

Oct. 31, 1933.

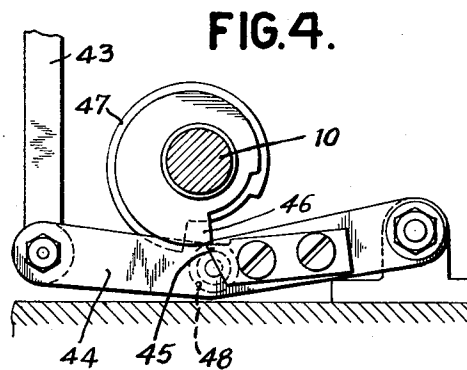
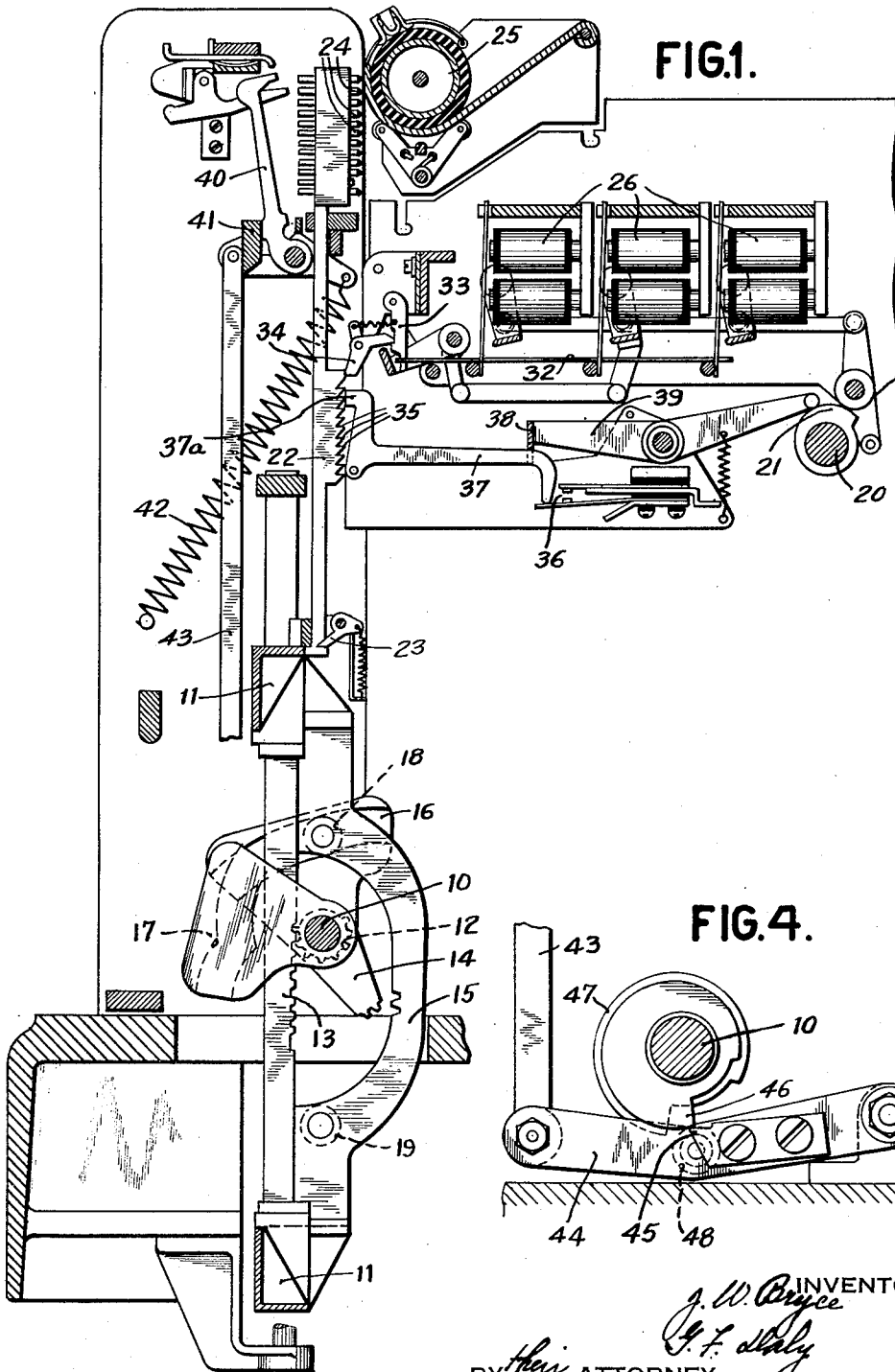
J. W. BRYCE ET AL

