

June 3, 1958

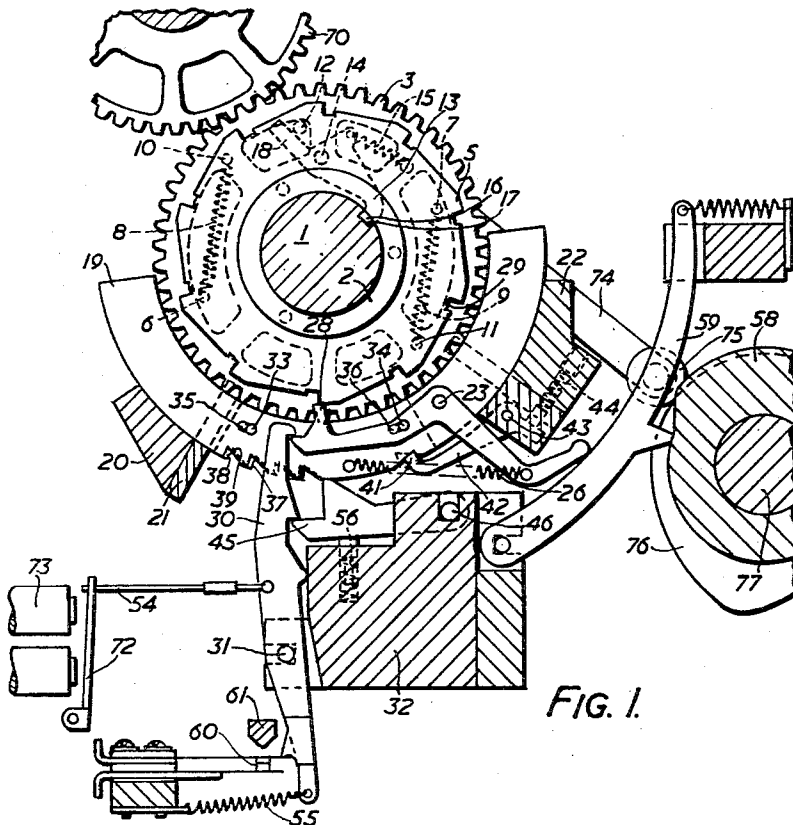
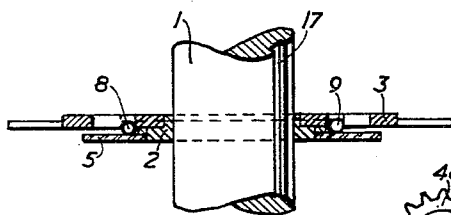
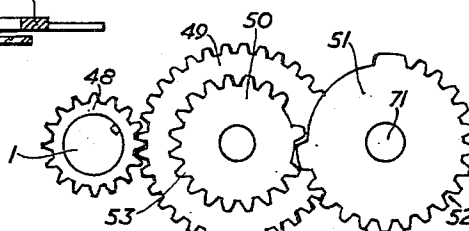
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2,837,023

RECORD CARD CONTROLLED PRINTING MECHANISMS

Filed Nov. 30, 1955

3 Sheets-Sheet 1



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RECORD CARD CONTROLLED PRINTING MECHANISMS

Filed Nov. 30, 1955

3 Sheets-Sheet 2

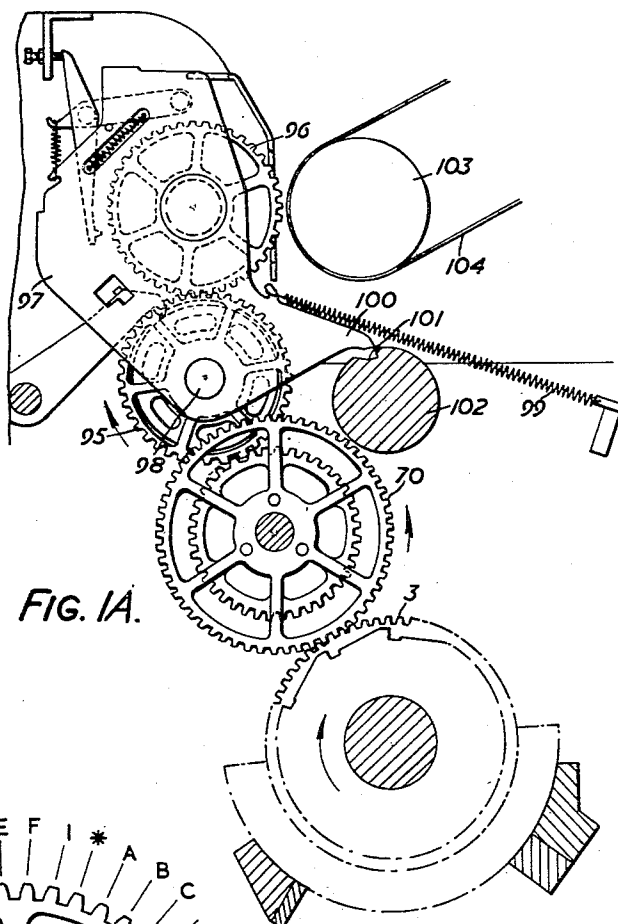


FIG. 1A.

