Nov. 28, 1939. W. B. AUSTIN 2,181,166

STATISTICAL MACHINE

Filed May 31, 1935 5 Sheets-Sheet 1

Fig. 2.

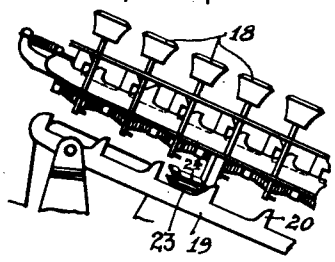
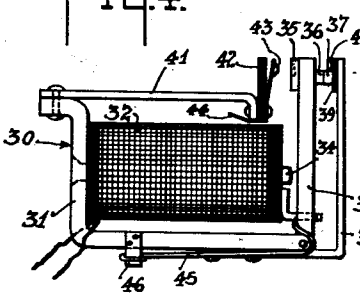


Fig. 4.



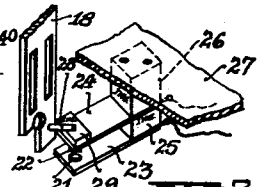


Fig. 3.

Fig. 1.

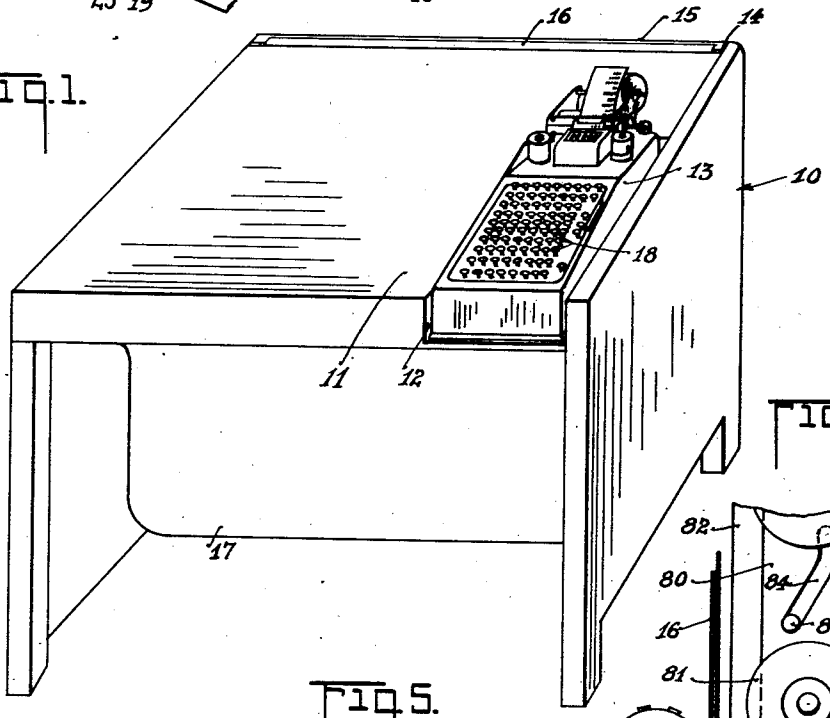


Fig. 7.

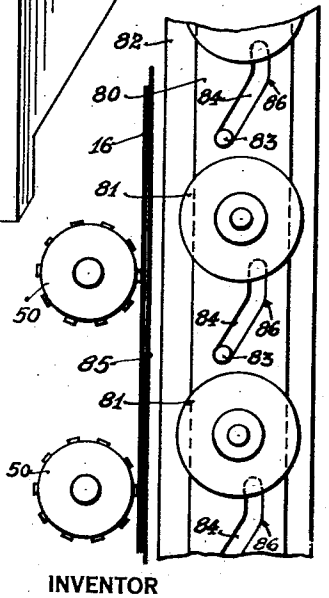


Fig. 6.

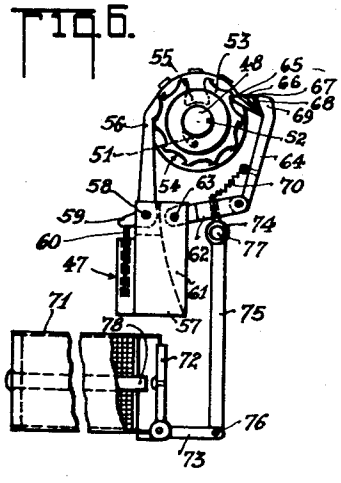
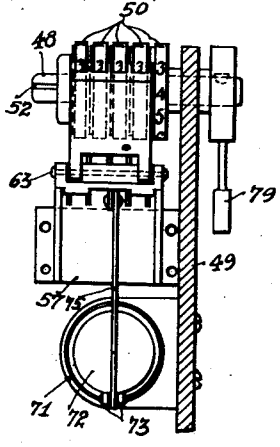


Fig. 5.



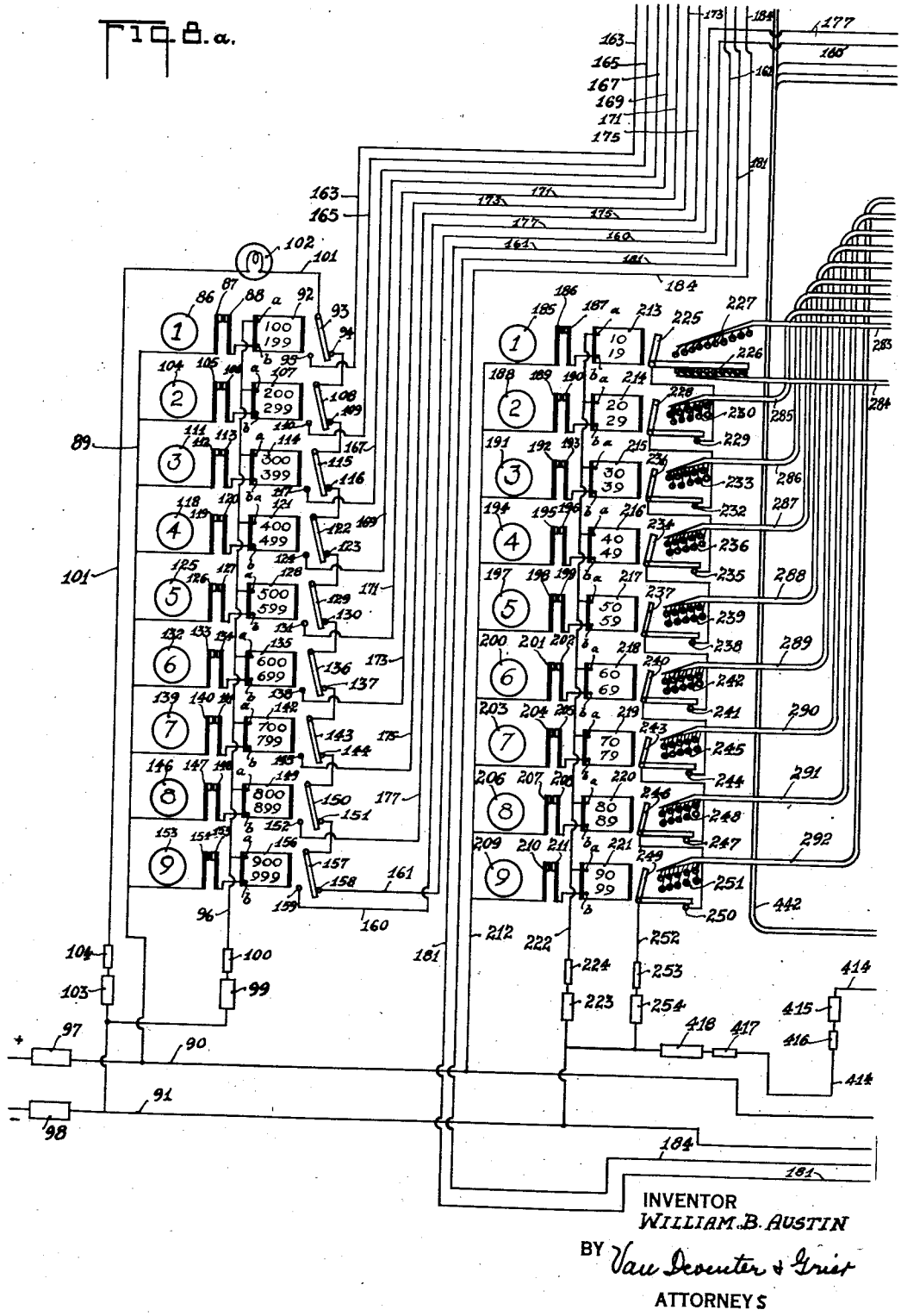
INVENTOR
WILLIAM B. AUSTIN
BY Van Deventer & Grier
ATTORNEYS

Nov. 28, 1939. W. B. AUSTIN 2,181,166

STATISTICAL MACHINE

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Fig. 8.a.



