July 17, 1956 K. A. KNUTSEN 2,755,022

APPARATUS FOR SAFEGUARDING AGAINST ERRORS IN ACCOUNTING DOCUMENTS

Filed March 22, 1951 8 Sheets-Sheet 1

Fig. 1

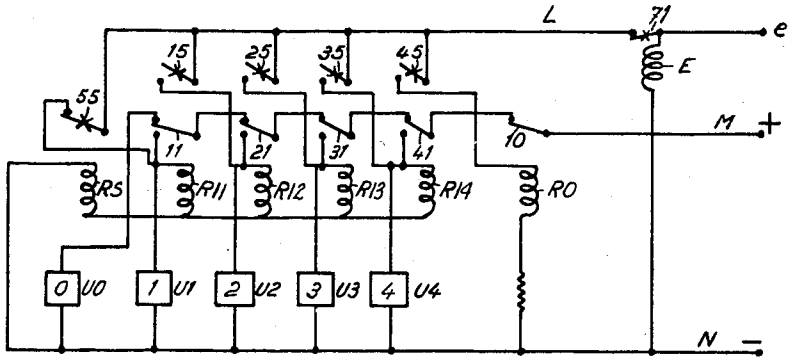
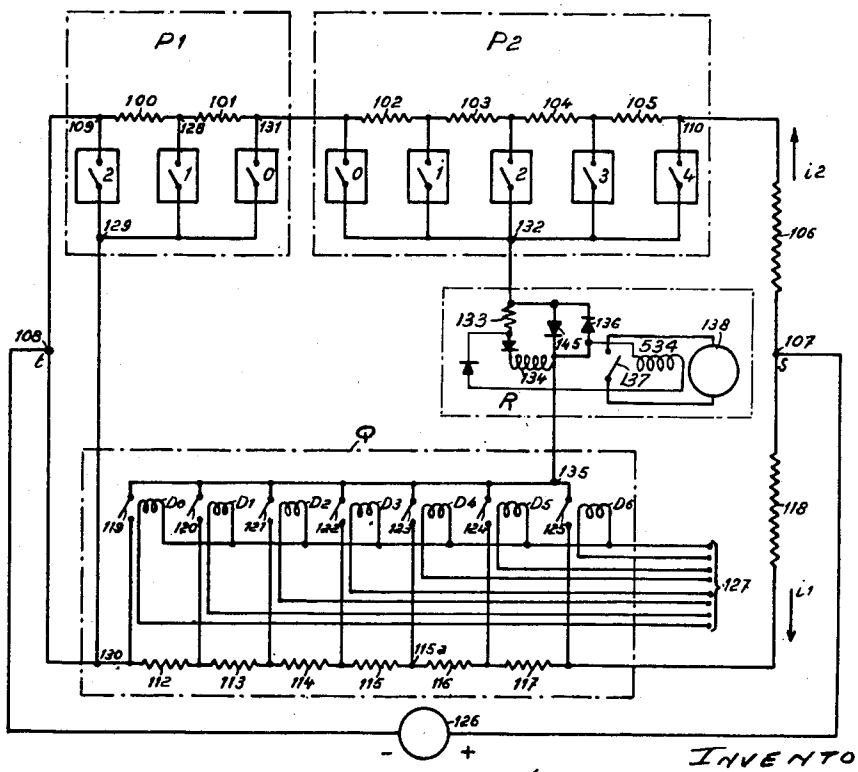


Fig. 2



INVENTOR
KNUT ANDREAS KNUTSEN

By: Wanscher, Lake & Co.
AGENTS

Fig. 3

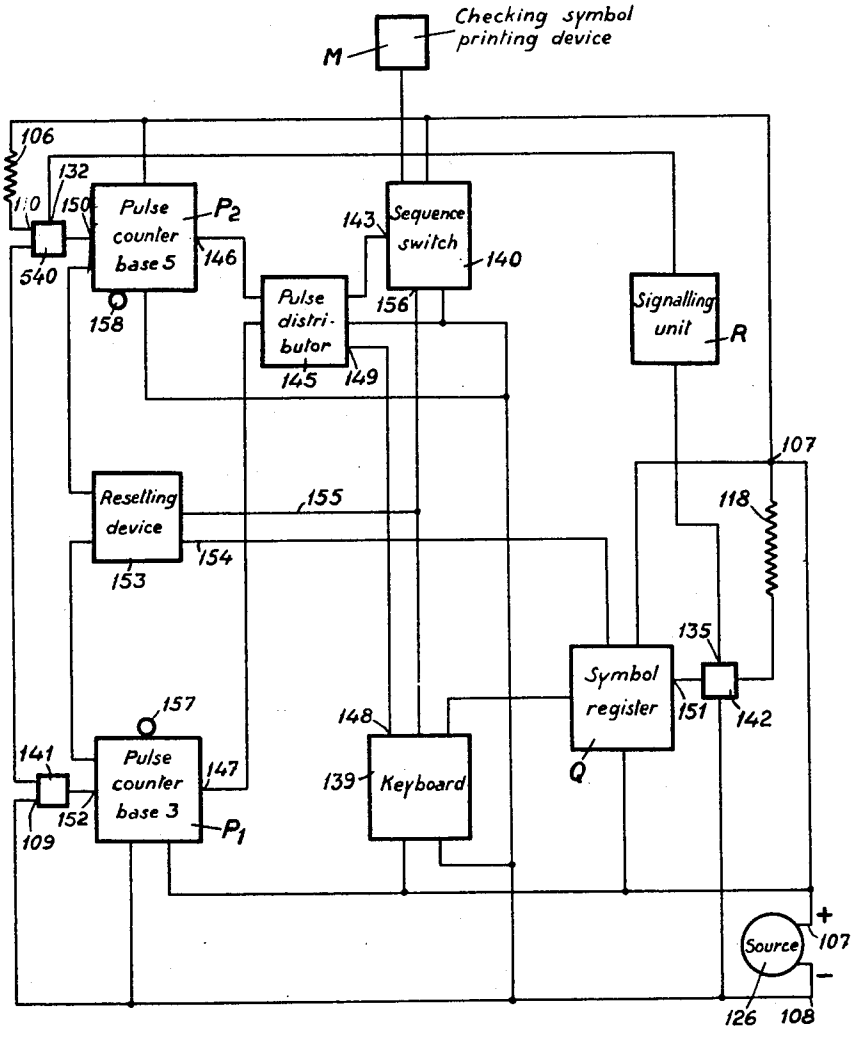
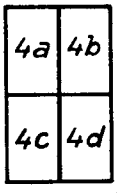


