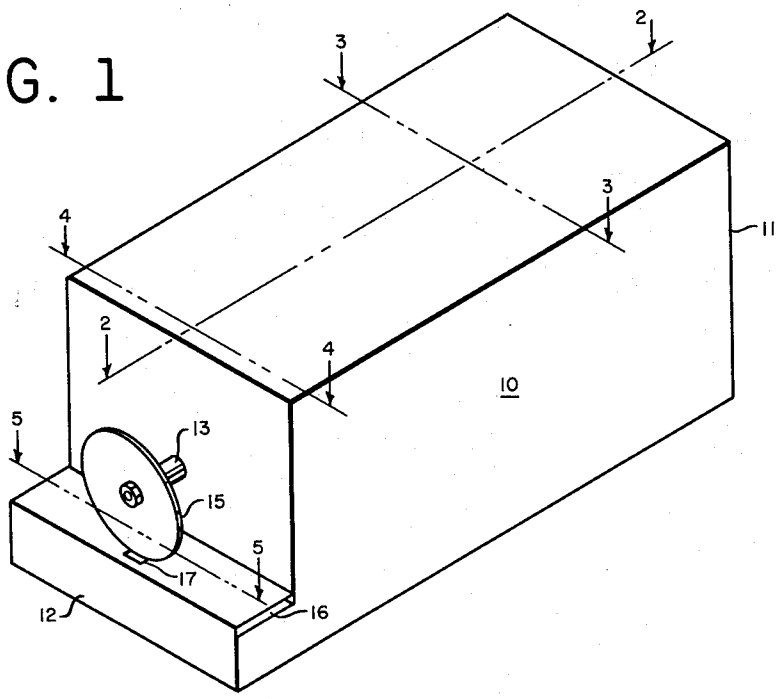
Nov. 19, 1963 A. F. HAYEK 3,111,085

DIFFERENTIAL TYPE WHEEL SETTING MEANS IN SIGNAL CONTROLLED PLATEN PRESS

Filed May 2, 1962 3 Sheets-Sheet 1

FIG. 1



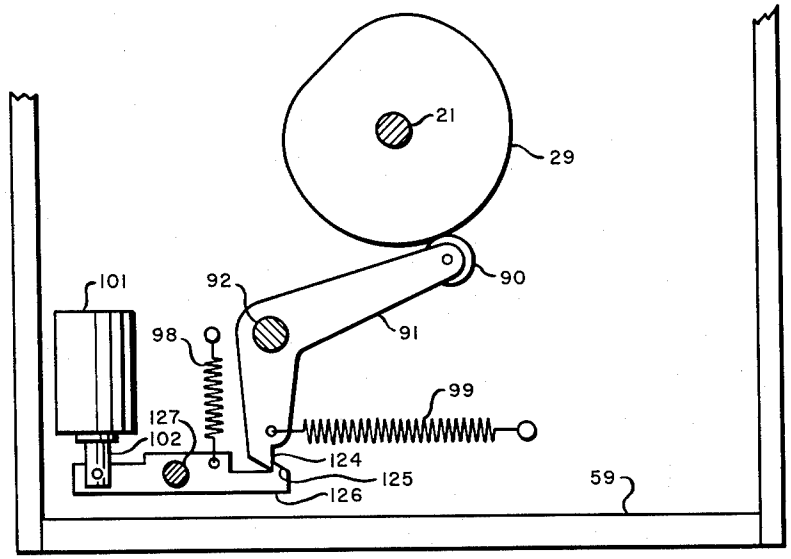




FIG. 4

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DIFFERENTIAL TYPE WHEEL SETTING MEANS IN SIGNAL CONTROLLED PLATEN PRESS

