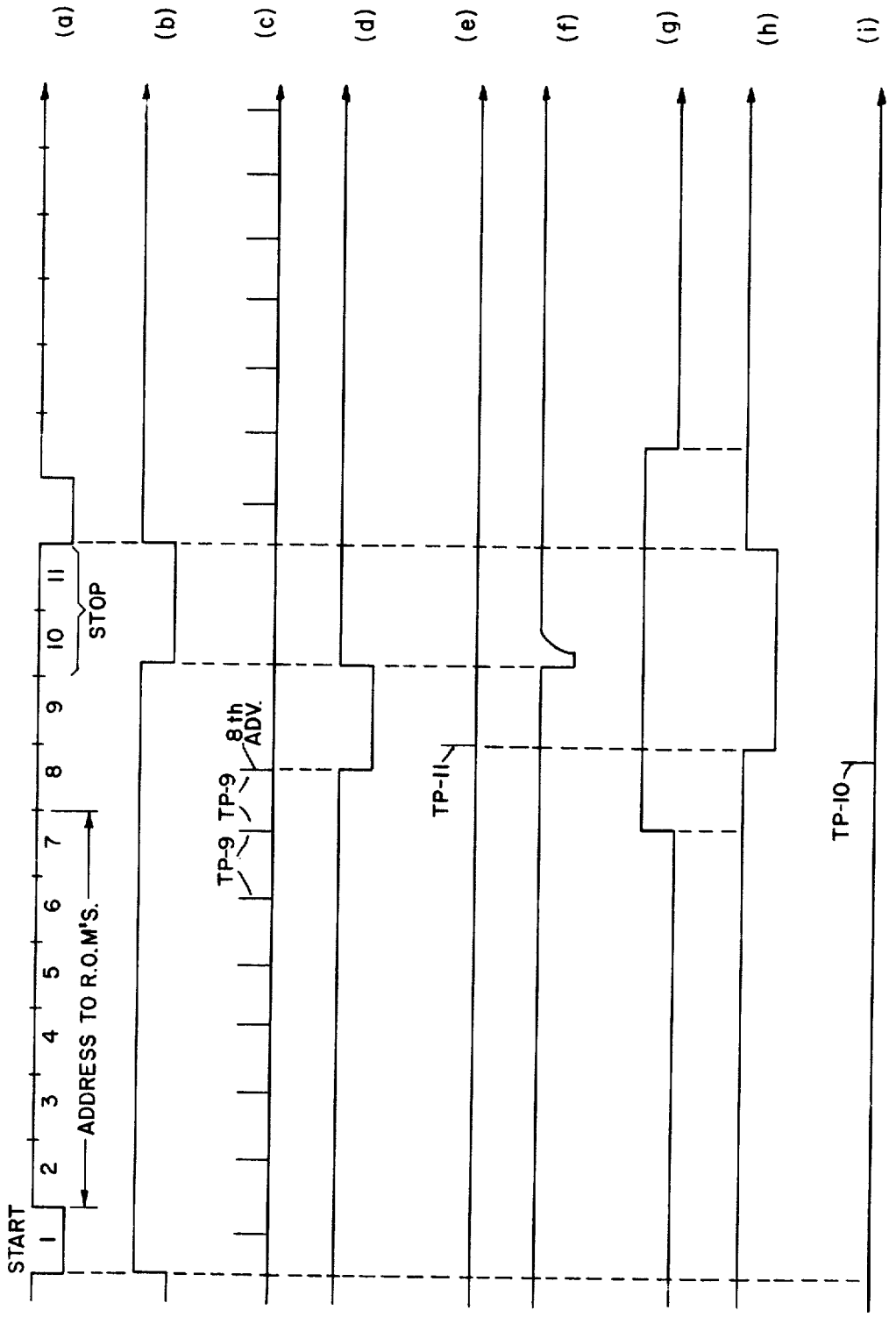

(a)
(b)
(c)
(d)
(e)
(f)
(g)
(h)
(i)
START
1
2
3
4
5
6
7
8
9
10
11
ADDRESS TO R.O.M'S.
STOP
TP-9
TP-9
TP-9
8th ADV.
TP-11
TP-10

FIG. 9.

BRAILLE COMMUNICATIONS TERMINAL

THE FIELD OF INVENTION

This invention relates to a braille communications terminal in general and, more particularly, improved braille printing or embossing apparatus which is simple in structure and flexible and versatile in its operation.

