March 26, 1940. M. G. DE SIMONE 2,195,080

ELECTROMECHANICAL MECHANISM FOR ACTUATING CALCULATING MACHINES AND RECORDING THE RESULTS THEREFROM

Filed April 18, 1934 4 Sheets-Sheet 1

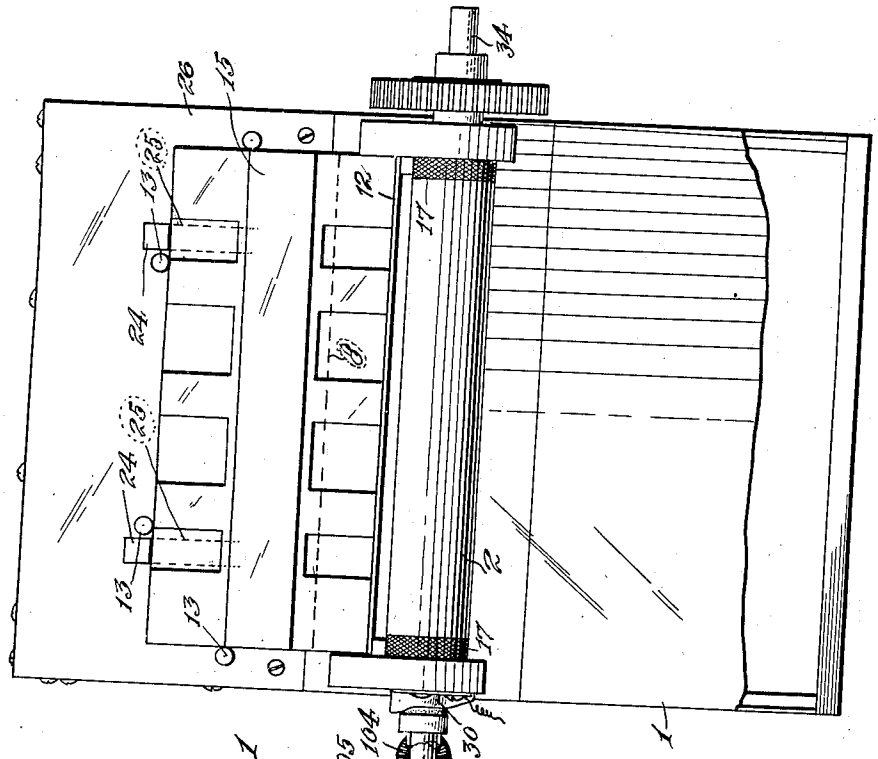


Fig. 1

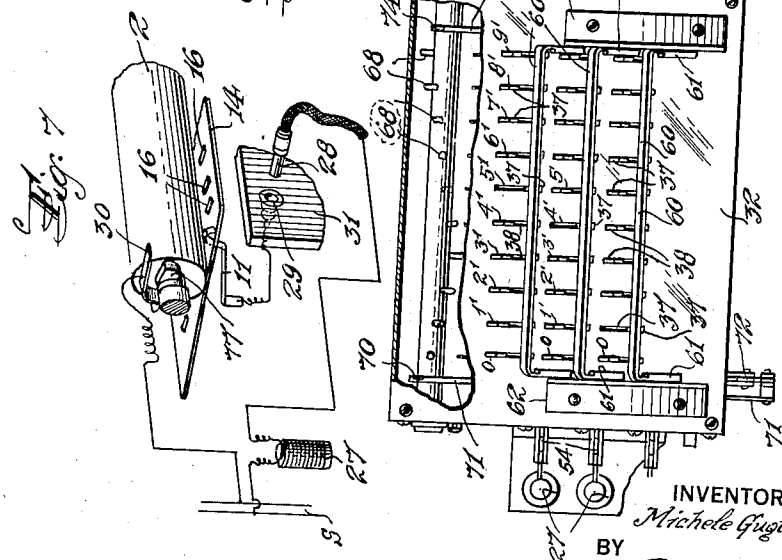


Fig. 2

INVENTOR
Michele Guglielmo De Simone
BY
A. D. T. Libby
ATTORNEY

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Filed April 18, 1934 4 Sheets-Sheet 2