1,933,309

ZERO PRINTING TABULATOR

Original Filed Feb. 21, 1930

2 Sheets-Sheet 1



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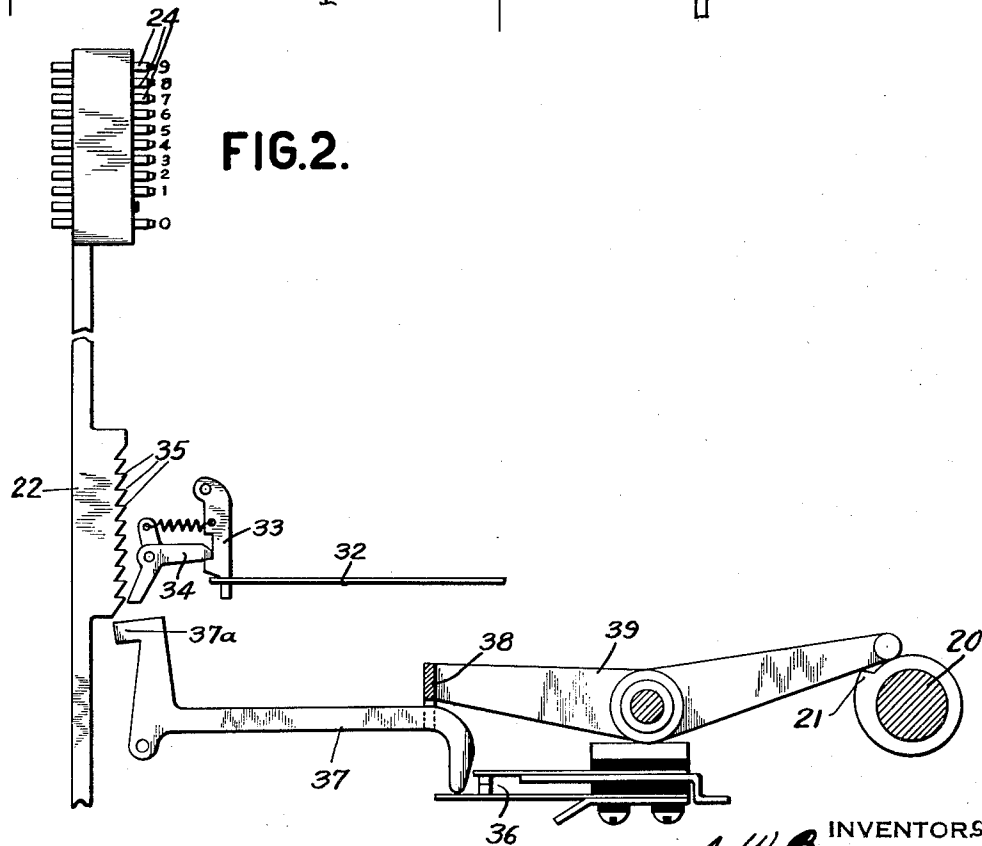
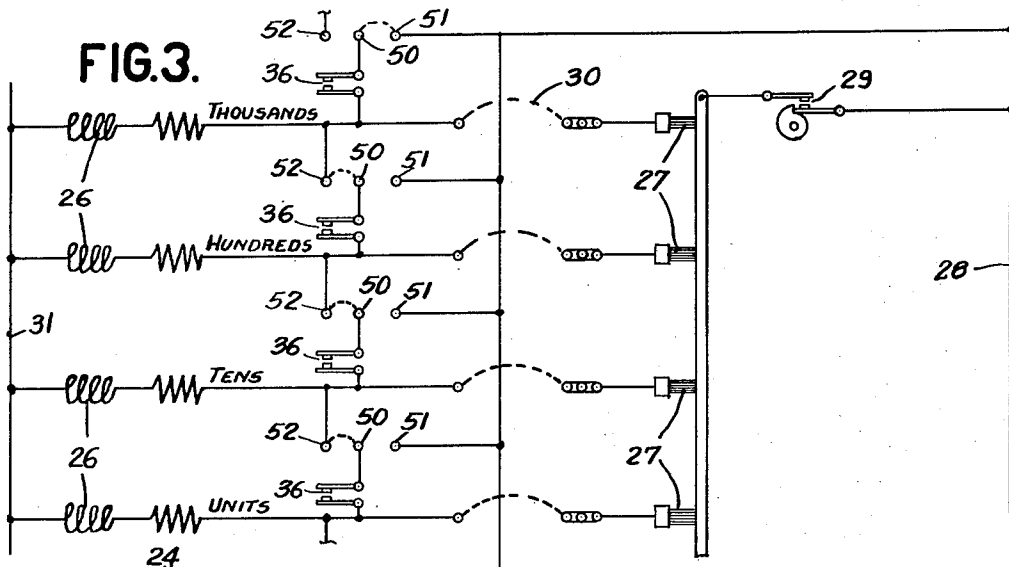
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ZERO PRINTING TABULATOR