BACKGROUND OF THE INVENTION

A conventional braille typewriter is essentially of a rather elaborate mechanical design which is relatively cumbersome, bulky, noisy and slow. It includes many movable mechanical parts, such as keys, linkages and code bars. To operate it, keys are actuated which, in turn, actuate the code bars to form the braille codes. The typewriter is generally noisy and susceptible to wear and tear and malfunctioning of many of the moving parts. It is limited in its speed of operation in that, essentially, it is bound by the inherent limitations of the speed with which its moving parts can be operated. It is also rather inflexible in terms of the scope and nature of its operation because of its inherent mechanical limitation and cannot be operated remotely by code or digital transmissions. Thus, there has not been available for persons who are not sighted, the same communication facilities (e.g. teletypewriters) which are available for sighted persons.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide improved apparatus for braille communications.

It is another object of the present invention to provide improved braille printing or embossing apparatus.

It is still another object of the present invention to provide an improved braille typewriter.

It is a further object of the present invention to provide a typewriter which is programmable and connectable to a communications line as a read out device or printer of braille signals from a remote location via a transmission line.

It is still another object of the present invention to provide a low cost automatic braille typewriter.

It is a further object of the present invention to provide a braille typewriter that can receive certain form of binary coded signals, such as ASCII code signals, and print out equivalent braille codes.

The foregoing and other objects of the present invention are achieved by providing a braille typewriter that comprises a plurality of individually actuable platens which are normally disposed in retracted positions and which move forward to extend positions against the back of an embossable sheet when actuated and a predetermined number of parallelly and adjacently disposed individually actuable braille code bars, each bar having a row of spaced embossing tips protruding from the bar. The code bars are aligned so that the embossing tips form a plurality of braille codes. Each code is made of an embossing tip from each of the code bars and, when a selected combination of the bars are actuated simultaneously, a braille code of a particular character is formed. The typewriter is provided with an electrical circuitry which is adapted to receive the binary coded braille characters, appearing in a series, to actuate the platens in a successive sequence in a row in response to the braille signal characters and actuate combinations of the braille bars in succession in synchronization with the actuation of the platens whereby a row of braille codes are formed.

It is another feature of the present invention to provide means for the typewriter to receive binary coded braille signals transmitted from a remote station.

It is still another feature of the present invention to include a suitable conversion means for converting binary coded alpha-numeric signals, such as ASCII code signals, and enable the typewriter to print out corresponding braille codes.

The foregoing and other objects and features of the present typewriter will be understood more clearly from the following detailed description of an illustrative embodiment of the present invention in conjunction with the accompanying drawings, in which:

FIG. **1** shows a partially broken top view of the typewriter that shows a plurality of platens, means for actuating the platens and the brailling bars;

FIG. **2** shows a side view along **2—2** of FIG. **1** detailing a platen, mechanism for advancing and retracting the platen, a side view of the braille bars and a mechanism for advancing the braille paper past a position between the braille embossing tips of the braille code bars and the extended position of the platen head;

FIG. **3** shows a partially broken rear view of the mechanism detailing the relative positions of the braille code bars and plates and their actuating mechanism;

FIG. **4** shows a fragmentary rear view of the brailling plates with one of the plates in an actuated position;

FIG. **5** shows a perspective fragmentary view of the platen head having recessed dies which cooperate with the embossing tips of braille code bars;

FIG. **6A** shows a fragmentary perspective view of a pair of the brailling plates and bars.

FIG. **6B** shows a side view of a brailling plate and braille code bar in a rest position;

FIG. **6C** shows an actuated position of the brailling plate and code bar shown in FIG. **6B**;

FIGS **7A** and **7B** show top cross sectional views, taken along the line **7—7** in FIG. **6C**, of one of a plurality of braille plates and their embossing tips respectively in rest (FIG. **7A**) and in actuated (FIG. **7B**) position;

FIG. **8** shows a functional block diagram of an electronic circuitry which controls the operation of the brailling plates and code bars, and the platen heads in response to the incoming code signals, in embossing braille codes into the braille paper; and

FIG. **9** shows a timing diagram helpful in explaining the operation of the various functional elements of the electronic circuitry shown in FIG. **8.**

DETAILED DESCRIPTION

Generally stated, the braille typewriter of the present invention includes a plurality of individually actuable platens disposed in a row; a given number of code bars, each bar having embossing tips spacedly positioned in a row and protruding therefrom and means including an electronic circuitry which is designed to actuate the platens in a successive sequence and actuate selected combinations of the code bars in succession in response to each of the binary coded braille signal characters in synchronization with the actuation of the platens, whereby a row of braille codes are embossed in the braille paper.