INVENTOR
WILLIAM B. AUSTIN

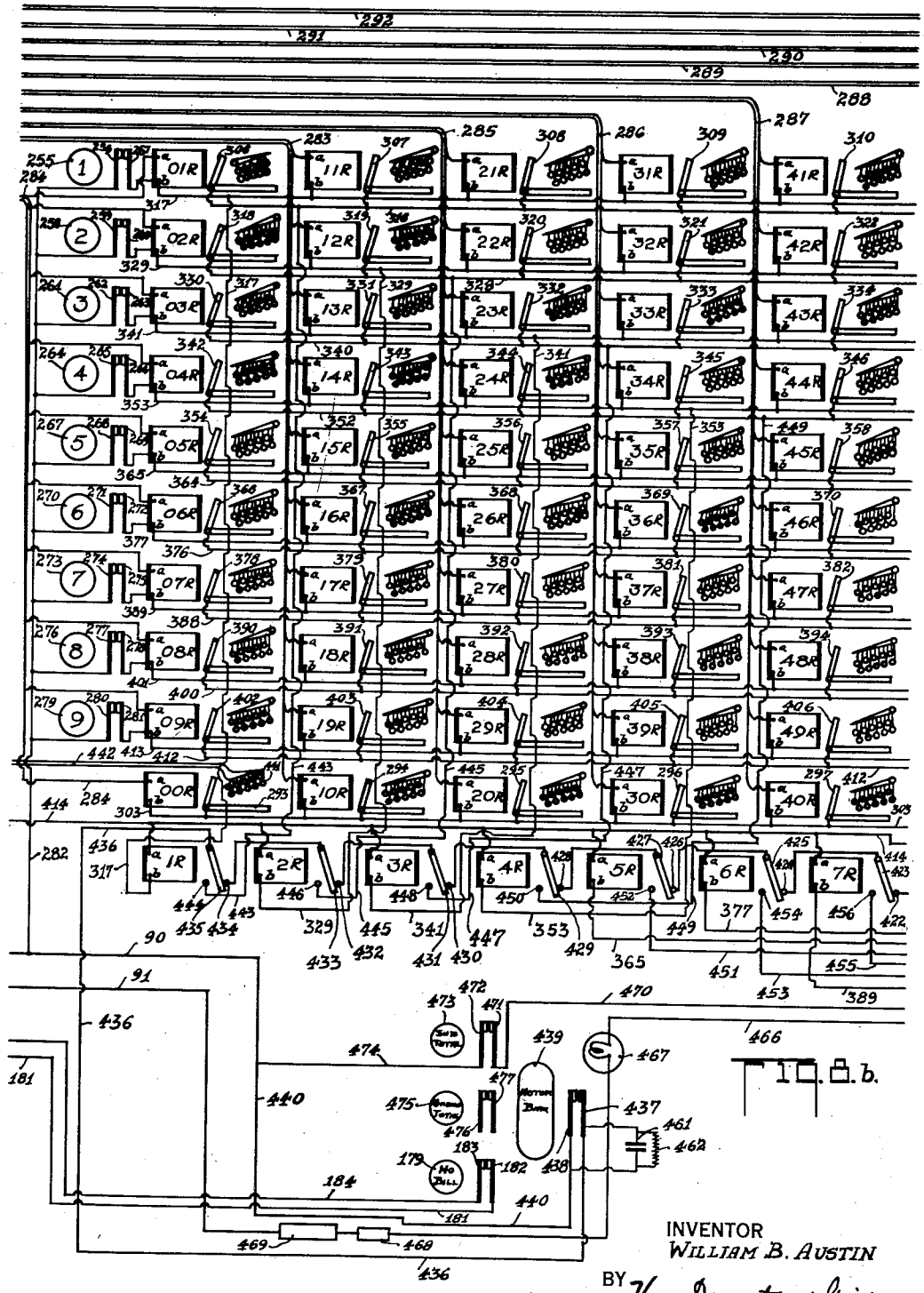
BY Van Deventer & Grier

ATTORNEYS

Nov. 28, 1939. W. B. AUSTIN 2,181,166

STATISTICAL MACHINE

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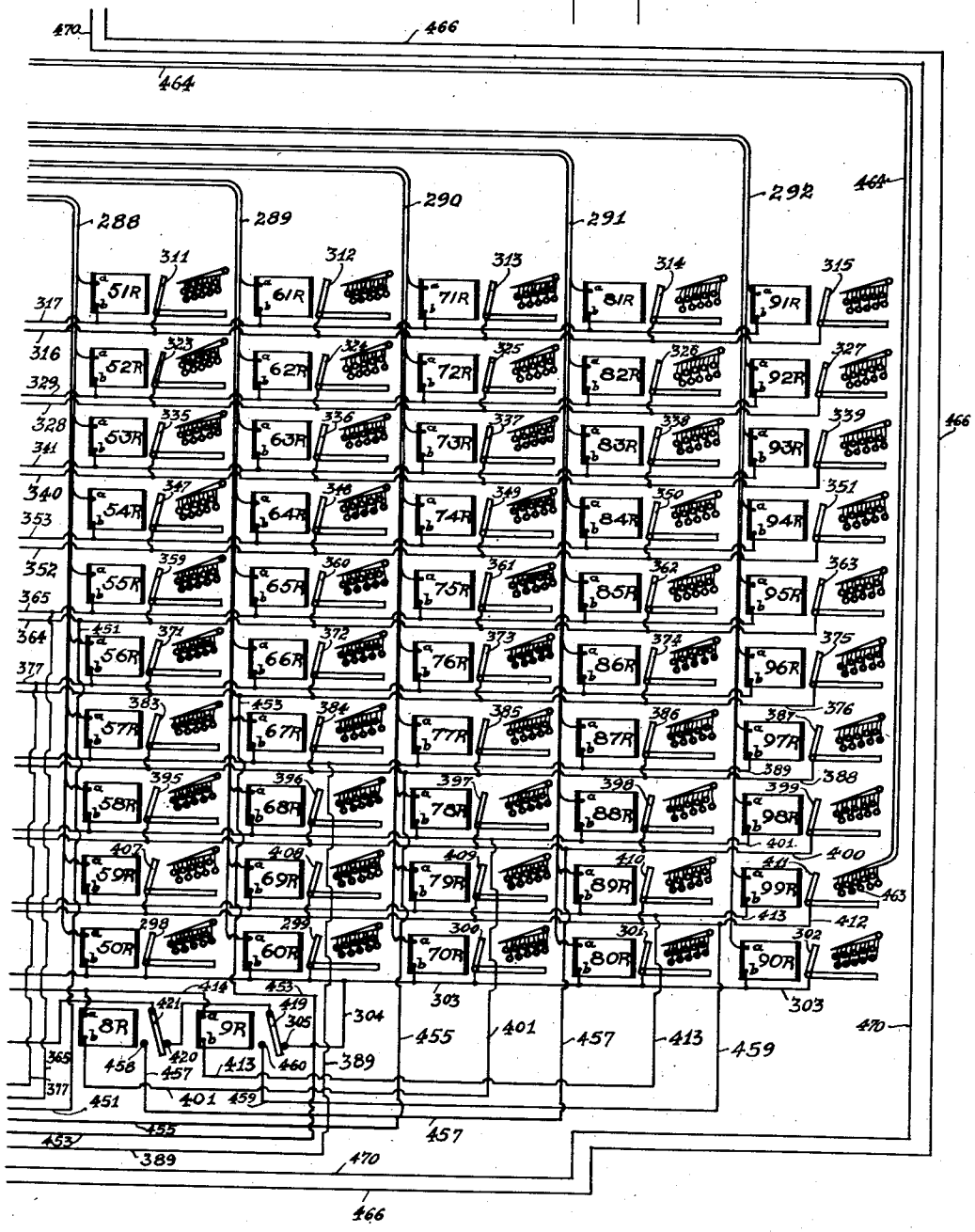
INVENTOR
WILLIAM B. AUSTIN
BY Van Deventer & Grier
ATTORNEYS

Nov. 28, 1939. W. B. AUSTIN 2,181,166

STATISTICAL MACHINE

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FIG. 8. C.



INVENTOR
WILLIAM B. AUSTIN
BY Vare Deventer & Grier
ATTORNEYS

Nov. 28, 1939. W. B. AUSTIN 2,181,166

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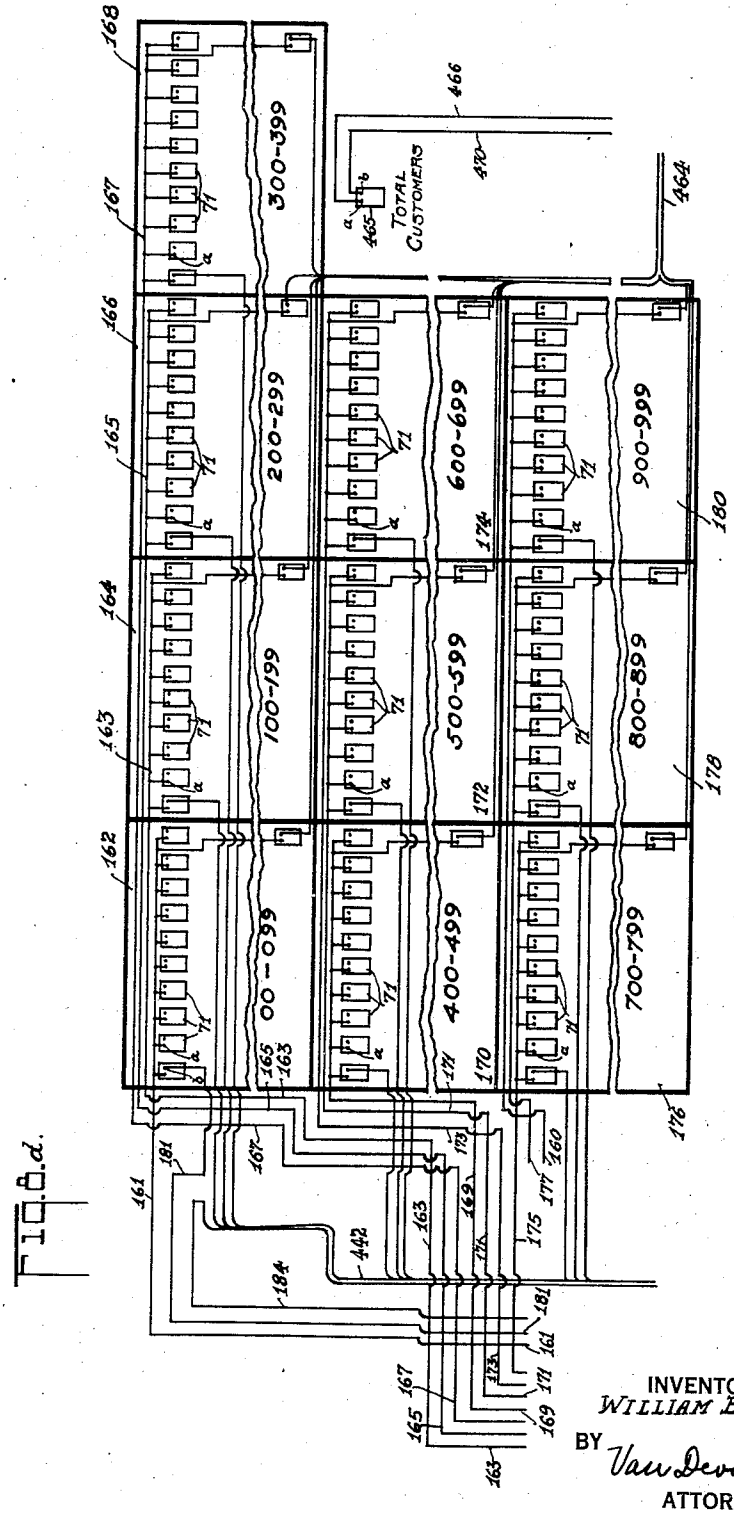


Fig. 8.d.