Fig. 5



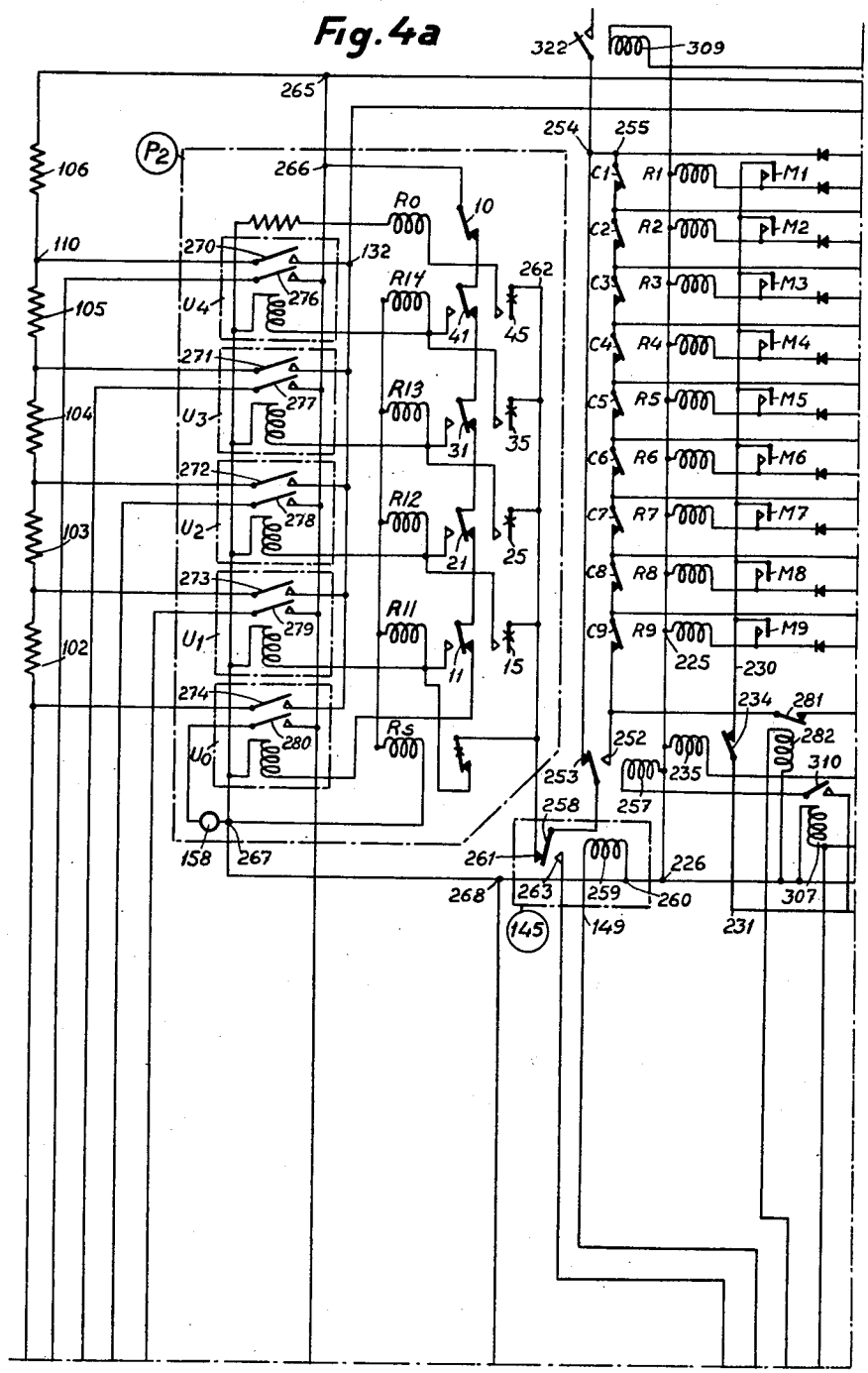
INVENTOR
KNUT ANDREAS KNUTSEN
By: Wanselius, Lake & Co.
AGENTS

July 17, 1956 K. A. KNUTSEN 2,755,022

APPARATUS FOR SAFEGUARDING AGAINST ERRORS IN ACCOUNTING DOCUMENTS

Filed March 22, 1951 8 Sheets-Sheet 3

Fig. 4a



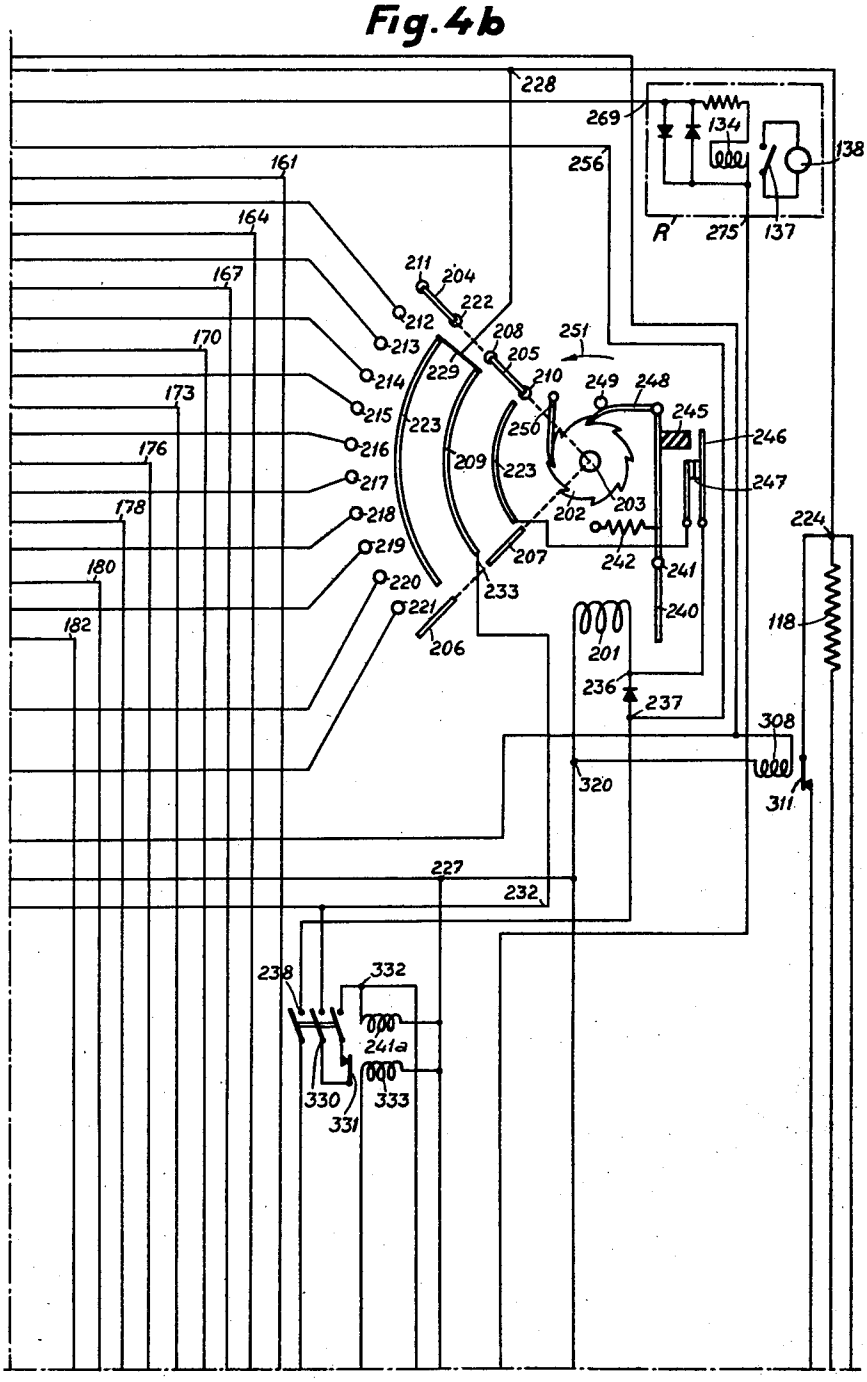
INVENTOR
KNUT ANDREAS KNUTSEN
By: Hamilton, Lake & Co.
AGENTS