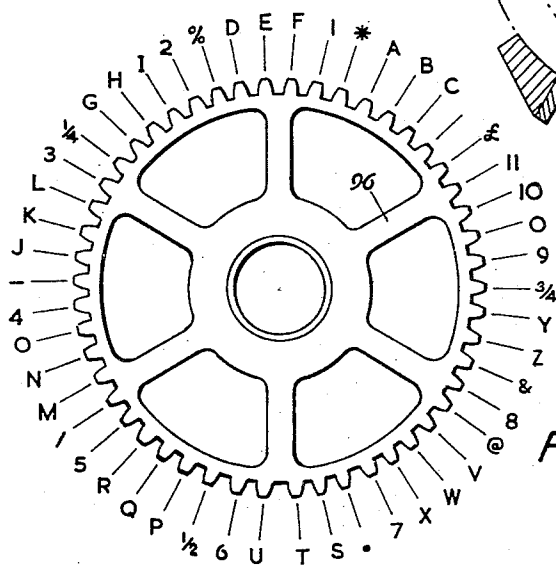


FIG. 1B.

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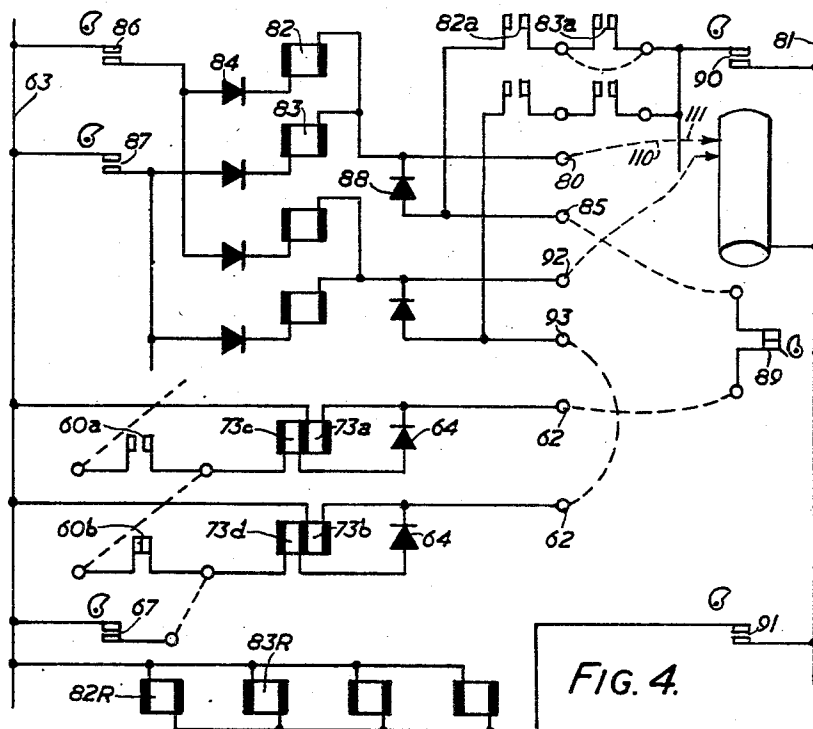
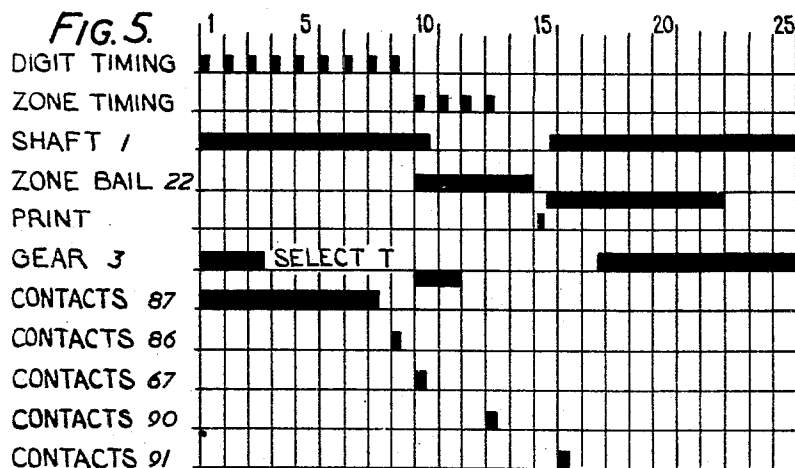
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RECORD CARD CONTROLLED PRINTING MECHANISMS