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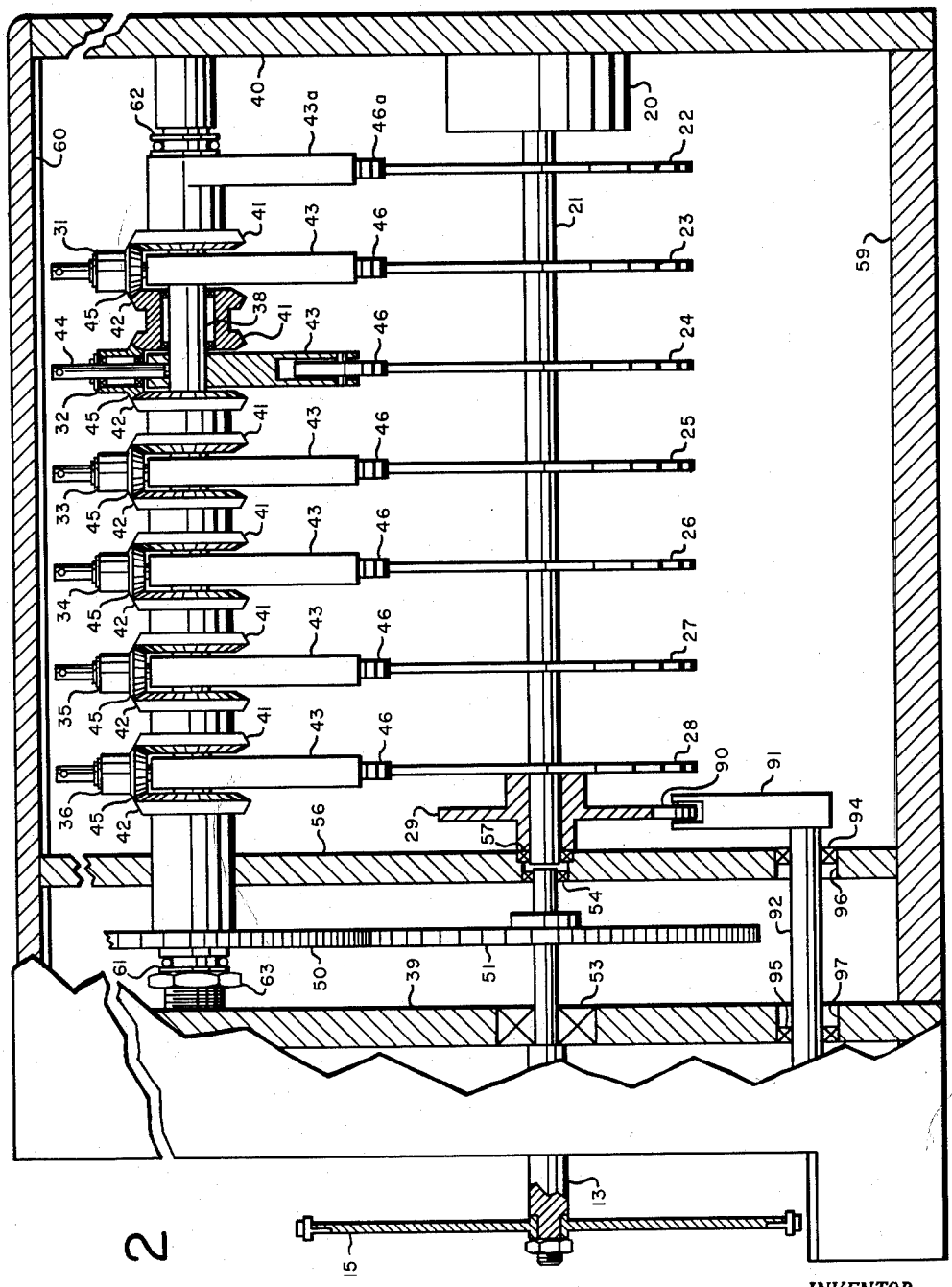



FIG. 2

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DIFFERENTIAL TYPE WHEEL SETTING MEANS IN SIGNAL CONTROLLED PLATEN PRESS