July 17, 1956 K. A. KNUTSEN 2,755,022

APPARATUS FOR SAFEGUARDING AGAINST ERRORS IN ACCOUNTING DOCUMENTS

Filed March 22, 1951 8 Sheets-Sheet 4

Fig. 4b



INVENTOR
KNUT ANDREAS KNUTSEN
By:
Wanetin, Lake & Co.
AGENTS

July 17, 1956 K. A. KNUTSEN 2,755,022

APPARATUS FOR SAFEGUARDING AGAINST ERRORS IN ACCOUNTING DOCUMENTS

Filed March 22, 1951 8 Sheets-Sheet 5

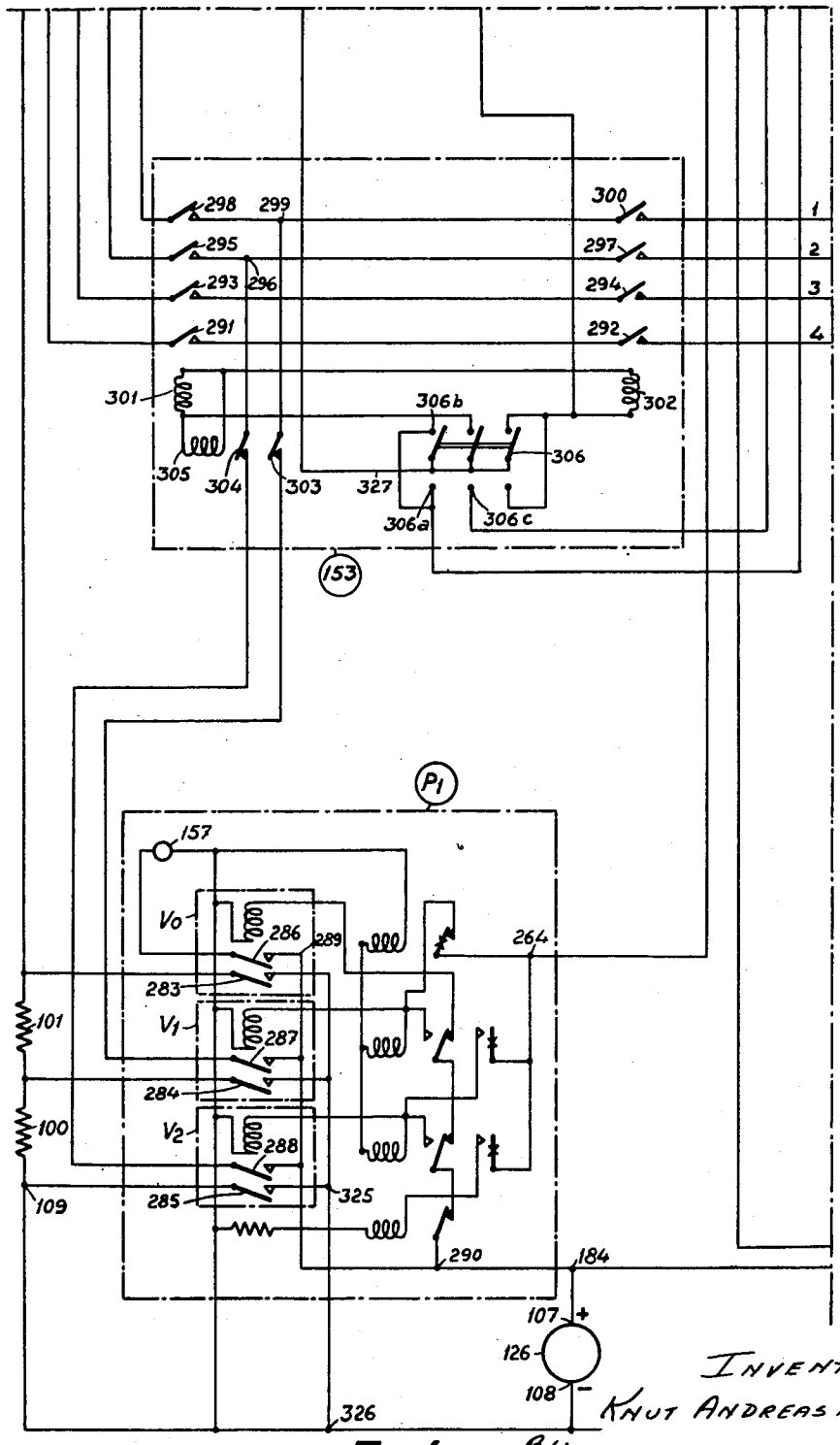