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3 Sheets-Sheet 3



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2,837,023

RECORD CARD CONTROLLED PRINTING
MECHANISMS

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February 14, 1955

19 Claims. (Cl. 101—93)

This invention relates to record card controlled print-
ing mechanisms.

The use of two holes in a column of a record card
to control the printing of a single character is well known.
This two hole coding is usually to represent a letter of
the alphabet or a symbol. The possible punching po-
sitions in a column are divided into two groups, which
are referred to as "digit" and "zone" positions. In order
to represent a letter of the alphabet, one hole is punched
in a digit position and a second hole is punched in a
zone position of the same column. It is known to use
ten digit positions with two zone positions and nine digit
positions with three zone positions.

It has been proposed to use nine digit positions with
three zone positions, and, in addition, to use certain
combinations of two digit positions, in order to provide
codings to represent extra symbols. The extra appa-
ratus necessary to respond to the occurrence of these
special two digit combinations adds appreciably to the
cost of the printing mechanism.

It is the object of the present invention to provide a
printing mechanism which is operable in response to dif-
ferentially timed digit and zone impulses derived from
the sensing of a record card, having means for providing
a further zoning impulse if a particular digit impulse
occurs in conjunction with any preceding digit impulse.

According to the invention a printing apparatus has a
printing member, means for printing a character by the
printing member in response to differentially timed digit
and zone impulses derived from the sensing of a record
card, means operated by the occurrence of one of the
digit impulses in conjunction with any preceding digit
impulse, and means for providing a further zone impulse,
at a different time to the card zone impulse times, when
said digit impulse operated means is operated. The
printing member may be positioned by separate digit and
zone selection means to select a character for printing.
Further, type characters may be arranged on the printing
member in groups, one character of each group being se-
lected in response to a digit impulse, two or more char-
acters being selected in response to a digit and a zone
impulse together, and a further character being selected
in response to a digit impulse together with a special zon-
ing impulse which occurs if the said latter digit impulse
precedes and occurs in conjunction with a chosen one of
the digit impulses.

The invention will now be described, by way of ex-
ample, with reference to the accompanying drawings, in
which:

Figure 1 is a partial sectional side view of the charac-
ter selecting mechanism for a print wheel;

Figure 1A is a view showing the print wheel and the
drive from the selecting mechanism;

Figure 1B is an enlarged view of the print wheel and
shows the arrangement of the characters on the type
teeth;

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Figure 2 is a diagrammatic sectional plan showing the
relation of certain parts of the clutch;

Figure 3 shows part of the gear train for intermittently
rotating the driving shaft;

5 Figure 4 is a diagram showing part of the circuit for
electrical zone impulse control and zero control;

Figure 5 is a schematic timing diagram.

10 The use of three zone positions in conjunction with
nine digit positions allows a maximum of forty charac-
ters to be recorded on a card; these characters can be,
for example, the digits 0-11 and the letters of the alpha-
bet together with a blank and an ampersand sign. It is,
however, desirable to be able to record and print other
symbols, such as fractions. To permit the printing of
15 eight more characters, the digit position "1" is used in
combination with the other digit positions to represent
an extra group of characters.

The cards are sensed in known manner to produce
timed impulses in accordance with punchings in digit po-
20 sitions "9" to "1," and in zone positions "O," "X" and
"Y." The coding of punched holes used to represent
the desired characters is set out in the table below:

Digit Position	Zone Position				
	—	1	Y	X	O
1	—	—	11	10	0
2	1	—	A	B	C
3	2	1/2	D	E	F
4	3	1/4	G	H	I
5	4	—	J	K	L
6	5	1/2	M	N	O
7	6	1/4	P	Q	R
8	7	—	S	T	U
9	8	1/2	V	W	X
	9	1/4	Y	Z	&

35 For example, the digit 7 is represented by a punching
at the "7" position of a card column, but holes punched
at the "7" and "X" positions of a column represent the
character T, and holes punched at the "7" and "1" digit
positions represent a full stop.