Referring to the drawings, as shown in FIGS. **1** and **2**, the braille typewriter includes a plurality of platens,

say 40 platens, P1 through P40 and six brailling code bars C1 through C6. These platens and bars make up a row or line of braille characters or codes. The platens are normally disposed in their retracted positions and their heads are held in a row adjacent to the code bars C1 through C6. The platens may be of a rectangularly shaped elongated member, as shown in FIG. 2. As shown in detail in FIG. 5, one end or head end 11 of the platen includes a flat surface 13 having a predetermined number of recessed dies 15. As shown in FIG. 5, a platen head may include six recessed dies positioned into three rows of two recessed dies each. As known, in the braille typewriter art, the six recessed dies are arranged to conform to the six positions in the format of a six bit braille code or character.

The tail or opposite end 17 (FIG. 2) of the platen is coupled to the frame 19 of the typewriter by means of a return spring 21, as shown in FIG. 2, for holding the platen P1 in a retracted position. For guiding the movement of the platen, there is provided guide means 22. The means includes a guide plate 23 held against a platen support bracket 25 by a pair of pins 27 and 28. The platen includes a pair of elongated slots 29 and 30. The slots are positioned to receive the pins 27 and 28 and are of a predetermined length that provide a limit to the translational movement of the platen, with the pins acting as the stops to the movement of the platen. Thus, as shown, the forward end walls 33 and 34 act as the limit for the deactuated position of the platen and the far end walls 37 and 38 as the limit to the actuated position of the platen shown in a dotted line. The actuated or extended position of the platen is precisely located by the limitation of the movement imposed by the guide pins 27 and 38 as they are hit and held against the back end surfaces 37 and 38 of the slots 29 and 30 when the actuating means causes the platen to move forward into the extended position. The withdrawn position of the platen is defined by the pins 27 and 28 acting against the forward end wall surfaces 33 and 34 of the platen as it is withdrawn to the deactuated position by the platen return spring 21 as shown.

As shown, there is also provided a plate member 39 disposed between the bracket and the platen. This plate may be made of a solid lubricant material such as Teflon which lubricates the platen to ease its movement. Associated with each of the 40 platens, there is provided an actuating means 40 of a suitable design that will actuate and move the platen forwardly into the operated or extended position shown in the dotted line in response to an actuating signal. When the actuating means 41 is de-energized as the actuating signal is removed, the associated return spring 21 is designed to retract the platen and withdraw it into the deactuated position.

The actuating means for the respective platen may be of a typical solenoid type arrangement, three, 41, 42, 43 of which are illustrated in FIG. 2. As illustrated, actuating means may include a solenoid 51 which is connected to an end 52 of a lever 53, pivotably mounted at the intermediate thereof by a pivot 54. The other end 55 of the lever is held against a pivot pin 56 attached to the tail end 17 of the platen P1.

The solenoid 51 is, as shall be shown later, under the control of an electrical signal indicative of the incoming binary coded digital characters. When energized by the signal, the armature of the solenoid is retracted leftwardly and applies a clockwise torque to the lever 53 about its pivot 54 to the actuated position as shown in a dotted line. The torque in turn exerts a force against the return spring 21 and moves the platen P1 forward into the actuated or extended position and places the recessed dies behind embossing tips of the braille code bars, as illustrated in FIG. 2 by a dotted line.

In the foregoing manner, each of the 40 platens is provided with an actuating mechanism for extending the platen head forwardly into its actuated position when an actuating signal is applied to its solenoid and returned to the retracted or deactivated position by the associated return spring when the actuating signal is removed.

Now, the brailling plate and code bar structure will be described in connection with the drawings. The braille codes are formed by a predetermined number of code bars, for example, by six flat elongated code bars of a design, two of which are partially illustrated in FIG. 6A. As shown in FIG. 6A, a braille code bar 61 may be of an elongated flat thin strip, one major side of which may be castellated with a plurality of parts 63 extending outwardly transverse to the length of the bar. There is mounted or formed integral with each of the extending portions 63, a protruding tip 65 which forms an embossing tip of the code bar. The tips are uniformly spaced along the length of the code bar 61. There are 40 embossing tips corresponding to the same number of the platens provided in the typwriter. The embossing tips are spaced so that they can be brought in alignment with a corresponding recessed die of a platen head when the platen head is actuated and moved forward to strike the corresponding recessed dies.

