

Sept. 1, 1936.

A. W. MILLS

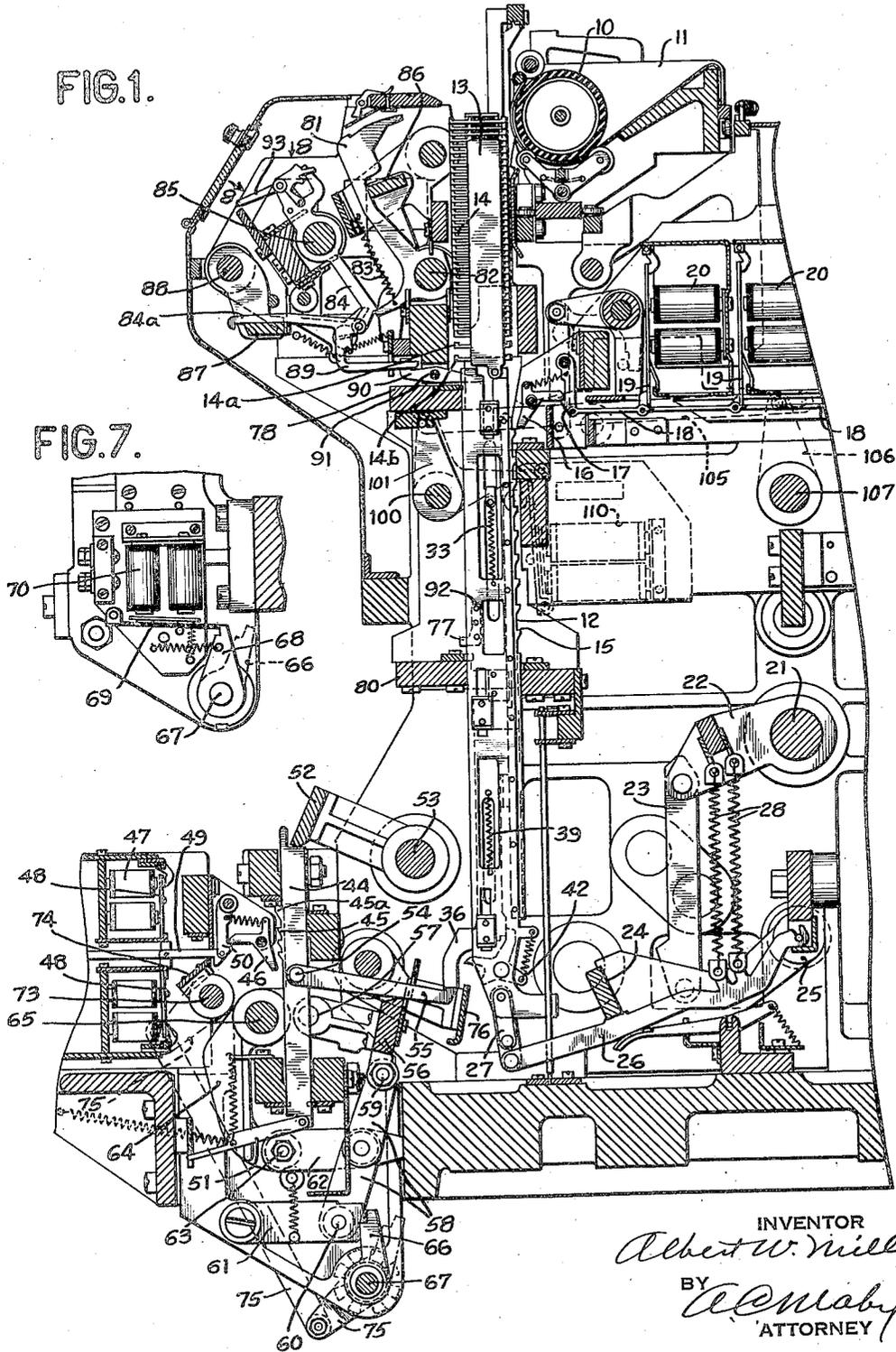
2,053,243

TABULATING MACHINE

Filed Dec. 8, 1933

3 Sheets-Sheet 1

FIG. 1.