INVENTOR
WILLIAM B. AUSTIN
BY Van Deventer & Grier
ATTORNEYS

Patented Nov. 28, 1939

2,181,166

UNITED STATES PATENT OFFICE

2,181,166

STATISTICAL MACHINE

William B. Austin, Ridgewood, N. J.

Application May 31, 1935, Serial No. 24,332

13 Claims. (Cl. 235—92)

This invention relates to improvements in statistical machines and has for a principal object the provision of an adding machine having electrically actuated devices associated therewith to count all like entries that are entered into the adding machine.

Another object of the invention is the provision of an adding machine and a plurality of counting registers associated therewith adapted to count the number of times each of a plurality of figures has been entered into the adding machine, each register counting one figure which may consist of one or more digits.

A further object of the invention is the provision of an adding machine having electrical contacts associated with the keys and adapted to complete electrical circuits for effecting controls outside of the adding machine per se without affecting the operation of the adding machine.

Another object of the invention is the provision of a plurality of keys each adapted to mechanically actuate an adding mechanism and each also adapted to control electrical circuits.

A further object of the invention is the provision of an accumulating and printing mechanism, keys for effecting set ups therein, said keys also being adapted to complete circuits through relays connected thereto for controlling electrical circuits associated with said keys.

Still another object of the invention is the provision of a machine including accumulating and printing mechanisms, keys for effecting set ups in said mechanisms and a plurality of other electrically actuated accumulating and printing devices each having at least one electro-magnetic winding associated therewith, said windings each having a wire associated with or controlled by some of said keys and another wire associated with or controlled by others of said keys, said last accumulators being adapted to have items entered therein in accordance with which of said keys are actuated but not in accordance with the values entered in said first accumulators.

Still a further object of the invention is the provision of a machine including accumulating and printing mechanisms, keys for effecting set ups in said mechanisms and a plurality of other accumulating and printing devices electrically actuated by the closing of contacts by the movement of said keys, one of said devices being provided for each possible combination of keys and arranged to enter a value of "one" each time its combination of keys is set up.

Another object of the invention is the provision of mechanisms for listing and totalizing the amounts from bills or the like and obtaining as a by-product of this operation counts totalizing the number of bills handled of each amount and the total number of bills handled.

Still another object of the invention is the provision of an accumulator for entering the codes corresponding to data, other accumulators into which statistical data is entered as a by-product of the first operation and still other accumulators for totalizing the number of steps in the operation.

Other objects and advantages of the invention will be obvious to those skilled in the art.

In certain types of statistical work it is desired to obtain a count of the number of times any given figure may appear in a large number of items. As an example of this, a case might be taken where a light and power company wish to make a rate study to determine how many consumers have used, for example, 10 kilowatt hours in a month, how many 11 kilowatt hours, how many 12 kilowatt hours, etc., possibly from 0 kilowatt hours up to 1,000 kilowatt hours. By existing methods and devices such a rate study requires a great many steps and is an expensive procedure.

By means of the device, which is the subject of the present application, rate studies may be obtained as a by-product of other work which has to be done. For example, the bills must be added up to determine what total the bills for a month amount to and a rate study may be obtained as a by-product of this operation without involving any more time than is required to enter the items into the adding machine and totalize them.

Another example of the use of the present invention is in questionnaire work. The answers to questions may be numbered with a code number and thereby the device can be caused to count how many people give answer No. 20, answer No. 506, answer No. 999, etc.

In using the device herein shown and described, a plurality of counting registers is associated with this adding machine, one register for each number, figure or amount from 0 to 999. It is obvious that the number of registers may be increased or decreased in accordance with the usage to which the machine is to be put. The counting registers are not disturbed during the entire operation of totalizing the bills; for example; and after the operation has been completed the total counts of all of the counters is

printed on a collective sheet, preferably in one operation.

Of course, it is obvious that as many printings as desired may be taken from these counting registers from time to time as the work progresses but it is usual to take the final totals entered into these registers at the end of an operation.

Referring to the drawings:

Figure 1 is a perspective view of the new and improved device incorporated in a casing having the form of a desk;

Figure 2 is a fragmentary view of a portion of the adding machine keyboard showing the relation of the adding machine key to its normal cooperating member in the adding machine and to contacts, associated with each key, which are closed by the actuation of a key without interfering with the normal controls in the adding machine controlled by the key;

Figure 3 is an enlarged detailed view showing a portion of an adding machine key and electrical contacts associated therewith;

Figure 4 is a view of a multiple contact relay of the character used in the device;

Figure 5 is a face elevation of one of the counting registers with its associated actuating magnet;

Figure 6 is an end view of the register shown in Figure 5 showing details of the mechanism and the relation of the magnet thereto;

Figure 7 is a fragmentary view showing one method of obtaining printings from the counting registers; and

Figures 8*a*, 8*b*, 8*c*, and 8*d*, together, constitute a diagram showing the electrical circuits of the device; Figure 8*a* showing a row of "one hundreds" keys of the adding machine, the contacts controlled thereby and the typical contact relays associated therewith; Figure 8*a* also showing the "tens" keys, the contacts associated therewith and the multiple contact relays controlled by these keys; Figure 8*b* taken with Figure 8*c*, showing the "units" keys of the adding machine, the contacts actuated thereby and the ten multiple contact relays associated with each key actuated contact; and Figure 8*d* showing the connections to the magnets controlling the counting registers.

The device, Figure 1, is housed in a casing **10** preferably made in the form of a desk. The upper surface **11** has a depression **12** formed therein to accommodate the adding machine **13**. The desk also has a slot **14** formed at the juncture of the rear edge of the upper surface or top **11** and a hinged back **15**.

A sheet of paper **16** may be inserted in the slot **14** so that totals may be printed from counting registers housed between the intermediate plate **17** and the hinged back **15**. The construction and the arrangement of the counting registers and the method of taking printings therefrom will presently be described.

The adding machine **13** may be of any desired type. In the preferred embodiment of the invention an adding machine of the "Burroughs" type, such as is shown and described in Patent No. 1,914,401, dated June 20, 1933, to T. M. Butler, Figure 1.

Figures 2 and 3 of the present application are fragmentary views of the depressible amount keys, designated by the numeral **18**, and their associated differential stop bars, one of which is designated by the numeral **19**. These differential stop bars are released by the mechanism after an amount key **18** is depressed and notches, one of which is designated by the numeral **20**, are engaged and stopped in certain positions by the keys **18** (in accordance with which key is depressed) and thereby control the amounts entered into the accumulator of the adding machine and control the positions of the printing bars.

The adding machine **13** has the new and additional feature of a pair of contacts associated with and adapted to be closed by each key. In order to keep the drawings from becoming too complicated by duplication of pairs only one pair of such contacts is shown, one contact being designated by the numeral **21** and the other by the numeral **22**.

The contact **21** is carried by a contact arm **23** and the contact **22** is carried by the contact arm **24**. The contact arms are separated by insulation **25** and are suitably supported on the plate **27** by means of a block of insulation **26**. Each key **18** is provided with a pin **28** projecting therefrom and a block of insulation **29**, carried on the arm **24** on the opposite side to that of the contact point **22**, is engaged by the pin **28** when an amount key **18** is depressed. As each depressed key of the adding machine is retained in the depressed position after being struck, the contacts **21**, **22** are held into engagement from the time a key is depressed until the machine accumulates and prints.

Cables forming terminals of the contact arms are lead from the adding machine to a plurality of relays. These relays are of the general form shown in Figure 4 and designated generally by the numeral **30**. They consist of a yoke or frame **31** having an electro-magnet **32** secured thereto.

An armature **33** is pivotally mounted on the frame **31** and is adapted to be attracted by the core **34** of the magnet when the latter is energized. The arm **33** carries a contact member **35** on one side thereof and a contact point **36** on an opposite side thereof. A bracket **38** is secured to the frame **31** and carries at its upper end a block of insulation **39** which in turn supports a contact point **37** in cooperative relation to the contact point **36**. A suitable lug **40** is provided for connecting the contact point **37** in circuit with some of the contact arms **23**, **24**, which connections will presently be described.

A supporting member **41** is secured to the frame **31** and has secured thereto an insulating block **42** forming a support for a plurality of contact points, one of which is designated by the numeral **43**. Each contact point **43** is provided with a suitable connector lug **44**.

In some of the relays employed in the device ten contact points **43** are used and the contact member **35** is of sufficient width to make contact with all ten of the contact points when the magnet **32** is energized.

Others of the relays employed have a single contact point **43** which is engaged by the contact member **35** when the armature **33** is attracted by the magnet **32**. Normally the contact point **36** and the contact point **37** are in contact with each other.