Fig. 4c

INVENTOR
KNUT ANDREAS KNUTSEN
By: Wasellius, Lake & Co.
AGENTS

July 17, 1956 K. A. KNUTSEN 2,755,022

APPARATUS FOR SAFEGUARDING AGAINST ERRORS IN ACCOUNTING DOCUMENTS

Filed March 22, 1951 8 Sheets-Sheet 6

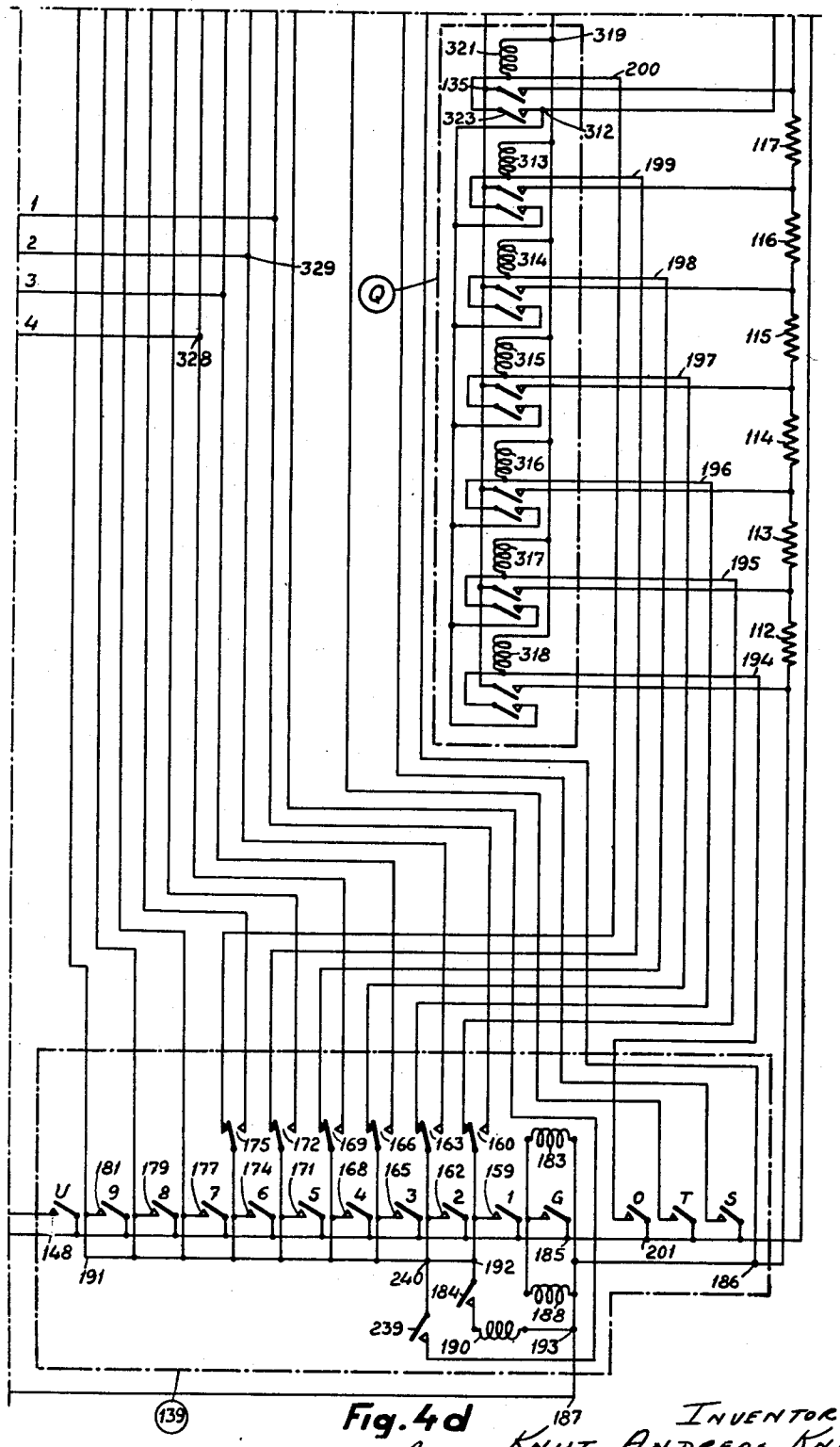


Fig. 4d

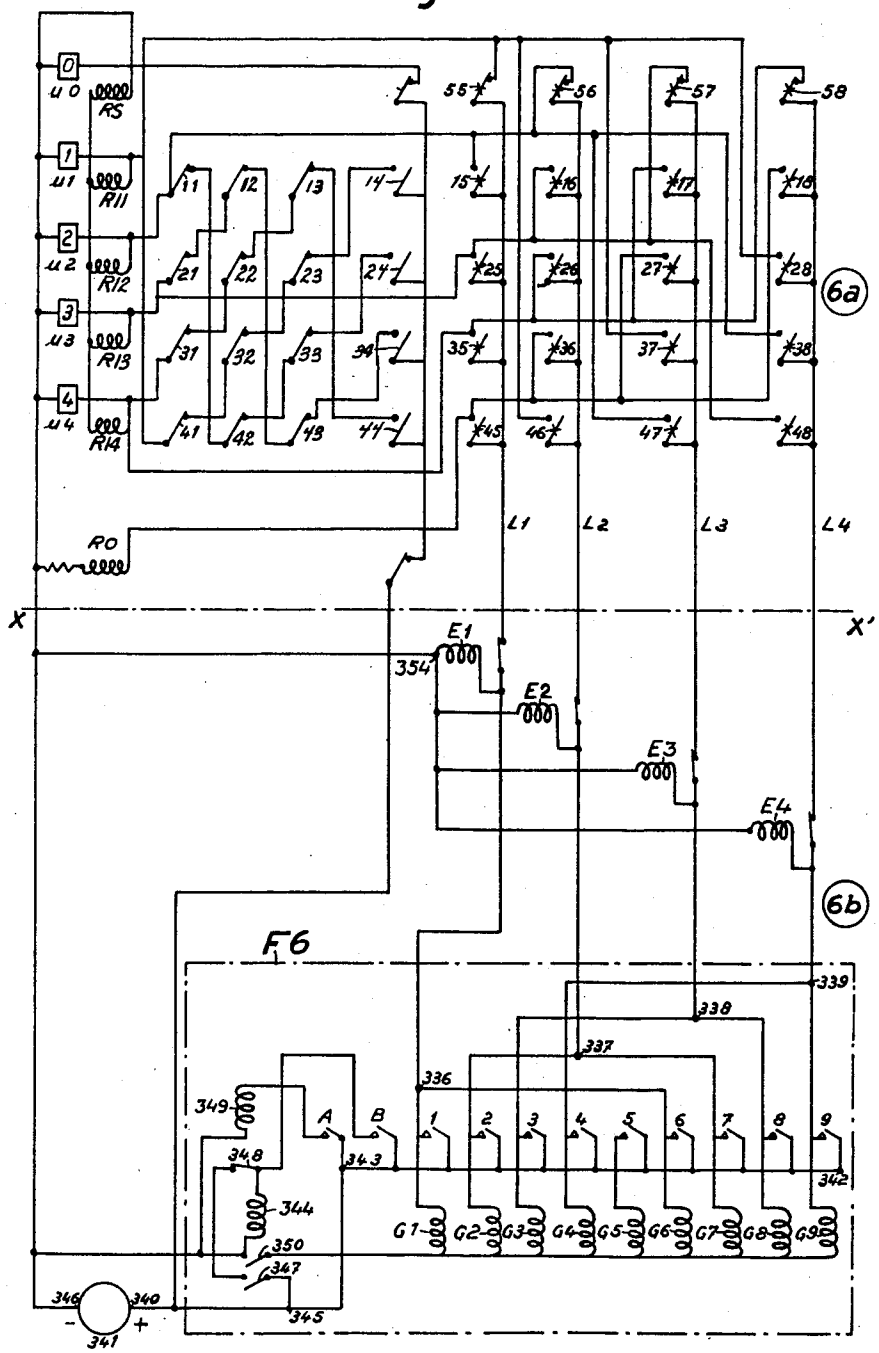
INVENTOR
KNUT ANDREAS KNUTSEN
By: Wallace, Lake & C, AGENTS