40 As the "1" digit position is used to provide both digit
and zoning impulses, the punching of a digit "1" com-
bined with a zone "1" or a zone "1" by itself cannot be
distinguished from a "1" digit, so that these two former
code combinations cannot be used from a card.

45 The cycle of the printing mechanism may be regarded
as being divided into twenty-five equal intervals (Fig-
ure 5). During the first nine of these intervals, the digit
impulses "9" to "1" may be received, so that this period
of the cycle will be referred to as the digit time. Simi-
50 larly, the zone impulses may occur in the intervals 10
to 13 of the cycle.

A shaft 71 (Figure 3) is driven by a motor (not
shown), which also drives a card feeding mechanism for
handling the cards under control of which data is to be
printed. The shaft 71 makes one revolution for each
55 cycle. An interrupted gear 51, which is secured to the
shaft 71, meshes with a gear 50. The gears 50 and 51
have the same number of teeth, and just before the be-
ginning of the cycle, a tooth 53 of the gear 50 is in mesh
with a space 52 of the gear 51. As the gear 51 rotates
60 clockwise, it will drive the gear 50 through half a revo-
lution, leave it at rest for a portion of the cycle, and
then drive it through the other half revolution.

A gear 49 is integral with the gear 50. The gear 49
drives a gear 48, having half the number of teeth of
the gear 49. The gear 48 is secured to a shaft 1. Hence
the shaft 1 makes two revolutions per cycle, coming to rest
65 during interval 10 and starting to revolve again just be-
fore the end of interval 15 (Figure 5).

70 A gear 3 is secured to a bushing 2 (Figures 1 and 2),
which is mounted for free rotation on the shaft 1. This

gear 3 drives through gears 70, 95 (Figure 1A) a type wheel 96 as described in United States Patent No. 2,679,797 to which reference should be made for a more detailed description. For the present purpose, it is sufficient to explain that the type wheel 96 is mounted on a plate 97 which is pivoted on the shaft 98 and which is biased in a clockwise direction by a spring 99. At a prescribed time in the printing cycle a projection 100 on the plate 97 enters a slot 101 in a cam 102 with the result that the print wheel 97 is swung towards a platen 103 to effect printing on the paper 104.

Reverting to Figures 1 and 2, a latch plate 5 is freely mounted on the bushing 2. The latch plate has ten notches 29 in the periphery. A pair of pins 6 and 7 are fixed in the latch plate 5, and a corresponding pair of pins 10 and 11 are fixed in two spokes of the gear 3. Springs 8 and 9 joint the corresponding pins of the two pairs together, and tend to turn the plate 5 clockwise with respect to the gear 3. This relative movement is limited by a stud 12 which is mounted on the plate 5 and projects into the space between two spokes of the gear 3. The springs also serve to retain the plate 5 in place on the bushing 2.

A stud 14 on the gear 3 acts as a pivot for a pawl 13, which is on the outer face of the gear. A spring 15 urges a nose 16 of the pawl into a slot 17 in the shaft 1. An extension 18 of the pawl lies adjacent to the stud 12. Thus the gear 3 is normally coupled to the shaft 1 by the pawl 13.

The gear 3 may be decoupled from the shaft 1 by a digit selection pawl 24. The pawl 24 is mounted on a zoning sector 19 by a stud 23. The pawl is normally engaged by an operating latch 30. The latch 30 is carried by a pin 31 which passes through a combed section of a cross bar 32.

Armature 72 of an electro-magnet 73 is connected to the latch 30 by a pull rod 54. When the magnet 73 is energised, the latch 30 is moved anti-clockwise against a spring 55, and releases the pawl 24. The pawl 24 is moved clockwise by a spring 26, to cause a nose 28 of the pawl to engage in one of the notches 29 in the latch plate 5.

The magnet 75 is energised by timed impulses resulting from the sensing of a record card. If a "7" punching is sensed, for example, the magnet will receive an impulse at interval 3 of the cycle (Figure 5). At this time, one of the high points on the plate 5 will be engaging the nose 28 of the pawl, so reducing the load on the latch 30. With the latch in the anti-clockwise position, the pawl 24 is free to drop into one of the notches 29, as the plate 5 rotates.

The latch plate 5 is now held stationary by the pawl 24, but the gear 3 continues to rotate with the shaft 1. The extension 18 of the pawl 13 engages the stud 12 in the plate 5, and the continued rotation of the gear 3 forces the pawl to turn anti-clockwise until the nose 16 is withdrawn from the slot 17 in the shaft 1. The gear 3 is now decoupled from the shaft 1 and comes to rest. The positioning of the notches 29 is such that the gear 3 is brought to rest before the end of the interval in which an impulse has been applied to the magnet 73 (Figure 5). Thus the gear 3 is driven for a part of the cycle which is dependent upon the digit punching sensed; the less the value represented by the punching, the longer is the time for which the gear is driven.