One of the relays (the one associated with the "1" key in the "tens" row) is provided with ten contact points **43** and ten contact points **37** so that when its armature **33** is in its normal position all ten of the contacts **37** are connected together and to the armature **33**. When its magnet **32** is energized contact with the ten contact points **37** is broken and contact is established between the contact member **35** and the ten con-

tact points 43. The details of these connections will be described in connection with the description of the diagram, Figures 8a, 8b, 8c and 8d.

A suitable spring 45 engages the armature 33 and engages a lug 46 carried by the frame 31 and is so arranged that normally the contacts 36 and 37 are engaged.

The device is provided with a plurality of counters controlled by the key contacts 21, 22 and the various relays 30. In the embodiment herein shown and described, 1,000 counters, such as shown in Figures 5 and 6, are used.

The counter, generally designated by the numeral 47, is comprised of a shaft 48 suitably journalled on a supporting plate or member 49. The shaft 48 carries a plurality of counter wheels. Each counter wheel is provided with an internal pawl 51, which is engaged by a keyway 52 when the counters are reset, as will presently be described. Each counter wheel has secured thereto a ten-toothed ratchet 53.

The ratchet has curved recesses 54 between each of 9 of the teeth and a deeper recess 55 between the 1st and the 10th tooth for the purpose of "carry-over", which will presently be described.

The curved recesses are successively engaged by a member 56 to prevent the counter wheel from "over-running". A metallic block 57 is secured to the plate 49 and forms a support for a plurality of the members 56, a pivot pin 58 serving to pivotally support all the members 56.

Each member 56 is provided with an ear 59, and a spring 60, imbedded in the block 57, retains each member 56 in engagement with its associated ratchet.

The block 57 has a cutaway portion 61 forming a recess therein. A yoke 62 is pivotally mounted in this depression by means of a pivot pin 63. The yoke 62 has pivoted thereto a pawl member 64 carrying at its upper end a plurality of pawls 65, 66, 67, 68, 69 of different lengths. A spring 70 is provided to keep one or more of the pawl members in engagement with one or more of the ratchets 53.

An electro-magnet 71, suitably supported on the plate 49, is provided with a pivoted armature 72. A lever 73 is secured to and extends outwardly from the armature 72. The yoke 62 has a boss 74 extending therefrom, and a connecting rod 75 connects the lever 73 to the boss 74. The connecting rod 75 is pivotally connected to the lever 73 by means of a pivot pin 76 and is connected to the boss 74 by a pivot pin 77.

When the magnet 71 is energized, its core 78 attracts the armature 72 and causes it to move to the left, as viewed in Figure 6, thereby swinging the lever 73 upwardly. This motion is imparted to the yoke 62 by means of the push rod 75 and is in turn imparted to a counter wheel by one of the pawls carried on the pawl member 64. The leverages are so designed that the counter wheel is moved one-tenth of a revolution and such action will accordingly enter a value of "1" into the counter.

When the pawl 65, which engages the ratchet associated with the "unit" counter wheel, moves the ratchet to a point where the depression 55 is encountered, the spring 70 causes the pawl 65 to enter the depression 55, at which time the pawl 66 will engage the ratchet associated with the "tens" counter wheel. This occurs after the "units" wheel indicates a value of "9".

With the pawl in the position just described movement of the counter, due to the energization of the magnet, will cause the pawl 65 to move the "units" wheel forward one step, which will be the "0", and at the same time the pawl 66 will move the "tens" wheel from "0" to "1" and in this way the "carry-over" is effected. The "hundreds" wheel, the "thousands" wheel and the "ten thousands" wheel operate in the same manner when the ratchets of the counter wheels of lower value have their depressions 55 in the position described above.

For resetting the numeral wheels the shaft 48 carries a bell crank 79 by means of which the shaft may be rotated in the direction in which the counter wheels normally rotate. As this shaft is rotated its keyway is engaged by the internal pawl 51 in the counter wheels and thereby the latter is positively rotated. The movement of the shaft 48 is so gaged that it will bring all of the counters with the "0s" uppermost.

In making a rate study, the items are entered into the adding machine 13 and the new and improved device automatically counts the number of bills of each value entered in the adding machine as a by-product of and without affecting the adding machine per se.

Before resetting the counters, as described above, the values shown in all of the counters are printed on a collective sheet 16. The sheet 16 is inserted into the slot 14 and a lever (not shown) is thrown. This lever moves a movable frame member 80 which carries a plurality of printing rollers 81 which may be made of rubber or any other suitable platen material. A stationary frame member 82 is provided with a plurality of studs or pins 83. The movable member 80 is provided with a plurality of slots 84 each of which is engaged by a pin 83.

A suitable ribbon or carbon paper 85 is positioned between the sheet of paper 16 and the printing rollers 81.

As the movable frame member 80 is moved downwardly, as viewed in Figure 7, the slanting portions of the slots 84 causes the frame member 80 to move to the left as well as downwardly until the portion 86 of the slot is reached.

At this time the printing rollers 81 are in position to print and further downward movement of the member 80 is guided in a straight line by the straight portions of the slots 84 and thereby the printing rollers 81 cause impressions from the counter wheels 50 to be printed on the paper 16. At the end of the printing stroke the movable frame member 80 is moved up to its normal position with the rollers 81 out of engagement with the ribbon 85 and the paper 16 so that the latter may be readily removed from the device.

After the printing operation the counters may be reset by means of the bell crank 79.

The relays 30 are supported within the casing 10 and the counters are assembled in a vertical plane within the casing substantially in line with the slot 14 in order that the printing, above described, may be effected with facility.

It is obvious that these elements may be grouped in many other arrangements without departing from the spirit of the invention.

The diagram of connections of the key contacts, the relays, and the counters will now be described.

The circuits are so arranged that active circuits are set up by the relays upon the actuation of the various keys of the adding machine and the circuits thus completed are subsequently energized by the actuation of a total key or the motor bar on the adding machine. Heretofore it has been customary to connect the, so called, "re-

turn wires" of various relay and magnet coils in common or to a "ground" connection, but in the present invention these "return wires" are selectively included in the circuits due to the actuation of other relays, and the wires; leading wires to these magnet coils may also be selectively included in circuits so that due to the selective inclusion of both ends of each winding in the circuit a great degree of flexibility is obtained.

In the present specification the outer end of each magnet winding, whether it be included in the relay or in a counter, will be designated as the "terminal *a*" of the winding. The inner end of the winding will be designated as the "terminal *b*" of the winding.

Although the relay is illustrated, in Figure 4, and its various forms described, to avoid confusion the armatures, contact points, and magnet windings in the diagram will be given different numerals so that they can be readily distinguished from each other.

Referring to Figure 8*a*;

The "hundreds" keys, together with their associated contact members and relays will first be described, followed by a description of the "tens" keys and their associated instrumentalities, and then the "units" keys and their instrumentalities.

The "hundreds" key, which is among the keys utilized in the adding machine to set up amounts from 100 to 199, is designated by the numeral **86**. This key has associated therewith contact arms **87** and **88**. The contact arm **87** is connected to a bus wire **89** which is in turn connected to the positive side **90** of a source of current. The contact arm **88** is connected to the *b* terminal of relay coil **92**. The *a* terminal of the relay coil **92** is connected to a bus wire **96** which is in turn connected to the negative side **91** of a source of current. A fuse **97** is positioned in the positive side of the line and a fuse **98** is positioned in the negative side of the line. The bus wire **96** has in circuit therewith a fuse **99** which is of preferably smaller capacity than that of the fuse **98**. The bus wire **96** also has in series therewith, a suitable resistor **100** to limit the amount of current flowing therethrough.

The relay coil **92** has associated therewith an armature **93** which is normally in contact with a contact point **94** and when attracted, due to the energization of the magnet **92**, the armature **93** breaks contact with the contact point **94** and establishes contact with the contact point **95**. The armature **93** is connected to the negative side of the line by means of a circuit wire **101**. The circuit wire **101** includes a lamp **102**, which may be used as a visual indicator, a fuse **103** and a current limiting resistor **104**, to prevent excessive current from flowing therethrough. When the "one hundreds" key **86** is to be pressed, contact is established between the contact arm **87** and the contact arm **88** and the magnet **92** is energized.

The "two hundreds" key **104** has contact arms **105** and **106** associated therewith, together with a relay coil **107**, having an armature **108** and contact members **109** and **110**. The armature **108** is normally in contact with the member **109**.

The "three hundreds" key **111** has contact arms **112** and **113** associated therewith, together with a relay coil **114**, having an armature **115** and contact members **116** and **117**. The armature **115** is normally in contact with the member **116**.

The "four hundreds" key **118** has contact arms **119** and **120** associated therewith, together with a relay coil **121**, having an armature **122** and contact members **123** and **124**. The armature **122** normally is in contact with the member **123**.

The "five hundreds" key **125** has contact arms **126** and **127** associated therewith, together with a relay coil **128**, having an armature **129** and contact members **130** and **131**. The armature **129** is normally in contact with the member **130**.

The "six hundreds" key **132** has contact arms **133** and **134** associated therewith, together with a relay coil **135**, having an armature **136** and contact members **137** and **138**. The armature **136** is normally in contact with the member **137**.

The "seven hundreds" key **139** has contact arms **140** and **141** associated therewith, together with a relay coil **142**, having an armature **143** and contact members **144** and **145**. The armature **143** is normally in contact with the member **144**.

The "eight hundreds" key **146** has contact arms **147** and **148** associated therewith, together with a relay coil **149**, having an armature **150** and contact members **151** and **152**. The armature **150** is normally in contact with the member **151**.

The "nine hundreds" key **153** has contact arms **154** and **155** associated therewith, together with a relay coil **156**, having an armature **157** and contact members **158** and **159**. The armature **157** is normally in contact with the member **158**.