Fig. 2

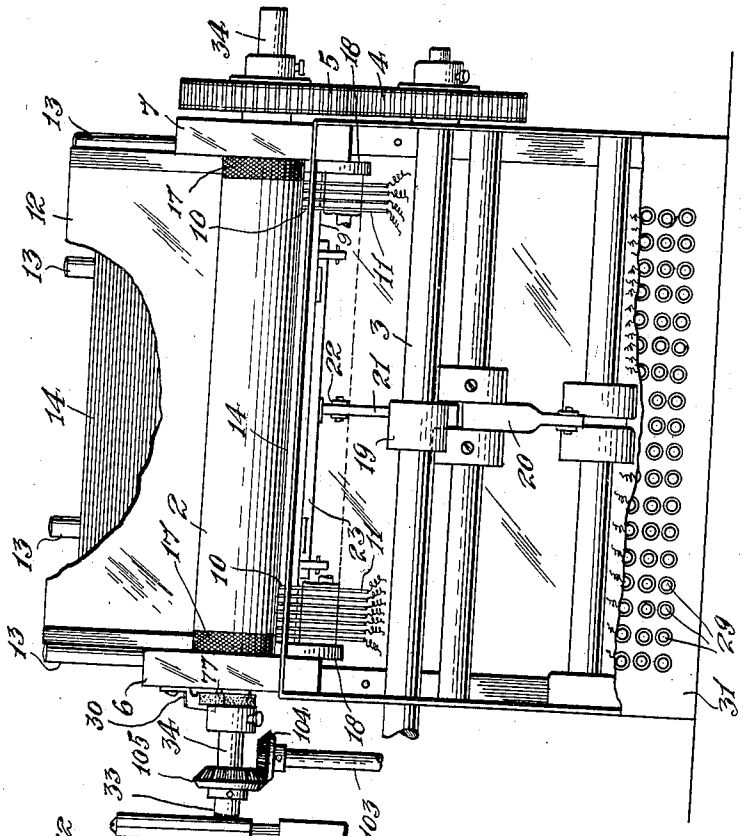
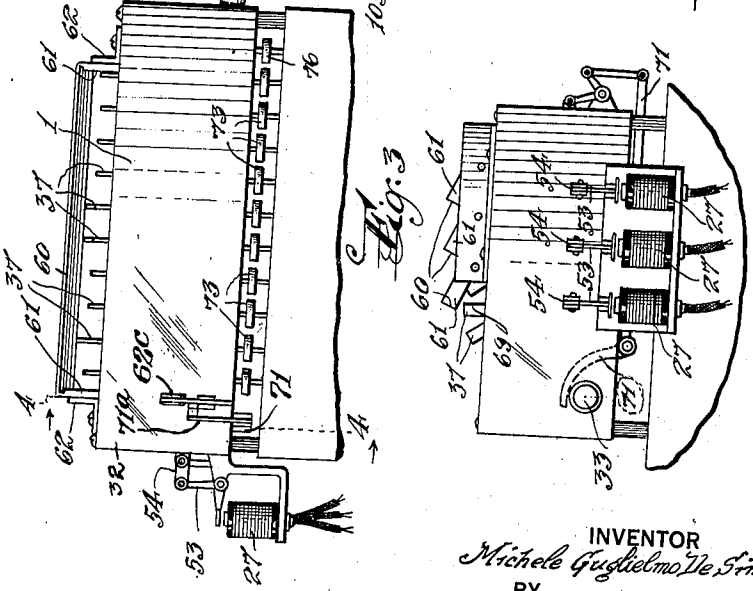


Fig. 3



INVENTOR
Michele Guglielmo De Simone
BY
A. D. T. Libby
ATTORNEY

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Filed April 18, 1934 4 Sheets-Sheet 3