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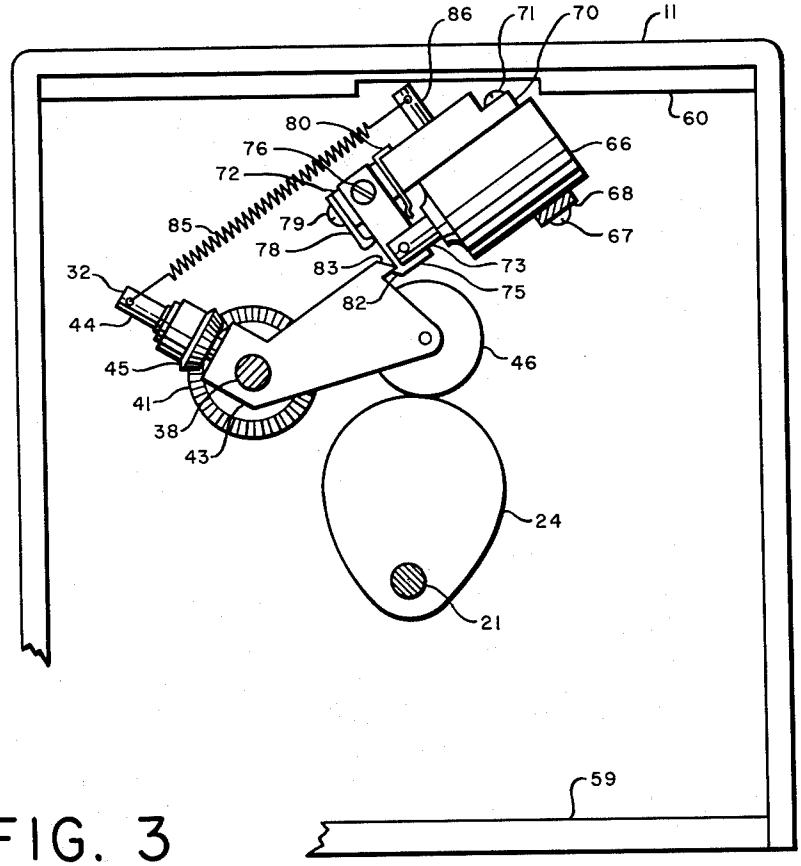



FIG. 3

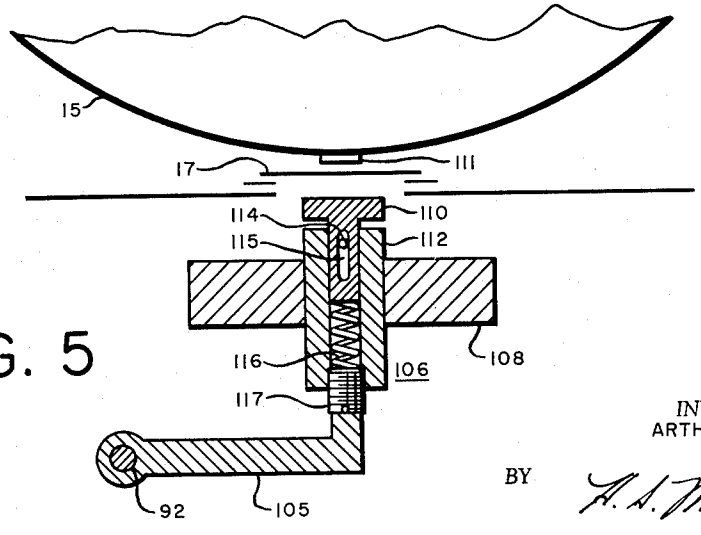



FIG. 5

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United States Patent Office 3,111,085 Patented Nov. 19, 1963



# 3,111,085
# DIFFERENTIAL TYPE WHEEL SETTING MEANS IN SIGNAL CONTROLLED PLATEN PRESS

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Filed May 2, 1962, Ser. No. 191,944
7 Claims. (Cl. 101—93)

This invention relates to printers and more particularly to rotary line printers which are capable of imprinting a message, one character at a time per line, in response to coded electric signals from computers, data processors or any other source capable of assembling the signal in the required format.

Digital computers and data processors in current use are capable of extremely high speed operation and rely on this feature for economic feasibility since they are extremely expensive to construct and operate. In order that the advantages of this high speed be fully realized, the information they supply must be recorded or otherwise reduced to a usable form as rapidly as possible.

In many instances the information must be reduced to printed form. Thus, printers capable of a reasonably high speed are required. However, reliability and durability of the printer must not be sacrificed to achieve high speed since a breakdown of the printer will result in a costly stoppage of the computer or processor.

One object of this invention is to provide a printer suitable for use with high speed digital computers and data processors which has very few moving parts.

Another object of this invention is to provide a printer which may be easily and quickly replaced due to its physical configuration.

A further object of the invention is to provide a printer which is reliable in operation and in which the moving parts are not subjected to large or destructive shocks and loads.

Yet another object of the invention is to provide a printer which is small in size, low in weight and which is easily assembled.

Another object of the invention is to provide a printer which employs pressure printing and is quiet in operation.