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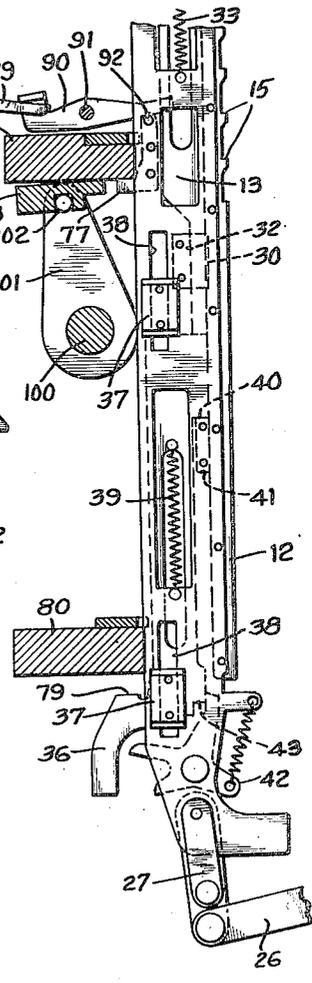
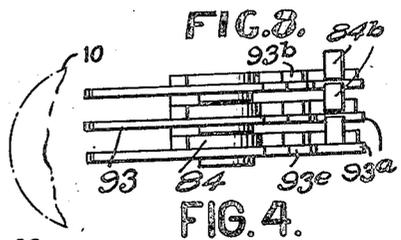
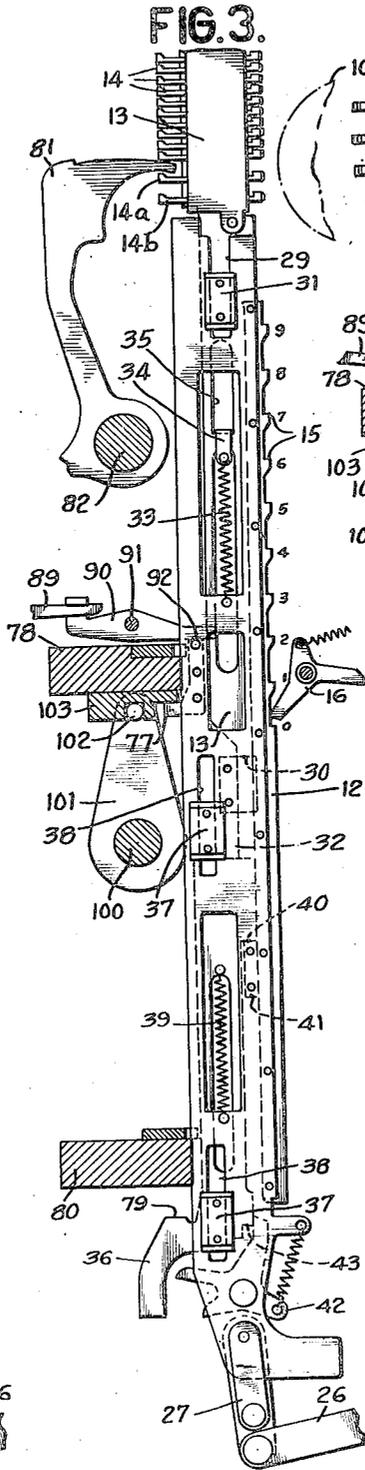
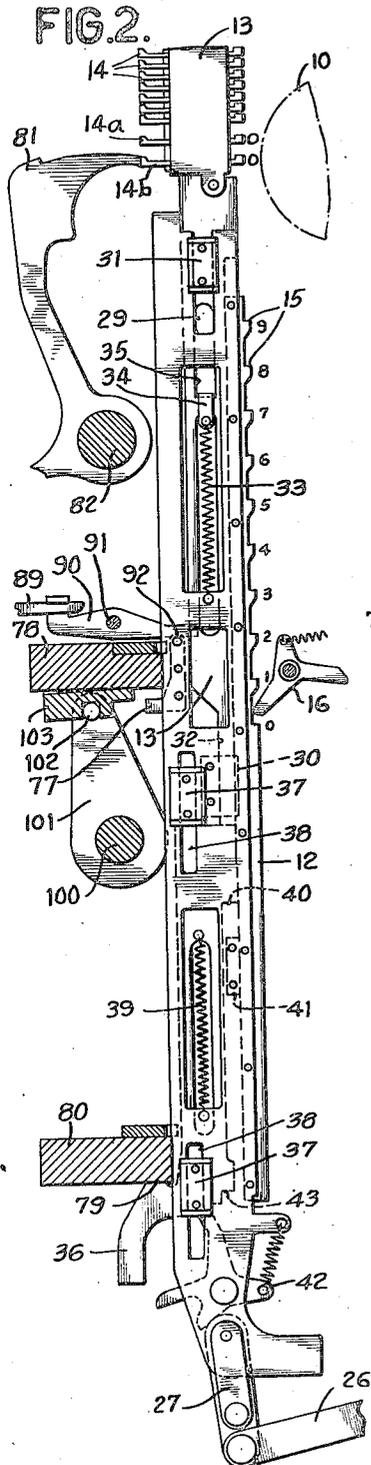
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2,053,243

TABULATING MACHINE

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3 Sheets-Sheet 2



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TABULATING MACHINE
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2,053,243

3 Sheets-Sheet 3

FIG. 5.

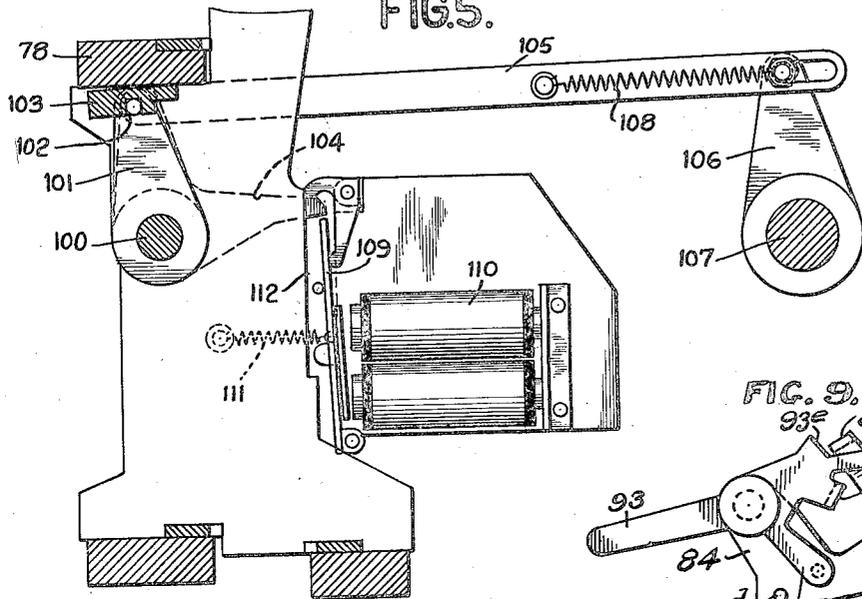


FIG. 9.

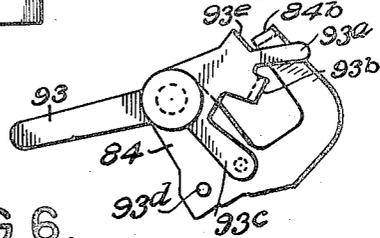
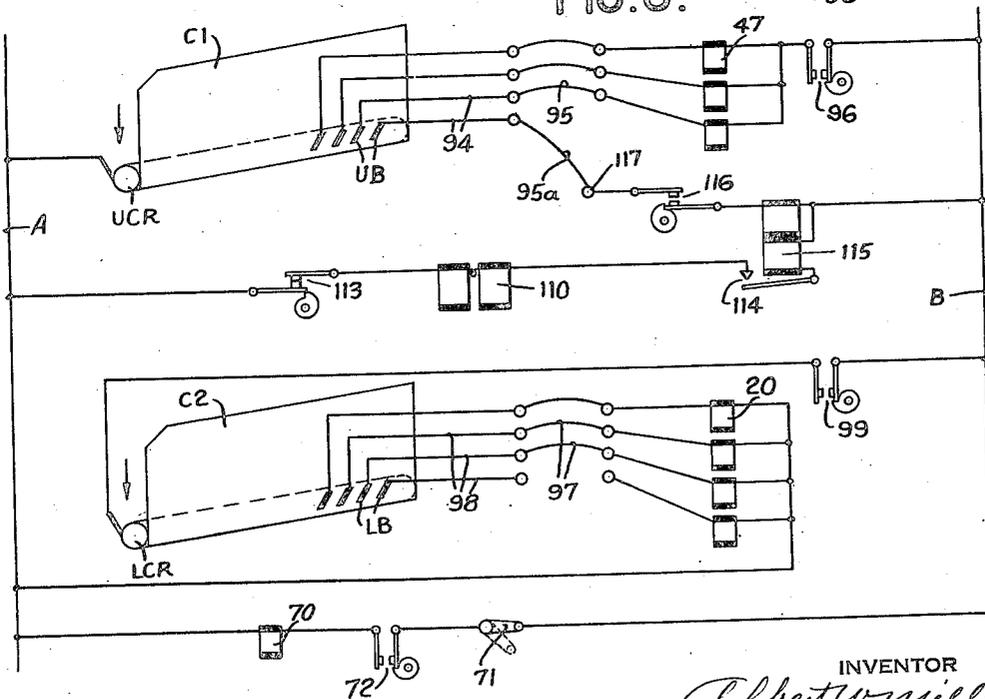


FIG. 6.