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1,933,309

ZERO PRINTING TABULATOR

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Original application February 21, 1930, Serial No. 430,257. Divided and this application March 6, 1931. Serial No. 520,600

8 Claims. (Cl. 101—93)

This is a division of application Serial No. 430,257 of J. W. Bryce and G. F. Daly, filed February 21, 1930.

The invention concerns a printing mechanism for accounting machines in which a plurality of conjointly operable type carriers each provided with a number of corresponding type are cyclically movable to different printing positions and in which it is desired at times to automatically suppress printing by a particular type on the carriers.

While the invention is not limited to such a use, it finds particular adaptation in properly suppressing zero printing in printing tabulators and will be described in connection with such a machine as described in the aforementioned application. Such machines are electrically controlled by perforated record cards on which data is represented by the location of perforations in the cards. The cards are divided into columns and index points, the commonest arrangement consisting of ten index points representing the nine digits and zero, for each column. Printing may be required either of the items as directly entered on the record cards or of a total of several items. In the latter case the several items must first be entered into the accumulating section of the machine and the printing controlled by the amounts standing in the accumulators. Different controls are naturally provided for these two printing operations but the physical operation of the printing mechanism proper is the same in either case.

The printing mechanism consists of a plurality of type carriers, usually one for each card column, each of which carries a type corresponding to each index point of the columns. If the control card index points represent the digits and zero, then, each type carrier will be provided with type representing these figures and the carriers will be automatically moved by the machine, in synchronism with the movement of the control cards past the analyzing mechanism in listing items to bring the proper type successively into printing position as the machine passes through the corresponding index point position.

When a type bar is to print a particular numeral one of the printing controls operates as the machine passes the proper index point to arrest the type carrier, which thereupon remains with its corresponding type in printing position until the end of the cycle when a hammer strikes all type which are in any printing position and effects printing of the required item. In printing totals the type carriers also move in synchronism with

the total picking mechanism so that as any number standing on an accumulator is picked for totaling its corresponding type will be passing through printing position and will be arrested in this position until towards the end of the printing cycle when as before it is struck by its hammer to effect printing.

It is the custom in punching record cards for these machines to place a perforation in each card column to minimize the risk of inadvertently omitting a significant figure and any column in which no significant figure or digit occurs is punched in the zero position. These zero perforations occur to the left of the first significant figure of a number as well as to the right of it but in printing numbers consisting of figures of several different denominational orders it is desirable to suppress the printing of all zeros to the left of the first significant figure while permitting the printing of all zeros to the right of this figure regardless of their position with respect to any other figure of the number.

A similar situation exists in regard to total printing as in this case the total picking mechanism selects the printing type in response to the positions of the counter elements of the accumulators and if the printing of zeros were entrusted to the picking mechanism a zero type would be selected for printing by every accumulator whose counter element did not register a digit. This again would result in undesirable printing of zeros to the left of the first significant figure of a number.