The invention is concerned with a printing mechanism comprising a plurality of tandem connected differentials, means for moving at least one rotary element of each differential a predetermined distance in response to an electric signal, said tandem differentials providing the sum of the movements of said individual elements at one end, rotary type bearing means responsive to the sum of the movements of the individual rotary element whereby said means is positioned to correspond to the said sum, a platen means positioned adjacent said type means, and means responsive to an electric signal for urging said platen means towards said type means after said means has been positioned to correspond to the sum.

The foregoing and other objects and advantages of the invention will appear more clearly from a consideration of the specification and drawings wherein one embodiment of the invention is described and shown in detail for illustration purposes only.

In the drawings:

FIGURE 1 is an isometric view of a novel single wheel printer constructed according to the invention;



FIGURE 2 is a cross-sectional view of the printer shown in FIGURE 1 taken along the line 2—2;

FIGURE 3 is a cross-sectional view of the printer shown in FIGURE 1 taken along the line 3—3;

FIGURE 4 is a cross-sectional view of the printer shown in FIGURE 1 taken along the line 4—4; and,

FIGURE 5 is a cross-sectional view of the printer shown in FIGURE 1 taken along the line 5—5.

The novel printer 10 is shown in FIGURE 1 with its top and front cover 11 and 12, respectively, in place. A print wheel drive shaft 13 extends through front cover 12 and is drivingly connected to print wheel 15 which turns with shaft 13. An opening 16 formed between top cover 11 and front cover 12 is adapted to receive a card or tape, not shown, on which a message is to be printed. The card when inserted passes under an inked ribbon 17 and over a depressing mechanism not shown in this figure which when actuated urges the card and ribbon simultaneously into contact with the type mounted on the periphery of that portion of wheel 15 which overlies ribbon 17. Thus, an impression of the type which overlies the ribbon is made on the card. Neither the ribbon or card advance mechanisms have been shown since both are beyond the scope of this invention and a wide variety of well-known mechanisms may be used. Power for operating these mechanisms is available within the printer and should be used, especially in conjunction with the card advance mechanism which must be of the intermittent type, so that a synchronized intermittent motion can be obtained to provide for the successive printing of characters on the line.

In FIGURE 2 a motor 20 drives a camshaft 21 at constant speed and a plurality of spaced cams 22, 23, 24, 25, 26, 27, 28 and 29 are drivingly mounted for rotation on shaft 21. A plurality of tandem connected differentials 31–36, inclusive, are mounted on a fixed shaft 38 which is mounted between a front wall 39 and a rear wall 40.

Each differential includes two bevel gears 41 and 42, and a spider assembly 43 mounted for free rotation on shaft 38. A shaft 44 on spider assembly 43 carries another bevel gear 45 which is free to rotate about shaft 44 and simultaneously meshes with gears 41 and 42. A cam follower 46 is mounted for rotation on the main body portion of spider assembly 43 and in the case of differential 32 engages and follows cam 24 which is mounted on shaft 21. Bevel gears 41 and 42 of adjacent differential are connected together by a common hub and rotate together. Bevel gear 41 of differential 31 has an arm assembly 43*a* extending normal to its axis and arm assembly 43*a* mounts a cam follower 46*a* which engages and follows cam 22. In addition cam followers 46 of differentials 31, 33, 34, 35 and 36 engage and follow cams 23, 25, 26, 27 and 28, respectively.

A spur gear 50 is drivingly connected to bevel gear 42 of differential 36. Gear 50 meshes with and drives another spur gear 51 of the same pitch and number of teeth which is drivingly mounted on shaft 13. Shaft 13 is journaled for rotation in a bearing 53 mounted in an opening in front wall 39 and in a bearing 54 mounted in an opening in a partition wall 56. The end of camshaft 21 remote from motor 20 is supported for rotation in a bearing 57 which is mounted in the same hole in partition 56 that

supports bearing 54. Front wall 39, partition 56 and rear wall 40 extend between a bottom plate 59 and top plate 60 to form a rigid support structure for the cams, the differentials and their support shafts.

In order to minimize the effect of backlash from the differentials on shaft 13, a pair of thrust bearings 61 and 62 are arranged on shaft 38 to maintain the differentials in intimate contact and a nut 63 is threaded on shaft 38 so that it engages one side of thrust bearing 61. Thus, nut 63 may be adjusted to increase or decrease the backlash. Care must be exercised that nut 63 not be tightened too much since it can introduce too much friction in the differentials. However, it must be tightened enough to eliminate most of the backlash, otherwise the position of print wheel 15 will be ambiguous.