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2,053,243

TABULATING MACHINE

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Application December 8, 1933, Serial No. 701,444

19 Claims. (Cl. 101-93)

The present invention relates to record controlled machines in general and, more particularly, to printing mechanism for such machines.

The broad object of the invention is to provide an improved printing mechanism which is more flexible than former printing mechanisms.

Another object is to provide record controlled means for controlling the printing of zeros by a group of printing elements.

A further broad object is to provide means controlled by records and adapted to suppress printing operations.

A further object is to provide record controlled means for controlling the column splitting mechanism associated with a group of printing elements.

A specific object is to provide means controlled by designations in a record card for changing the effect of the column splitting mechanism temporarily for individual cards without stopping the machine or manually manipulating the column splitting mechanism.

Another specific object is to provide means controlled by the record cards for changing the effect of the column splitting mechanism.

A further specific object is to simplify and improve the printing mechanism proper.

Various other objects, features, and advantages of the present invention will be specifically pointed out in the following description and claims, or will be apparent after a study of the description, claims, and/or the accompanying drawings.

In the drawings:

Fig. 1 is a vertical section of a portion of a machine embodying the present invention.

Fig. 2 is a detail view of a type bar assembly positioned to print an alphabetical zero.

Fig. 3 is a similar view showing a type bar assembly positioned to prevent printing of a zero.

Fig. 4 is a view of the lower half of a type bar assembly positioned to print a numerical zero.

Fig. 5 is a detail view, on a larger scale than Fig. 1 showing more clearly certain parts shown in the latter view.

Fig. 6 is a circuit diagram.

Fig. 7 is a detail view showing means for controlling the operation of certain parts in Fig. 1.

Fig. 8 is a fragmentary enlarged view of the column splitting mechanism as viewed in the direction of the arrows 8-8 in Fig. 1.

Fig. 9 is an enlarged side elevation of the column splitting mechanism shown in Fig. 8.

The printing mechanism may be of any suitable form but, for convenience, may be assumed to be substantially identical with the one described in application S. N. 634,690 filed September 24, 1932 by A. W. Mills, now Patent No. 2,016,682. It includes the usual platen 10 (Fig. 1), rotatably mounted on the movable carriage 11,

and a number of vertically movable type bar assemblies including carriers 12 slidably mounted on each of which are type heads 13. The purpose of this type of construction will be explained more fully hereinafter. Each type head has type elements 14 adapted to print the numerals 1 to 9 and the letters A to Z. The type elements 14 are arranged in nine groups in the following order from top to bottom, in Fig. 1: 9, I, R, Z; 8, H, Q, Y; 7, G, P, X; 6, F, O, W; 5, E, N, V; 4, D, M, U; 3, C, L, T; 2, B, K, S; 1, A, J: Below the "J" type element are two zero type elements 14a, 14b, (Figs. 2 and 3) referred to hereinafter as the numerical zero and the alphabetical zero, respectively, which are spaced from each other and from the "J" type element by a distance equal to that between centers of three successive type elements 14. The numerical type elements 14 correspond to the usual numeral type elements of a conventional Hollerith type bar but are spaced far enough apart to make room for three alphabetical type elements between successive numeral type elements.

The numeral type elements are selected for a printing operation in identically the same manner as in conventional Hollerith tabulating machines, for instance like in Patent No. 1,822,594, under control of a perforation in one of the index-point positions 1 to 9 of a record card column. The alphabetical type elements are selected under control of combinations of perforations, each of which may comprise a perforation in one of the index-point positions "0", "11", and "12" with another in one of the remaining nine index-point positions. Thus the letter "I" of the top group is selected by the combination of a "9" perforation and a "12" perforation in one of the columns of the record card; the letter "R" by a "9" perforation and an "11" perforation; while the letter "Z" is selected by the combination of a "9" perforation and a "0" perforation. The entire code is given below, the first vertical row of each column giving the letter and the second vertical row the index-point values of the perforations;

A-1,12	J-1,11	S-2,0
B-2,12	K-2,11	T-3,0
C-3,12	L-3,11	U-4,0
D-4,12	M-4,11	V-5,0
E-5,12	N-5,11	W-6,0
F-6,12	O-6,11	X-7,0
G-7,12	P-7,11	Y-8,0
H-8,12	Q-8,11	Z-9,0
I-9,12	R-9,11	

The selection of the alphabet type elements 14 is effected by arresting each carrier 12 in the appropriate position corresponding to the value of a perforation in index point positions "1" to "9" of the record card and by further movement of

the type head 13 relative to its carrier one, two, or three steps according to whether the other perforation of the combination necessary for a selection is in the "12", "11", or "0" positions, respectively. This selecting operation will be explained more fully hereinafter.

As a matter of convenience the four positions of the type elements in each group will be termed zones 1, 2, 3, and 4, the numeral types being in zone 1; the letters A to I, being in zone 2; letters J to R in zone 3; and letters S to Z in zone 4. The "0", "11", and "12" perforations, which control the selection of the alphabetical type elements, will be termed zone perforations. The mechanism which effects relative movement between each carrier 12 and its type head 13, for convenience, may be termed the zoning mechanism.

Each carrier 12 is provided with a series of stops 15, which, as seen in Figs. 2 and 3, are labelled 0 to 9, which represent the corresponding index-point positions on the record card. As the carrier 12 is moved upwardly, the stops 15 move in succession past a stopping pawl 16. The latter is held in the position of Fig. 1 by a latch 17 which has connection 18 with armature 19 of the usual print magnet 20.