To provide the striking movement of the code bars against the platens, each of the bars is provided with a brailling plate 66. The plate 66 is of an elongated thin strip of a suitable design which are movable coupled to the corresponding code bar 61. The coupling means 67 and 68 may be of a conventional design that provides a parallelogram movement to the code bar 61 in response to the movement of the brailling plate 65. Thus, as illustrated in FIG. 6B, when the brailling plate 66 is moved to the right, the parallelogram action of the linking means 67 and 68 translates the rightward motion of the brailling plate into a counterclockwise and downward motion of the code bar 61. This brings the code bar 61 toward the brailling plate 66 until it is stopped by the plate or by the limit to the movement of the coupling means. FIG. 6B represents deactuated position of the code bar. But, when the brailling plate 66 is moved leftwardly, the linking means 67 and 68 imparts a parallelogram action to the code bar 61 away from the brailling plate in a clockwise direction, as illustrated in FIG. 6C. This represents the actuated position of a code bar.

As illustrated in FIGS. 3 and 4, there is provided a solenoid actuated lever mechanism and a retracting spring means for each of the six brailling plates. Each of the six brailling plates is connected to a corresponding one of the six solenoids 81 through 86. As illustrated in FIGS. 3 and 4, for a typical solenoid 81, it is connected to an end of a lever 87 pivotably connected about its pivot 88. The other end of the lever 89 is connected to an end of the brailling plate via a linkage 91.

As illustrated in FIG. 3, preferably three of the six brailling solenoids 81, 82 and 83 may be positioned at one end or right end and the remaining three, 84 through 86 at the opposite or left end so that the first three brailling bars are actuable to move the corre-

sponding brailling plates to the right and the remaining brailling bars to move to the left. Referring to FIGS. **3**, 4, 6 and **7**, in the normal deactuated position, the return springs **101–106** connecting the associated brailling plates to the typewriter frame **107** retract the plates to their retracted or withdrawn positions. The result is that all of the embossing tips are withdrawn in the retracted position, as illustrated in FIG. **6B**. The sets of six embossing tips, one tip from each of the code bar, form braille codes, and are positioned in their retracted positions. As illustrated in part in FIG. **7A** in the retracted positions, all of the tips are on the same elevation. But, when selected ones of the bars are actuated, for example, the second (**C2**) and third (**C3**) bars, the tips of the actuated bars are moved forwardly above the others to a higher level. This is illustrated by FIG. **7B** which shows a cross sectional view of the six tips making up a code when the second and third code bar tips are lifted.

As illustrated in FIGS. **1A**, **6A**, **7A** and **7B**, the brailling plates and code bars may be paired into two's, **C1** and **C2**, **C3** and **C4**, **C5** and **C6**. The paired plates may be held, as shown in FIG. **2**, between guide plates **127** which may be made of Teflon or the like material that act as solid lubricants to enhance the sliding movement. The actuating means, namely, the solenoids **81–86**, and associated coupling means **67** and **68** are also paired so that they move opposite to each other when the associated solenoids are actuated. When deactuated, the tips forming the codes, e.g. **115–120** shown in FIG. **7A** are brought together closer to a transverse line **125**. But when actuated, the tips of the actuated bars (e.g., **C2** and **C3**) spread apart away from the line **125** as shown by the tips **116** and **117** of the two actuated bars **C2** and **C3**. Referring to the platens, their recessed dies **15** of the platen are so spaced that they receive the actuated corresponding embossing tips.

In summary then, referring generally to FIGS. **1–7**, the typewriter includes a suitable number of platens, such as **40**, disposed in a line or row corresponding to a number of braille code characters to be formed into the row. It includes six braille code bars, and associated actuating mechanisms. It also includes suitable means, as explained below, which are designed to actuate **40** platens which can be actuated one at a time in a sequence from left to right to form a row of codes. A predetermined combination of the six bars can be actuated simultaneously for each of the incoming braille signals in sychronization with the actuation of a platen to form a braille code. As each of the **40** platens, **P1-P40** in FIG. **1** are actuated, in effect **40** identical braille codes can be formed by the actuated braille bars. But, only one set of six embossing tips (e.g. FIG. **1**; **127**) in alignment with the actuated platen strike against the head of the actuated platen head and forms the selected braille code in the embossable sheet **140**.

