

[72] Inventor **Tasaku Wada**
Tokyo-to, Japan
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[73] Assignee **Kokusai Denshin Denwa Kabushiki Kaisha**
Tokyo-to, Japan
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[33] **Japan**
[31] **42/41263**

3,072,047	1/1963	Maudsley et al.	101/93
3,120,801	2/1964	Davies et al.	101/93
3,128,693	4/1964	Thiemann	101/93
3,232,222	2/1966	Jones	101/93
3,354,819	11/1967	Sturzing et al.	101/93
3,363,737	1/1968	Wada et al.	197/98

Primary Examiner—William B. Penn

Attorneys—Robert E. Burns and Emmanuel J. Lobato

[54] **ELECTROMAGNETIC SETTING MEANS AND HAMMER ACTUATING MEANS IN PRINT WHEEL ARRANGEMENTS**
6 Claims, 8 Drawing Figs.

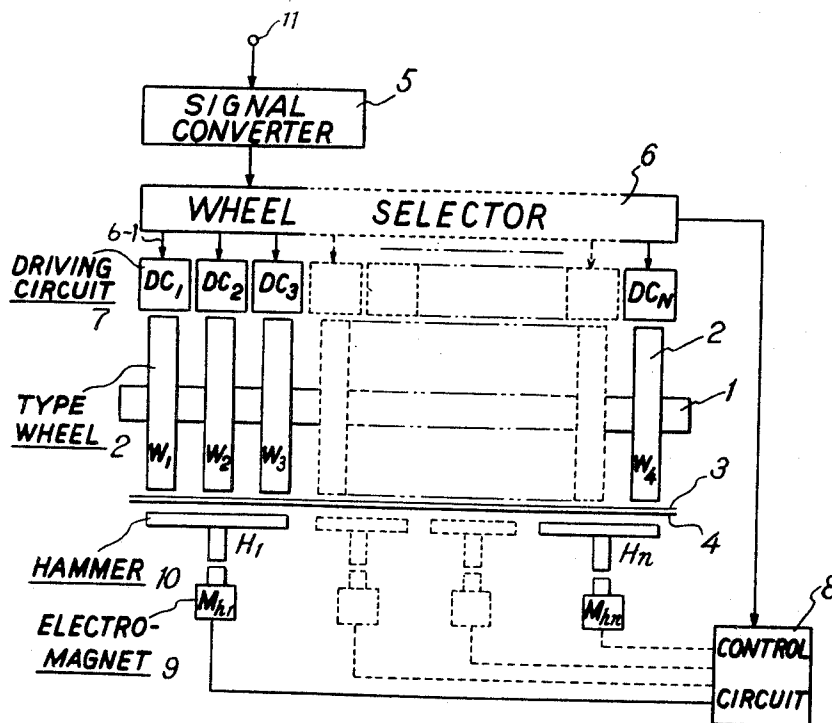
[52] U.S. Cl. **101/93 C,**
310/56, 310/49
[51] Int. Cl. **B41j 1/28,**
B41j 9/38, H02k 37/00
[50] Field of Search. **101/93 RC,**
110, 96, 95, 99; 310/49, 168, 169, 156

[56] **References Cited**

UNITED STATES PATENTS

3,344,325	9/1967	Sklaroff	310/49
3,469,131	9/1969	Stellwagen	310/156 X

ABSTRACT: A printer for selecting automatically types of numerals and/or characters in response to input signals and for printing the selected types of numerals and characters on a printing paper, in which a plurality of type wheels are arranged rotatably on a shaft at regular intervals. Each of the type wheels has an even number of permanent magnets radially arranged from the center of the type wheel at regular intervals in the alternating arrangement of magnetic polarities of the permanent magnets. Type characters are fixed along the periphery of each type wheel at respective projections each arranged between adjacent two of the permanent magnets. One of the types is selected by rotating each type wheel in the clockwise or counterclockwise direction by driving alternately a pair of electromagnets arranged oppositely to one of the types and the pole of one of the permanent magnets respectively until the selected type opposes a print hammer.