One contact member of each of the above "one hundreds" through the "nine hundreds" keys are connected to the bus wire **89**. The other of each of the contact members is connected to the *b* terminal of the associated relay coils. The *a* terminals of the relay coils are all connected to the bus wire **96**.

The contact member **94** is connected to the armature **108**; the contact member **109** is connected to the armature **115**; the contact member **116** is connected to the armature **122**; the contact member **123** is connected to the armature **129**; the contact member **130** is connected to the armature **136**; the contact member **137** is connected to the armature **143**; the contact member **144** is connected to the armature **150**; the contact member **151** is connected to the armature **157**; and the contact member **158** is connected by means of a wire **161** to the *a* terminal of all of the counter magnets **71** in the group or bank **162**, which represents counters registering bills from "00" to "099". With all of the armatures **93**, **108**, **115**, **122**, **129**, **136**, **143**, **150** and **157** in their normal positions, as shown in Figure 8*a*, all of the counters in the bank **162** have their *a* terminals connected to the negative side of the line.

The contact member **95** is connected by means of a wire **163** to the *a* terminals of all of the counter magnets **71** in the bank **164** of counters provided for counting bills showing amounts of "100" to "199". The contact member **110** is connected by means of a wire **165** to the *a* terminals of all of the counter magnets **71** in the bank **166** which counts all bills having amounts from "200" to "299". The contact member **117** is connected by means of a wire **167** to the *a* terminals of all of the counter magnets **71** in the bank **168** which counts all bills having amounts from "300" to "399". The contact member **124** is connected by means of a wire **169** to the *a* terminals of all of the counter magnets **71** in the bank **170** which counts all bills having amounts from "400" to "499". The contact member **131** is connected by means of a wire **171** to the *a* terminals of all of the counter magnets **71** in the bank **172** which counts all bills having amounts from "500" to "599". The contact member **138** is connected by means of a wire **173** to the *a* terminals of all of

the counter magnets 71 in the bank 174 which counts all bills having amounts from "600" to "699". The contact member 145 is connected by means of a wire 175 to the *a* terminals of all of the counter magnets 71 in the bank 176 which counts all bills having amounts from "700" to "799". The contact member 152 is connected by means of a wire 17 to the *a* terminals of all of the counter magnets 71 in the bank 178 which counts all bills having amounts from "800" to "899". The contact member 159 is connected by means of a wire 160 to the *a* terminals of all of the counter magnets 71 in the bank 180 which counts all bills having amounts from "900" to "999".

With this arrangement the *a* terminals of the "00" to "099" counter magnets are connected to the negative side of the line at all times except when one of the relay armatures above described, is attracted due to the energization of its magnet thereby breaking contact with the *a* terminal of the counter magnets in the banks 162 and establishing contact with the *a* terminals of the counter magnets of any other banks.

If the "five hundreds" key 125 is depressed contact is established between the contact arms 126 and 127 energizing the magnet 128 and attracting the armature 129. The armature 129, upon being attracted, breaks contact with the contact member 130 and establishes contact with 131 thereby connecting the negative side of the line to the *a* terminals of the counter magnets in the bank 172 via the wire 171.

The 00 counter magnet, which is the one in the upper left hand bank 162, Figure 8*d*, has its *b* terminal connected by means of a wire 181 to a contact arm 182 associated with the "no bill" key 179.

The contact arm 182 has a contact arm 183 adapted to cooperate therewith when the key 179 is depressed. The connections to the contact arm 183 will presently be described.

The "tens" key 185 has associated therewith contact arms 186, 187. The "twentys" key 188 has associated therewith contact arms 189, 190. The "thirtys" key 191 has associated therewith contact arms 192, 193. The "fortys" key 194 has associated therewith contact arms 195, 196. The "fiftys" key 197 has associated therewith contact arms 198, 199. The "sixtys" key 200 has associated therewith contact arms 201, 202. The "seventys" key 203 has associated therewith contact arms 204, 205. The "eightys" key 206 has associated therewith contact arms 207, 208. The "ninety" keys 209 has associated therewith contact arms 210, 211. The contact arms 186, 189, 192, 195, 198, 201, 204, 207 and 210 are connected by a bus wire 212 which is in turn connected to the positive side of the line 90.

The contact arm 187 is connected to the *b* terminal of relay magnet coil 213. The contact arm 190 is connected to the *b* terminal of relay magnet coil 214. The contact arm 193 is connected to the *b* terminal of relay magnet coil 215. The contact arm 196 is connected to the *b* terminal of relay magnet coil 216. The contact arm 199 is connected to the *b* terminal of relay magnet coil 217. The contact arm 202 is connected to the *b* terminal of relay magnet coil 218. The contact arm 205 is connected to the *b* terminal of relay magnet coil 219. The contact arm 208 is connected to the *b* terminal of relay magnet coil 220 and the contact arm 211 is connected to the *b* terminal of relay magnet coil 221. The *a* terminals of all these coils are connected by a bus wire 222 and through a limiting resistor 224 and a fuse 223 to the negative side of the line 91.

An armature 225 associated with the relay coil 213 is normally in contact with a group of contact points 226 and, when attracted by the coil 213, breaks contact with the contact point 226 and establishes contact with a group of contact points 227. The groups 226 and 227 each contain ten contact points.

An armature 228, associated with the magnet coil 214, is normally in contact with a contact point 229 and when attracted by the magnet 214 breaks contact with the contact point 229 and establishes contact with a group of contact points 230.

An armature 231, associated with the magnet coil 215, is normally in contact with a contact point 232 and when attracted by the magnet 215 breaks contact with the contact point 232 and establishes contact with a group of contact points 233.

An armature 234, associated with the magnet coil 216, is normally in contact with a contact point 235 and when attracted by the magnet 216, breaks contact with the contact point 235 and establishes contact with a group of contact points 236.

An armature 237, associated with the magnet coil 217, is normally in contact with a contact point 238 and when attracted by the magnet 217, breaks contact with the contact point 238 and establishes contact with a group of contact points 239.

An armature 240, associated with the magnet coil 218, is normally in contact with a contact point 241 and when attracted by the magnet 218 breaks contact with the contact point 241 and establishes contact with a group of contact points 242.

An armature 243, associated with the magnet coil 219, is normally in contact with a contact point 244 and when attracted by the magnet 219, breaks contact with the contact point 244 and establishes contact with a group of contact points 245.

An armature 246, associated with the magnet coil 220, is normally in contact with a contact point 247 and when attracted by the magnet 220 breaks contact with the contact point 247 and establishes contact with a group of contact points 248.

An armature 249, associated with the magnet coil 221, is normally in contact with a contact point 250 and when attracted by the magnet 221, breaks contact with the contact point 250 and establishes contact with a group of contact points 251.

The group of contact points 230, 233, 236, 239, 242, 245, 248, and 251 each contains ten contact points.

The armature 225 is permanently connected to the contact point 229; the armature 228 is permanently connected to the contact point 232; the armature 231 is permanently connected to the contact point 235; the armature 234 is permanently connected to the contact point 238; the armature 237 is permanently connected to the contact point 241; the armature 240 is permanently connected to the contact point 244; the armature 243 is permanently connected to the contact point 247; the armature 246 is permanently connected to the contact point 250 and the armature 249 is connected by means of a

wire 252, through a limiting resistor 253, and a fuse 254, to the negative side of the line 91.

The connections to the groups of contacts will presently be described.

In the "units" section, the "one" key 255 has associated therewith contact arms 256 and 257; the "two" key 258 has associated therewith contact arms 259 and 260; the "three" key 261 has associated therewith contact arms 262 and 263; the "four" key 264 has associated therewith contact arms 265 and 266; the "five" key 267 has associated therewith contact arms 268 and 269; the "six" key 270 has associated therewith contact arms 271 and 272; the "seven" key 273 has associated therewith contact arms 274 and 275; the "eight" key 276 has associated therewith contact arms 277 and 278; the "nine" key 279 has associated therewith contact arms 280 and 281.

The contact arms 256, 259, 262, 265, 268, 271, 274, 277 and 280 are connected to a bus wire 282 which is in turn connected to the positive side of the line 90.

The contact arm 257, which is associated with the "one" key 255, is connected to the *b* terminal of each of the relay coils in the horizontal row 01—R to 91—R inclusive and to the relay 1—R in the lower portion of the diagram, by means of a bus wire 317. The contact arm 260, which is associated with the "two" key 258, is connected in a like manner to the *b* terminal of each of the relay coils in the horizontal row 02—R to 92—R inclusive and to the relay 2—R in the lower portion of the diagram, by means of a bus wire 329. The contact arm 263, which is associated with the "three" key 261, is connected in a like manner to the *b* terminal of each of the relay coils in the horizontal row 03—R to 93—R inclusive and to the relay 3—R in the lower portion of the diagram, by the wire 341. The contact arm 266, which is associated with the "four" key 264, is connected in a like manner to the *b* terminal of each of the relay coils in the horizontal row 04—R to 94—R inclusive, and to the relay 4—R in the lower portion of the diagram, by means of a bus wire 353. The contact arm 269, which is associated with the "five" key 267, is connected in a like manner to the *b* terminal of each of the relay coils in the horizontal row 05—R to 95—R inclusive and to the relay 5—R in the lower portion of the diagram, by means of a bus wire 365. The contact arm 272, which is associated with the "six" key 270, is connected in a like manner to the *b* terminal of each of the relay coils in the horizontal row 06—R to 96—R inclusive, and to the relay 6—R in the lower portion of the diagram, by means of a bus wire 377. The contact arm 275, which is associated with the "seven" key 273, is connected in a like manner to the *b* terminal of each of the relay coils in the horizontal row 07—R to 97—R inclusive, and to the relay 7—R in the lower portion of the diagram, by means of a bus wire 389. The contact arm 278, which is associated with the "eight" key 276, is connected in a like manner to the *b* terminal of each of the relay coils in the horizontal row 08—R to 98—R inclusive, and to the relay 8—R in the lower portion of the diagram, by means of a bus wire 401. The contact arm 281, which is associated with the "nine" key 279, is connected in a like manner to the *b* terminal of each of the relay coils in the horizontal row 09—R to 99—R inclusive, and to the relay 9—R in the lower portion of the diagram, by means of a bus wire 413.