When a type carrier is used to print numerals only, it will, of course, be controlled by a single perforation in one of the index-point positions "0" to "9", inclusive. In such case each type head 13 and its carrier 12 is maintained in the relationship shown in Figs. 1 and 3, and as the card is passing the lower brushes, a circuit completed through the perforation in the card will energize the magnet in a well known manner and will effect the release of pawl 16, causing it to engage the stop 15 corresponding in value to the location of the single perforation in the record card. This operation results in bringing the corresponding numeral type element in the type head 13 to the printing point.

The carriers 12 are moved upwardly by a cam operated shaft 21 which carries arms 22 having depending link connection 23 with a bail 24 pivoted at 25. Also pivoted at 25 are actuating arms 26 which are connected at their free ends to the lower extremity of carriers 12 through link connections 27. Arms 26 are urged in a clockwise direction by springs 28 which are connected at their upper ends to a cross bar secured to arms 22. Thus, as the arms 22 and bail 24 are rocked in a clockwise direction by shaft 21, the springs 28 will rock the arms 26 in the same direction and will cause elevation of the carriers 12.

The manner in which the type bar assemblies comprising carriers 12 and heads 13 are constructed to permit relative movement will now be explained, after which the zoning mechanism whereby such relative movement is effected will be set forth briefly.

The carrier 12 is shown in Figs. 2 and 3 as being provided with a slot 29 and a guide 30 which are adapted to receive slotted block 31 and lower end 32 respectively of the type head 13, the block 31 sliding within the slot 29, and the lower end 32 sliding in the guide 30. A spring 33, whose lower end is anchored to the carrier 12, is provided at its upper end with a hooked member or clip 34 which engages the lower edge of an opening 35 in the shank of the type head 13, the spring 33 tending to resiliently hold the head 13 in cooperation with the carrier 12.

Mounted upon the lower portion of each carrier 12 is a slide 36 provided with grooved blocks 37

which cooperate with suitable slots 38 in the carrier 12. A spring 39, anchored at its lower end to the carrier 12 and at its upper end to the slide 36, tends to move the slide downwardly to bring a shoulder 40 in the slide into engagement with a block 41 riveted to the carrier 12 as in Figs. 1, 3, and 4. With the parts assembled as in Fig. 3, spring 39 draws the slide 36 downwardly to cause the shoulder 40 to engage the block 41 on the carrier 12 and spring 33 urges the type head 13 downwardly so that the lower end 32 thereof engages the slide 36.

It is plain that, if the slide 36 is moved upwardly, relative to carrier 12, the head 13 will move likewise.

A spring-pressed latch 42, pivoted at the lower end of the carrier 12, is adapted to cooperate with three stop shoulders 43 formed in the slide 36. It is obvious that when the slide is moved upwardly one or more steps with respect to the carrier, the latch 42 will cooperate with one of the steps 43 to hold the parts in their displaced relationship. The manner in which such displacement is automatically effected under control of the zone perforations in the card will now be explained.

Associated with each alphabetical type bar assembly is a vertically slidable comb 44 (Fig. 1) which is adapted to be moved downwardly and then upwardly during each cycle of the machine. Each comb has a series of three stops or lugs 45 which, on the upward movement of the comb pass a stopping pawl 46 in synchronism with the passage of the zoning perforations "0", "11", and "12" past the upper brushes of the machine. Each pawl 46 is controlled by a zone magnet 47, the energization of which operates its armature 48 to draw a link 49 to the left (Fig. 1) to release a latch 50 thus freeing the associated pawl 46 and allowing the latter to be moved by its spring into engagement with one of the stops 45. By this action further upward movement of the comb 44 is prevented for the time being. The combs 44 are moved upwardly by means of a spring operated arm 51 and moved downwardly by a bail 52 secured to a shaft 53.

The bail engages the upper ends of the combs and moves the latter downwardly whenever the shaft 53 is rocked at the proper time by a suitable cam (not shown).

At the extremity of the downward stroke of each comb 44, a cam lug 45a thereon is adapted to engage pawl 46 to cause the latter to be relatched by latch 50. Comb 44 has pivoted thereto at 54 an arm 55 whose free end lies in the path of movement of the associated slider 36 and whose lower edge rests upon a bail 56 which is pivoted at 57. Under control of the zone perforations "0", "11", and "12", the pivot point 54 of arm 55 may take one of three positions below that of Fig. 1. In this figure, the parts are shown with the comb 44 in the position it assumes when no zone holes are present in the card, that is, when numerals only are to be printed.

When the carrier 12 is in its lowermost position the bail 56 is rocked to the position of Fig. 1 to move the arm 55 in a similar direction into engagement with the lower extremity of slide 36 as shown. It will be apparent that the distance which the free end of arm 55 is moved upwardly under control of the bail 56 depends upon the location of pivot point 54 at such time. Thus, if the point 54 is located as shown in Fig. 1, the free end of arm 55 will be moved upwardly to the position shown in Fig. 1 where it barely touches slide 36. A zone perforation in the "0" index-

point position will result in the movement of the free end of arm 55 three steps upwardly from the position of Fig. 1; a perforation in the "11" position will cause it to move two steps; while a perforation in the "12" position will cause it to move only one step above the position of Fig. 1. These steps of movement are, of course, transmitted to the slide 36 and it, in turn, will be moved upwardly one, two, or three steps in accordance with the setting of the related comb 44, the latch 42 carried by the carrier 12 serving to hold the slide in its displaced position with respect to the carrier.

Bail 56 is actuated through the medium of a toggle mechanism comprising links 58, one of which is pivoted to the bail at 59, and the other is pivoted at 60 to an arm 61. The point of connection of the links 58 carries an arm 62 which is also pivoted at 63 to an arm 64 secured upon a cross shaft 65. The shaft 65 is rocked in a counterclockwise direction to the position of Fig. 1, once each card cycle by a suitable cam (not shown) thus tending to straighten the toggle comprising links 58.

Referring to Figs. 1 and 7, an arm 66 carried by a rod 67 is adapted to be rocked from the broken line positions of Figs. 1 and 7 to the solid line position of Fig. 1 prior to the straightening of the toggle links 58. When shaft 65 is rocked in a counterclockwise direction under control of its cam, the right end of arm 61 will be engaged by arm 66 so that the pivot 60 of the toggle will be restrained against downward movement and subsequent straightening of the toggle will cause the bail 56 to rock in a counterclockwise direction (Fig. 1).