The zoning sector 19 is supported and guided by a cross bar 20 and a comb member 21, and by a zoning bail 22, which also has a comb section. A zone latch pawl 42 is pivotally mounted on the zoning bail 22 by a rod 43. The zone latch pawl is normally held in engagement with a notch 41 in the zoning sector 19 by a spring 44.

The zoning bail 22 is mounted so that it may move concentrically with the shaft 1. A cam follower lever 74 is pivotally attached to an arm (not shown), which

is attached to a boss mounted on the shaft 1. The boss carries a second arm which is attached to the zoning bail 22. The outer end of the lever 74 carries a roller 75 which is held against a cam 76 by a spring (not shown). The cam 76 is secured to a shaft 77. The shaft 77 is driven in synchronism with the shaft 71 through a train of gears (not shown).

The shape of the cam 76 is such that the zoning bail 22 is moved anti-clockwise at constant speed during intervals 10 to 14 of the cycle, and is moved back to the normal position from the mid point of interval 15 to the end of interval 22 (Figure 5).

An auxiliary zoning plate 37 is attached to the zoning sector 19 by two studs 33 and 34. The studs pass through slots 35 and 36 in the sector 19, so that the plate 37 is allowed a limited movement relative to the sector. The sector 19 has four triangular notches 38 in the periphery, and the plate 37 has corresponding notches 39. The plate 37 also has a notch corresponding to the notch 41, but facing in the opposite direction.

A zone selecting pawl 45 is pivotally mounted on the cross bar 32 by a rod 46. In the normal position of the zoning sector, the zone selecting pawl 45 is held against the periphery of the sector 19, and of the plate 37, by a spring 56.

It has been assumed that the digit selection pawl 24 was engaged with the latch plate 5 by a "7" impulse so that the gear 3 is stationary when the zoning bail 22 starts to move. As the zoning bail moves anti-clockwise, the sector 19 is also moved in the same direction, since it is engaged by the pawl 42. The pawl 24 is carried by the sector 19, so that the latch plate 5 and the gear 3 are also rotated in the opposite direction to that in which they rotated at the beginning of the cycle.

The zone selecting pawl 45 is prevented from entering the notches 38 by the operating latch 30. If the magnet 73 now receives an "X" impulse, the operating pawl will release the zone selection pawl. The rate of movement of the zoning bail 22 is such that the pawl 45 will enter the second notch 38. The pawl will encounter the trailing edge of the notch 39 in the plate 37, preventing further movement of the plate. The zoning sector continues to move, but the displacement of the notch 41 relative to the corresponding notch in the plate 37 forces the pawl 42 out of engagement, so that the zoning sector 19 is brought to rest with the notches 38 and 39 in alignment. The bail 22 continues to move, the pawl 42 riding on the periphery of the sector 19.

The angular distance between adjacent notches 38 is one fifth of that between adjacent notches 29 on the latch plate 5. Movement of the latch plate 5 equal to the separation of adjacent notches 29 causes a movement of the type wheel 96 (Figures 1A and 1B) such that five characters pass the printing line. The full movement of the bail 22 produces a movement of the sector 19 equal to the separation between adjacent notches 29.

The energisation of the magnet 73 by an "O," "X" or "Y" impulse causes the pawl 45 to engage with respectively the first, second or third notch 38 of the zoning sector.

If a hole at the digit position "1" is combined with a hole punched at another digit position, a zoning impulse occurs, timed to energise the magnet 73 when the pawl 45 is able to engage the fourth notch 38 of the zoning sector, that is, at the beginning of interval 13 of the cycle. An electrical circuit by which a zoning impulse is made to occur at this time will be described later.

If no zone impulse occurs, the zoning sector moves the full distance. Hence the type wheel 96 is moved respectively 1, 2, 3, 4 or 5 character positions from that in which it was set in response to a digit impulse, when an "O," "X," "Y" or "1" impulse, or no impulse occurs.

If no digit impulse occurs, the digit selection pawl 24 is released just after the zoning bail has begun to move, because the movement of the zoning sector 19 carries

the pawl 24 away from under the operating latch 30. Hence the pawl 24 engages in the notch 29 which is next in the anti-clockwise direction, to that which is engaged when a digit "1" impulse occurs. A zone impulse may then cause the appropriate zoning movement to take place.