The cross-section shown in FIGURE 3 illustrates the arrangement of the differentials with respect to the cams. This figure shows in particular the arrangement of differential 32 and cam 24. However, all of the differentials, with the exception of 31, as noted previously, are identical. In addition, the associated cams are similar in many respects and a detailed explanation of how they differ will be made later.

A solenoid 66 is anchored by a screw 67 to a support bar 68 which extends parallel to camshaft 21. A bracket 70 is attached to solenoid 66 by a screw 71 and extends toward spider assembly 43. An extension 72 of bracket 70 protrudes beyond the end of armature 73 of solenoid 66 and supports a link 75 which has one end pivotally connected to extension 72 by a screw 76 and its other end pivotally connected to armature 73.

A stop member 78 is attached to the end of extension 72 by a screw 79 and limits the movement of link 75 toward the spider assembly 43 and when the position of link 75 is controlled by spring 80 and stop 78, as illustrated, detents 82 and 83 prevent spider assembly 43 and cam follower 46 from following cam 24.

Spider assembly 43 and its cam follower 46 are urged toward cam 24 by a coil spring 85 which has one end attached to shaft 44 of assembly 43 and its other end attached to an ear 86 which projects from bracket 70. Thus, when solenoid 66 is energized and armature 73 is drawn, against the force exterted by spring 80, into the solenoid, detent 82 disengages from detent 83 permitting cam follower 46 to follow cam 24. At the end of one complete revolution of cam 24, the detent 83 will engage detent 82 and latch the spider assembly if solenoid 66 is deenergized since the spring 80 will return armature 73 and detent 82 to the position illustrated.

The spiders and the latching mechanisms for each of the differentials are identical with that shown and described in FIGURE 3. In addition, the bevel gear 41 of differential 31 is connected to an assembly 43*a* which is identical to the spider assembly and carries a follower 46*a* which is released in the same manner as in follower 46 shown in FIGURE 3.

However, cams 22–28, inclusive, are not all identical even though they are all quite similar in many respects. In the embodiment chosen for illustration, cams 22 and 23 are identical and cams 26, 27 and 28 are identical. Thus, only five different cam shapes are required. Each cam moves its associated follower and assembly a predetermined angular distance during a first portion of each cycle of rotation; maintains the follower and assembly stationary during the second portion of each cycle; and restores the follower and assembly to the original or starting position during the third and final portion of the cycle. The proportion of time consumed to complete each of the cycles may vary widely; however, sufficient time must be reserved to perform each function, and since each of the functions takes much less than ⅓ of the cycle, great latitude is provided in the cam design.

Cam 22 is designed so that when follower 46*a* is released and follows the cam, assembly 43*a* and gear 41 are rotated through 5.625° during the first portion of any given cycle to provide one unit of movement. Thus gear 50 will be rotated a like amount. Cam 23 is identical to cam 22 and rotates spider 43 of differential 31 through 5.625° during the first portion of any given cycle. However, due to the differential action, this movement results in a movement of 11.25° at gear 50 and provides two units of movement.

Cam 24 will rotate spider assembly 43 of differential 32 through 11.25° during the first portion of any cycle when the associated follower 46 is unlatched to provide by differential action a movement of 22.5° or four units at gear 50. Cam 25 rotates spider assembly 43 of differential 33 through 22.5° during the first portion of any cycle when its associated follower 46 is unlatched and provides by differential action a movement of 45° or eight units at gear 50. Cams 26, 27 and 28 rotate the spider assemblies 43 of differentials 34, 35 and 36, respectively, through 45° during the first portion of any cycle whenever an associated follower 46 is unlatched and each provides via differential action 90° or 16 units of movement of gear 50.

It should be noted at this point that the latching mechanism of differentials 34 and 36 are controlled as a unit, thus, cam 27 provides 90° or 16 units of movement and cams 26 and 28 together provide 180° or 32 units of movement. It is necessary to combine two cams to provide the 180° movement, since a cam throw of 90° is not readily obtainable; therefore, two cams and two differentials are utilized to secured the necessary throw to provide the 180° movement required at gear 50.