July 17, 1956 K. A. KNUTSEN 2,755,022

APPARATUS FOR SAFEGUARDING AGAINST ERRORS IN ACCOUNTING DOCUMENTS

Filed March 22, 1951 8 Sheets-Sheet 7

Fig. 6



INVENTOR
KNUT ANDREAS KNUTSEN

By: Haseltine, Lake & Co.
AGENTS

July 17, 1956 K. A. KNUTSEN 2,755,022

APPARATUS FOR SAFEGUARDING AGAINST ERRORS IN ACCOUNTING DOCUMENTS

Filed March 22, 1951 8 Sheets-Sheet 8

Fig. 7

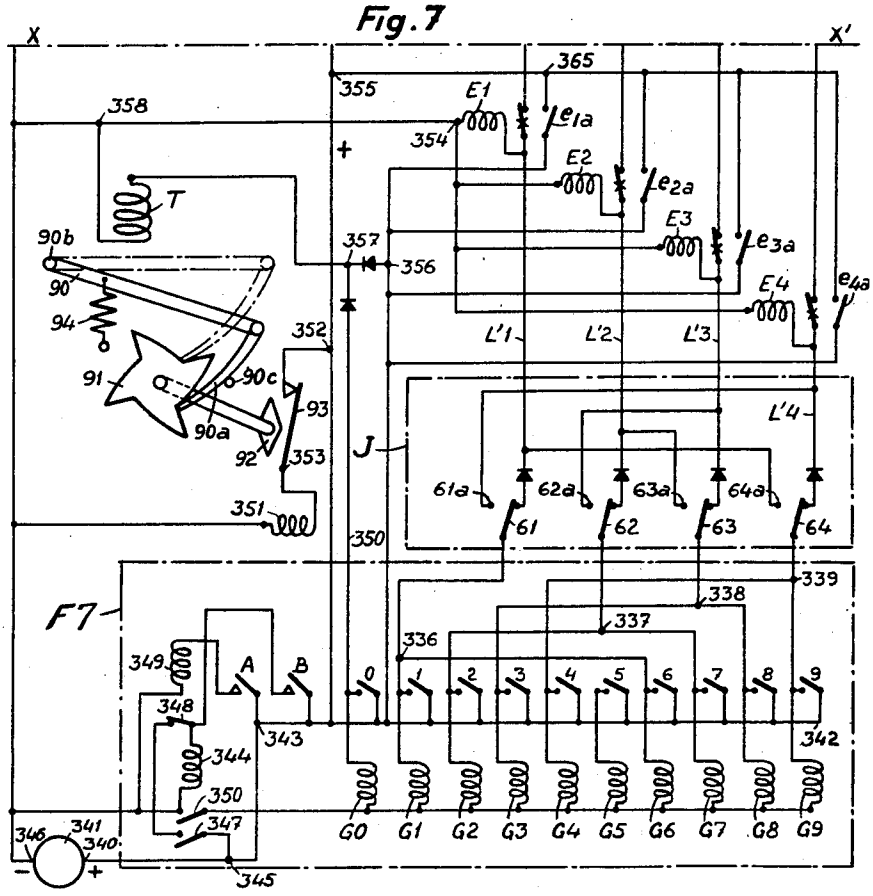
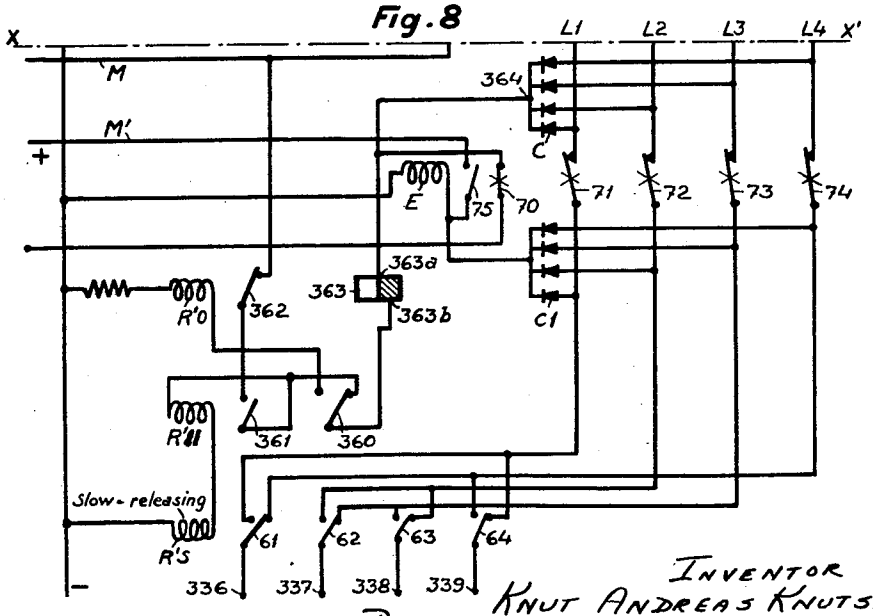


Fig. 8



INVENTOR
KNUT ANDREAS KNUTSEN
By: Hamilton, Lake & Co.
AGENTS

United States Patent Office 2,755,022 Patented July 17, 1956

2,755,022

APPARATUS FOR SAFEGUARDING AGAINST ERRORS IN ACCOUNTING DOCUMENTS

Knut Andreas Knutsen, Paris, France, assignor to Compagnie des Machines Bull (Societe Anonyme), Paris, France

Application March 22, 1951, Serial No. 216,887

Claims priority, application France March 31, 1950

13 Claims. (Cl. 235—61.6)

The present invention relates to a variant of the principle described in patent application Ser. No. 190,507 of October 17, 1950, for "Process Avoiding Errors in Accounting Machines and Electric Devices Utilizing the Said Process"; according to which principle, in order to reveal and thus prevent errors in the transcription or utilization of the data of a given accounting document, to the registered number is added a supplementary figure, suitably determined, called the control symbol.

The known devices have for object to reveal a possible error in an isolated figure simultaneously with a possible error in the transposition of two successive figures.

When it is desired to achieve a device of this type for figures written according to the decimal system of numeration: there may be used the control by eleven, in which case there must be available, to write the symbol, a special sign to designate the figure ten; or there may be used a control with a base less than eleven.

In this case the control system fails to detect certain errors which depend on the chosen base, but a special sign is no more required for representing the number ten. For example a control device with a base 3, which is adapted to calculate the sum of the digits of a number to be registered and deduce from this sum the greatest integral multiple of 3 which it contains, will not detect digital error equal to 3 or 6 or 9. These numbers 3, 6, 9 are said to be the "gaps" of the control device. An object of the present invention is to obtain as good a protection against errors as that which is provided by the "control by eleven" when one wants to check the listing on a card or the like, by an accounting machine, of a datum printed or, more generally, readable on an accounting document handled by this machine. This result can be obtained in many different ways, but two devices are hereafter disclosed which make it possible to calculate the remainder of the division by an integer called base of the sum of the digits of the number or datum to be checked. Devices for this pattern can easily be arranged according to the base chosen. Another device, which is a variant of the above mentioned devices is also hereafter disclosed, permits of computing the remainder of the division by an integral base of a number equal to the algebraic sum of the digits of increasing denominational orders of the number to be checked, when said digits are alternatively given + and − signs, the lower order digit being positive. Such a device, working with a base 11, can replace the device SC in the Figure 2 of the above-mentioned patent application Ser. No. 190,507 of October 17, 1950. These three control devices deliver "partial symbols." The invention consists essentially in the use, in a single checking device, of at least two devices of this kind, whose bases are such that the "gaps" inherent to one of them are suppressed by the other or others and vice versa.