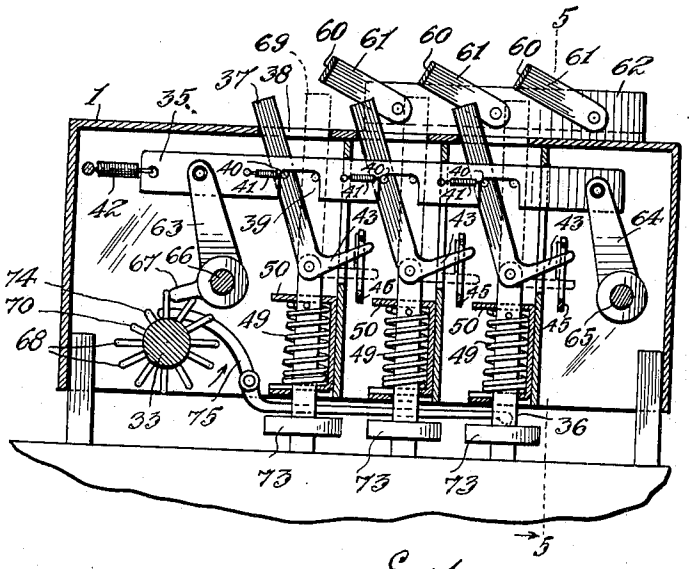


Fig. 4

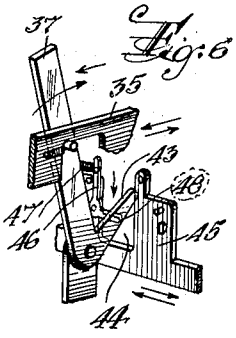


Fig. 6

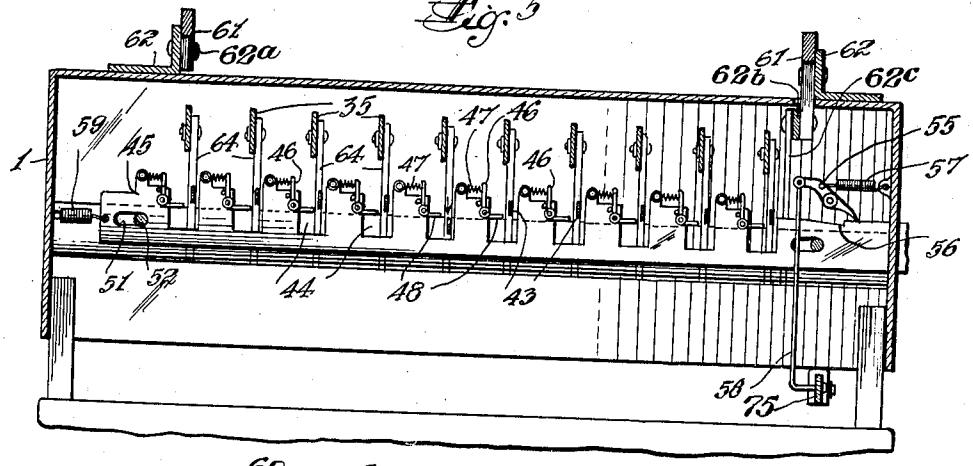


Fig. 5

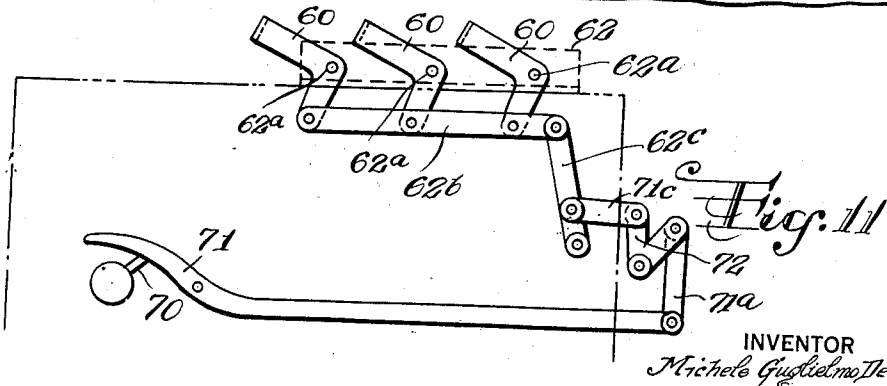


Fig. 11

INVENTOR
Michele Guglielmo De Simone.
BY
A. D. T. Libby
ATTORNEY

March 26, 1940. M. G. DE SIMONE 2,195,080

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Filed April 18, 1934 4 Sheets-Sheet 4