The control of zero printing is therefore usually removed from the main printing controls of the machine entirely and placed under a separate system depending for its selection of a zero type in any column on the printing of a digit in some column to the left of it thus automatically preventing zero printing in all columns to the left of the first significant figure. Heretofore this has been accomplished by mechanical means, of which the most common form consists of a pawl carried by each type carrier of the next higher order. This pawl cooperates with a cam surface and abutment formed on the type bar of the next higher order which permits the zero type of the latter to be carried past printing position if it lies to the left of the first significant figure, but stops all the type bars in zero printing position, which do not represent digits to the right of this figure. This arrangement requires the zero selecting pawls to slide upon the type carrying members causing much friction and possible sticking of these members. Furthermore, if a given num-

ber contains a great many zeros in successive columns the friction may interfere with the operation of some of the type bars.

According to the present invention these inconveniences are avoided by providing a system of zero suppression whose control and operation is entirely removed from the type carrying members. Preferably this takes the form of an electrical system which may operate independently upon each carrier on which zero printing suppression is required.

The principal object of the invention is to provide a printing character suppression system removed in its control and operation from the mechanical structure of the type carriers and more particularly to provide an electrically operated system of printing character suppression.

A further object of the invention is to provide a printing device of this nature in which a separate control system is provided for printing the particular character which is to be selectively suppressed.

A further object of the invention is to provide for electrically suppressing the printing of zeros to the left of the first significant figure in a printing tabulator, while permitting the printing of zeros in any position to the right of this figure.

A further object of the invention is to adapt the selective character suppression system to split bank operation so that, when different portions of a printing bank are used to print independent items, the operation of the system in one portion of the bank will have no effect in the other portions.

The utility of the invention may be explained best in connection with a printing tabulator designed to print numbers consisting of figures of different denominational orders and will be clearer from a specific example. If the number 300546 is to be printed the type bars of the significant figures 3, 4, 5, and 6 will be arrested in the printing positions for these figures and all the other type bars of the particular bank will tend to move to zero printing position. In this particular number it is necessary to print zeros from the two type bars to the left of the 5 and suppress all zeros to the left of the 3. In other words, it is necessary to provide for stopping all type bars to the left of the 3 so that no printing will result when their hammers are operated.

In machines of this type the digit printing is controlled by electrical control circuits which energize printing call magnets to stop the type bars in the required digit position. According to the present invention these circuits are not energized to cause zero suppression, the latter being controlled by a separate circuit energizing the printing call magnets to arrest the printing bar in a non-printing position located in advance of the zero printing position. Just after the machine cycle passes the "one" index point position this latter circuit is energized to arrest all carriers in non-printing position which are not to print zeros or digits while permitting all carriers which are to print zeros to pass through such non-printing position to zero printing position.

The invention will be more clearly understood from the following detailed description which should be read in connection with the attached drawings in which:

Fig. 1 is a section through the printing mechanism of a card controlled printing tabulator showing the mechanical arrangement of the zero suppressing control contacts, all features not es-

sential to an understanding of the invention being omitted for the sake of clearness.

Fig. 2 is a detail position view of a type bar in zero printing position.

Fig. 3 is a local wiring diagram of the zero suppressing control circuits.

Fig. 4 is a detail of the hammer operating cams.

The print shaft 10 is rotated to raise and lower the type bar crosshead 11 (Fig. 1). It raises the crosshead with a steady motion through pinion 12 meshing with a rack 13 on the crosshead and lowers the crosshead through a sector 14 cooperating with a rack 15 on the crosshead. Both the up and down movements are started by slotted cams 16 and 17 cooperating with pins 18 and 19 respectively which are mounted on the crosshead. A shaft 20 suitably geared to shaft 10 carries a cam 21 for operating the zero printing mechanism in a manner to be explained.

On the crosshead there is a series of type bars 22 which are releasably operated by the crosshead through a spring pressed pawl 23 mounted thereon and engaging a notch in the lower end of the type bar. At its upper end the type bar is provided with printing type 24 corresponding to the different digits. The type bar rises with the crosshead 11 so that each type 24 arrives opposite the platen 25 at the corresponding point of the machine cycle. The type bar may be arrested in position to print from any type by a printing magnet 26 which is controlled by timed impulses initiated by the cooperation of perforations in cards with the analyzing brushes.