According to the present invention: in order to use a checking symbol for a number comprising several figures, it is not indispensable that the number formed by combining these figures with the checking symbol or control symbol has a simple arithmetical property, as was the case with the "control by eleven." A symbol can also be computed through the application of a linear algebraic formula which can be applied not only to the digits of a number to be checked but also to those which conventionally represent a group of letters. This symbol is simply marked or otherwise registered besides the said number. The devices according to the present invention are above all devised to check the identity of the symbol registered on the accounting document with the checking symbol which they calculate.

According to one preferred embodiment of the invention, in order to obtain the definitive symbol there are added together the partial symbols furnished by two control devices whose bases have been suitably selected.

Specifically, one can use 3 and 5, or 4 and 5, or 3 and 7, or 4 and 7, or 5 and 6.

A control or check made according to the present invention comprises:

A first register for calculating a partial symbol corresponding to a first base p and to the datum listed by the accounting machine;

A second register, similar or not to the first one, for calculating another partial symbol corresponding to a second base q and to the said datum;

A comparing unit which is adapted to add the two partial symbols and to compare the checking symbol with the symbol registered on the handled accounting document.

If it is desired to register the checking symbol this comparing unit can be made to control its registration by connecting it with a regular card-punching machine or the like. Checking devices of this pattern can be used with figures corresponding to a numeration system with a non-decimal base. If, for example, it is desired to control groups of letters and figures, a given arithmetic value will be assigned to each letter of the alphabet: there can thus be obtained a system based on 34 (24 letters plus 10 figures, the O and the I being confused with the corresponding figures 0 and 1).

According to the invention, three calculating devices will be provided, having for example, such bases as, 2, 5, 7 or 3, 4, 7 or 3, 5, 7, according to the embodiment of the invention desired, and one device for comparing the sum of the three partial symbols with the symbol appearing in the accounting document.

Fig. 1 is a circuit diagram of a relay actuated register, which meters numerical impulses;

Fig. 2 is a circuit diagram of a comparing unit;

Fig. 3 is a block diagram of a checking device arranged according to the present invention;

Figs. 4*a*, 4*b*, 4*c*, 4*d*, taken together and assembled according to Fig. 5 show the complete circuit diagram of the checking device schematically shown by Fig. 3;

Fig. 5 shows the outline of the Figs. 4*a* to 4*d* when assembled;

Fig. 6 is a schematic circuit diagram of a register adapted to calculate a "partial symbol" corresponding to the base 5;

Fig. 7 represents a second embodiment of a part of the register of Fig. 6;

Fig. 8 represents a third embodiment of a part of the register of Fig. 6;

In order to understand the action of a checking device as shown in Figs. 4*a*, 4*b*, 4*c* and 4*d*, attention must first be given to Fig. 1, which represents a cyclic totalizer which has a storing capacity equal to 5 and no carry-over device. This totalizer, shown in rest position, stores therefore one unit or zero every time a positive pulse, pertaining to a train of substantially periodical pulses is applied to the admission terminal of the totalizer.

Five relays are shown, R0 to R14 (plus a relay RS in series with the relays R11 to R14); the signalling devices u_0 to u_4, respectively corresponding to the registered digits 0 to 4, represent electromagnetic relays as is shown in Fig. 4*a*, etc. Each of the relays R_{11} to R_{14} has two contact units. One of them is quick closing and the other one slow closing. In another embodiment each winding R_{11} to R_{14} is replaced by two relays connected in parallel and respectively provided with two contact units. One of these relays is slow acting and the other one is quick acting. In the Figure 1 the contact units **10, 11, 21, 31, 41,** are quick closing. The contact units **15, 25, 35, 45, 55,** are slow closing. The delays in closing of the latter contact units are substantially equal and smaller than the repetition period of the metered pulses. Trains of periodical positive pulses, hereafter called "numerical," are impressed on the input terminal *e*. (The relay E limits the duration of this impulse by opening its delay contact **71**.) Line M, at which a positive voltage is applied permanently forms with the line N the inputs of a holding circuit for the relays R_{11} to R_{14}. An initial impulse applied to line L, with the system at rest (position 0), passes through **55** and energizes R_{11}, which is maintained by the line M and the contact unit **11** when RS has opened its contact **55** with delayed action. This relay prepares the passage of the second impulse to R_{12} by its slow closing contact **15**, which closes. This is then positioned 1, whence the next following positions are achieved, each in turn, every time that an impulse appears at L. Each relay which is excited under the influence of an impulse cuts off the holding circuit for the relays of lower numbers and prepares by its slow closing contact the feeding of the relays of a higher number by the following impulse.

The device operates in the manner described until an impulse reaches R0. This relay opens its contact **10**, which cuts off the holding circuit for all the relays, and the system reverts to the position 0.

A register as shown in Fig. 1 having a storing capacity equal to 4, can replace the counting part of the checking unit which is shown in Fig. 2 of the patent application Ser. No. 190,507 of October 17, 1950, hereabove quoted.

This counting part does not make any carry-over and consists in a sequence switch which receives trains of numerical pulses to be metered from a similar, step-by-step transmitting sequence switch. The number of pulses in each train is equal to the digit which is listed or printed by the accounting machine associated with the checking device. The use of the register of Fig. 1 in a comparing unit according to the invention, is hereafter explained in connection with the schematic circuit diagram of Fig. 2. At the top thereof are to be seen the similar signalling devices (0, 1 and 2 within a square) of a register P_1 with the base 3 and also those (0, 1, 2, 3, 4 within a square) of a similar register or counter P_2 with the base 5. It is assumed that each signalling device consists of an electromagnetic relay, which is inserted in the connections connecting the input terminal of the corresponding relay R with the input line N (Fig. 1). Each relay comprises a contact unit normally open and a pair of such contact units, when closed, are adapted to short-circuit one or the whole, of the series connected resistors: **100, 101,** which are inserted in a circuit **106, 107, 126, 108, 109, 110** comprising the D. C. source **126**. Other series connected resistors **112 . . . 118** are connected in parallel with the resistances **100 . . . 106**. Any of the resistors **112** to **117** of the symbol registering device Q can be connected to any of the resistors of the counter P_2 by the connection **132—133—134—135** and one of the contact units **119 . . . 125** respectively controlled by the relays D_0 to D_6. The latter are fed by 8 lines **127**, seven of which are connected to distinct keys of a keyboard, adapted to convert the symbol printed or marked on the accounting document into an appropriate positive pulse. This keyboard is shown in the diagram of Figures 4*a* to 4*d*. Any of the resistors **100** to **105** is equal to any of the