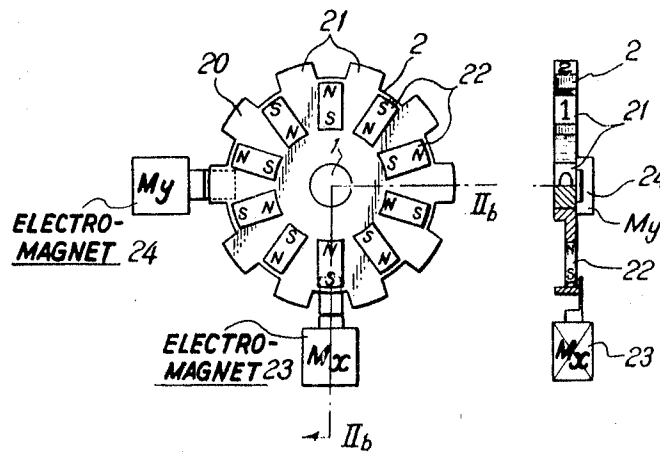
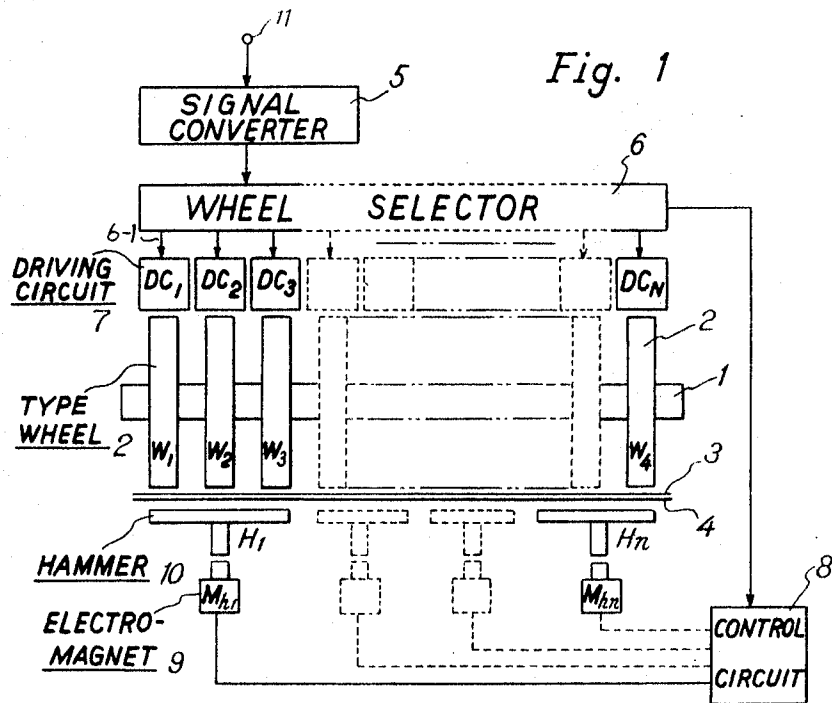