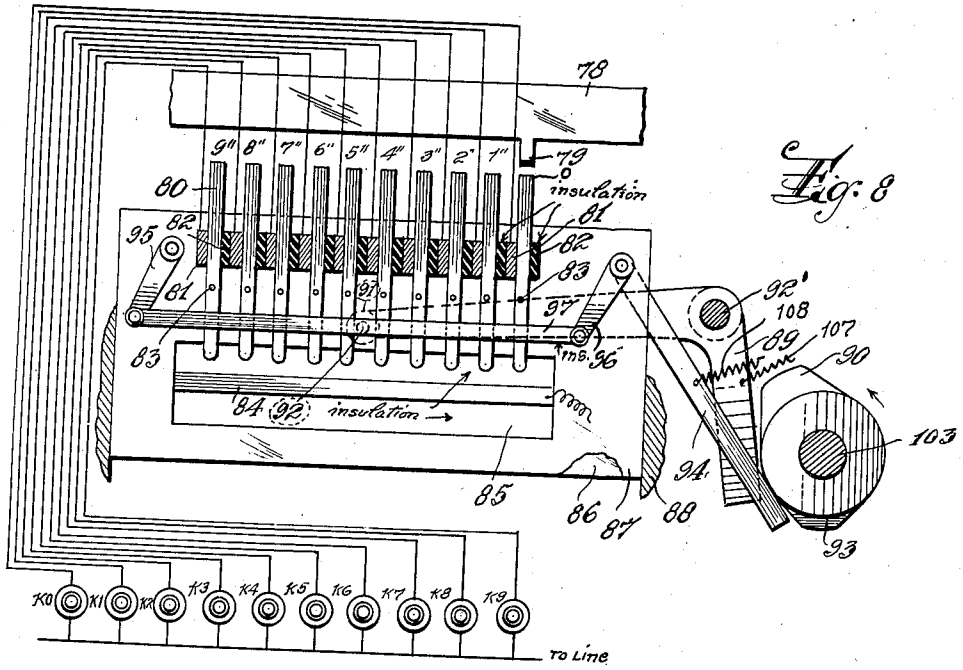


Fig. 8

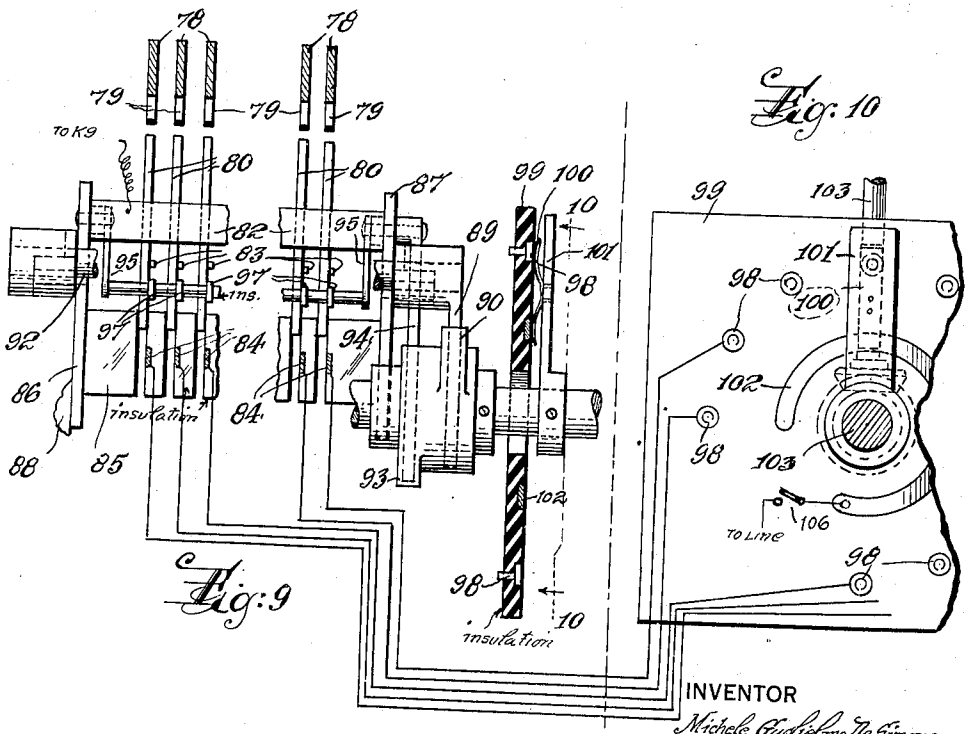


Fig. 9

Fig. 10

INVENTOR
Michele Guglielmo De Simone
BY
A. D. T. Libby
ATTORNEY

Patented Mar. 26, 1940 2,195,080

UNITED STATES PATENT OFFICE

2,195,080

ELECTROMECHANICAL MECHANISM FOR ACTUATING CALCULATING MACHINES AND RECORDING THE RESULTS THEREFROM

Michele Guglielmo de Simone, Stapleton, Staten Island, N. Y.

Application April 18, 1934, Serial No. 721,103

7 Claims. (Cl. 235—61.6)

This invention relates to an electro-mechanical mechanism for use in actuating calculating machines and for recording the results of such calculating machines.

It is one of the objects of my invention to provide an electro-mechanical mechanism or a combination of mechanisms whereby electrical impulses, governed by a predetermined pattern or design which is passed through a sending mechanism, are caused to operate a setting up mechanism to position stops therein corresponding to the electrical impulses sent to the setting up mechanism and as controlled by said pattern or design or equivalent mechanism for sending these electrical impulses in a predetermined manner. The said stops of the setting up mechanism are mechanically utilized to assist in the operation of selecting keys of a calculating machine or mechanism, whereby when the calculating machine or mechanism is set in operation by the setting up mechanism, the results of the calculating machine or mechanism will be recorded in such a manner that the record may be subsequently and directly used for other purposes, including the passing of said records through a tabulating machine whereby the record or results of the calculating machine or mechanism may be quickly summarized.

In carrying out the above general object of my invention, it is a further object to correlate or co-ordinate the previously referred to mechanisms in such a way that they will operate positively and in successive and continuous cycles to perform all of the necessary functions of the above referred to mechanisms.

A further object of my invention is to provide apparatus to be hereinafter described, the parts of which are positively timed in their operation as distinguished from synchronous operation of devices, all of which will be set forth in the specification.

Another object of my invention is to provide an electro-mechanical mechanism which may be applied to calculating machines whereby the speed of operation thereof is materially increased so that more work can be turned out from such a calculating machine in a given time.

A still further object of my invention is to provide a recording mechanism which may be aded to a calculating machine and tabulating machine for the purpose of recording the results flowing from such machines or mechanisms continuously and without interruption of the ordinary performance of such machines or mechanisms.

These and other ancillary objects will be understood by one skilled in this art after reading the specification taken in connection with the annexed drawings, wherein:

Figure 1 is a plan view of part of the mechanism showing that part which sends the current impulses, and a portion of the mechanism which receives the electrical impulses for controlling other parts of the apparatus.

Figure 2 is a vertical front view of Figure 1.

Figure 3 is an end view of the mechanism shown at the left of Figure 2.

Figure 4 is a view on the line 4—4 of Figure 2.

Figure 5 is a view on the line 5—5 of Figure 4.

Figure 6 is a perspective view of certain details shown in Figure 4.

Figure 7 is a diagrammatic view of the circuit arrangement through the impulse-sending mechanism and one of the electro-magnets shown in Figures 1, 2 and 3.

Figure 8 is an elevational view of part of the mechanism used for recording the results of the calculating machine.