resistors **112** to **117**. The resistors **106** and **118** are equal and very large with respect to the resistors **100**. For example the resistor **106** has a 10,000 ohms resistance and the resistor **100**, a 100 ohms resistance. The relay **134, 534,** inserted in the connection **132, 133, 134, 534, 135** is adapted to close a contact unit **137** and to trigger in that way a signalling device **138**, when it is traversed by a current of adequate intensity. The rectifiers **145, 136,** preferentially of the copper-oxide pattern, exert a current-limiting action with respect to the relay **134, 534** when the error made by the accounting machine is great. It is supposed, by way of example, that resistance **106** $=10{,}000$ ohms and that resistance **100**$=100$ ohms. The closing of one of the contact units **1** and **0** of the counter **P1** causes one or both resistors **100, 101** to be short circuited by the corresponding connection **128, 129, 130** or **131, 129, 130**. If it is assumed that the counter **P2** has registered 4, the counter **P1** the digit 0, and the symbol registered in Q is 4, the terminal **110** is connected with the terminal **115***a*. If resistance **106**$=r_1$, resistance **100** $=R$, the current intensity in line **107, 118, 130**$=i_1$, the current intensity in line **107, 106, 110, 131, 129, 130** $=i_2$, the following equation is obtained: $(r_1+6R)i_1 = (r_1+4R)i_2$ whence

$$\frac{i_1}{i_2}=\frac{r_1+4R}{r_1+6R} \qquad \text{(Eq. 1)}$$

$$V_{115a}-V_{130}=4Ri_1$$

by substituting for i_1 its value derived from Equation 1:

$$V_{115a}-V_{130}=4R\frac{(r_1+4R)}{(r_1+6R)}\cdot i_2$$

As

$$\frac{r_1+4R}{r_1+6R}=\frac{10.400}{10.600}=0.98$$

one has $V_{115a}-V_{135}=0.98$, $4Ri_2 \neq V_{110}-V_{132}$

By the conjugate limiting effect of the resistor **133** and the setting of the relay **134—534**, the latter exerts no action on the contact unit **137**. Neither does it exert such an action when the sum of the partial symbols respectively in the counters **P1** and **P2** equals the marked symbol registered in Q.

If there is an error, a current passes through the relay **134—534**, which actuates the contact unit **137**.

Fig. 3 shows a block diagram of a checking device according to the present invention. The identical elements in Figures 2 and 3 have the same reference numbers. In this checking device a key-board **139**, handled by a typewriter, converts into positive pulses, which it transmits to a sequence switch **140** the successive digits of a number listed on a table or the like by a tabulating machine or any other accounting machine, as a result of the transfer therein of this number, marked on a printed accounting document, which indicates also the number symbol. These digits are then successively transmitted by the sequences switch, in form of trains of numerical positive pulses, in the first place to a pulse counter P_2, working with the base 5, in the second place to a second pulse counter P_1, working with the base 3, by way of the connections **143, 145, 146** and **143, 145, 147** which comprise a pulse distributor **145**, controlled by the key-board through the connection **148, 149**. The sequence switch **140** is a selector of the pattern shown in Fig. 2 of the above-mentioned patent application Ser. No. 190,507, filed on October 17, 1950. The pulse counter P_1 and P_2 are like those shown by the enclosed Figure 1. The key-board **139** is also adapted to transfer to the symbol register Q, in the same form as to the sequence switch, the symbol which is marked on the said accounting document and corresponds to the transferred number. This symbol is equal to the sum of the remainders of the division by 5 and 3 of the sum of the digits of the said printed number. The units **139, 140,** P_1, P_2, Q, **145** are connected to an energizing D. C. source

126. The comparing unit, which is called upon to compare the checking symbol, that is the sum of the partial symbols registered in the counters P_1 and P_2 with the symbol registered in the register Q, is the same as that hereabove disclosed in connection with Fig. 2. The resistors **102, 103, 104, 105** are schematically represented by the rectangle **540** which is connected to the output **150** of the pulse counter P_2. The resistors **100, 101** are schematically represented by the rectangle **141**, which is connected to the output **152** of the second pulse counter P_1. The resistors **112, 113, 114, 115, 116, 117** are schematically represented by the rectangle **142**, which is connected to the output **151** of the symbol register Q. The rectangle R represents schematically the aggregate formed by the resistor **133**, the relay **134, 534**, and the rectifiers **145** and **136** in Figure 2. It is connected to the block **540** and to the block **142** by the terminals **132** and **135** respectively. The resetting to zero of the symbol register Q is controlled by a resetting device **153** through the connection **154** and the resetting of the counters P_1 and P_2 is controlled by the said device, operating in conjunction with the sequence switch **140** by means of the connection **155, 156**. Electrical lamps **157** and **158**, mounted on the pulse counters P_1 and P_2, let know when lit that these counters are set or reset to zero.

The Figures *4a, 4b, 4c, 4d* show the complete circuit diagram of the checking device schematically shown by the Figure 3. In these figures the contact units are shown in rest position. The key-board comprises **14** digit keys that are closed by manual depression. The keys 1, 2, 3, 4, 5, 6, 7, 8, 9 are respectively connected to the sequence switch **140** by the connections **159, 160, 161—162, 163, 164—165, 166, 167—168, 169, 170—171, 172, 173—174, 175, 176—177, 178—179, 180—181, 182**. The six first connections respectively comprise six two-way contact units, **160, 163, 166, 169, 172, 175**, that are the parts of an electromagnetic relay **173** which can be inserted by the digit key G in the circuit **107, 184, 185, 186, 187, 108**, in parallel with a similar relay **188**. The latter relay controls the normally open contact unit **189**, which is mounted in series with the relay **190** in the line **191, 192, 193** which connects the negative terminal **108** of the source **126** one of the springs of the digit keys **1, 2, 3, 4, 5, 6, 7, 8, 9**, U. When the relay **183** is deenergized the digit keys **1, 2, 3, 4, 5, 6** are connected to the symbol register Q by the connections **159, 160, 195—162, 163, 196—165, 166, 197—168, 169, 198—171, 172, 199—174, 175, 200**. The digit key zero is permanently connected to this symbol register by the connection **201, 194**. The role of the digit keys U, T and S will be indicated hereafter. The sequence switch is very similar to a selector of automatic telephone with eleven positions. It comprises an electromagnet **201** which is adapted, when energized, to give a ratchet **202** a rotating step-by-step motion by means which will be described hereafter. In its rotational movement about the shaft **203** the ratchet **202** drives four rows of double contact brushes, keyed at 90° apart. For the sake of clarity only two rows **204, 205** and **206, 207** are represented. These brushes move, during the rotation of the wheel **202**, over contact studs and sectors arranged in four superposed banks, forming two pairs. In the upper bank eleven contact studs **211** to **221** are spaced over an angle somewhat smaller than 90°. In the immediately subjacent bank an input stud **222** and a contact sector **223** are successively brought into contact with the studs of the upper bank by the brush **204** which, in its initial position, connects the studs **211** and **222**. In this same position the brush **206** of the preceding row of brushes is in contact neither with the stud **221** nor with the sector **223**. In the other pair of banks the upper bank comprises an input stud **208** and a contact sector **209**, whilst the lower bank comprises an input stud **210** and a contact sector **223**. The sectors **223** and **209**, which are connected to one another, are connected to the source **126** by the line **107, 184, 224, 228, 229**. When the brushes **204** and **205** have rotated through 90° from their shown initial position two other brushes, not shown, respectively come into contact with the studs **211, 222** and **208, 210**. Each of the hereabove-mentioned connections, which connect the keyboard **139** with the sequence switch is a part of a circuit comprising, when the corresponding digit key is depressed, the terminal **107** of the source **126**, the line **184, 185**, the said connection, a dry rectifier, a relay, the line **225, 226, 227, 186, 108**. Each one of these relays R1, R2, R3 . . . R9 controls one of the cut-off contact units C1, C2 . . . C9 and one of the holding contact units M1 to M8. Each of the latter contacts is connected to the positive terminal **107** of the source by the sector **209** and the connection **230, 231, 232, 233**, which comprises a cut-off contact unit **234**, controlled by a relay **235**. This relay is inserted in the circuit **221, 235, 226, 227, 187, 108** whose completion is secured by the passage of a brush over the contact stud **221**.