Turning to Fig. 7 it will be noted that rod 67 carries an arm 68 whose upper end is adapted to be engaged by the free end of an armature latch 69 operated by a magnet 70. Energization of this magnet will permit arm 68 to rock in a counterclockwise direction under the influence of a spring and thereby rotate the rod 67 and the arm 66 to the solid line position of Fig. 1. The magnet 70 is in series with a switch 71 (Fig. 6) and cam contacts 72 which close once at the proper time in each card cycle to energize magnet 70.

When the machine is used for printing numerals only, the zoning mechanism may be partially disabled to lighten the operating load on the machine by opening the switch 71 so that the magnet 70 remains deenergized and the arm 66 remains in the position shown by broken lines in Figs. 1 and 7 and straightening of the toggle through the action of the controlling cam will merely cause the pivot 60 to move downwardly, arm 61 rocking about a pivot to permit such action, but the pivot point 59 will remain undisturbed.

The shaft 53 has arm and link connections (not shown) with a shaft 73 to which is secured a bail 74. Through this connection rocking of shaft 53 to restore the combs 44 will be accompanied by clockwise rotation of bail 74 to restore latches 50 and armatures 48 as described in the Mills application. The shaft 73 also has an arm and link connection 75 with rod 67 so that clockwise rotation of shaft 73 will cause similar movement of rod 67 to re-latch arm 68 by the free end of armature latch 69.

As each carrier 12 descends from printing position with its slide 36 held in displaced position by latch 42, it is necessary to restore the slide 36 to its lowermost position before a new zone selection operation. To this end a cam operated bail 76 is provided which is moved upwardly from

the position shown in Fig. 1 before the carriers 12 reach their lowest positions, and when so moved the bail 76 is in a position to strike an extension of latch 42 as the carrier moves downwardly. This effects release of the slide 36, which, under the influence of its spring 39, will then resume its normal position. Following this action the bail 76 is lowered and each slide 36 is in readiness to receive a new setting under control of related arm 55.

It will be understood from the foregoing description that, in the case where a perforation occurs in one of the "1" to "9" index-point positions only, the mechanism controlled by the zone magnets 47 will not be effective to shift slide 36 relative to carrier 12 and the type assembly will be arrested differentially purely by the operation of print magnet 20, as in former Hollerith tabulating machines. On the other hand, if a zone perforation also appears in the "0", "11", or "12" positions, the magnet 47 will be effective in conjunction with magnet 20 to control the zoning mechanism as described to cause selection of one of the three alphabet types separating numeral types. If no perforation appears in a given column, the associated carrier 12 will move to its upper limit of travel where a stop 77 secured to carrier 12 strikes a fixed cross bar 78 as in Fig. 4. In this position the numerical zero type element 14a will be at the printing point.

When a zero hole appears alone in any column and the magnet 70 is rendered active by closure of switch 71, the zoning mechanism will be operative to shift the slide 36 three steps as in Fig. 2 and the type head will be stopped in the position of Fig. 2 by coaction of a shoulder 79, formed in slide 36, with a fixed cross bar 80. In this case the alphabet zero type element 14b will be in position to print. In case switch 71 is open and a zero perforation is present in one of the card columns, the zoning mechanism will be ineffective and the associated carrier 12 will be arrested by stop 77 with the numerical zero type element 14a in position to print as described above. Whether or not a zero is actually printed will depend upon the operation of the type hammers and the operation of certain novel mechanisms comprising the present invention both of which will be described hereinafter.

The printing hammers are designated 81 in the drawings and are controlled in substantially the same manner as those in Patent No. 2,042,324, issued May 26, 1936, to John Royden Peirce. Such differences as may exist will be described in detail hereinafter.

The type hammers 81 (Fig. 1) are loosely pivoted on a cross rod 82 and are operated by springs 83. Normally hammer latches 84, pivoted on a cross shaft 85, prevent the springs from forcing the hammers into contact with the heads of type elements 14, 14a or 14b. The hammers are re-latched after each operation by means of a cam operated bail 86 mounted on shaft 82. Pivoted to each latch 84 is a spring operated hook member 84a normally in position to be engaged by a bail 87 secured to a shaft 88. The latter is operated by a cam (not shown) which functions once each card cycle to draw any members 84a which may be in the position of Fig. 1 to the left and operate the latches 84 to release the related hammers 81 for actuation by their springs to strike the type elements at the printing point. Each member 84a has a rightwardly extending tail 89 underlying an offset lug in the left hand end of a lever 90 pivoted at 91 (see Figs. 2, 3, and 4 also).

The right-hand end of each lever 90 extends into the path of a pin 92 (Figs. 2, 3, and 4) secured to the side of stop 77 of the related carrier 12. The pin 92 is so placed that movement of the carrier 12 to the position of Fig. 4 (which, it will be recalled is the position taken by the carrier when no hole is present in a card column, or a zero hole appears and magnet 70 is inactive), will cause the lever 90 to be rocked counterclockwise to cause disengagement of the related hook member 84a from bar 87. This operation obviously prevents release of the printing hammer corresponding to the carrier 12 which has moved to the position of Fig. 4.

The column splitting mechanism is substantially identical with the one described in the Peirce application mentioned above. A hammer coupling member 93 (see Figs. 1, 8, and 9) is pivoted to the upper end of each latch 84. The members 93 have narrow tongues 93a which are adapted to underlie bent-over lugs 84b formed in the adjacent latch 84 which lugs act as stops to limit counterclockwise movement of members 93. A bent-over lug 93b formed in each member 93 permits only limited clockwise movement of each member 93 by contact with the edge of the latch 84 to which said member is pivoted. A short arm 93c, formed in each member 93 has a rivet or boss adapted to engage holes 93d in latch 84 to retain members 93 in the operative position of Fig. 9 or the alternative inoperative position in which lug 93b engages latch 84. Each member 93 also has an abutment 93e adapted to engage the lug 84b of the next adjacent latch 84 to the one on which such member is pivoted.

Referring to Fig. 8 it will be assumed that the three coupling members 93 shown correspond to the units, tens, and hundreds denominational orders, ranging from bottom to top, respectively, of a bank assigned to printing data and that all are in the position of Fig. 9. If the hundreds type bar now moves to print a "4", for example, its latch 84 will be rocked clockwise (Fig. 9) as described above to release the hammer for the hundreds type bar as described above. The abutment 93e of the hundreds coupling hammer will, by engagement with the lug 84b of the tens latch 84, rock the latter clockwise also. The latch 84 of the units type bar will also be operated by the tens latch 84 due to the abutment 93e of the coupling member 93 of the tens latch engaging the lug 84b of the units latch and rocking the units latch 84 clockwise with reference to Figs. 1 and 9. Thus, if neither the units nor tens type bars are arrested in one of the numerical positions 1 to 9 or A to Z, inclusive, the three type bars corresponding to the three coupling members 93 shown in Fig. 8 will print "400".