Now, referring to FIGS. **1** and **2**, generally, the typewriter may also be provided with a braille paper or sheet feeding mechanism of a conventional design. Referring to FIG. **2**, the sheet member is the usual braille paper but which could be made of a suitable material composition, that which can be embossed readily, is advanced through a path defined by a pair of guides **142** and **143** and fed into a position between the extended position of the platen and the embossing tips of the brailling code bars **C1–C6**. The sheet may be of the same type as the continuous forms which are used in computer sheet printers. The sheet is then advanced by a suitable means **146** shown as a tractor pin mechanism of the type used in computer printers having a plurality of sprocket pins **147** positioned on both sides of a drive belt **148** so that they go through the apertures **149** (FIG. **1**) disposed along the two sides of the sheet **140**. As the belt **148** with the sprocket pins are driven clockwise, by a suitable drive means **150** such as a sprocket, the paper is advanced forward past the embossing tips and the extended position of the platen head. The paper is advanced incrementally or stepwise by a predetermined distance to a new row after a row of the braille codes are embossed onto the paper, as will be described in detail below in connection with the electrical circuitry of the present typewriter.

To operate the present typewriter, a suitable means may be provided which is designed to receive the incoming code signals, and in response, actuate the platens in succession and actuate different combinations of the brailling code bars in succession against the actuated platens to form braille codes corresponding to the particular code signals. One such approach is an electrical circuitry shown in FIG. **8**. The circuitry according to the present invention receives each of the character signals one at a time and derives a platen actuating signal for each signal character. Forty signals corresponding to a **40** signal character making up a row are derived in this manner in series and used to actuate the **40** platens in succession. The circuit is also designed to convert each code character to six decoded signals for actuating the six braille bar solenoids in synchronization with the actuation of a corresponding platen to form a braille code and this is repeated **40** times for the **40** incoming braille signal characters representing a row of braille codes. The binary coded signals are arranged in the form of a series train of pulses wherein each of the braille code signals may consist of six binary bits.

Referring to FIG. **8**, the circuitry may comprise a register **160**, a suitable keyboard **162** for inputting binary code signals to the register **160**, a master clock **163** and a divider **164** for clocking in the input signal bits to the register **160**, a temporary input buffer **171**, code converting means **175–176** which may be made of a programmable read only memory, OR gates **180**, AND gates **183**, and an output buffer **185** all operatively connected in series, for generating signals for actuating a selected combination of braille bar solenoids **81-86** in synchronization with the actuation of a platen solenoid in response to each of the braille signal characters. The circuitry is also provided with a latch **200**, a clock pulse counter **205**, aa decoder **207**, a second counter **221** used as a divider, character signal counter **223** and associated decoder **224** connected in the manner shown for generating the platen solenoid actuating signals sequentially as the binary code signal characters are received.

Now referring to the various component parts of the circuitry, the register **160** is of a conventional design, such as an integrated circuit that is available from General Instruments as a part designated AN 51010, that can receive eight binary character code bits in parallel and send out the bits serially. The code is read out in series into a temporary input buffer **171** under the command of a buffer-full enable signal in the usual manner when the register **160** is full. When loaded, the register

160 allows the clock signal from the master clock 163 to apply clock pulses to it via a divider 164. The read out is accomplished when the register 160 applies a buffer-full enable signal via its feedback path 165 to enable AND gate 321 which applied the clock divided by 16 to the strobe input of the register 160. This causes the register to be read out into the input buffer 171 via the OR gate 172.

The input buffer 171 is of a conventional design arranged to receive the incoming signal from the communication line or from the register 160 and reads out in parallel to the code converting means in the form of read only memories (ROM) 175 and 176. If the incoming characters are in ASCII code, they are converted into the braille code by one of the ROMS. The ROMS are of conventional design. They have six inputs and eight inputs (6×8). Thus, there are 64 addresses for each of which a different six bit braille code is provided. For upper and lower case as in Bandot selectric codes (EBCD) a single bit is provided on the LC or UC ROM output. The six bit ROM outputs representing braille characters are read out simultaneously to actuate a particular combination of the braille solenoids 81–86 in a timed manner as explained below so that they actuate the combination of six braille embossing tips which form the corresponding braille code or character.

More specifically, the six outputs are then gated through AND gates 180 and OR gates 183 to a buffer register 185. The buffer is read out to a driver amplifier 187 to 192 to drive the bar solenoids 81 to 82.