Figure 9 is a partial view looking at the mechanism from the right-hand end of Figure 8, with certain parts omitted for the purpose of clarity.

Figure 10 is a view on the line 10—10 of Figure 9.

Figure 11 is a skeletonized view of the operating levers shown at the top of Figure 4, with means for actuating them.

In the several views of the drawings, 1 is the framework of a mechanism for sending electrical impulses in a predetermined manner. This is done by means of a roll 2 operated in any satisfactory manner as through the medium of a power-driven shaft 3 and gears 4 and 5. The shaft 3 is driven positively by the power shaft of the calculating mechanism to be later referred to. The roll 2 is supported on two insulating blocks 6 and 7. Between the blocks 6 and 7 and below the roll 2, and extending rearwardly to the dotted line 8, is an insulator 9. The forward edge of the insulator 9 is provided with a plurality of slots 10 within each of which is positioned a relatively thin flexible spring contact member 11, the purpose of which will be directly pointed out.

Just back of the roll 2 is located a partition member 12 which, together with pins 13, forms a compartment for a stack of cards 14 which may be held in place by a suitable weight member 15 not shown in Figure 2. The cards 14 are perforated at 16 (see Fig. 7) in a perforating machine previous to their being stacked in the

sending mechanism. Since the perforated card and mechanism for putting perforations therein are no part of my present invention and are well understood in the art, they need not be further described herein, except to say that the perforations are made according to the merchandise and price thereof that is desired to be calculated, or other data desired to be placed on the card for future tabulation purposes.

The roll 2 is provided with knurled surfaces 17 at its opposite ends, and cooperating with these knurled surfaces are a pair of rolls 18 preferably of some other material than the roll 2 which is usually made of steel, whereas the rolls 18 may be made of fiber, hard rubber, or other suitable material. The drive shaft 3 carries a cam 19 which engages a lever 20 connected to other suitable levers, one of which, 21, is connected through a link 22 to a slide 23 carrying projections 24 adapted to work in guide-ways 25 cut in the plate 26 just below the stack of cards 14.

By reason of the mechanism just described, as the shaft 3 is turned, the fingers 24, which only project very slightly above the surface of the plate 26, engage the edge of the bottom card and bring it forward between the knurled surfaces 17 and the rolls 18, which then carry the card forward over the top surface of the insulator 9 so that the perforations in the card pass over the slots 10, carrying the spring contact members 11, whereby current impulses are passed from the source of current S through a magnet 27, through a switch contact plug 28, a jack 29, and one of the springs 11, through a perforation 16 in the card 14, to the roll 2, it being understood that the spring 11 passes momentarily through the perforation 16 in the card 14 and contacts with the roll 2, from which the current passes by means of a spring brush contact 30 back to the other side of the circuit or source of current S. Thus an impulse current will be sent through the magnet 27 for a purpose which will be later pointed out.

Referring to Figure 2, the spring contacts or jacks 29 are carried on a suitable strip of insulation 31 as shown in Figure 2. It may be mentioned at this point that a large number of spring contact members 11 are provided, together with their associated jacks 29, whereas a much smaller number of magnets 27 is required, as will be later pointed out. By this arrangement, I am able to connect up through the switch strip 31 any desired combination of perforations on the cards, according to the pattern or design thereof, as determined by the punched holes 16 therein. Thus, suppose for example the slots in the insulator 9 and the springs 11 are eighty in number and only sixteen magnets are used on the setting-up mechanism, then by reason of the switch arrangement as described, these magnets may be connected to sixteen springs 11 chosen according to the designation on the cards desired to be passed through the sending mechanism.

The setting-up mechanism shown at the left of Figures 1 and 2, comprises a casing 32 in which is positioned an operating shaft 33 either connected directly to the roll shaft 34 or suitably geared thereto, whereby it turns at the same speed as the roll 2. Within the casing 32 is positioned a plurality of series of mechanical devices which are more clearly shown in Figures 4, 5 and 6. A set of these mechanical devices includes a slide bar 35 with which are associated a plurality of key-operating pins 36, the upper ends of which terminate in bell-crank levers having a long arm 37 projecting through a slot 38 in the top of the casing 1. As shown in the various figures, only three of the bell-crank levers 37 are shown in any one row, but it is to be understood that there are as many in this row as desired. For certain classes of calculating machines, there may be sixteen rows at right angles to the axis of the drive shaft 33. In the decimal row, there are from 0 to 9' or ten of these rows, each having a slide bar 35 and the necessary number of key-operating pins and their associated bell-crank levers, the ends 37 of which extend through the casing as described.

As will be seen by reference to Figures 4 and 6, the slide bar 35 has a plurality of notches 39 within which is adapted to play a pin 40 to which is fastened a spring 41 attached to the slide 35 so as to normally hold the lever 37 against one side of the wall of the notch 39 as indicated in Figure 4. The slide 35 is normally held in retracted position by the spring 42. The other arm 43 of the bell-crank lever, carried by the pin 36, projects into a notch 44 in a slide bar 45 which is positioned to move at right angles to the bar 35. Each slide bar 45 carries a bell-crank lever associated with each notch 44. To one arm 46 of these bell-crank levers, is attached a spring 47 for holding the lever in retracted position as indicated in Figure 5. The other arm 48 of these bell-crank levers extends across the notch 44 so as to trap the arm 43 of one of the bell-crank levers mounted on the pins 36 as will be described in the operation of the mechanism.