The disclosed printer utilizes a parallel binary coded signal to position the print wheel as a function of the signal. Six parallel conductors convey the signal and are connected to the solenoids so that the least significant or first digit controls the solenoid which latches assembly 43*a* of differential 31; the next least significant or second digit controls the solenoid which latches assembly 43 of differential 31; the third and fourth digits control the solenoids which latch assemblies 43 of differentials 32 and 33, respectively; the fifth digit controls the solenoid which latches assembly 43 of differential 35; and the sixth digit controls the solenoids which latch the assemblies 43 of both differentials 34 and 36.

When the binary code 000001 is applied via the six parallel conductors only the solenoid associated with assembly 43*a* is energized and only that assembly is unlatched. Thus gear 41 of differential 31 is rotated counterclockwise and since all the other spider assemblies are latched, gear 50 will rotate clockwise 5.625°. If the code is 000010 then only spider assembly 43 of differential 31 is unlatched and gear 50 will rotate 11.25° counterclockwise. It should be noted that due to the differential action the direction of rotation of gear 50 will be reversed for alternate assemblies. Thus, when the binary code 000100 is applied the spider assembly 43 of differential 32 is rotated counterclockwise and gear 50 rotates counterclockwise 22.5°. The code 001000 unlatches spider 43 of differential 33 causing gear 50 to rotate 45° clockwise; the code 010000 unlatches spider 43 of differential 35 causing gear 50 to rotate 90° clockwise; and the code 100000 unlatches spider 43 of differentials 34 and 36 causing gear 50 to rotate 180° counterclockwise. In every instance the assemblies 43 are rotated counterclockwise. If the cam followers are arranged to rotate clockwise, the direction of rotation of gear 50 will be reversed in every instance. When the code unlatches more than one assembly simultaneously, the net movement of gear 50 is the algebraic sum of the individual movements set forth above. A complete table is set forth on the next page giving all of the codes and the printing wheel positions corresponding thereto along with a suggested arrangement of characters mounted on the wheel.

*Table I*

| Wheel Position | Character | Binary Code | Wheel Position | Character | Binary Code |
|---|---|---|---|---|---|
| 1 | A | 000011 | 33 | g | 100011 |
| 2 | B | 000010 | 34 | h | 100010 |
| 3 | C | 001101 | 35 | i | 101101 |
| 4 | D | 001100 | 36 | j | 101100 |
| 5 | E | 001111 | 37 | k | 101111 |
| 6 | F | 001110 | 38 | l | 101110 |
| 7 | G | 001001 | 39 | m | 101001 |
| 8 | H | 001000 | 40 | n | 101000 |
| 9 | I | 001011 | 41 | o | 101011 |
| 10 | J | 001010 | 42 | p | 101010 |
| 11 | K | 010101 | 43 | q | 110101 |
| 12 | L | 010100 | 44 | r | 110100 |
| 13 | M | 010111 | 45 | s | 110111 |
| 14 | N | 010110 | 46 | t | 110110 |
| 15 | O | 010001 | 47 | u | 110001 |
| 16 | P | 010000 | 48 | v | 110000 |
| 17 | Q | 010011 | 49 | w | 110011 |
| 18 | R | 010010 | 50 | x | 110010 |
| 19 | S | 011101 | 51 | y | 111101 |
| 20 | T | 011100 | 52 | z | 111100 |
| 21 | U | 011111 | 53 | 1 | 111111 |
| 22 | V | 011110 | 54 | 2 | 111110 |
| 23 | W | 011001 | 55 | 3 | 111001 |
| 24 | X | 011000 | 56 | 4 | 111000 |
| 25 | Y | 011011 | 57 | 5 | 111011 |
| 26 | Z | 011010 | 58 | 6 | 111010 |
| 27 | a | 100101 | 59 | 7 | 000101 |
| 28 | b | 100100 | 60 | 8 | 000100 |
| 29 | c | 100111 | 61 | 9 | 000111 |
| 30 | d | 100110 | 62 | 0 | 000110 |
| 31 | e | 100001 | 63 | . | 000001 |
| 32 | f | 100000 | 64 | (blank) | 000000 |

It should be noted that each wheel position is displaced 5.625° from the next and that code 000000 results in no movement of the wheel. This zero or rest position is blank and 63 additional positions each spaced 5.625° from the next are provided on the wheel.