Now, if the upper member 93 (Fig. 8) associated with the hundreds type bar is moved clockwise (Fig. 9) until its lug 93b stops further movement of said member, the abutment 93e of this member will move to a position below the lug 84b of the tens latch 84. As a result, the moving of the hundreds type bar to the "4" position, as before, will cause an idle movement of the coupling member of the hundreds latch 84 and neither the tens nor units latches 84 will be operated and only the numeral "4" will be printed.

It will be seen that the coupling members 93 may be selectively set to inactive position to split the solid bank of type bars into arbitrary groups and under these conditions any type bar assuming a position other than zero will, through members 93, cause zeroes to be automatically printed

to the right of the operated type bar up to the point where a coupling member is set to inactive position.

The zoning perforations in the "0", "11", and "12", index-point positions of a record card are sensed by the upper brushes UB (Fig. 6) during the cycle preceding the one wherein sensing of the perforations in the "1" to "9" position is effected by the lower brushes LB as in the Mills application mentioned above.

A typical circuit established by the zone perforations is traced as follows referring to Fig. 6: Left-hand line wire A, upper contact roll UCR, and an upper brush UB, through a "0", "11", or "12" perforation in card C1, a wire 94, a plug wire 95, a magnet 47, and cam contacts 96, to right-hand line wire B. A typical circuit established by a perforation in the "1" to "9" positions is traced as follows: Line wire A, a magnet 20, a plug wire 97, a wire 98, a lower brush LB and lower contact roll LCR through a hole in card C2, and cam contacts 99, to line wire B. As described before herein, a circuit is also established through magnet 70 when switch 71 is closed, as would be the case when alphabetical printing is being done.

Tabulating machines embodying the alphabetical printing mechanism herein described usually are built with two large printing banks, one adapted for alphabetical work, and the other adapted for simple numerical work wherein the type bars are provided with numerical type elements only. The alphabetical printing bank is used primarily to print descriptions of goods on invoices, and mixed numeral and alphabetical data such as grades, qualities, colors, or abbreviations of units like pounds, ounces, quarts, etc. In order to attain maximum flexibility, and capacity, the machine is constructed to print numerical data such as amounts and totals from both the alphabetical and numerical printing banks. Such a machine is described in the Mills application.

It frequently is desired, for instance, to use the alphabetical printing bank to print data such as the heading of an invoice in alphabetical characters immediately above numerical data in much the same fashion as in the following example:

FIRESTONE RUBBER CO

200 SMITH STREET

CLEVELAND OHIO

98500 605000

100750 50000

15000 1090550

2875000 39005000

This operation can not be performed on prior machines except by very roundabout methods involving a great many manual operations and much skilled supervision of the machine. This is due to the fact that, to print the numerical data properly, the coupling members 93 must be set, some to operative and some to inoperative position, to split the printing bank into at least two sections in order to prevent printing of zeros between sections, and at the same time permit automatic printing of zeros to the right of any operated type bar within each section; whereas, in order to print the alphabetical data correctly, all the coupling members 93 in the columns devoted to the name and address must be set to inoperative position in order to prevent printing zeros in the blank spaces separating the parts of a name. It should be remarked here, that the cards are

perforated in such fashion that blank, unperforated columns separate the parts of the name and address. In the case of the above example, it would be necessary to set all the members 93 to inoperative position in order to prevent printing of zeros between the parts of a name, whereas all but the members 93 of the next column to the right of the units column in both sections would have to be set to operative position in order to print zeros in the amounts. As an illustration, if the coupling members 93 were set to split the alphabetical printing bank into two groups and permit automatic printing of zeros as well, the name and address would appear as follows:

15 **FIRESTONE RUBBERCO**
 2000SMITHOSTREET
 CLEVELAND0OHIO.

Obviously the above is both inaccurate and confusing by reason of the unwanted zeros between the words and numerals.

The present invention provides a very simple and effective zero suppression device which enables a result like that illustrated by the above example to be secured without material change in construction of the machine and avoids the use of complicated mechanisms. Rotatably mounted beneath bar 78 is a shaft 100 having secured thereto upwardly extending arms 101 each carrying a pin 102 (Fig. 5) extending into a groove in a stop bar 103 common to all the alphabetical type assemblies, the bar 103 being actually supported by said pins. The bar is prevented from becoming detached from the pins by virtue of the fact that said bar is very close to the bar 78 and also bears lightly against both of the arms 101.

Secured to shaft 100 is a bellcrank 104 to one arm of which is pivoted a link 105 having a pin and slot connection to an arm 106 secured to a shaft 107, a spring 108 normally holding the pin on arm 106 at the left end of the slot. The other arm of the bellcrank 104 extends horizontally over the free end of a latch 109 to which is secured an armature operable by a magnet 110. A spring 111 normally holds the latch 109 against a pin 112 with the end of the latch underneath the end of arm 104. The latter, however, does not quite touch the end of the latch in order to avoid binding the latch when magnet 110 is energized.

The shaft 107 may be rocked clockwise once during each cycle by any suitable means, such as a cam. If the magnet 110 is deenergized at this time, the end of bellcrank 104 will merely strike the end of latch 109 and the shaft 100 will rock only a negligible amount. The spring 108 will, of course, be stretched and prevent jamming of the parts as would occur if the pin and slot connection were not provided.

In the example given above, it may be assumed that the group of cards concerned in the printing of the data as shown comprises three alphabet cards perforated to represent the name, street address, and city and State, respectively, each of which cards also is provided with a special "12" perforation in some convenient column, not devoted to alphabetical data.

The numerical data may be assumed to be recorded on four cards, none of which have a "12" perforation in the column corresponding to the one in which the "12" perforation appears in the alphabetically perforated cards. The seven cards comprising the group will also have a code number, account number, or serial number perforated therein to enable the cards to be first brought

together as a group by well known sorting machine methods. The cards will be fed past the brushes UB in the order in which the data appears from top to bottom in the example given. It will be assumed also, that the members 93 of all type bar assemblies, except the ones corresponding to the columns immediately to the right of the units column of both sections of the type bank, have been set to the operative position of Fig. 1 so that zeros can be printed automatically in all columns to the right of any operated type bar assembly in either section except in the single column to the left of the units column in both sections.