Each of the pins 36 is provided with a spring 49 for returning it to normal position after having been actuated by means to be presently described. As shown in Figure 4, each of the pins 36 and its associated spring 49 is carried in mounting members 50. Each of the slides 45 is provided at both ends with a guide slot 51, and the frame carries a guide pin 52 at each end of the slide bar 45 to guide it in its movement. Each of the slide bars 45 is adapted to be operated by its individual magnet 27 acting through a lever 53 connected by a link 54 to the end of the slide bar. As each of the slide bars 45 is operated by the electro-magnet 27, it is held in operated position by a pawl 55 which engages a notch 56, the pawl being held in engaging position by a spring 57 until released by a rod 58 as will be later explained. When the pawl 55 is released, the slide 45 is returned to normal position by a spring 59.

Mounted across the top of the casing 32, are a plurality of U-shaped return levers 60, each having an arm 61 at each end pivoted to brackets 62 at opposite ends of the casing 32. These U-shaped return levers are positioned over one end of the slots 38 at the top of the casing 32, and normally are above the path of movement of the arms 37 of the bell-crank levers carried on the pins 36.

Each of the slide bars 35 is carried on arms 63 and 64, the arms 64 being rotatably carried on a rod 65, while the arms 63 are carried on a rod 66. The arm 63 is one arm of a bell-crank lever, the other arm, 67, of which is adapted to be engaged by one of the pins 68 carried by the shaft 33. As shown in Figure 1, these pins are preferably evenly spaced arcuately around the operating shaft 33, longitudinally of its length within the casing 1, there being one pin for each of the rows 0 to 9' inclusive. Consequently, these pins engage the arms 67 of the bell-crank levers connected to the slide bars 35 in sequence as the shaft 33 turns.

Considering now the operation of my mechanism so far described, as the shaft 33 turns, the pins 68 carry the slide members 35 successively forward to bring the bell-crank lever ends 37 under the levers 60, all of these levers in any one row being operated simultaneously. The mechanism is so timed, that as the card 14 passes under the roll 2, a contact is made as has been described, completing a circuit through the magnet 27 operating the slide bar 45 connected with the armature of the magnet, so as to move the cooperating slide bar 45 just as the bell-crank lever end 37 comes under or in line with the path of movement of the arm 61 of the U-shaped operating lever.

As has been explained, the pawl 55 holds the slide 45 in this position so the end 48 of one of the bell-crank levers carried on the slide bar 45 will pass over the top of the arm 43 as will be seen by reference to the fifth one from the left-hand end, referring to Figure 5, thereby trapping this bell-crank lever in the position shown by dotted line 69 (see Figure 4). Therefore, as the shaft 33 turns, other lever ends 37 will be trapped under another one of the levers 60, it being understood that only one lever 37 will be trapped in the decimal row 0 to 9' for any given sequence of operations.

As the card 14 passes under the roll to the point where all of the perforations have functioned to operate the magnets 27, the trapping of the corresponding ends 37 is thus completed. Immediately then, a pin 70 on one end of the shaft 33 actuates a lever 71 which, through cooperating links 71*a* and 71*c* and levers 72 and 62*c*, the latter of which is connected to connecting bar 62*b* to which the ends of the levers 60 are connected, whereby movement of the bar 62*b*, operates all of the U-shaped operating levers 60 pivoted at 62*a* on the frame member 62, bringing them down into engagement with the ends 37 which have been trapped in the position 69, and then forcing these levers downwardly and likewise the pins 36 into engagement with buttons or keys 73, or equivalent parts on a calculating machine, or the calculating part of the mechanism. In general, this calculating mechanism is no part of my present invention, except for certain details which will be later pointed out.

Immediately following the setting of the keys 73 of the calculating machine as described, another pin 74 on the shaft 33 engages a lever 75 which in turn actuates the rod 58, thereby operating the pawl 55 and releasing the bars 45 so they will return to their normal position. Also, the actuation of the lever 75 serves to engage a button or bar 76, usually referred to as the touch-bar, which sets in operation the mechanism within the calculating machine, whereby this part of the mechanism operates to register the products or additions of the amounts previously punched on the cards passed through the sending mechanism as described.

It may be noted at this point that after any one lever end 37 has been trapped as explained, no more cooperating lever ends 43 in that particular row can be trapped, because the lever ends 43 are moved to the right, looking at Figure 5, to a point where the ends 43 will contact with the top of the bell-crank levers 48, so that, as the slides 35 are moved in any additional rotation by the shaft 33, the arms 43 will merely push downwardly on the top of the arm 48 of the bell-crank lever with which it is associated, without passing below it; and as the pin 68 on the shaft 33 passes the lever arm 67, the spring 43 pulls the slide 35 back to normal position without trapping any more of the lever ends 43. In addition, it may be noted that as the card finally passes from under the roll 2, the contact brush 30 rides on to an insulator 77, thereby opening the circuit from the source of power so none of the relays 27 and the associated trap slides 45 can be falsely set.