When a code representing an upper case character is received, the ROm 175 will be addressed to provide an output level on the LC-8 output of ROm 175. Since subsequent characters will be upper case, the upper case ROM 176 will be used. ROM 176 is enabled by a latch 324 when its Q level goes to the 1 state. The start bit when advanced to the last stage of the input buffer 171 allows AND gates 326 and 328 (see waveform (d) in FIG. 9) to be enabled, which occurs when the LC 8 or UC 8 bits are decoded by the ROMS. The LC 8 bit resets the latch 324. Thus, the upper case ROM 176 becomes enabled and will decode subsequent characters as they are received in the input buffer 171. When a lower case character is received, the upper case ROM 176 will decode at a 1 level on its UC 8 output which enables the gate 326 to allow the latch 324 to be set, thereby enabling the lower case ROM to decode subsequent received characters.

The AND gates 180 are actuated by a timing signal from an AND gate 211. The gate 211 is enabled when the start bit is advanced to the last stage of the input buffer 171 for embossable braille characters. However, when upper or lower case characters are decoded, the LC 8 and UC 8 outputs are operative to inhibit the gate 211 until the next embossable character is received. Similarly, special unembossable characters, say in ASCII code, are used to inhibit the gate 211 which will prevent actuation of the solenoids and embossing of characters. The output of the OR gates 183 are then buffered at the buffer 185 and stored there until a timing circuit 213 (a one-shot, OS, multi-vibrator being suitable) interposed between the gate 211 and the buffer 185 removes an inhibit signal from the buffer 185. As will be made clearer later, the inhibit signal is removed at a time (see FIG. 9, waveform (h)) intermediate the interval of time used for actuating the platen (see FIG. 9, waveform (g)). The outputs of the buffer 185 are applied via suitable amplifiers 187–192 to actuate the braille bar solenoids 81–86.

While the binary code signals are being received and converted into the braille solenoid actuating signals as described above, in the meantime, there received binary code signals are also used to generate the platen solenoid actuating signals. Various elements 160–320 shown in FIG. 8 are operatively connected to provide the following operations: Briefly stated, the series train of binary coded braille signal characters are counted and then in response to each count signal a platen actuating signal is generated. The circuitry is so designed that platen solenoid actuating signals are generated and applied in succession so that the left most of the platen is actuated first and others to the right in a successive sequence. The circuitry is also designed so that the actuation of each of the succeeding platens are timed to occur in synchronization with simultaneous actuation of different combinations of the braille code bars actuated in a sequence until a row of braille codes are embossed. When a row of the braille codes are completed, a count signal signifying the end of row is also applied to the means for actuating the incrementally advancing means 150 for advancing the paper 140 to a succeeding row.

Referring to FIG. 8, there is shown the logic circuitry for providing synchronization between the actuation of the platens P1 to P40 and the brailling bars C1 to C6. The logic is also operable with a synchronously received code character, or may arrive from the keyboard register 160 or the line 331. The first or start bit of the incoming data appears at the OR gate 172 output and sets a latch flip-flop (see FIG. 9, waveform (*a*)) The Q output then allows the CLK (163) to be gated through and Gate 340 allowing the counter 205 to count CLK pulses. A divide by sixteen counter 205 is used. The counter should have a total capacity which is a number larger than the total number of bits in the input code characters. The counter 205 counts the clock pulses, which have a repetition rate much greater than the bit rate of the incoming data. A decoder 207 is connected to the stages of the counter 205 and provides output pulses upon the ninth (TP–9) tenth. (TP–10) and eleventh (TP–11) clock pulses. The TP–9 pulses (FIG. 9; waveform (*e*)) are applied to the input buffer register 171 and strobe that register to read the data bits into the register. The TP–9 pulses have a repetition rate faster than the incoming data. The start bit from the OR gate 712 starts the counter 205 and begins each character cycle. The Latch 200 is set enabling the counter 205 to count clock pulses, as by applying the Q output of the latch 200 to an ANd gate 340 to which the clock 163 is input connected. Then, the eighth TP–9 pulse will advance the start bit into the last stage of the input buffer 171 (see FIG. 9, waveform (*c*)).