Fig. 2A

Fig. 2B

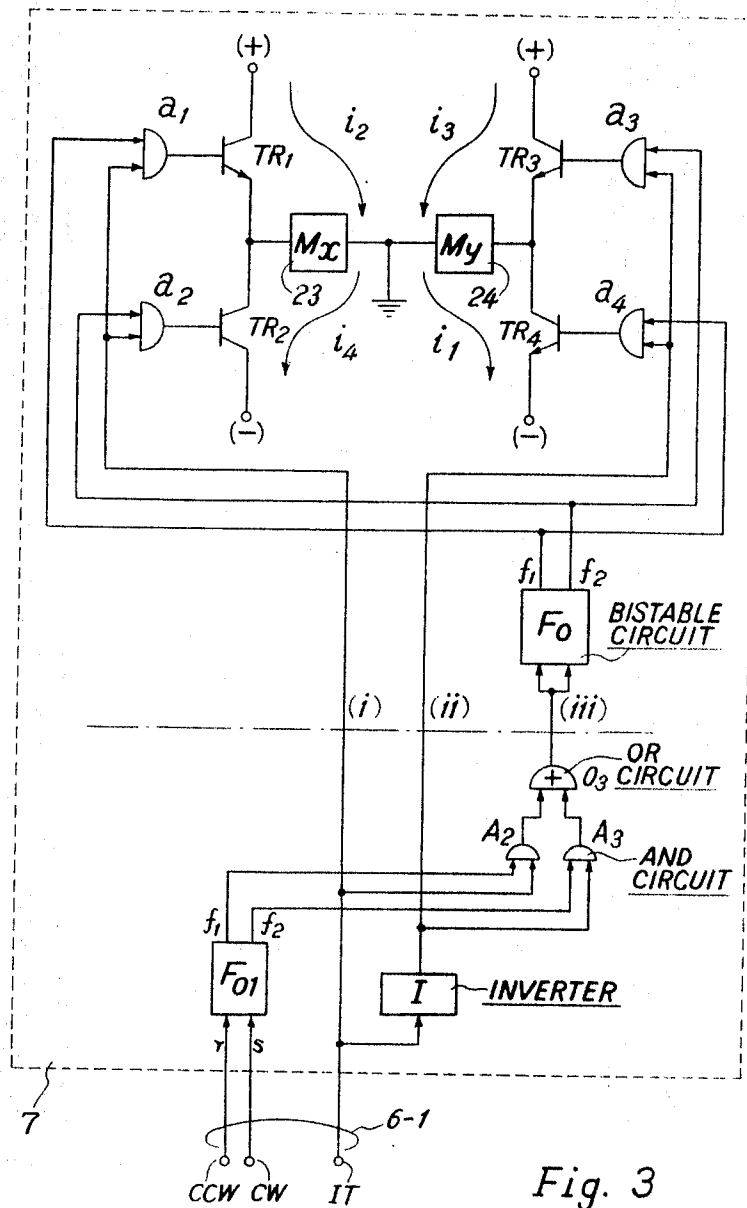


Fig. 3

Fig. 4

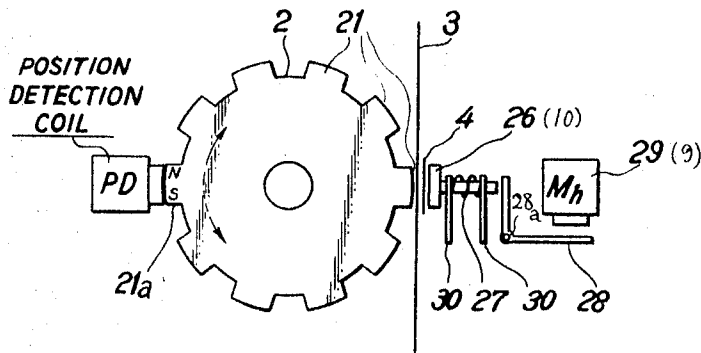
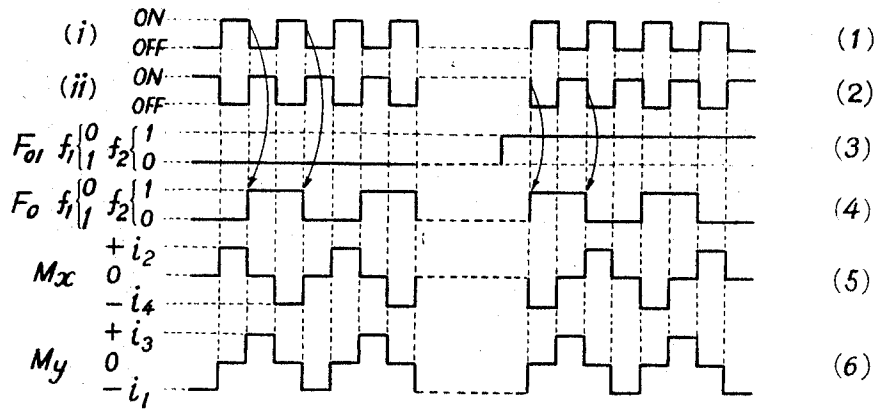


Fig. 5

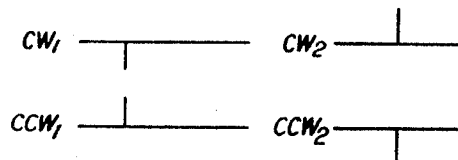


Fig. 6

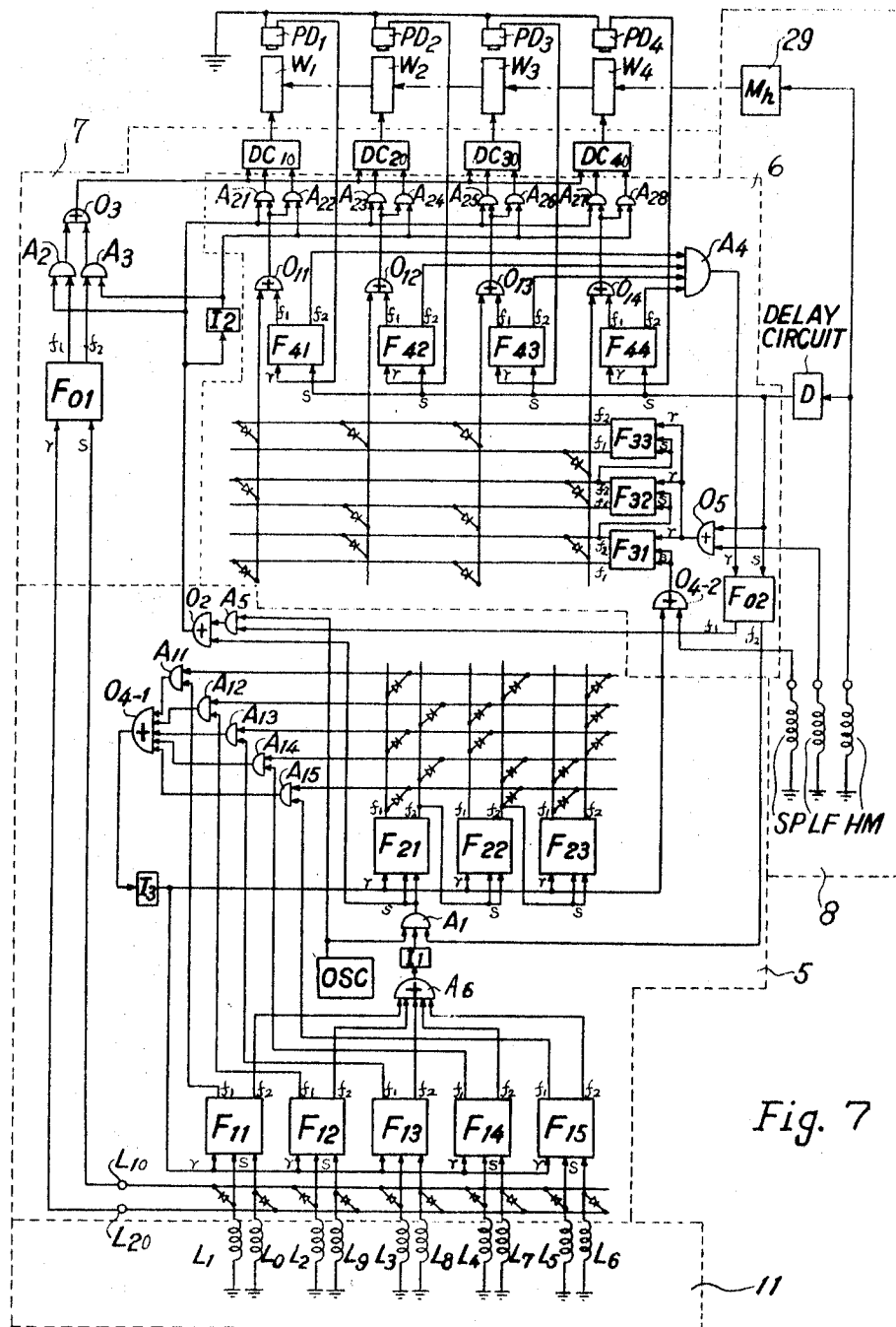


Fig. 7

ELECTROMAGNETIC SETTING MEANS AND HAMMER ACTUATING MEANS IN PRINT WHEEL ARRANGEMENTS

This invention relates to a printer for selecting automatically types of numerals and/or characters in response to input signals and for printing the selected numerals and characters on a printing paper.