The connections of the *a* terminals of these relays will now be described.

Each contact point in group 227 is connected, by means of a cable 283, to an *a* terminal of the relay coils in the group from 10—R to 19—R inclusive. These contacts, associated with the "tens" keys, in the "tens" section, are utilized in forming all numerals from 10 to 19. Contact is established between the armature 225 and the contact points 227 when the "tens" key 185 is depressed, due to the energization of the magnet 213.

As pointed out above, the armature 225 is normally in contact with the contact points 226; each of these contact points is connected by means of a cable 284 to an *a* terminal of a relay coil in the group from 00—R to 09—R inclusive.

Each of the contact points in the group 230 is connected, by means of a cable 285, to an *a* terminal of a relay coil in the group from 20—R to 29—R inclusive.

Each of the contact points in the group 233 is connected, by means of a cable 286, to an *a* terminal of a relay coil in the group from 30—R to 39—R inclusive.

Each of the contact points in the group 236 is connected, by means of a cable 287, to an *a* terminal of a relay coil in the group from 40—R to 49—R inclusive.

Each of the contact points in the group 239 is connected, by means of a cable 288, to an *a* terminal of a relay coil in the group from 50—R to 59—R inclusive.

Each of the contact points in the group 242 is connected, by means of a cable 289, to an *a* terminal of a relay coil in the group from 60—R to 69—R inclusive.

Each of the contact points in the group 245 is connected, by means of a cable 290, to an *a* terminal of a relay coil in the group from 70—R to 79—R inclusive.

Each of the contact points in the group 248 is connected, by means of a cable 291, to an *a* terminal of a relay coil in the group from 80—R to 89—R inclusive.

Each of the contact points in the group 251 is connected, by means of a cable 292, to an *a* terminal of a relay coil in the group from 80—R to 99—R inclusive.

The armature 293 is associated with the relay coil 00—R; the armature 294 is associated with the relay coil 10—R; the armature 295 is associated with the relay coil 20—R; the armature 296 is associated with the relay coil 30—R; the armature 297 is associated with the relay coil 40—R; the armature 298 is associated with the relay coil 50—R; the armature 299 is associated with the relay coil 60—R; the armature 300 is associated with the relay coil 70—R; the armature 301 is associated with the relay coil 80—R; the armature 302 is associated with the relay coil 90—R.

The armatures 293 to 302 inclusive, and the *b* terminals of the relay coils in the group 00—R to 90—R inclusive are connected in common by a bus wire 303 and this bus wire is connected by means of a wire 304 to a contact point 305 associated with the relay 9—R.

The armatures 306 to 315 inclusive are associated with the group of relays 01—R to 91—R inclusive and are connected together by means of a bus wire 316 which in turn is connected by means of a wire 443 to a contact point 444 associated with the relay 1—R.

The armatures 318 to 327 inclusive are asso-

ciated with the group of relays 02—R to 92—R inclusive and are connected together by means of a bus wire 328 which in turn is connected by means of a wire 445 to a contact point 446 associated with the relay 2—R.

The armatures 330 to 339 inclusive are associated with the group of relays 03—R to 93—R inclusive and are connected together by means of a bus wire 340 which in turn is connected by means of a wire 447 to a contact point 448 associated with the relay 3—R.

The armatures 342 to 351 inclusive are associated with the group of relays 04—R to 94—R inclusive and are connected together by means of a bus wire 352 which in turn is connected by means of a wire 449 to a contact point 450 associated with the relay 4—R.

The armatures 354 to 363 inclusive are associated with the group of relays 05—R to 95—R inclusive and are connected together by means of a bus wire 364 which in turn is connected by means of a wire 451 to a contact point 452 associated with the relay 5—R.

The armatures 366 to 376 inclusive are associated with the group of relays 06—R to 96—R inclusive and are connected together by means of a bus wire 376 which in turn is connected by means of a wire 453 to a contact point 454 associated with the relay 6—R.

The armatures 378 to 387 inclusive are associated with the group of relays 07—R to 97—R inclusive and are connected together by means of a bus wire 388 which in turn is connected by means of a wire 455 to a contact point 456 associated with the relay 7—R.

The armatures 390 to 399 inclusive are associated with the group of relays 08—R to 98—R inclusive and are connected together by means of a bus wire 400 which in turn is connected by means of a wire 457 to a contact point 458 associated with the relay 8—R.

The armatures 402 to 411 inclusive are associated with the group of relays 09—R to 99—R inclusive and are connected together by means of a bus wire 412 which in turn is connected by means of a wire 459 to a contact point 460 associated with the relay 9—R.

The *a* terminals of the group of relays 1—R to 9—R inclusive are connected together and to the negative side of the line by means of a wire 414, via a fuse 415, a limiting resistor 416, a second limiting resistor 417 and a second fuse 418.

The relay 9—R has an armature 419 normally in contact with the contact point 305 and permanently connected to a contact point 420, associated with the relay 8—R; the relay 8—R has an armature 421 normally in contact with the contact point 420 and permanently connected to a contact point 422, associated with the relay 7—R; the relay 7—R has an armature 423 normally in contact with the contact point 422 and permanently connected to a contact point 424, associated with the relay 6—R; the relay 6—R has an armature 425 normally in contact with the contact point 424 and permanently connected to a contact point 426, associated with the relay 5—R; the relay 5—R has an armature 427 normally in contact with the contact point 426 and permanently connected to a contact point 428, associated with the relay 4—R; the relay 4—R has an armature 429 normally in contact with the contact point 428 and permanently connected to a contact point 430, associated with the relay 3—R; the relay 3—R has an armature 431 normally in contact with the contact point 430 and permanently connected to a contact point 432 associated with the relay 2—R; the relay 2—R has an armature 433 normally in contact with the contact point 432 and permanently connected to a contact point 434, associated with the relay 1—R; and the relay 1—R has an armature 435 normally in contact with the contact point 434 and connected by means of the wire 436 to a contact arm 437 which is associated with the motor bar key 439.

The contact arm 438, in cooperative relation with the contact arm 437, is connected via the wire 440 to the positive side of the line.

The contact arms 437 and 438 are bridged with a suitable condenser 461 to limit or reduce sparking. The condenser 461 is bridged with a resistor 462 having high resistance and serving to discharge the condenser.

When none of the relays 1—R to 9—R have been energized the act of pressing the motor bar 439 completes a circuit which may be traced as follows:

From the positive side of the line 90 via the wire 440 to the contact arm 438 and to the contact arm 437 which is in contact therewith due to the depression of the motor bar; from 437 current flows via the wire 436 to the armature 435 of the relay 1—R, to the contact 434 which is normally in contact therewith and thence to the armature 433 of the relay 2—R.

Since the armature 433 is normally in contact with the contact point 432 and the remainder of these relays through the relay 9—R, all have their armatures normally in contact with contact points as above described, current flows from the contact point 432 via the armature 431, the contact point 430, the armature 429, the contact point 428, the armature 427, the contact point 426, the armature 425, the contact point 424, the armature 423, the contact point 422, the armature 421, the contact point 420, the armature 419, the contact point 305, and is delivered via the wire 304 to the bus wire 303 which connects to the *b* terminals of the relays 00—R to 90—R and at the same time flows, via the same bus wire, to armatures 293 to 302 inclusive associated with these relays.

If the *a* terminal of any one of the relays 10—R to 90—R receives an impulse from the negative side of the line via any one of the relays 213 to 221 inclusive associated with the "tens" keys, said first relays will operate. If none of the "tens" keys has been operated, a "zero" circuit is maintained, which may be traced as follows:

From the negative side of the line 91, via the wire 252 and via the armature 249, the contact point 250, the armature 246, the contact point 247, the armature 243, the contact point 244, the armature 240, the contact point 241, the armature 237, the contact point 238, the armature 234, the contact point 235, the armature 231, the contact point 232, the armature 228, the contact point 229, the armature 225, the group of contact points 226 and via the cable 284 to the *a* terminals of the relays 01—R to 09—R and to the *a* terminal of the relay 00—R.

Since, of this group, the only relay receiving current via its *b* terminal is the 00—R relay, this relay only will be actuated. The *b* terminals of all the other relays from 01—R to 90—R are not energized due to the fact that none of the armatures associated with the relays 1—R to 9—R have been actuated.

The connections of the device, when the 00—R relay is energized, will presently be described in

connection with the description of the handling of the "no-bills".

If one of the relays 1—R to 9—R has been actuated due to the depression of a "tens" key and/or a "units" key, the circuit to the bus wire 303 feeding the relays 00—R to 9—R is disabled. For example, suppose the relay 5—R is energized due to the pressing of the five key in the "units" row, designated as 267, closing the contacts 268 and 269 and supplying current to the *b* terminals of the relays 05—R to 95—R and the relay 5—R via the bus wire 365, the relay 5—R is energized, due to the fact that its *a* terminal is connected to the negative side of the line via the bus wire 414 which is energized due to the depression of the key 267.

The armature 427 is attracted and leaves the contact point 426 to establish contact with the contact point 452. This breaks the "zero" circuit above described and when the motor bar 439 is depressed the current flows via the wire 436 and via the armatures and contact points of the relays 1—R to 4—R and to the armature 427 of the relay 5—R. Due to the fact that the armature 427, when attracted, makes contact with the contact point 452, current flows from the armature 427 via this contact to the bus wire 351 which energizes the armatures 354 to 363, inclusive, which are associated with the relays 05—R to 95—R, therefore the relays 1—R to 9—R respectively are adapted, when actuated, to energize the armatures associated with the relays 01—R to 91—R through the relays 09—R to 99—R.