When the start bit propagates to the last stage of the register 171, a complete character will be stored therein. The output level at the first or "start" register stage is shown in waveform (d) of FIG. 9. One shot 202 is triggered by this level. After a short delay, the one shot 202 puts out a pulse (RST–1) (waveform (f)) which resets the latch 200 and also, resets the counter 205. Reset occurs before the next TP–9 pulse is due, approximately then clock pulse periods being suitable. The counter 205 is then enabled upon the receipt of the

first or start bit of the next character from the keyboard register **160** or from the line **331.**

The platens are actuated during each character printing cycle. A counter **221,** which divides by eight and then recycles, is used. The counter **221** includes suitable gating for providing an output when it reaches a count of seven. Thus, upon the seventh TP–9 pulse in each character printing cycle, a counter **223** having sufficient stages to count to **40** is advanced. The counter may be a six stage binary counter. The outputs of the counter are applied to a binary to decimal decoder **224.** This decoder has **40** output lines each corresponding to a successive one of the platens P–1 to P–40, respectively. The **40**th line provides an output level when the counter **223** reaches a count of **40.** When this output occurs, the platen P–**40** at the end of the line is actuated. The output is therefore used for a line feed signal to advance the drive motor for the tractor mechanism **146** (FIG. **2**) which then advances the sheet to present next line between the platens and brailling bars. This output is also used to reset the counter **223**

The platen solenoids **51-1** to **51-40** are enabled to be actuated in sequence by the outputs of the decoder **224.** The **40** outputs sequentially enable **40** AND gates **231** to **270.** A one shot multi-vibrator **226** is triggered by the output of the counter **221** when it reaches a count of seven and provides a pulse time (see FIG. **9,** waveform (g) during which the platen solenoids **51-1** to **51-40** are actuated. Thus, when the counter **221** counts its seventh TP–**9** pulse, the counter **223** is advanced to a count of one. The decoder **224** then enables the first AND gate **231.** The one shot **226** pulse provides, during its pulse time, an output from the gate **231** which is amplified in the first **281** of 40 platen solenoid driven amplifiers **281** to **320.** The first platen is then actuated and will remain actuated for the one shot pulse duration. The first platen **P–1** is then brought to the actuated position fully and reaches a steady state position before the brailling bars C–**1** to C–**6** are actuated and their embossing tips press the sheet against the recessed dies of the platen. The timing is such (see FIG. **9,** waveforms (*g*) and (*h*) that the platen is held in actuated position until the braille bars are deactuated and the embossing tips drop out of embossing relationship with the platen. The timing is obtained through the use of one output from the decoder **207** which is coincident with a clock pulse (TP–**11** being used) occurring after the pulse (TP–**9**) which provides for actuation of the platen solenoids. Also, the one shot **213** provides a pulse time or duration shorter than the pulse time provided by the one shot **226.** The second through 40th platen solenoids are similarly actuated in timed relationship with the braille bars as each successive character is received and stored in the input buffer register **171.**

If a special (unembossable) character is decoded by the ROM **175** or **176,** or in the case of special ASCII control character, an AND gate **330** decodes such a control character. These unembossible characters when decoded by the ROM's or by the gate **330,** are applied via an OR gate **332** to enable an AND gate **334.** The AND gate **334** sets a latch **336** when the tenth clock pulse TP–**10** appears during a character cycle. The Q output of the latch **336** inhibits the AND gate **211,** thus preventing TP–**11** from enabling the actuation of the embossing means (viz) the buffer **185** read out). The Q output of the latch **336** inhibits AND gate **342** from advancing the platten counter **223.** The reset pulse at the end of the character cycle is applied to reset the latch **336.** The reset is initiated with power on by applying a reset pulse to the same line as provided for the one shot **202** output.

Because of the flexibility and versatility of the circuitry, the present typewriter can be readily adapted to suit different needs. For example, it can be adapted as a braille print out terminal of regular transmission line **331** in a communication network, very much in the same way that teletype (TTY) terminals connected to the public switched telephone network via network transmission lines. This may be accomplished by using a suitable means for detecting the reception of an ASCII coded character from the communications line **331.**

While the typewriter is described in terms of having means for typing 40 braille codes per line, this need not be so limited. Shorter line can be readily programmed by using as the line feed signal an output any particular one, e.g., **20, 25** etc. of the 40 outputs from decoder **224** and the number of codes per line can be increased by increasing the number of platens and associated mechanical elements and adjusting the circuitry accordingly.

Various other changes and modifications may be made by one skilled in the art on the basis of the foregoing disclosure without departing from the spirit and scope of the present invention. Accordingly, the foregoing description should be taken as illustrative and not in any limiting sense.