There have been heretofore proposed many kinds of printers of this type, such as (i) a printer using typebars, (ii) a printer using a typedrum driven axially and circumferentially for each input signal or using a typepalette driven along X-Y directions for each input signal, and (iii) a printer of the on-the-fly type using a continuously revolving typedrum. In these cases, since the printing operation of the printer (i) or (ii) is substantially carried out in a mechanism, this printer (i) or (ii) has to have a great number of mechanical parts, the complicated mechanical construction, and a large size. The printer (ii) has also to have a functional mechanism to drive the type drum or the type palette in the above mentioned manner. In the printer (iii), it is essential to exactly drive a hammer to print a selected character on the printing paper at the appropriate instant against the revolving drum. Accordingly, the driving and control means of this printer (iii) will have a large size and a high price. Moreover, since the driving motor must be continuously driven for each of the above-mentioned printers, the conventional printers have disadvantages, such as high operation noise or wasteful consumption of the electric power.

An object of this invention is to provide a printer capable of eliminating the above-mentioned disadvantages.

Another object of this invention is to provide a printer capable of separately performing its type-selecting operation and the printing operation for selected types of character.

The construction and operation of the printer of this invention will be better understood from the following discussion in conjunction with the accompanying drawings, in which the same or equivalent parts are designated by the same character, numeral or symbol, and in which:

FIG. 1 is a block diagram illustrating the constructive principle of the printer of this invention;

FIG. 2A is a side view for illustrating an example of a type wheel to be employed in the printer of this invention;

FIG. 2B is an elevation of the type wheel in FIG. 2A including a section along rectangularly crossed planes II_a;

FIG. 3 is a connection diagram for illustrating an example of the driving circuit employed for driving the type wheel;

FIG. 4 shows time charts explanatory of the operation of the driving circuit shown in FIG. 3;

FIG. 5 is a rough side view for describing examples of the printing means and the position detection means employed in the printer of this invention;

FIG. 6 shows wave from diagrams for describing the operation of the printer of this invention; and

FIG. 7 is a connection diagram illustrating an example of an actual application of the printer of this invention.

The constructive principle of the printer of this invention will first be described with reference to FIG. 1. A plurality of type wheels 2 ($W_1, W_2, W_3, \dots, W_N$) are rotatably arranged on a shaft 1 at appropriate spacings by the use of antifriction means, such as ball bearings, so that each type wheel 2 is separately rotatable on the shaft 1. Types of necessary numerals and/or characters are arranged around the periphery of the type wheel 2. The number of the type wheels 2 is determined so as to meet with the number of characters for a printing line. A print hammer 10 or a necessary number of print hammers 10 ($H_1, H_2, \dots, H_n$) is/are arranged in face of an edge of the type wheel 2 or edges of the type wheels 2. A printing paper 3 and an ink ribbon 4 are inserted between edges of the type wheels 2 and the hammers 10. Each of the type wheels 2 is driven by a corresponding one of driving circuits 7 ($DC_1, DC_2, \dots, DC_N$) in a stepping manner to select a desired

character and, if necessary, to restore to the initial state. A signal converter 5 receives input signals applied from an input terminal 11 and converts respectively them to digital signals to rotate the type wheels 2 in the stepping manner in the clockwise or counterclockwise direction in response to respective digital signals. A wheel selector 6 distributes the converted digital signals to the respective driving circuits 7 to select and drive successively the type wheels 2. The signal converter 5 detects further function signals. A control circuit 8 carries out all necessary control operations. By way of example, the control circuit 8 controls electromagnets 9 driving the hammers 10 in response to the selection operation of the wheel selector 6.

The summarized operation of the printer shown in FIG. 1 is as follows. A first input signal is applied, after signal conversion performed in the signal converter 5, to the driving circuit DC_1 driving the type wheel W_1 so as to select a type of character or numeral corresponding to the first input signal. A second input signal is applied, after signal conversion, to the driving circuit DC_2 driving the type wheel W_2 so as to select a type of character or numeral corresponding to the second input signal. In a manner similar to these operations, input signals are successively applied, after signal conversion in the signal converter 5, to the respective driving circuits 7 through the wheel selector 6. The control circuit 8 comprises, by way of example, a counter counting the number of digital signals applied to the driving circuits 7. If the counting state of the counter reaches a predetermined number, the control circuit 8 drives the electromagnets 9 driving the hammers 10 to print the selected types of character and/or numeral on the printing paper 3. While any of the type hammers 10 is driven, the type-selecting operations for other type wheels 2 can be carried out. Accordingly, the type-selecting operation and the printing operation for selected types of character and/or numeral can be overlapped and performed separately. When a line-feed signal is received in the signal converter 5, the printing paper 3 is fed in a conventional manner by an appropriate length by paper feed means not shown.