Taking the table showing the card coding, in conjunction with the fact that the type wheel movement is reversed during the zone time, it will be apparent that the characters on the type wheel 96 are arranged in the order 9, $\frac{3}{4}$, Y, Z, &, 8, @, V, W, X, 7, ., S, T, U, 6—1, *, A, B, C, blank, £, 11, 10, 0 as illustrated in Figure 1B, (the selection of the * and £ signs will be described later). At the beginning of the cycle, the character " $\frac{3}{4}$ " will be opposite the printing line, since the gear 3 is decoupled from the shaft 1 approximately four-fifths of a cycle interval after a digit impulse occurs. In the case of the example, the gear 3 will drive the type wheel 96 to position the character "6" at the printing line in response to the digit impulse, and the type wheel will then move two character positions in the reverse direction to finally position the character "T" at the printing line.

At approximately the beginning of interval 15 of the cycle, the projection 100 (Figure 1A) enters the slot 101 and the type wheel 96 is rocked to effect printing of the selected character, in a manner described in the beforementioned patent.

Immediately after printing, the digit selection pawl 24 is disengaged from the latch plate 5 by an arm 59, which is operated by a cam 58 on the shaft 77. At the same time, the cam 76 starts to return the zoning sector 19 to the normal position, the movement being completed by the end of interval 22 of the cycle.

Towards the end of interval 15, the shaft 1 commences the second revolution of the cycle. Since the gear 3 has been selectively driven, the nose 16 of the pawl 13 will not be aligned with the slot 17 in the shaft 1. Consequently, the shaft 1 will rotate without driving the gear 3 until the nose of the pawl 13 drops into the slot in the shaft. The gear 3 is then synchronised with the shaft, so that, at the end of the cycle, the gear 3 will have driven the type wheel 96 to bring the character " $\frac{3}{4}$ " opposite the printing line, and the wheel is reset ready for the next cycle.

Figure 4 shows the electrical circuit for energising the magnet 73. A socket 80 is connected by plug wires 110 to a brush illustrated diagrammatically at 111 which senses a selected column of the record card. When a hole in the card is sensed, the brush 111 makes contact with an earthed sensing roller 112, so a circuit is made between the socket 80 and an earth line 81. This partially completes an energising circuit to two relays 82 and 83 which close contacts 82a and 83a respectively. The relays 82 and 83 are of the mechanically latched type, so that these contacts remain closed until released by the energising of resetting coils 82R and 83R.

The relay 82 is connected through a rectifier 84 and cam operated contacts 86 to a supply line 63, the polarity of which is positive with respect to the earth line 81. The relay 83 is similarly connected through a rectifier and cam operated contacts 87 to the line 63.

Contacts 86 and 87 are operated by cams (not shown) on the shaft 77 and are timed so that the contacts 86 are closed for the first half of interval 9 (Figure 5) and contacts 87 are closed from the beginning of the cycle until halfway through the interval 8. The socket 80 is connected through a rectifier 88 to another socket 85.

When any digit from 9-2 is sensed, the relay 83 is operated and contacts 83a close. If a "1" is sensed, then contacts 82a close. Therefore when a "1" and another digit are sensed, both contacts will be closed.

Whenever a hole is sensed, the socket 85 will be reduced to earth potential. This socket is connected by a wire (shown dotted) to a socket 62 connected to a coil 73a

of the magnet 73. The coil is also connected to the line 63, so that whenever a hole is sensed, the coil 73a is energised.

Coil 73a can also be energised by a connection being established from the socket 85 to the line 81 through the contacts 82a, 83a and contacts 90 which are closed during the first half of interval 13 of the cycle (Figure 5) by a cam (not shown) on the shaft 77. A similar cam closes contacts 91 to energise the resetting coils 82R and 83R during interval 16 of the cycle.

Thus, for example, if a "7" and a "1" digit (representing the character ") are sensed, the magnet 73 will be energised three times; the first is when the "7" is sensed, releasing the pawl 24. The second, when the "1" is sensed, will have no effect as the pawl 45 is prevented from moving by the zoning sector 19. Contacts 82a and 83a are closed so that in interval 13 when the contacts 90 are closed, the magnet will be energised a third time, allowing the pawl 45 to engage the fourth notch 38.

The magnet 73 of a second column may be controlled by making similar connections to plug sockets 92 and 93.

A plurality of character selecting mechanism similar to that already described may be mounted on the shaft 1 to form a multi-column printing mechanism, each character selecting mechanism driving a separate type wheel. The type wheels may be fitted with hammer lock controls similar to those described in the forementioned patent.