The contact points 441 associated with the armature 293 of the relay 00—R are each connected by means of the cable 442 to the countermagnets representing 00 in each of the banks of counters; i. e., 00, 100, 200, etc., through 900 inclusive.

The connection to the 00 counter magnet has the contact arms 182 and 183 in series therewith through the wires 181 and 184. The contact points 182 and 183 are normally open and associated with the "no-bill" key 179. By means of this key the 00 counter may be caused to count the number of entries of "no-bills".

The "no-bill" key is depressed, closing the contacts 182 and 183 thereby completing a circuit from one of the contacts 441 to the *b* terminal of the 00 counter magnet in the bank 162. The *a* terminal is connected via the wire 161 to the "zero" circuit which is maintained by the relays associated with the "hundreds" keys and thence to the negative side of the line.

After depressing the "no-bill" key, the motor bar 439 is depressed, thereby closing the contacts 437 and 438 and permitting current to flow from the positive side of the line through the series of armatures and contacts associated with the relays 1—R to 9—R inclusive and thence, via the wire 304, to the bus wire 303 which supplies current to the *b* terminals of the relays 00—R, 10—R through 90—R. Of this last group of relays, the 00 relay is the only one energized due to the fact that its *a* terminal is connected via the cable 284 to one of the contact points in the group 226 with which the armature 225 is normally in contact. From the armature 225, current passes, via the "zero" circuit maintained by the armatures of the relays associated with the "tens" keys and via the wire 252 to the negative side of the line. This permits current to flow only through the winding of the relay 00—R and the armature 293 is attracted, thereby establishing a circuit between the contact in the group 441 and the bus wire 303, whereupon current flows via the cable 442 and via the wire 184, the "no-bill" contacts 182 and 183 and via the wire 181 to the *b* terminal of the 00 counter magnet.

To select the 100 counter, the 100 key 86 is depressed, thereby closing the contacts 87 and 88, energizing the relay 92, and attracting the armature 93. This disables the "zero" circuit through the relays associated with the "hundreds" keys, due to the fact that the armature 93 breaks contact with 94 and establishes contact with the contact point 95, permitting current to flow via the wire 163 to the *a* terminals of all of the counters in the bank 164 containing counters from 100 to 199.

The motor bar 439 is then pressed, closing contacts 437 and 438, and energizing the relay 00—R in the same manner described above in connection with the "no-bill" selection. This attracts the armature 293, causes it to establish contact with the group of contacts 441, connecting the same with the bus wire 303 and delivering current via the cable 442 to the *b* terminal of the 00 counter, the 100 counter, the 200 counter and each succeeding 00 counter through 900 counter, but as the counter magnets in the bank 164 only have their *a* terminals connected, and as the 100 is the only one having its *b* terminal connected, the 100 counter magnet is the only one through which current can pass to cause it to add a 1.

The other relays have their contacts connected via cables to a corresponding counter magnet in each bank but in order to keep the drawings as simple as possible, they are not herein described, with the exception of the contact points associated with the relay 99—R. This group of contacts is designated by the numeral 463 and they are connected via a cable 464 to the counter representing 99 in each bank of counters; i. e., 099, 199, 299, 399, etc., through 999, inclusive.

When numerals are selected which do not contain zeros the connections are slightly different due to the fact that one or more of the relays 1—R to 9—R is actuated, thereby disabling the circuit to the bus wire 303 which energizes the relays 00—R to 90—R. As an example of this, suppose the figure 999 was selected. The "nine" key in the "hundreds", "tens" and "units" columns are depressed.

When the "nine" key 153 in the "hundreds" column is depressed, contacts 154 and 155 are closed, thereby energizing the relay 156 and attracting the armature 157. The armature 157 breaks contact with 158 and makes contact with 159, thereby connecting the *a* terminals of the counter magnets in the bank 180 to the negative side of the line, via the wire 160.

When the "nine" key 209 in the "tens" column is depressed, the contact points 210 and 211 are closed, thereby energizing the relay 221 and attracting the armature 249. This disables the "zero" circuit associated with the "tens" column, due to the fact that when the armature 249 is attracted it breaks contact with the contact point 250 and establishes contact with the ten contact points in the group 251 and establishes circuits via the cable 292 with the *a* terminals of the relays 90—R to 99—R inclusive.

When the "nine" key 279 in the "units" column is depressed, the contacts 280 and 281 are closed. This supplies current from the positive side of the line 90 to the bus wire 413 which connects to the *b* terminals of the relays 09—R to 99—R but since the *a* terminal of the relay 99—R is the only relay in this group which is connected by the action of the "nine" key 209 in the "tens"

row, it, only, will be energized and will attract the armature 411. At the same time the relay 9—R is energized, due to the fact that its b terminal is also connected to the bus wire 413. The operation of this relay will presently be described.

When the relay 99—R attracts the armature 411 it establishes a connection between the wire 412 and the ten contacts in the group 463. These last contacts are connected via the cable 464 to the 99 counters in each of the banks as above described.

Since the a terminals in the bank 180, only, are connected to the negative side of the line via the wire 188, due to the depression of the "nine" key 153 in the "hundreds" column, and the b terminal of the 999 counter magnet only is energized, the 999 counter in this bank only will receive current when the wire 412 is supplied with energy.

The wire 412 is energized in the following manner:

Remembering that normally a circuit is maintained from the motor bar contact 437 through the armatures, and contacts of the relays 1—R to 9—R inclusive, for feeding the bus wire 303 via the wire 304, which is in turn connected to the b terminals of the relays 00—R to 90—R, when the relay 9—R was energized, as described above, its armature 419 is attracted and the circuit between the motor bar contact and the bus wire 303 is disabled due to the fact that contact between the armature 419 and the contact point 305 is broken. The armature 419, upon leaving the contact 305, establishes contact with the contact point 460.

Now, when the contact points 437 and 438 are connected by the depression of the motor bar 439, current flows from the positive side of the line 90 via the wire 440, contact 438, contact 437, and the wire 436 to the series of armatures and contacts in the relays 1—R to 8—R, inclusive, thence to the armature 419 associated with the relay 9—R and via the contact point 460 and the wire 459 to the bus wire 412. As above described, current can only flow through the magnet associated with the 999 register in the bank 180 due to the completion of the circuit from its a terminal, because of the depression of the "nine" key 153 in the "hundreds" row.

The device is also provided with a counter 465 for counting the total customers. The a terminal of this counter is connected via a wire 466, if desired, through a single lamp 467, limiting resistor 468, a fuse 469, to the negative side of the line. The b terminal of this counter is connected via a wire 470 to a contact arm 471 which is associated with a sub-total key 473. The contact arm 471 has cooperating therewith, a contact arm 472 which is connected by a wire 474 to the positive side of the line.

When a series of one customer's bills has been added in the adding machine, the sub-total key 473 is depressed and the counter 465 is energized and a value of 1 is entered.

The "grand total" key 475 has contacts 476 and 477 associated therewith but these contacts are not shown as connected to any circuits. It is obvious that these contacts may be connected to control electrical circuits in a manner similar to that shown in connection with other keys.

Having shown and described a simple embodiment of the invention, which may be taken to be illustrative of the same, it is obvious that many changes may be made without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. In combination, a plurality of keys arranged in rows having orders of "units", "tens", and "hundreds", a pair of contacts and a plurality of relays interconnected therewith for each key in said "units" row, each of said relays including a plurality of contacts adapted to be closed by the actuation thereof, a plurality of banks of magnetically operated counters, individual connections between said relay contacts and said counters whereby any given relay may control the energization of a single counter in each of said banks, a pair of contacts and a single relay interconnected therewith for each key in said "tens" row, said last relays each including a plurality of contacts adapted to be closed by the actuation thereof, said contacts being interconnected with the relays associated with the "units" keys, a plurality of back contacts on the relay associated with at least one of the "tens" keys for maintaining "zero" circuits when said relay is in its normal position, connections between said back contacts and at least one relay in each plurality of relays associated with the "units" keys, single back contacts on the other relays associated with the "tens" keys and included in said "zero" circuit, a relay and a pair of contacts associated with each of the keys in the "hundreds" row, said relays being adapted normally to maintain a circuit including the return wires of all said counters in one of said banks and to maintain circuits including the return wires of all of said counters in another of said banks when said "zero" circuit is disabled by the depression of any key in the "hundreds" row, the bank being determined by the key depressed.

2. In a key controlled statistical device, a plurality of keys arranged in denominational rows, a plurality of counters each having an actuating winding, said counters being arranged in banks, a pair of electrical contacts associated with each key, a plurality of multi-contact relays associated with each of said keys in one of said denominational rows, said relays having their contacts interconnected with the windings of said counters, whereby any given relay may control the energization of a single counter in each bank, a single relay for each key in a second of said denominational rows adapted to be energized when its key is depressed, said single relays being provided with multi-contacts, connections between the contacts of said single relays and the actuating windings of said first relays whereby said single relays may control the energizing of said first relays; a double-throw, single-contact relay associated with each pair of contacts of the keys in a third of said denominational rows, and individual connections between the contacts of said last relays and the return circuits of the banks of counter windings, whereby said first relays and said last relays conjointly control the energization of said counter windings.