The type wheels 2, the selected type of which has been printed on the printing paper 3, may be stopped at their selected positions or restored to their initial positions. In the former case, digital information indicative of the selected positions of the type wheels 2 is stored in the wheel selector 6 so that the type selecting operations for the just succeeding printing line are performed in consideration of the stored digital information corresponding to the respective type wheels 2.

The type hammer 10 may be provided for each of the type wheels 2, for each of groups of the type wheels 2, or for a printing line. If the application of the input signals has a pause such as used in an order telegraph system, the type hammer 10 may be driven at any time during the pause to print the selected types even if the number of selected types does not reach the predetermined number.

An example of the type wheel 2 will be described with reference to FIGS. 2A and 2B. In this example, a plurality of projections 20 are provided along the periphery of the wheel at regular intervals, and types 21, such as numerals "0" to "9," are fixed on the respective projections 20. Moreover, the same number of permanent magnets 22 as the types 21 are arranged at respective spacings between adjacent projections 20 so that magnetic poles of the adjacent permanent magnets 22 are different from each other. In other words, an even number of permanent magnets 22 are radially arranged at the same intervals in the alternating arrangement of magnetic polarity, and a necessary number of types 21 are fixed on the respective projections 20 arranged between adjacent two permanent magnets 22. A pair of electromagnets 23 (M_x) and 24 (M_y) are arranged near the periphery of the wheel 2 so that one opposes the pole of one of the permanent magnets 22 and the other opposes one of the projections 20. Moreover, poles of the electromagnets 23 and 24 oppose, at the side surface of the wheel 2, poles of all the permanent magnets 22 in case of a

case of revolution of the wheel 2. Accordingly, if the electromagnets 23 and 24 are alternately magnetized, the wheel 2 can be rotated by torque which is caused by the combination action of the attractive force and of the repulsive force between the permanent magnets 22 and the electromagnets 23 and 24. Details of these operations are described below. The numbers of the projections 20 and of the permanent magnets 22 increase in proportion to increase of the number of types 21 under the above-mentioned principle. A plurality of pairs of electromagnets may be provided to increase the torque for rotating the wheel 2.

With reference to FIGS. 3 and 4, an example of the driving circuit 7 will be described. This driving circuit 7 magnetizes alternately the electromagnets 23 and 24 in response to pulses applied from a terminal IT. Terminals CW and CCW are employed to apply respectively a control pulse for rotating the wheel 2 in the clockwise direction and a control pulse for rotating the wheel 2 in the counterclockwise direction. These terminals IT, CW and CCW composes a group of terminals 6-1 which connect between the wheel selector 6 and a driving circuit DC₁ as shown in FIG. 1. It is now assumed that a bistable circuit F₀₁, such as RS flip-flop circuit, is set by the control pulse applied from the terminal CW so that its outputs f_1 and f_2 become respectively states "1" and "0." Moreover, if it is assumed the outputs f_1 and f_2 of a bistable circuit F₀ are respectively established to states "1" and "0," since the output (iii) of a polarity inverter I assumes the state "1" and only an AND gate a_1 is opened in a case of no pulse (i.e.; the state OFF of FIG. 4 (1)) from the terminal IT, a transistor TR₄ flows a current i_1 through the electromagnet 24. In this case, if the pulse from the terminal IT assumes the state ON, this pulse is applied to an AND gate a_1 through a line (i) and opens this AND gate a_1 . Accordingly, a transistor TR₁ flows a current i_2 through the electromagnet 23. Next, if the pulse from the terminal IT assumes the state OFF, the output (ii) of the polarity inverter I is established to the state "1" which turns, through an AND gate A_3 and an OR gate O₃, the state of the bistable circuit F₀ so as to have the state "0" of the output f_1 and the state "1" of the output f_2 . Accordingly, an AND gate a_3 is opened and a transistor TR₃ flows a current i_3 through the electromagnet 24. Moreover, if the pulse from the terminal IT assumes the state ON, this pulse passes through the line (i) and opens an AND gate a_2 . Accordingly, a transistor TR₂ flows a current i_4 through the electromagnet 23. When the pulse from the terminal IT assumes thereafter the state OFF, the state of bistable circuit F₀ is further reversed through an AND gate A_2 and the OR gate O₃. Accordingly, the AND gate a_4 is opened and the transistor TR₄ flows a current i_1 through the electromagnet 24. As mentioned in details above, the electromagnets 23 and 24 are alternately magnetized by currents i_1 , i_2 , i_3 and i_4 which have successively opposite polarities as shown in time chart (5) and (6) of FIG. 4. The wheel 2 is rotated in the clockwise direction in this operation.

In a case of revolution of the wheel 2 in the counterclockwise direction, a control pulse is applied to the terminal CCW to reset the bistable circuit F₀₁ in the state "0" of the output f_1 and the state "1" of the output f_2 . In response to this reversal of the state of the bistable circuit F₀₁, flowing order of the currents i_1 , i_2 , i_3 and i_4 is reversed against the flowing order for the clockwise directional revolution.