The analyzing brushes are shown diagrammatically at 27 (Fig. 3) and serves to complete circuits through the card perforations from the right side of line 28, cam contact 29 (closed only while index point positions 9—1 are being analyzed) hole in the card, plug connection 30, printing magnet 26, to left side of line 31.

Energization of magnet 26 attracts its armature and pulls a call wire 32 to the right thereby releasing a latch 33 which normally holds stop pawl 34 free of ratchet teeth 35 on the type bar. When the pawl 34 is released it is spring actuated into engagement with the proper ratchet tooth 35 to prevent further upward movement of the type bar, thus holding the proper type 24 opposite the platen. This arresting of the type bar does not interfere with the upward movement of the crosshead 11 as the spring operated pawl 23 is merely cammed out of the notch in the lower end of the type bar.

Zeros are not printed directly from the normal controls of the machine but as usual according to the presence of digit printing on a type bar to the left. The type bars (see Figs. 1 and 2) carry the 1 to 9 type in the usual manner but the normal space for the zero type is provided with a blank slug so that if the type bar is stopped in this position no printing will result. The zero type is placed in lowermost position so that if the bar rises to its uppermost position zero will be printed. If zero printing is to be suppressed the type bar must be stopped by pawl 34 with the blank slug opposite the printing line. Special contacts 36 are provided to carry the impulses to the print magnets as the blank slug arrives opposite the printing line. The contacts 36 are held open by levers 37 which are normally held against the resiliency of contacts 36 by a bail 38 carried by arms 39. Cams on shaft 20 hold the bail depressed until the "1" ratchet tooth on the type bar passes the stop pawl 34. At this time the cams on shaft 20

permit bail 38 to rise, releasing levers 37 to the resiliency of spring contacts 36.

An inspection of Fig. 2 will show that if any type bar has been stopped in position to print from type from 1 to 9 the lever 37 is held in position to maintain the contacts 36 open, the lever 37 having an extension 37a cooperating with the ratchet on the type bar for this purpose. If any type bar has not been stopped at this time its ratchet will have cleared extension 37a of lever 37 and lever 37 will assume the position shown in Fig. 2, the contacts 36 closing for this particular type bar. An impulse is sent through any closed contacts 36 at this instant to the print magnet of the type bar to the right. This operation, which will be explained more in detail in connection with the circuit diagram causes any type bar to the left of the first significant figure of a number to be arrested with its blank slug opposite the printing line, while any type bar to the right of the first significant figure which has not been selected to print digits from 1 to 9 will rise to its uppermost position to print zero.

Printing is effected from the selected type by hammers 40 operated by a bail 41. A spring 42 tends to rock the bail clockwise to force the hammers against the type but a rod 43 (see also Fig. 4) cooperates with cams on printing shaft 10 to prevent release of the bail until all the type are positioned for printing. The rod or link 43 is pivoted to a lever 44 which carries a nose piece 45 cooperating with a cam 46 fixed to print shaft 10. Shortly after the type bars are properly positioned the nose piece 45 drops quickly to a low portion of cam 46 permitting the bail 41 to operate the hammers to effect printing. Shortly after this a second cam 47 on print shaft 10 encounters a roller 48 journaled on lever 44 and lowers the link 43 to return the bail 41 to inoperative position. A portion of the bail restores the hammers 40.