What is claimed is:

1. Apparatus for embossing braille codes on a deformable sheet, comprising:

a plurality of individually actuable platens disposed for movement between extended positions upon actuation and retracted positions upon deactuation,

a predetermined number of individually actuable braille code bars, each bar having a row of protruding and spacedly positioned embossing tips, said bars being disposed so that the embossing tips of the actuated combination of said code bars form a braille code,

a plurality of actuating means for said plurality of platens,

a predetermined number of actuating means for said predetermined number of code bars,

means for receiving code character signals in the form of a series train of binary coded digital signals,

means for generating a train of count signals representing the count of the incoming binary coded digital signals,

means responsive to the successive character count signals for generating enabling signals to enable the plurality of platen actuating means to actuate said plurality of platens in a sequence,

decoding means responsive to each of the binary coded signal characters for deriving actuating signals for enabling different combinations of said code bar actuating means at the same time in synchronization with the actuation of each of the platens, whereby a row of braille codes are embossed on the deformable sheet interposed between the actuated platens and code bars corresponding to the incoming braille signals.

2. The apparatus according to claim 1, including means for generating the enabling signal for each of said platen actuating means comprising timing means for applying said enabling signal to corresponding platen actuating means for a predetermined time interval in response to each of the character signals and means for generating the actuating signals comprises means for applying said decoded signal for a time interval falling within and less than said predetermined time interval during which said enabling signal is applied to a platen.

3. The apparatus according to claim 1, including said braille signal receiving means includes a register for receiving a binary coded digital signal one at a time, said actuating signal generating means for enabling the code bar actuating means includes an input buffer for temporarily storing the received binary coded signal character from said register means, converting means responsive to the output of said input buffer for deriving a combination of the braille code bar actuating signals, and means for gating the braille code bar actuating signals to the code bar actuating means simultaneously in synchronization with the actuation of a corresponding platen.

4. The apparatus according to claim 3, said input register means is adapted to receive braille signals from a keyboard means.

5. The apparatus according to claim 4, including gating means disposed between said input register means and input buffer for receiving incoming code signals in a serial data form from a communications line.

6. The apparatus according to claim 3, wherein said gating means, input buffer and converting means are adapted to receive an incoming signal in the form of a series train of coded data and converting said coded data into a combination of the braille code bar actuating signals.

7. The apparatus according to claim 6, wherein the incoming signals are in the form of a series train of bits in frames, each frame including a starting bit, a predetermined number bit positions, said braille signal counting means including:

a clock generating clock pulses from said clock until said register stores the binary coded digital signals which make up a character,

first decoder responsive to the output of said first counter for providing a first output having a predetermined number of output pulses corresponding to the number of bits in said register,

second counter responsive to said predetermined number of output pulses from said first output for generating a count signal timed to occur at the last pulse of the predetermined number of pulses, and

means for applying the successive output pulses of said second counter to the plurality of said platen actuating means in a sequence.

8. Apparatus according to claim 7, including

a third counter for receiving the count signals from said second counter,

second decoding means connected to said third counter for generating said platen actuating signals,

a plurality of gating means, said second decoder means being interposed between said third counter, and

timing means responsive to the count signals from said second counter for enabling said gating means in succession, each for a predetermined time interval after the time position corresponding to the last bit of the character bits being received by said input buffer register.

9. Apparatus according to claim 8, wherein said braille code bar actuating means, said gating means includes a predetermined number of gates for gating the output of said converting means,

said first decoder providing a second output pulse timed to occur at the last bit position of the braille code bits,

coincidence gating means disposed between said gate means and said second output of said first decoding means and responsive to said second output and the start bit of the braille code applied to said input buffer for generating an enabling signal to said gates to channel the output of said converting means therethrough,

an output buffer for receiving and storing the signal from said converting means channeled through said gates, timing means responsive to the output of said coincidence gating means and enabling said buffer means to output said stored signals to the braille bar actuating means during a time interval intermediate between the start and stop of the platen actuating signal applied to the corresponding platen actuating means.

10. The apparatus according to claim 9, including means for setting the typewriter to terminate each row of braille codes when a particular number of codes are embossed, and

means for generating a signal for advancing the embossable sheet in response to the completion of said particular number of codes, and

means responsive to said advancing signal for advancing said embossable sheet by a predetermined distance.

11. The apparatus as set forth in claim 6, wherein said converting means comprises a pair of read only memories, and means for enabling different ones of said memories for converting upper and lower case characters stored in said register.

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