In a brief summary, the flowing order of the currents i_1 , i_2 , i_3 and i_4 in the electromagnets 23 and 24 is as follows: a. For the clockwise directional revolution of the wheel 2:

$$i_1-i_2-i_3-i_4-i_1-\dots\dots\dots$$

b. For the counterclockwise directional revolution of the wheel 2:

$$i_1-i_4-i_3-i_2-i_1-\dots\dots\dots$$

In these cases, the currents i_1 , i_2 , i_3 and i_4 are respectively the minus current for the electromagnet 24, the plus current for the electromagnet 23, the plus current for the electromagnet

24, and the minus current for the electromagnet 23 as shown in FIG. 3 and time charts (5) and (6) of FIG. 4. Accordingly, polarities of the electromagnets 23 and 24 are alternately reversed so that the electromagnets 23 and 24 attract alternately the nearest one of the permanent magnets 22 having a magnetic pole different from the magnetic pole of the magnetized electromagnet 23 or 24. As the result of this control operation, the wheel 2 is rotated in the clockwise direction or in the counterclockwise direction. In this case, the number of shifts of the types arranged on the projections 20 is equal to the number of pulses applied to the terminal IT while each of the electromagnets 23 and 24 is magnetized by the same number of pulses as shown in time charts (5) and (6) of FIG. 4.

With reference to FIG. 5, the printing operation of the printer of this invention will be described. In this FIG. 5, the permanent magnets 22 and the electromagnets 23 and 24 are omitted for simple illustration. When a type of desired characters or numerals has been just selected, a driving pulse is applied to an electromagnet 29 so that a L-typed lever 28 is attracted to the magnetized electromagnet 29 with respect to a fixed axis 28a. In response to this attraction, the other end of the L-typed lever 28 pushes a type hammer 26 (10), through the type ribbon 4 and the printing paper 3, to the type 21. The type hammer 26 is supported by a pair of supporters 30 and restored by the resilient force of a spring 27 after the above-mentioned printing.

With reference to FIGS. 5 and 6, the construction and operation of an example of detecting means for detecting the revolution direction of the wheel 2 and for detecting the restoration of the wheel 2 to a predetermined state. The detection means comprises a permanent magnet 21a fixed on one of the projections 20 and a position detection coil PD detecting the change of magnetic flux generated from the permanent magnet 21a. If the wheel 2 starts its revolution from an initial state where the position detection coil PD and the permanent magnet 21a are opposed to each other, pulses CW₁ and CCW₁ are detected by the position detection coil PD as shown in FIG. 6 in accordance with the clockwise or counterclockwise revolution direction of the wheel 2 respectively. Accordingly, the revolution direction of the wheel 2 can be detected by detecting the polarity of the induced pulse CW₁ or CCW₁. Moreover, a pulse CW₂ or CCW₂ is induced to the position detection coil PD in accordance with the clockwise or counterclockwise revolution direction of the wheel 2 at the state where the position detection coil PD and the permanent magnet 21a are opposed to each other. Accordingly, if the wheel 2 is stopped in response to the induced pulse CW₂ or CCW₂, the wheel 2 can be restored to the predetermined state.

With reference to FIG. 7, an actual application of the printer of this invention will be described in detail. This example is a printing system for numerals of four figures. Input signals of this application are generated from 10 keys generating pulses in response to respective keying of keys, such as proposed in U.S. Pat. No. 3,363,737 "Pulse Generating Key Board." Ten coils L₁ to L₆ and diodes connected to the respective coils correspond to the 10 keys. Bistable circuits F₁₁ to F₁₅ are controlled by pulses from the keys. A bistable circuit F₀₁ is employed to determine the revolution direction of each type wheel W₁, W₂, W₃ or W₄ by its output state. The coils L₁ to L₅ are connected, through respective diodes and a terminal L₁₀, to the bistable circuit F₀₁. The coils L₆ to L₆ are connected, through respective diodes and a terminal L₂₀ to the bistable circuit F₀₁. The type wheels W₁, W₂, W₃ and W₄ for four figures are controlled by respective driving circuits DC₁₀, DC₂₀, DC₃₀ and DC₄₀. In this case, the driving circuits DC₁₀ to DC₄₀ are designed so as to rotate the respective type wheel W₁ to W₄ in the clockwise or counterclockwise direction in accordance with pulses passed through the terminal L₁₀ or L₂₀ respectively. Position detection coils PD₁, PD₂, PD₃ and PD₄ have the same function as the position detection coil PD described with reference to FIG. 4 for the respective type wheels W₁, W₂, W₃ and W₄. A pulse generator OSC generates