Thus far the description has been limited to that structure which, in response to a binary coded signal, positions the print wheel **15** so that a preselected character will be placed in the printing position. However, additional structure is provided for displacing a platen so that the selected character will be imprinted on a paper or strip which is interposed between the selected character and the platen. Referring again to FIGURE 2, cam **29** mounted on camshaft **21** engages a cam follower **90** which is mounted on and drives an assembly **91** having a shaft **92** projecting laterally therefrom. Shaft **92** passes through walls **56** and **39** and is rotatably mounted in bearings **94** and **95** which are pressed into openings **96** and **97** in walls **56** and **39**, respectively.

The cross-sectional view shown in FIGURE 4 shows the arrangement of shaft **21**, cam **29**, cam follower **90**, assembly **91** and shaft **92** in greater detail than the view shown in FIGURE 2. Assembly **91** has a detent **124** which engages a similar detent **125** on a lever **126** which is pivotally mounted on a shaft **127**. The two detents are maintained in engagement by a spring **98** which exerts a force on lever **126** and by another spring **99** which exerts a force on assembly **91**. A solenoid **101** has its armature **102** connected to lever **126** at the end remote from detent **125** and when energized overcomes the force exerted by spring **98** permitting the detents to disengage. Thus spring **99** urges cam follower **90** into engagement with cam **29** and when the follower encounters the flat portion of the cam, a large rotation is imparted to shaft **92**. This large rotation is used to move the platen located under print wheel **15**. If the signal has been removed from solenoid **101**, the two detents under the coercive forces exerted by springs **98** and **99** will engage after the flat spot on cam **29** passes cam follower **90**.

The voltage for energizing solenoid **101** to unlatch cam follower **90** is supplied in a seventh conductor with the input signal from the computer or data processor. This voltage will provide energization to unlatch the solenoid so that printing may be completed. An alternative arrangement is possible. Here solenoid **101**, lever **126** and spring **98** are eliminated and follower **90** is permitted to



operate shaft **92** each cycle of operation. Since wheel position **64** is blank, nothing can be printed when no signal or code 000000 is present. The modification shown in FIGURE 4, however, provides less wear, longer life, and one additional character since the 64th wheel position may contain a character and printing is only completed in those cycles of operation when a character has been inserted by the computer.

Printing is accomplished by moving a platen surface under the print wheel **15** toward the selected character which has been positioned at the bottom and urging the inked tape **17** and a piece of paper which has been inserted into contact with the selected type on the bottom of the wheel thus causing the character to be imprinted on the paper. FIGURE 5 illustrates the platen mechanism and shows its structural relationship to the print wheel **15** and drive shaft **92**. Shaft **92** supports and drives an L-shaped push rod **105** and when rotated counterclockwise lifts the platen assembly **106** which rides in a vertical guide block **108**. The rotation of shaft **92** caused by the throw of cam follower **90** and assembly **91** is sufficient to urge the T-shaped platen member **110** of platen assembly **106** into contact with the type **111** mounted on the periphery of wheel **15**.

Assembly **106** comprises a cylindrical body **112** having a circular hole therethrough in which T-shaped platen **110** rides. Platen **110** is held in place by a pin **114** which passes through a slot **115** in the lower body portion of the platen and a spring **116** positioned in the hole between the lower end of the platen and a threaded plug **117** which is inserted in the lower end of the circular hole and completes the support for T-shaped platen **110**. Thus, spring **116** and threaded plug **117** provide both the necessary clearance for the platen and quiet pressure printing.

While only one specific embodiment of the invention has been shown and described in detail, it is obvious that many different arrangements may be made to perform the same functions; therefore, applicant wishes it clearly understood that the invention is not limited to the specific arrangement described and shown in detail for illustration purposes.

What is claimed is:

1. A printing mechanism comprising,
a plurality of tandem connected differentials, each of said differentials having a first and a second bevel gear with the second bevel gear of each differential connected to the first bevel gear of the next differential, a spider assembly including at least one bevel gear rotatable thereon and mounted for rotation between the first and second bevel gears of each differential;
means responsive to a coded electric signal for selectively rotating a predetermined distance the first bevel gear of the first differential and all of the spider assemblies to provide a rotary output at the second bevel gear of the last differential which corresponds to the sum of the individual movements of the spider assemblies and the first bevel gear of the first differential which are moved in response to the coded electric signal;
type bearing means responsive to said rotary output whereby said type bearing means is positioned to correspond to the coded electric signal;
platen means located adjacent said type bearing means;
and means for urging said platen toward said type bearing means after said type bearing means has been positioned by the rotary output to correspond to the coded signal.