An additional feature of my invention is the mechanism for recording the results obtained from the calculating part of my apparatus. In certain types of calculating machines which are operated by buttons similar to the buttons 73 (see Figure 4), the additions or multiplications delivered by the machine on actuating the touch-bar 76 (see Figure 2), are printed directly on a sheet, but then these sheets have to be rehandled through a perforating machine before the results thereon can be passed through a tabulating machine.

To avoid this extra time and labor, I have provided a mechanism for perforating the results directly on cards or sheets may be passed immediately through a tabulating machine. This recording mechanism is shown in Figures 8, 9 and 10. In these figures, 78 illustrates a portion of one of the bars operated by the mechanism of the calculating machine immediately after the touch-button or bar has been actuated as previously described. A description of one of the sets of the mechanism will suffice for all.

The bar 78 has a projection 79 which may be operated by the mechanism of the calculating part of the apparatus so that the lug or projection 79 comes over any one of the plungers 80, there being 0 to 9'' rows and as many in a row to correspond with the buttons 73 or equivalent parts on the calculating machine. Each of the plungers 80 is frictionally or otherwise suitably carried in a suitable support and in electrical engagement with a contact member 81 and separated from the adjacent contact member 81 by an insulator 82. Each of the members 81 is connected to its associated perforating magnets K^0 to K^9.

Each contact plunger 80 has a pin 83 for a purpose which will be later described.

Normally positioned below each of the plungers 80 in the various rows 0 to 9'', is a contact strip 86 carried by an insulator 85. The insulator 85 is supported between two support members 86 and 87. The members 86 and 87 comprise a frame held between guide members 88 so that the frame carrying the insulator 85 may be moved upwardly by means of a lever 89 pivoted at 92' actuated by a cam 90 carried on a shaft 103 which may be connected through gears 104 and 105 to the shaft 33, whereby the shaft 103 is driven at the same speed as shaft 33 but timed for the proper sequence of operations. The opposite end of the lever 89 is connected at 91 to the side members 86 and 87 by reason of a cross-connecting rod 92. An additional cam 93 operates on the end of a lever arm 94 to actuate the arms 95 and 96 connected together by insulated bars 97. At the proper time, lever 89 is returned by spring 107 and the lever 94 is returned by spring 108.

Each of the contact strips 84 is connected by wires to its respective contacts 98 carried on an insulator 99, which contacts are adapted to be engaged by a contact spring 100 carried on a rotating arm 101. The opposite end of the spring engages an arcuately positioned contact strip 102

which is connected to one side of the source of power.

In the operation of this mechanism, it is to be understood that the various bars **78** are moved to their proper position over the plungers **80**, and after the bars **78** have all been set, the cam **90** moves to operate the lever **89** carrying the insulator **85** upwardly, so that the plungers **80** in a given row are brought into engagement with the contact strips **84**.

As soon as the cam **90** passes from engagement with the end of the lever arm **89**, spring **107** restores the lever to the position shown in Figure 8, but the plungers, which have been brought into contact with the projections **79** of the selected members **78**, remain in contact with their respective contact strips **84**, and the members **78** are allowed to be returned to their normal position by the calculating machine mechanism, ready for the computations to be set up on the calculating mechanism.

While these computing devices are being operated, the recording mechanism is being simultaneously carried out by reason of the switch contact member **101** that is being rotated, so that a circuit is completed successively through the various magnets K^0 to K^9 which actuate the perforating means. After these operative steps have been completed, the cam **93** actuates the lever **94** to move the bars **97** which are in engagement or approximate engagement with the pins **83** on the plungers **80**, to carry all of the then depressed plungers back to normal position, after which the spring **108** restores the lever **94** to normal position ready for the next sequence of operations.

From what has been said, it will be understood that the various parts of the apparatus are so timed that the sequence of operations is going on simultaneously. For example, as the card is being passed through the sending mechanism, the apparatus which I have chosen to call the setting up mechanism is setting up devices for the purpose of actuating the calculating machine, and when the operations in the setting up mechanism have all been completed, then the calculating mechanism is set into operation, and while this is in action to operate the recording mechanism, another card from the sending mechanism is actuating the setting up mechanism for another set of results, and so on. Since the operations of the various mechanisms take but a few seconds, each of the operations follow each other successively and are all going on simultaneously, although in slightly different phase relationship one to the other.

It is to be understood that Figures 8, 9, and 10 have been made more or less diagrammatic for the purpose of better illustrating this part of my invention.

It may be mentioned at this point that the recording mechanism shown in Figures 8, 9 and 10 may be applied to or utilized in connection with any adding, calculating or tabulating machine to record the totals from such machines or mechanisms. In the application of this recording mechanism to such machines, however, a switch **106** is provided so that the current may be cut off at any time, whereby only the desired results may be recorded. The switch **106** may, of course, also be used in connection with the recording of the results of my entire apparatus as heretofore described.