If no "1" zoning is required in certain columns of the card, because the extra group of characters is not to be printed, the brushes which sense these columns can be connected to the sockets 62, thus freeing the relays 82 and 83 for use with brushes sensing columns which do need the extra symbols provided by the "1" zoning selection. This affords a considerable reduction in the total number of relays required.

In a multi-column mechanism it is desirable to have means for suppressing printing of zeros to the left of the first significant digit. This is effected under control of contacts 60 (Figure 1 and 4). When the operating latch 30 is moved anti-clockwise by the magnet 73, the contacts 60 are allowed to open, and are held open when the latch returns.

The sensing brushes for two adjacent columns, for example are connected by plug wires (not shown) to two sockets 62 (Figure 4). These sockets are connected to the operating coils of the magnets 73a and 73b, for two columns of the printing mechanism, the other side of each coil being connected to the supply line 63. The contacts 60a, 60b and cam controlled contacts 67 are connected in series, and to the supply line 63. The contacts 67 are operated by a cam (not shown) mounted on the shaft 77, so that they are closed for the first half of interval 10 of the cycle.

It will be assumed that the magnet 73a has received a digit impulse, say a "7" impulse, so that the contacts 60a are open. At interval 10, the other magnet receives a "0" impulse from the card. The operating coil of the magnet 73b is energised, but there is also a circuit through a rectifier 64, a differential 73d coil of the magnet, and the contacts 67 to the line 63. With both coils operated, the armature is not attracted. This allows the corresponding wheel to be driven for the full zoning movement, which leaves the blank position at the printing line. The circuit to the differential coil 73c is not made at "7" time since the contacts 67 are open. The contacts 60 are reset before the end of the cycle by a bail 61.

The type wheel positions corresponding to "1" zone and "1" zone combined with a "1" digit cannot be selected, as explained above, but it is convenient to make use of these two positions to print a pound sterling sign (£) and an asterisk (*). The asterisk is placed on the type wheel between the "A" and the "1." To select this position it is necessary for the magnet 73 to be operated by a "1" digit and also again when the contacts 90 close. This cannot normally be effected because the contacts 83a will remain

open. If, however, these contacts are shorted out by a plug wire (shown dotted), selection of the asterisk can be made in response to a "1" punched in the card.

To select the pound sign, which is placed between the character "11" and the blank position on the type wheel, it is necessary to energise the magnet 73 only when the contacts 90 close. This can be effected by punching a "1" in the card and shorting out the contacts 83a as for an asterisk. In addition, the socket 85, instead of being plugged direct to the socket 62, is plugged via normally closed contacts 89. These are opened by a cam (not shown) on shaft 77 during interval 8 of the cycle, so that when the hole representing the "1" is sensed, contacts 82a close but the magnet 73 will not be operated until the contacts 90 close.

What we claim is:

1. Printing apparatus comprising a printing member having a plurality of type characters, means for sensing a record member which has digit and zone data thereon representing the character to be printed, said sensing means generating digit and zone impulses at prescribed times in accordance with the said digit and zone data, control means operated in response to the occurrence of two digit impulses, means operated by said control means for generating a further zone impulse at a time different from said prescribed times, and means controlled by said digit and zone impulses and said further zone impulse for selecting a type character for printing.

2. Printing apparatus comprising a printing member having a plurality of type characters, means for sensing a record member and for generating digit and zone impulses at prescribed times dependent on the date on said member, control means responsive to the joint occurrence of a digit impulse at one of said prescribed times and an earlier digit impulse, means operated by said control means for generating a further zone impulse at a time after the prescribed times of said zone impulses, and means controlled by said digit impulses, said zone impulses and said further zone impulses for selecting one of said type characters for printing.

3. Printing apparatus comprising a printing member having a plurality of type characters, selecting means for selecting a prescribed type character for printing, said selecting means including digit selecting means and zone selecting means, means for sensing a record card and for generating digit impulses and zone impulses at prescribed times in accordance with the data sensed, means for operating said digit selecting means by said digit impulses, control means operated on the joint occurrence of a digit pulse at one said prescribed time and of an earlier generated digit impulse, means operated by said control means for generating a special zone impulse after said prescribed times for said zone impulses, and means for operating said zone selecting means alternatively by said zone impulses and by said special zone impulse.

4. Printing apparatus comprising a printing member having a plurality of groups of type characters, sensing means for sensing a record card and for generating digit impulses at any of a plurality of prescribed times and zone impulses at any of a plurality of prescribed times dependent on the data on said card, control means operated by the joint occurrence of a digit impulse at one of said prescribed times and an earlier generated digit impulse, means operated by said control means for generating a special zone pulse at a time subsequent to said prescribed times for said zone impulses, means operated by a digit impulse for selecting one of said groups of said type characters, and means operated alternatively by a zone impulse and said special zone impulse for selecting for printing a type character from said selected group.