Referring to Figs. 1 and 2 it will be recalled that just after the type bar 22 passes the 1 printing position an arm 37 is released by bail 38. If the type bar has been arrested to select a significant figure this arm 37 is held by the extension of a type bar on which the ratchet teeth are formed but if the type bar has not been selected for significant figure printing it has at this time risen sufficiently to permit the arm 37 to rock, closing contacts 36. These contacts 36 control zero printing (see Fig. 3). One contact of each pair 36 is connected to a socket 50. Opposite this socket is one 51 connected directly to main line 28. Another socket 52 is connected with the printer magnet for the adjacent column to the left. When a bank of printing type is to be formed socket 50 of the extreme left hand accumulator element is plugged to socket 51 while all other sockets 50 are plugged to sockets 52 as indicated by the dotted lines in the figure. Now if the type on the extreme left is selected for printing during any cycle, the contacts 36 in the thousands order remain open and no blank position selective circuit at all is established and all type which are not selected for significant figures rise to their highest position to position the zero type opposite the printing line. If this left hand type is not selected for significant figure printing its contacts 36 close just after the type passes the one printing position and the suppression circuit is established from main line 28, to sockets 51 and 50 and contacts 36 to printer magnet 26 of the thousands order, thus arresting the type bar in this order in the blank position so that there will

be no printing. If the hundreds order likewise has not been selected for a significant figure printing, its contacts 36 close.

The circuit is then extended from socket 52 of this order to socket 50 to the hundreds contacts 36 and through contacts 36 of the hundreds order to the hundreds print magnet 26, whereupon this type bar also is arrested in blank position. Now assuming that the tens type bar has been selected for a significant figure, its contacts 36 remain open. Consequently there will be no suppression circuit for the units order and this type bar will rise to its highest position, positioning its zero type opposite the printing line. Thus the suppression circuit is only closed through a printing magnet when no type bar to its left is selected for digit printing. The suppression circuit has a branch extending through the suppression contacts 36 of each of the lower orders but this branch circuit will be interrupted for all the remaining type bars by the selection of any bar for significant figure printing whereupon zeros will be printed to the right of the first significant figures in any column in which a significant figure does not occur.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

We claim:

1. In an accounting machine, a type bar having a plurality of digit type and a zero type separated therefrom by a blank space, means for moving the bar to bring the several type successively into printing position and means for selectively stopping the type bar in its movement with the blank space in printing position to suppress zero printing.

2. In an accounting machine, a plurality of type bars each having a plurality of significant figure type and a zero type separated therefrom by a blank space, means for moving the type bars to bring the several type successively into printing position and means for selectively arresting the bars with the different type in zero position and means controlled by the type bars for arresting all type bars to the left of that which is selected for the first significant figure and during the movement thereof with the blank space in printing position.

3. In an accounting machine, a plurality of type bars each having a plurality of significant figure type and a zero type separated therefrom by a blank space, means for moving the type bars to bring the several type successively into printing position and means for arresting the bars to select the different type for printing, means normally tending to arrest all type not selected for significant figure printing with the blank space opposite the printing line and means controlled by each type bar on being selected for significant figure printing to incapacitate said last named means with respect to all type bars to the right.

4. In an accounting machine, a plurality of type bars each having a plurality of significant figure type and a zero type separated therefrom by a blank space, means for moving said type bars to bring the several type successively into printing position, an electromagnet for selectively ar-

- resting each bar in position to print from its several type and a zero suppression circuit including contacts for each electromagnet operated by the respective type bars in the absence of significant figure printing to close the circuit to the printing magnet to stop the bars with the blank space opposite the printing line and means associated with each type bar for interrupting the circuit for all electromagnets to the right when the type bar is selected for significant figure printing.
5. In an accounting machine, a plurality of type bars, a zero suppression circuit including electrical devices tending to suppress zero printing on all of said type bars and means controlled by each of said type bars on selection of the same for significant figure printing to interrupt said zero suppression circuit with respect to all type bars to the right.
6. In an accounting machine, a type bar having a plurality of type, means for moving the bar to bring the several type successively into printing position and electrical means controlled by the type bar for preventing the movement of certain type into printing position.
7. In an accounting machine, a type bar having a plurality of type, means for moving the bar to bring the several type successively into printing position and electrical means including settable contact devices controlled by said bars for preventing the movement of certain type into printing position.
8. In an accounting machine having ordered type bars, each having numeral printing type and a zero type, means for moving the bars to differential positions in accordance with controlling devices, zero type selecting circuits and means controlled by a higher order type bar for controlling the zero type selecting circuit of lower order.
- JAMES W. BRYCE.
GEORGE F. DALY.

25	100
30	105
35	110
40	115
45	120
50	125
55	130
60	135
65	140
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75	150