2. A printing mechanism as set forth in claim 1 in which the means responsive to the coded electric signal for selectively rotating a predetermined distance the first bevel gear of the first differential and all of the spider assemblies to provide a rotary output at the second bevel gear of the last differential comprises,

a latched lever arm connected to each of said elements which are to be rotated,

a cam follower connected to each lever arm,

cam means positioned for rotation adjacent each of said cam followers, each of said cam means providing a predetermined angular rotation of the lever arm and the rotary element at which it is attached,

means for rotating said cam means,

and means responsive to the said coded electric signal for selectively unlatching the lever arms.

3. A printing mechanism as set forth in claim 1 in which the means for urging said platen toward said type bearing means after said type bearing means has been positioned by the rotary output comprises,

a pivoted lever means having a cam follower attached thereto at one end and engaging said platen means at its other end,

a cam means mounted for rotation adjacent said cam follower, said cam means providing movement of said follower and said platen at a predetermined angular displacement which occurs after the type bearing means has been positioned.

4. A printing mechanism comprising;

a plurality of tandem connected differentials;

each of said differentials having a first and a second bevel gear with the second bevel gear of each differential connected to the first bevel gear of the next differential, a spider assembly including at least one bevel gear rotatable thereon and mounted for rotation by the first and the second bevel gears of each differential;

means responsive to a coded electric signal for selectively rotating the first bevel gear of the first differential and all of the spider assemblies a predetermined distance to provide a rotary output at the second bevel gear of the last differential which corresponds to the sum of the individual movements of the spider assemblies and the first bevel gear of the first differential;

rotary type bearing means responsive to the rotary motion of the said second bevel gear of the last differential whereby said means is positioned to correspond to the said sum;

platen means positioned adjacent said rotary type bearing means;

and means responsive to an electric signal for urging said platen means toward said type bearing means after it has been positioned.

5. A printing mechanism as set forth in claim 4 in which the means responsive to the coded electric signal for selectively rotating a predetermined distance the first bevel gear of the first differential and all of the spider assemblies to provide a rotary output at the second bevel gear of the last differential comprises,

a latched lever arm connected to each of said elements which are to be rotated,

a cam follower connected to each lever arm,

cam means positioned for rotation adjacent each of said cam followers, each of said cam means providing a predetermined angular rotation of the lever arm and the rotary element at which it is attached,

means for rotating said cam means,

and means responsive to the said coded electric signal for selectively unlatching the lever arms.

6. A printing mechanism as defined in claim 4 in which the means responsive to an electric signal for urging said platen means toward said type bearing means after it has been positioned comprises,

a latched pivoted lever means having a cam follower attached thereto at one end and engaging said platen means at its other end,

a cam means mounted for rotation adjacent said cam follower, said cam means providing movement of said follower and said platen,

and means for unlatching said lever in response to the said electric signal so that said cam follower may follow the cam means which provides movement at a predetermined angular displacement which occurs after the type bearing means has been positioned.

7. A printing mechanism comprising,

a plurality of tandem connected differentials each including at least three rotary elements,

a latched lever arm connected to at least one rotary element of each differential,

a cam follower connected to each lever arm,

cam means positioned for rotation adjacent each said cam follower, each of said cam means providing a predetermined angular rotation of the lever arm and the connected rotary differential element when the follower engages the cam and the cam is rotated,

means for rotating the cam means,

means responsive to a coded electric signal for selectively unlatching preselected lever arms in response to said coded signal to permit the cam followers connected thereto to follow the adjacent cam means whereby each unlatched lever arm rotates its connected rotary differential element a preselected angular distance to provide a rotary output at one end of said tandem connected differentials which corresponds to the sum of the angular displacements of the rotary elements connected to the unlatched lever arms,

type bearing means responsive to said rotary output for assuming a position in accordance therewith,

platen means positioned adjacent said type bearing means, and

means responsive to an electric signal for urging said platen means toward said type bearing means after it has been positioned.

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