5. Printing apparatus comprising a printing member having a plurality of groups of type characters, sensing means for sensing a record card and for generating at least one digit impulse at any of a plurality of prescribed digit times and at most one zone impulse at any of a

plurality of prescribed zone times, control means operated on the joint occurrence of a digit impulse at one of said prescribed digit times and of an earlier generated digit impulse, means operated by said control means for generating a special zone pulse at a time after said prescribed zone times, means operated on the first digit impulse for selecting one of said groups of said type characters, and means operated alternatively by a zone impulse and said special zone impulse for selecting for printing a type character from said selected group.

6. Printing apparatus comprising a type wheel, carrying a plurality of groups of type characters, a rotating shaft, digit selection means for coupling a type wheel to the shaft in one direction, a zoning member, means for moving the zoning member, zone selection means for coupling the type wheel to the zoning member for rotation in the other direction, sensing means for sensing a record card and for generating at least one digit impulse at any of a plurality of prescribed digit times and at most one zone impulse at any of a plurality of prescribed zone times, control means operated on the joint occurrence of a digit impulse at one of said prescribed digit times and of an earlier generated digit impulse, means operated by said control means for generating a special zone pulse at a time after said prescribed zone times, means for operating said digit selection means by the first digit impulse to select a group of type characters, and means for operating said zone selection means alternatively by a zone impulse and said special zone impulse for selecting for printing a type character from the selected group.

7. Apparatus as claimed in claim 5, having first means operated by any of the digit impulses except said one digit impulse, and second means operated by said one digit impulse, and means for providing said special zone impulse if both said first and second means are operated.

8. Apparatus as claimed in claim 7, in which said first and second means comprise electro-magnetic relays.

9. Apparatus as claimed in claim 8, in which said first means comprises a mechanically latched electro-magnetic relay.

10. Apparatus as claimed in claim 9, having timing means operating in synchronism with the sensing of the record card for controlling the operation of said first and second means, and further synchronous timing means for applying said special zone impulse to control the position of the printing member under control of contacts of said first and second means.

11. Apparatus as claimed in claim 6, having a single operating electro-magnet for controlling both the digit and zone selection means.

12. Apparatus as claimed in claim 11, having a gear and a latch plate mounted concentrically with the shaft, the type wheel being driven by the gear, means constraining the gear and the latch plate to move together, when the gear is driving the type wheel in said one direction, or when the latch plate is driven in the opposite direction, a plurality of notches in the latch plate engageable by a digit selection pawl, means coupling the gear to the shaft, and means for decoupling the gear from the shaft when the digit selection pawl engages with a notch in the latch plate.

13. Apparatus as claimed in claim 12, in which the digit selection pawl is mounted on the zoning member and may be released to engage the latch plate either by energising the operating magnet by a digit impulse, or by movement of the zoning member.

14. Apparatus as claimed in claim 13, having a zoning bail, means for coupling the zoning bail to the zoning member and means for decoupling the zoning member when the operating magnet is energised by a zone impulse.

15. Apparatus as claimed in claim 14, having an auxiliary zoning plate attached to the zoning member so as to have a limited movement relative thereto, a plurality

of notches in the zoning sector and the auxiliary zoning plate, a pawl carried by the zoning bail and engageable with one of said notches, said pawl being disengaged by the auxiliary zoning plate if a notch in said plate is engaged by a zone selection pawl.

16. Apparatus as claimed in claim 15, in which said special zone impulse is timed to occur after the zone impulses from the card and before the movement of the zoning bail has been completed.

17. Apparatus as claimed in claim 16, having a first 10 electro-magnetic relay operable by any of the digit impulses except said one impulse, a second electro-magnetic relay operable by said one impulse, and means for applying said special zone impulse to the operating magnet when the first and second relays have both been oper- 15 ated.

18. Apparatus as claimed in claim 17, in which the first relay type has means for mechanically latching the contacts of said relay in the operated position.

19. Apparatus as claimed in claim 18, having a circuit, 5 for applying said special zone impulse to the operating magnet, which includes manually adjustable connections.

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2,046,464	Knutsen	July 7, 1939
2,175,530	Knutsen	Oct. 10, 1939
2,227,143	Knutsen	Dec. 31, 1940
2,386,422	Beattie	Oct. 9, 1945