driving pulses, the period of which is proportional to the revolution speeds of the type wheels W_1 to W_4 . Bistable circuits F_{21} , F_{22} and F_{23} determine the number of the driving pulses applied to the type wheel W_1 , W_2 , W_3 or W_4 . If the number of types on the wheel 2 increases, the number of these bistable circuits F_{21} , F_{22} , ... increases. Bistable circuits F_{31} , F_{32} and F_{33} form a shift register which selects successively the type-wheels W_1 , W_2 , W_3 and W_4 . The number of stages of the shift register increases in proportion to the number of figures of the printed numerals. Bistable circuits F_{41} , F_{42} , F_{43} and F_{44} are employed for restoring the respective type wheels W_1 , W_2 , W_3 and W_4 to their initial state. Pulse generating coils SP, LF and HM are employed for spacing function, paper-feed function and hammer-driving function respectively. A bistable circuit F_{02} is employed to detect the restored state of all the type wheels W_1 , W_2 , W_3 and W_4 and to stop the restoring operation of the driving circuits DC_{10} , DC_{20} , DC_{30} and DC_{40} . Each of the bistable circuits F_{01} , F_{02} , F_{11} , F_{12} , F_{13} , F_{14} , F_{15} , F_{21} , F_{22} , F_{23} , F_{31} , F_{32} , F_{33} , F_{41} , F_{42} , F_{43} and F_{44} has one or two setting input or inputs s , a resetting input r and two outputs f_1 and f_2 as shown. In the setting condition of each bistable circuit, the outputs f_1 and f_2 assumes respectively the states "1" and "0." On the contrary, the outputs f_1 and f_2 assumes respectively the states "0" and "1" in the resetting state. Two groups of diodes connected respectively to the bistable circuits F_{21} to F_{23} and to the bistable circuits F_{31} to F_{33} form respectively diode-AND circuits. When two setting pulses are applied to any of the bistable circuits, its state is restored to the initial reset state.

The operation of the circuitry shown in FIG. 7 is described in a case of printing a numeral "3." When a key indicative of the numeral "3" is selected from the 10 keys and pushed, the coil L_3 generates a pulse which is applied to the bistable circuit F_{13} and the bistable circuit F_{01} to set them. The output state of an AND gate A_6 turns from the state "1" to the state "0" which is changed to the state "1" by a polarity inverted I_1 . Since an output f_2 of the bistable circuit F_{02} assumes the state "1" at this time as mentioned below, the output pulses of the pulse generator OSC pass through the AND circuit A_1 . The bistable circuits F_{21} to F_{23} are successively reversed by the pulses passed through the AND gate A_1 . At the same time, the output pulses of the AND gate A_1 pass through an OR gate O_2 and AND gates A_2 and A_{21} since the output state f_1 of the bistable circuit F_{01} assumes the state "1" and the output state of the OR gate O_{11} assumes the state "1" in response to the instant combination of output states "100101" of the bistable circuits F_{31} , F_{32} and F_{33} . An AND gate A_{22} is opened at the output state "0" of the OR gate O_2 . The driving circuit DC_{10} drives the wheel W_1 by the use of outputs of an OR gate O_3 and the AND gates A_{21} and A_{22} . In this case, the output pulses of the AND gates A_2 and A_3 instruct the driving circuit DC_{10} to rotate the wheel W_1 in the clockwise and counterclockwise direction respectively. When the wheel W_1 is rotated by three steps of type positions (20) by three pulses from the pulse generator OSC, and AND gate A_{13} is opened by the output of the bistable circuit F_{13} and the output states "101001" of the bistable circuits F_{21} , F_{22} and F_{23} . The output pulse of the AND gate A_{13} passes through an OR gate O_{11} and is applied, after polarity inversion at a polarity inverter I_3 , to the bistable circuits F_{21} , F_{22} and F_{23} to reset them. The output pulse of the inverter I_3 is further applied, through an OR gate O_{12} to the shift register consisting of three bistable circuits F_{31} , F_{32} and F_{34} . Since the AND gate A_1 is closed in response to the reset of the bistable circuit F_{13} , the output pulses of the pulse generator OSC cannot reach the driving circuit DC_{10} . Accordingly, the type wheel W_1 is stopped at a state where the number "3" can be printed. At the same time, since an OR gate O_{12} is opened in accordance with the output states "011001" of the shift register (F_{31} , F_{32} and F_{33}), the driving circuit DC_{20} for driving the type wheel W_2 is just ready for control pulses from the OR gate O_2 . In response to the next keying of a selected key, the type wheel W_2 is driven in accordance with numerical information indicated by the selected key.

After all the type wheels W_1 , W_2 , W_3 and W_4 have been driven by four times of keying as mentioned above, a pulse is generated from the pulse generating coil HM in response to keying of a hammer key and drives the hammer magnet 29 so as to print the selected numerals of four figures on a printing paper (not shown) similarly as mentioned with reference to FIG. 1. The output pulse of the pulse generating coil HM passes through a delay circuit D having a delay time longer than the operating time of the hammer magnet 29 and then sets the bistable circuit F_{02} and the bistable circuits F_{41} , F_{42} , F_{43} and F_{44} . The output pulse of the delay circuit D resets, through an OR circuit O_5 , the bistable circuits F_{31} , F_{32} and F_{33} . In response to the set of the bistable circuit F_{02} , the pulses from the pulse generator OSC pass through an opened AND gate A_5 to drive all the driving circuits DC_{10} , DC_{20} , DC_{30} and DC_{40} . Since each of the type wheel W_1 , W_2 , W_3 and W_4 has a permanent magnet 21a as shown in FIG. 5, each of the detection coils PD_1 , PD_2 , PD_3 and PD_4 generates a pulse when the type wheel is restored to the initial state where the permanent magnet 21a opposes to the corresponding detection coil PD_1 , PD_2 , PD_3 or PD_4 . Pulses generated from the respective detection coils PD_1 , PD_2 , PD_3 and PD_4 reset respectively the bistable circuits F_{41} , F_{42} , F_{43} and F_{44} to close respective pairs of AND circuits (A_{21} and A_{22}), (A_{23} and A_{24}), (A_{25} and A_{26}) and (A_{27} and A_{28}), so that all the type wheels W_1 , W_2 , W_3 and W_4 are stopped at their initial states because of stopping of the pulse supply from the pulse generator OSC to the driving circuits DC_{10} , DC_{20} , DC_{30} and DC_{40} . In response to the reset of all the bistable circuits F_{41} , F_{42} , F_{43} and F_{44} , a resetting signal is applied through an AND gate A_4 to the bistable circuit F_{02} . At the same time, this example of the printer is ready for further selecting and printing of the next numerals.