3. In a key operated statistical machine, a plurality of denominational rows of keys of "units", "tens" and "hundreds" orders, a plurality of counting devices arranged in banks, a pair of contacts associated with each of said keys, magnetic actuating means for each of said counting devices, a plurality of relays associated with each of the "units" keys and having combinational circuits including said contacts, said re-

lays and said actuating means, whereby when one of said "units" keys is depressed said relays enable circuits including at least some of said actuating means, a relay for each of the "tens" keys for completing the energization of said first relays, and a relay for each of said "hundreds" keys including connections for energizing said enabled circuits of said actuating means, one of said counting devices being provided for each possible combination of said keys and arranged to enter a value of "1" each time its combination of keys is depressed.

4. In a key operated statistical device in which the keys are arranged in denominational rows of "units", "tens" and "hundreds" orders, a pair of electrical contacts associated with each key, a plurality of counters each having an actuating magnet, said magnets having actuating and return circuit terminals and arranged in banks, a plurality of relays associated with each key in said "units" row, combinational circuits controlled by said relays and adapted to complete connections to an actuating terminal of one magnet in each of said banks, electrical means associated with each key in said "tens" row for effecting the energization of one relay associated with each of said units keys, electrical means associated with each key in said "hundreds" row for connecting the return circuit terminals of all of the actuating magnets in one of said banks to a source of current, and an actuating key and pair of contacts associated therewith, said contacts being connected to said source and to said completed connections whereby one of said actuating magnets in one of said banks may be energized when said actuating key is depressed.

5. A statistical device according to claim 4 in which the relays associated with the contacts of at least two of said denominational rows of keys normally maintain "zero" circuits including at least one of said counters, and in which an additional key is provided for connecting said "zero" circuit to said source of current for counting bills upon which no amounts occur.

6. In a statistical device having a group of "units" keys, a group of "tens" keys and a group of "hundreds" keys, a plurality of counters each controlled by an electro-magnetic winding, said counters being arranged in banks, a pair of key contacts and a double-throw relay for each of said "hundreds" keys, said relays having actuating windings included in circuits with said key contacts and having their double throw switches normally maintaining a "no-hundreds" circuit, which normally maintains a return circuit for all of the windings in one of said banks having a value of less than 100, said "no-hundreds" circuit being adapted to be disabled when a "hundreds" key is depressed, thereby disabling the return circuit of the windings of said bank having a value of less than 100 and completing the return circuits for all of the windings in another of said banks depending upon the value of the "hundreds" key depressed, a pair of key contacts and a double-throw relay for each of said "tens" keys, said second relays having actuating windings in circuit with said second key contacts and having its double-throw switches normally maintaining a "no-tens" circuit, a pair of key contacts and a double-throw relay for each of said "units" keys, a third series of relays being grouped with each of said "units" keys and having actuating windings controlled by said second relays, the contact arms of said last relays each being adapted to deliver electric current to the electro-magnetic winding of one counter in each of said banks which has had its return wire connected to a source of current by one of said first relays, and a "zero-zero" circuit associated with said "units" keys and normally maintained when no "units" key is depressed.

7. The invention according to claim 6 in which each series of said third relays grouped with each of said "units" keys is comprised of ten relays and in which said "zero-zero" circuit associated with said "units" keys includes double-throw relays having contacts connected in series with said "zero-zero" circuit whereby the energization of any one of said last relays due to the depression of a key in said "units" row will disable said "zero-zero" circuit.

8. In a key operated statistical device in which the keys are arranged in denominational rows of "units", "tens" and "hundreds" orders, a pair of electrical contacts associated with each key, a plurality of counters each having an actuating magnet, said magnets having actuating and return circuit terminals and arranged in banks, a plurality of multi-contact electrical relays associated with each key in said "units" row, each relay having a magnet with actuating and return circuit terminals and having its contacts connected to the actuating circuit terminal of one counter magnet in each of said banks, a second plurality of multi-contact relays one of which is connected with each pair of key contacts of said "tens" row of keys, each of said last relays having its contacts connected to control the return circuits of one relay in each of said first groups, a relay associated with the key contacts of each key in said "hundreds" row having its contacts connected to one side of a source of current and to the return circuit terminals of all of the counter magnets in one of said groups.

9. A statistical device according to claim 8 in which no "zero" keys are provided in said denominational rows, in which the relays associated with said "tens" and "hundreds" keys maintain zero circuits enabling at least one of said multi-contact relays associated with one key in said units row, and in which a "zero-zero" circuit is associated with said "units" row of keys comprised in part of contact arms and contact points of a series of single-contact double-throw relays, each of which is adapted to disable said "zero-zero" circuit when a key in said first row of keys is depressed.

10. In combination, a plurality of keys arranged in denominational rows having orders of "units", "tens" and "hundreds", a contactor and a plurality of relays each having one terminal of its actuating magnet interconnected therewith for each key in said units row, said relays being termed "units" relays and each being provided with an armature contact member and a plurality of contacts adapted to be contacted by said contact member, a plurality of banks of magnetically operated counters, connections between the contacts of said "units" relays and the magnets of said counters, a cooperating member for each of said contactors, connections between all said cooperating members and one side of a source of current, a contactor and a single relay having one terminal of its actuating magnet interconnected therewith for each key in said "tens" row, a cooperating member for each of said second contactors, connections between all said second cooperating members and said side of said source of current said single relays

being termed "tens" relays and each being provided with an armature contact member and a plurality of contacts adapted to be contacted by said contact member, connections between said contacts of said single relays and the actuating magnets of said "units" relays, back contacts on a plurality of said second relays for mantaining "zero" circuits when said second relays are in their normal position, connections between said back contacts and at least one relay in each plurality of relays associated with the "units" key contactors, single back contacts on the others of said single relays and included in said "zero" circuit, a contactor and a relay having one terminal of its actuating magnet interconnected therewith for each key in the "hundreds" row said last relays being termed "hundreds" relays and each being provided with a pair of contacts and a contact arm normally in contact with one contact thereof and adapted to engage the other contact when the relay is actuated, connections between the normally engaged contacts of said "hundreds" relays, the other side of said source and the magnets of a bank of said counters having values of less than 100, said circuit being termed "no hundreds" circuit and being normally maintained when no "hundreds" key is depressed whereby only counters in said bank having values of less than 100 will be actuated when "units" or "tens" keys are depressed.

11. In a statistical device, in combination, a plurality of keys arranged in denominational rows having orders of "units", "tens" and "hundreds", electrical contacts controlled by said keys, a plurality of relays associated with each pair of contacts controlled by the keys in the "units" row said relays being termed "units relays" and each being provided with an armature contact member and a plurality of contacts adapted to be contacted thereby, a plurality of counter magnets grouped in banks, connections between the contacts in said pluralities and said magnets, a single relay associated with each pair of counters controlled by keys in the "tens" row, said single relays each having a contact arm, a contact adapted to be engaged by said arm when the relay is energized one of said last relays having a plurality of back contacts and the others having a single back contact, all of said arms and back contacts being normally included in a "zero tens" circuit, a plurality of relays associated with the contacts controlled by keys in said "hundreds" row, said last relays each having an armature contact member and a contact adapted to be engaged thereby when the relay is energized and a back contact which is normally engaged by the armature contact member, connections between said armature contact members and said back contact members and a source of current for normally maintaining a "zero hundreds" circuit enabling the return circuits of the magnets in one of said banks, and connections between said first contacts said last relays and the return circuits of the magnets in others of said banks whereby the depression of a key in the "hundreds" row will disable said "zero hundreds" circuit and enable the return circuits of magnets in another of said banks.

12. In a statistical device, in combination, a plurality of keys arranged in denominational rows having the orders of "units", "tens" and "hundreds", contact devices associated with the keys in the "units" row, a plurality of relays having actuating windings associated with each contact device each of said relays having a group of contacts and a contact member normally maintaining a "zero units" circuit and adapted to disable said "zero" circuit and establish contact with said plurality of contacts when its actuating winding is energized, a plurality of banks of counters, an actuating magnet for each counter, connections between the contacts in said groups and said counter magnets whereby the contacts in each group when the relay associated therewith is energized enables circuits to one magnet in each bank of counters, a contact device and a relay having its actuating coil associated therewith for each key in said "tens" row, said last relays each having contact arms and contacts and connections associated therewith normally maintaining a "zero tens" circuit and also having a plurality of contacts interconnected with the magnets of said first relays whereby the circuits associated with said "tens" row acting conjointly with the circuits in said "units" row may energize one relay in each plurality of said first relays, and instrumentalities and connections associated with the keys in the "hundreds" row normally maintaining a "zero hundreds" circuit enabling the return circuits of the counter magnets in one of said banks when no "hundreds" key is depressed, and for disabling said normally maintained circuit and completing the return circuits for the actuating magnets in another of said banks when a "hundreds" key is depressed.

13. In combination, a plurality of keys arranged in denominational rows having orders of "units", "tens" and "hundreds", electrical contacts controlled by said keys, a group of multi-contact relays associated with each key of said "units" order, the relays in each group having one coil terminal thereof interconnected with the contacts controlled by its key, a single-relay associated with each key of said "tens" order each relay having its actuating coil interconnected with the contacts controlled by its key, said single relays each having multi-contacts adapted to be engaged by an armature contactor when actuated, a plurality of back contacts on one of said single relays, a single back contact on each of the other single relays, the back contacts on each relay being normally engaged by its armature contactor, individual connections between said multi-contacts of said single relays and the other coil terminals of said first relays, a plurality of banks of counters each actuated by a single electromagnet and each magnet terminating in an actuating coil terminal and a return circuit coil terminal, connections between the contacts of said first relays and the actuating terminals of said magnets, means individually associated with the key contacts of said "hundreds" order and the return circuits of the magnets of each of said banks of counters, and "zero" circuits for each row of keys normally maintained when none of said keys in its row are depressed, said "zero" circuits being adapted to be disabled upon the depression of one or more of said keys whereby a key of one order may close contacts to effect the completion of one side of the circuit to the magnets and a key of a different order may effect the completion of the other side of said last circuit.

WILLIAM B. AUSTIN.