Because of the many detail parts entering into the construction of my various mechanisms, it will be appreciated that the construction of these details may be varied considerably, and I therefore do not wish to be unduly limited in the scope of the appended claims.

What I claim is:

1. Apparatus for the purpose described including; mechanism for sending electrical impulses in a predetermined manner, a setting up mechanism comprising groups of mechanical devices, each group having a single electro-magnet for receiving said electrical impulses and energized for a small fraction of a cycle of operation and also having parts adapted to be trapped by its electro-magnet in position for actuating members on a calculating mechanism, means also included in said setting up mechanism for moving said parts into trapping position, means in each of said groups moved directly by said electro-magnet for trapping said parts adapted to be trapped according to said electrical impulses, further means for actuating simultaneously all of said trapped parts to move said members on the calculating mechanism, and still further means for starting said calculating mechanism into operation, and means for releasing said trapping means for the purpose described.

2. Apparatus for the purpose described including, mechanism for sending groups of electrical impulses in predetermined intervals, mechanism for translating said impulses into mechanical movements to actuate members on a calculating mechanism, said translating mechanism including parts for engaging said members on the calculating mechanism, said parts being controlled by presetting devices some of which, including slidable bars operatively associated with levers carried by said engaging parts, are successively operated mechanically, and others, including slidable bars carrying trapping means for trapping said levers, are successively operated electrically by said electrical impulses for selecting certain of said engaging parts so they will engage said members on the calculating mechanism, and means for operating all of said translating parts simultaneously after said devices have been preset, means comprising part of said translating mechanism for starting the calculating mechanism into operation, and further means comprising part of said translating mechanism to restore said translating mechanism to normal position ready to receive another group of electrical impulses.

3. Apparatus for the purpose described as set forth in claim 1, characterized in that said parts on the setting up mechanism which are to be trapped comprise main slide bars and levers carried on other parts which actuate the members on the calculating mechanism, and further characterized in that said trapping means comprise auxiliary slide bars positioned at right angles to the main slide bars and carrying levers for trapping the first-mentioned levers according to the order of said electrical impulses.

4. A setting up mechanism for the purpose described including a casing having a plurality of rows of spaced slots therein, a rotatable shaft carried by the casing and having a plurality of pins longitudinally and arcuately spaced on the shaft; a plurality of main slide bars positioned to be operated in one direction by said pins, a plurality of auxiliary slide bars positioned at right angles to said main bars, an electro-magnet for operating each of said auxiliary slide bars, means for catching said bar in operated position, actuating members for moving parts of other mecha-

nisms, levers carried by said members and having arms extending through said slots in the casing, said lever arms being moved by said main slide bars, and other arms extending across the plane of movement of said auxiliary slide bars, levers carried by said auxiliary slide bars and having arms adapted to be moved into the path of movement of the other of said arms of the first-mentioned levers to trap the same according to the actuation of said magnets and movement of the auxiliary slide bars moved thereby, levers for engaging all of said trapped arms, means operated by said shaft for moving said last-mentioned levers and said arms and members carrying the same, and means including a pin on said shaft for releasing said auxiliary slide bars immediately after said actuating members have been operated.

5. A setting up mechanism as set forth in claim 4, further characterized in that said levers for engaging the trapped arms are positioned in parallel on the top of the casing, being pivoted at opposite ends thereof and each one overlying all the slots in a decimal row while said actuating members extend through slots in the bottom of the casing.

6. A setting up mechanism for the purpose described including, a casing having 0 to 9 decimal rows of slots, a main notched slide bar for each row, key operating pins positioned in a row, one for each slot in the row and each having a bell-crank lever with one arm extending through one of said slots, said arm having means moving in a notch in said bar for engaging the slide bar, and means for normally holding said means on one side of its notch, transverse slide bars having notches therein to receive the other arms of said bell-crank levers, auxiliary bell-crank levers carried by said transverse slide bars so one arm thereof extends into the notches therein to engage the second-mentioned arm of the bell-crank levers on the main slide bars, means for moving said main slide bars successively and consequently all of said bell-crank arms projecting through said slots in alignment with said main bar, means for operating said auxiliary bars at a time to cause the bell-crank levers carried thereby to trap one of the bell-crank levers in fully operated position, and means for simultaneously acting on all of said trapped bell-crank levers to move certain of said operating pins as described.

7. In apparatus for the purpose described including, mechanism for sending groups of electrical impulses at predetermined intervals, mechanism for translating said impulses into mechanical movements to actuate members on a calculating mechanism, said translating mechanism including parts for engaging said members on the calculating mechanism, said parts being controlled by presetting devices some of which including slidable bars operatively associated with levers carried by said engaging parts are successively operated mechanically and others, including slidable bars carrying trapping means for trapping said levers, are successively operated electrically by said electrical impulses, and means for operating all of said translating parts simultaneously after said devices have been preset.

MICHELE GUGLIELMO DE SIMONE.