The magnet 110 is in a series circuit including cam contacts 113 (Fig. 6), contacts 114, and one coil of a double coil relay 115 operating contacts 114, and extending between line wires A and B. The other coil of the relay 115 and a pair of cam contacts 116 are connected in series between a plug socket 117 and line wire B. The cam contacts 113 open momentarily at the "11" position while cam contacts 116 close momentarily at the "12" position in each cycle. The plug socket 117 may be connected by plug wire 95a to the plug socket associated with the upper brush UB sensing the column in which the special "12" hole appears in the three alphabet cards.

When the first card representing the name "Firestone Rubber Co." is sensed by the upper brushes UB (Fig. 6), the zoning perforations in the "0", "11", and "12" positions of the columns containing alphabet data will establish circuits through magnets 47 to control the zoning mechanism as described, in preparation for the printing of the alphabetical data during the next cycle under further control by print magnets 20.

The magnet 70 will also be energized during this first cycle to permit the zone mechanism to be effective. The special "12" perforation in the first card will establish a circuit at the "12" point in the cycle and is traced as follows: line wire A, contact roll UCR and an upper brush UB through the "12" perforation in card C1, wire 94, plug wire 95a, socket 117, cam contacts 116, (closed at the "12" point only), and a coil of relay 115 to line wire B. Contacts 114 close and a holding circuit is then established as follows: line wire A, cam contacts 113 (closed except at the "11" point in the cycle) magnet 110, contacts 114, and the other coil of relay 115, to line wire B.

Energization of magnet 110, as has been explained, unlatches bellcrank 104 and permits the rocking of shaft 107 at the proper time to draw link 105 to the right, rocking shaft 100 and arms 101 clockwise, thus bringing the left edge of the stop bar 103 into the path of the stops 77 on the carriers 12 as in Fig. 3. When no perforation appears in any column devoted to alphabet data designations, the carriers 12 and type heads 13 tend to move to the position of Fig. 4 where the numerical zero type elements 14a will be in position to print in case any of the coupling members 93 of adjacent type bars are effective to cause printing of a zero to the right of a significant figure.

The right-hand edge of bar 103 (Fig. 3) is made thick enough to stop, in the position of this figure, all alphabetical type assemblies corresponding to columns having no perforation, this result being secured by virtue of stops 77 striking stop bar 103. In this position of the type bar assemblies, the blank space between the "J" type 14 and the numerical zero type 14a will be at the printing point and release of the hammers 81 by any of

the operative coupling members 93 will have no effect. Thus, zeros will not be printed to the left of type bars printing alphabetical data unless the proper column in the card has a "0" perforation.

It is obvious that in the latter case, the zoning mechanism will be effective to shift the slide 36 to the position of Fig. 2 to bring the alphabetical zero type element 14b to the printing line, the shoulder 79 then arresting the slide 36 and type head 13 regardless of the position of the bar 103. It is obvious from Fig. 2, of course, that the bar 103 if moved to the left as, it would be in this case, will have the same effect as bar 80.

It is quite plain that, when stop bar 103 is operated under control of the first card, as described, only such data will be printed under control of the first card as may be actually represented by perforations in the card and nothing will be printed which does not appear on the card.

In the case of the second two cards, the machine will function as described above to print only the perforated data, the coupling members 93 having no effect. Since the last four cards of the illustrative example have no special "12" perforation, the magnet 110 will not be energized and the stop bar 103 will be inactive. Thus for these four cards the coupling members 93 will be fully effective to cause zeros to be printed where indicated in the illustrative example.

It is evident that zeros will be printed automatically under mechanical control by the coupling members 93 when the magnet 110 is not operative, as when the relay 115 is not energized by a special "12" perforation or is not plugged to an upper brush UB, whereas the zeros will be printed only under electrical control by perforations in the card when relay 115 and magnet 110 are operative.

The mechanism described above is particularly advantageous in printing on very narrow record sheets or strips, such as small size invoices or bills where both the heading in alphabetical characters and numerical data such as items representing purchases or sales must necessarily be printed by the alphabetical printing bank. The same is true when the numerical data to be printed from the card exceeds the capacity of the numerical printing bank and in part, at least, must be printed by the alphabetical printing bank.

The invention is not limited to use with an alphabetical printing bank but also may be used with a simple numerical printing bank where at times it may be desired to print only under control of perforations in the card and automatic mechanical control of printing of zeros is not wanted, that is, zeros are to be printed only when zero perforations actually appear in the card.

As an illustration of its adaptability, the invention is not limited merely to suppressing automatic printing of zeros but can, by a relocation of the stop bar 103 and operation thereof at the proper time, be used to completely suppress printing under control of a designation in any record. For example, by locating the stop bar 103 slightly above and to the left of all the stops 77 when the latter are in the position of Fig. 1, the energization of magnet 110 immediately prior to the beginning of the cycle in which the data designations are read by the lower brushes LB will result in the operation of stop bar 103 to prevent movement of the type bars from the position of Fig. 1. This feature of the invention permits it to be used in machines where it may be desired to suppress printing of certain data without sup-

pressing the accumulation of the same data in the usual way.

It will be apparent to those skilled in the art of constructing record controlled machines that the invention described herein has other uses than those described and, furthermore, is not limited either to the specific embodiment or to the type of printing mechanism described herein, which are purely illustrative, but may be changed in details or embodied in other types of printing mechanism.

What is claimed is:

1. A record controlled machine comprising recording mechanism including a plurality of recording devices, means for splitting the recording devices into groups, and means controlled by predetermined records of a successively presented group of records for changing the effect of the splitting means.

2. A record controlled machine comprising recording mechanism including a plurality of recording devices, column splitting means associated with said recording devices, and record controlled means for limiting the scope of the column splitting means.

3. A record controlled machine comprising printing mechanism including a bank of type-bars, a plurality of hammers associated with said type-bars, selectively operable means for coupling said hammers to automatically print zeros from selected type-bars and not from others, and means controlled by a record for nullifying the effect of all active coupling means.

4. A record controlled machine comprising printing mechanism, devices for taking impressions from the printing mechanism, a plurality of selectively operable devices associated with said impression taking means adapted when active to couple adjacent impression taking devices together to effect automatic printing of zeros and when inactive to split the printing mechanism into sections, and means controlled by the controlling records for nullifying the effect of the active selectively operable devices.