If a space is to be left at the position of one of the type wheels W_1 , W_2 , W_3 and W_4 , in a printing line a pulse is generated from the pulse generating coil SP for the spacing function by keying a spacing key (not shown) so that the output states of the bistable circuits F_{31} , F_{32} and F_{33} are changed so as to select the next driving circuit.

If the printing paper 3 is to be fed after the printing operation, a pulse is generated from the pulse generating coil LF for the paper-feed function by keying a paper-feed key (not shown) so that the paper 3 is fed by paper-feed means (not shown) and the bistable circuits F_{31} , F_{32} , and F_{33} are reset.

As mentioned above, the circuitry of FIG. 7 is possible to print numerals of four figures. This circuitry can be easily modified to increase the number of types on a type wheel and/or to increase the number of type wheels. Moreover, if input telegraph signals are detected in a receiving detector including a numeral and/or character detector, such as matrix, and if the detected signals are applied to the output side of the pulse generating coils L_1 , L_2 , L_3 , ..., this circuitry can be applied to print the numerals and/or characters selected in response to the input telegraph signals.

As understood from the above-mentioned details, the printer of this invention has following merits: 1. Since the mechanism of the printer is simple and each type wheel is separately driven by an electric circuit, the printer of this invention can be formed into a small size with a light weight and operated in a high-printing speed without so large noise. 2. Since the number of mechanical parts is small, the high reliability can be maintained without complicated maintenance. 3. Since all the type wheels have the same construction, they can be made in a low price by the use of molding technique. 4. Since the respective type wheels can be driven at the same time as the printing operation of the other type wheels, the selection of types and the printing of the selected types can be separately performed in a high speed. 5. Since the mechanism is stopped in a case of no input signals or no keying of the keys, the wasteful consumption of electric power and the wear and tear of mechanical parts are low.

I claim:

1. A printer comprising a shaft; a first plurality of type wheels rotatably mounted on said shaft, each said type wheel

having a first plurality of permanent magnets mounted thereon and arranged in a circle about the wheel axis, and a plurality of type characters fixed along the periphery of the type wheel; a plurality of electromagnets mounted on said printer and disposed adjacent said type wheels, and driving circuit means connected to said electromagnets for energizing said electromagnets; input means electrically coupled to said driving circuit means for generating pulses for energizing said electromagnets; selector means electrically coupled to said input means to distribute successively the pulses to the driving circuit means to create a magnetic force between selected electromagnets and adjacent permanent magnets on said type wheels to rotate said wheels on said shaft to present selected type in a printing position; type hammer means mounted adjacent said type wheels for radial movement with respect to said type wheels; and means for selectively moving said type hammer means toward said type wheels at said printing position for operation to print a printing paper with said type characters, wherein said type characters on said wheels are successively selected by rotation of said wheels and opposed to said type hammer means.

2. A printer according to claim 1, further comprising a second plurality of permanent magnets including position determining magnets mounted one each on each of said type wheels, a plurality of detection coils fixedly mounted adjacent said type wheels, one for each said position determining magnet, and sensing means connected to said detection coils for detecting changes of magnetic flux due to movement of said position determining magnets with said type wheels, whereby the revolution direction of each type wheel, and a starting position thereof, can be detected by said sensing means.

3. A printer according to claim 2, in which the driving circuit means include means for driving the respective type wheels to restore said type wheels to their starting positions.

4. A printer according to claim 1, in which one of said wheels has a blank printing character at a starting position of said one wheel, and in which the printer is further provided with spacing means comprising means connected to said driving circuits for temporarily preventing operation of one of said driving circuits in order to maintain said one wheel at its said starting position to leave one spacing on the printing paper during said operation of said means for moving said type hammer means.

5. The invention as set forth in claim 1, in which each said wheel has radially extending spaced projections about its periphery, said type characters being mounted on said projections, and in which said permanent magnets on each wheel are disposed respectively between said spaced projections with their poles arranged radially of the wheel with alternating polarities, each said wheel has a pair of said electromagnets mounted adjacent thereto, one electromagnet of each said pair being disposed adjacent one of said projections when the other electromagnet is disposed adjacent one of said permanent magnets, and comprising means including said driving circuits for alternately energizing first one of said electromagnets in each of said pairs and then the other to drive said type wheels.

6. A printer according to claim 5, in which said driving circuit means comprise a plurality of bistable circuit means, one said bistable circuit means for each said pair of electromagnets, for being triggered to determine the order of alternate energizations for each said pair of electromagnets in accordance with the state of said bistable circuit means, whereby each of the type wheels can be rotated in the clockwise and counterclockwise directions in accordance with the state of the bistable circuit means.