5. A record controlled machine comprising reciprocable type-bars movable to a zero printing position and to a position to print a character other than zero; a series of printing hammers one for each type-bar; a series of coupling devices, each associated with a printing hammer, said devices adapted to be set to active positions to couple together the printing hammers of type-bars which have been moved to a position to print a character other than zero and the printing hammers of adjacent type-bars which have been moved to a position to print zero; means for positioning the type-bars in accordance with data designations in controlling records whereby to print characters other than zero; and means controlled by a predetermined designation in one of said records for arresting in a non-printing position those type-bars which would ordinarily print a zero under control of the coupling devices.

6. A record controlled machine comprising a plurality of vertically movable type-bars each having a zero type element and numeral and alphabetical type elements; means controlled by perforated records for moving the type-bars to positions to print characters in accordance with data designations in the perforated records, said means, when no data designation appears in any column, tending to move the associated type-bar to a zero printing position; a plurality of hammers, one for each type-bar; means for operating

said hammers to take impressions from the type-bars, coupling devices adapted to connect adjacent hammers together so that operation of one hammer is accompanied by operation of the other; means controlled by each type-bar, when displaced by the moving means, for releasing the associated hammer for operation by its operating means; a normally ineffective stop-bar movable from an inactive to an active position; stops on the type-bars adapted to cooperate with said stop-bar when the latter is moved to active position whereby to arrest type-bars which would normally move to zero printing position in a position intermediate zero position and an adjacent character printing position; and means controlled by a designation in one of said records for moving the stop-bar to active position.

7. A zero suppression device for record controlled machines wherein a group of type-bars have stops which normally arrest the type-bars in a zero printing position when no perforations appear in the corresponding columns of the controlling records comprising a normally inactive stop-bar common to all the type-bars and adapted when operated to be moved to an active position in the path of the stops which normally arrest the type-bars in zero printing position, said stop-bar being adapted by coaction with the stops to arrest the type-bars in a non-printing position; means tending to operate the stop-bar once for each record, means for preventing the moving means from operating the stop bar, and means controlled by a designation in a record for disabling the preventing means.

8. A zero suppression device for printing mechanism wherein a series of type-bars are normally moved to a zero position unless selectively stopped at some other position, comprising a stop member common to all the type-bars, said stop-member being operable to arrest in a non-printing position all type-bars not selectively stopped in a printing position whereby to suppress printing of zeros, and means for selectively operating the stop-bar.

9. A zero suppression device for type elements which normally move to a zero position unless selectively moved to a position to print a character other than zero, comprising means for arresting the type elements in a non-printing position, a latch for preventing the arresting means from moving to effective position, means normally tending to operate the arresting means, a magnet for releasing the latch to permit the last named means to operate the arresting means, and a circuit for selectively controlling the magnet.

10. A zero suppression device for printing elements which normally move to a zero printing position unless selectively set to a position to print a character other than zero, comprising means movable to prevent the printing elements from moving to a printing position, means for restraining the preventing means for moving to effective position, a magnet for releasing the restraining means, and a circuit for controlling the operation of the magnet.

11. A zero suppression device for record controlled machines wherein printing elements normally are moved to a printing position once during each cycle of the machine, comprising means operable to prevent movement of the type elements to a printing position, means normally preventing the first-named means from being effective, and means controlled by a designation in one of the controlling records for disabling the last-named preventing means whereby to enable

the first-named preventing means to be effective.

12. A record controlled machine comprising a plurality of printing elements normally movable to a printing position, means operable to prevent said elements from moving to a printing position, and means controlled by a designation in one of the controlling records for disabling the preventing means.

13. A record controlled machine comprising a plurality of recording devices, means for operating the recording devices to record data under control of the controlling records, means movable to a position to prevent effective operation of the recording devices by the operating means, means connected to the operating means and normally tending to move the preventing means to said position, and locking means controlled by a special designation in one of the records for holding the preventing means against movement by the moving means.

14. A record controlled printing machine comprising a plurality of type bars each adapted to print both alphabet data and numerical data in columnar form, means controlled by records having either alphabet data or numerical data for operating the type bars in accordance with such data, automatic cipher printing mechanism operable to cause ciphers to be printed to the right of each operated type bar, and means controlled by records having alphabet data for nullifying the effect of the cipher printing mechanism.

15. A record controlled machine comprising printing mechanism adapted to print both alphabet data and numerical data in the same columns of a work sheet; automatic cipher printing mechanism adapted to normally control the printing mechanism to cause a cipher to be automatically printed in any column to the right of a column containing numerical or alphabet data when the first named column would otherwise be left blank, including selectively settable coupling devices between the respective columns; and means controlled by records having alphabet data for preventing the set coupling devices from having their normal effect with respect to the columns in which ciphers would ordinarily be automatically printed in response to control by the coupling devices.

16. A record controlled printing machine comprising a bank of type bars, each type bar being adapted to print both alphabet data and numerical data; means for positioning the type bars to print under control of either alphabet data or numerical data designations in columns of the controlling records corresponding to such type bars including printing hammers, one for each type bar; automatic cipher printing control elements adapted, when selectively set to effective positions, to couple adjacent printing hammers for automatically controlling the printing of ciphers by type bars corresponding to columns of the records in which no data designations appear; a stop bar adapted when moved to operative position, to position the type bars in a non-printing position whereby to nullify the effect of the printing hammers controlled by the coupling elements; and means controlled by a designation in an alphabet record for moving the stop bar to operative position.

17. In a printing machine of the class described, printing mechanism and manually settable automatic cipher printing mechanism therefor, means for nullifying the effect of the cipher printing mechanism irrespective of the setting thereof, and means controlled by a designation in one of

the controlling records for operating the nullifying means.

18. In a printing mechanism, the combination of a plurality of printing elements differentially 5 settable to print both numerical and alphabetical data; automatic cipher printing control means connecting said printing elements and normally tending, when the printing elements are differentially set to print numerical or alphabet data, to 10 cause adjacent printing elements to automatically print zeros adjacent such numerical or alphabet data; and a device common to said printing ele-

ments for temporarily nullifying the effect of the cipher printing control means on the printing elements.

19. In a record controlled machine, printing mechanism, means to control the printing mechanism to cause ciphers to be printed automatically, 5 means to prevent the printing mechanism from printing ciphers automatically under control of the cipher printing mechanism, and means controlled by the records for controlling the operation of the preventing means. 10

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