As it has been hereinabove said, the electromagnet **201** is called upon to rotate intermittently the ratchet **202**. The energizing circuit **108, 187, 227, 201, 236, 237, 238, 239, 240** of this electromagnet comprises a contact unit **238**, controlled by a relay **241** and a make-contact unit **239**, controlled by the above mentioned relay **190**. Under conditions which will be hereafter examined, the contact units **238** and **239** are closed and the electromagnet **201** energized. It attracts then a blade **240**, which rocks about a pin **241**. This attraction tightens a spring **242** and an insulating push rod **245**, mounted on the lever **240**, displaces the blade **246** so as to open a contact **247**. A pawl **248**, rotatably secured at the end of the lever **240**, is adapted to engage one of the forty-four peripheral recesses of the ratchet **202**. When the electromagnet **201** is no longer energized, the spring **242** pulls the lever **240**, causing the pawl **248** to rotate the ratchet **202** in the direction of the arrow **251** till the pawl is stopped by the stop **249**. The corresponding step displacement of the brush **204** brings it into contact with the contact stud **212**. A counter-pawl **250** prevents the ratchet **202** from rotating back when the pawl **248** is retracted by the clockwise movement of the lever **240**. The rotation of the ratchet closes again the contact unit **247**, that causes a new one step rotation of the ratchet and this motion goes on automatically till the brush **204** has taken the initial position of the brush **206** shown by Fig. *4b*.

The contact studs **212** to **220** are respectively connected to cut-off contacts C1 to C9, that form a chain **255—252** which is terminated by an output **252** of the sequence switch. In the connection pertaining to the stud **220** is inserted a cut-off contact **281** which is controlled by a relay **282**. Another output **253** of the sequence switch and the cut-off contact C1 are connected by the line **254, 255, 256, 237** to the feeding line **237, 238, 239, 240** of the electro-magnet.

Either output **252, 253** can be connected to the pulse distributor **145** by a make-and-break contact unit controlled by a relay **257**. The pulse distributor, which is enclosed in a rectangle marked in dash-and-dot pattern, comprises a make-and-break contact unit **258** and a relay **259** which controls it. The latter relay is inserted in an energizing circuit **107, 184, 185, U, 148, 149, 259, 260, 227, 187, 108** which is completed by depressing the finger key U. When this key is in rest position either output **252, 253** of the sequence switch **140** is connected with the pulse counter P2 by the line **261, 262**. When the key is depressed either switch output is connected to the pulse counter P_1 by the line **263, 264**. The counter P_2 is a specific embodiment of the counter of Fig. 1, in the point that the rectangles u_0, u_1, u_2, u_3, u_4 in the Figure *4a* are substantially identical relays, individually controlling 2 contact units and that a lamp **158** acts as a clearing indicator. Direct current energy is fed to the pulse counter P_2 by the lines **266, 265, 228, 224, 107** and **267,**

268, 227, 193, 187, 108. The five contact units 270, 271, 272, 273, 274 represents the contact units 4, 3, 2, 1, 0 of the counter P_2 of Figure 2 and are connected in parallel, by the connection 132, 269 to the signalling unit R, which is itself connected to the symbol register Q by the line 275, 135. Four other contact units 276, 277, 278, 279 of the relays u_4 to u_1 are respectively connected, by the resetting connections 291, 292—293, 294—295, 296, 297—298, 299, 300 to the energizing lines of the relays R_{14}, R_{13}, R_{12}, R_{11}. The latter lines are respectively connected to the digit keys 4, 3, 2, 1. The two sets of contact units 291, 293, 295, 298—292, 294, 297, 300 are a part of the resetting device 153 and are respectively controlled by the relays 301, 302. The contact unit 280 is adapted to switch on and out the indicating lamp 158. The three relays V_0, V_1, V_2 of the pulse counter P_1 are substantially identical to the relays u_0 to u_4 of the counter P_1. The contact units 283, 284, 285 correspond to those referenced 0, 1, 2, in the counter P_1 of Fig. 2. The contact units 286, 287, 288 are connected in parallel to the positive terminal 107 of the source by the line 289, 290, 185, 184. The contact units 287 and 288 are respectively connected by the connections 303, 299, and 304, 296 to the 2 resetting connections which correspond to the relays u_1 of the counter P_2. The contact units 303 and 304 are controlled by a relay 305. The two relays 301 and 305 are connected in parallel on the one hand, to a contact stud of the three-pole, double-throw switch 306 normally open, which is adapted to control, as will be shown hereinafter, either the resetting of the pulse counter P_2, or that of the pulse counter P_1. In its two closing positions, by way of its terminals 306*a* or 306*b*, it is adapted to energize the relays 307, 308 and 309. The relay 307, when energized, closes the contact unit 310 which energizes the relay 257. The relay 308, when energized, opens the contact unit 311 inserted in the holding circuit 224, 312, 323, 321, 319, 320 of the relay 321 and, more generally, of the other relays 313, 314, 315, 316, 317, 318 of the symbol register Q. The energizing of the relay 309 closes the contact unit 322 and connects the output 254 of the sequence switch to a printing device shown in M in Figure 3, which is adapted to register the sum of the partial symbols, hereinabove called checking symbol. The operation of the checking device represented by the Figures 4*a*, 4*b*, 4*c*, 4*d* is as follows:

The operator registers first the symbol marked or printed on the accounting document besides the number to be transferred into the machine, which is for example 7859. This symbol being 6, he depresses the finger key 6 and a positive pulse energizes the relay 321 of the symbol register Q. The latter relay closes its two contact units and is held energized by the holding circuit hereinabove mentioned and thus completed. The relay 134 of the signalling unit is then connected to the positive terminal of the source 126 through the resistor 118. After this registration, the operator releases the digit key 6 and depresses the key G. By so doing the relays R_1 to R_9 of the sequence switch are connected to the terminals 159 to 181 of the keyboard and the contact unit 184, controlled by the relay 188, gets closed. A locking finger key not shown is simultaneously depressed and keeps the key G depressed when it is released by the operator. When the latter wants it to come into its undepressed position, he depresses once more the locking key, as is usual in the regular writing machines for typing words in capital letters. The operator depresses then the key S, which is also provided with a locking key not shown and remains depressed after releasing. The switch 238 gets closed and the relay 241 is held energized by the connection 330, 331, 332. The operator types afterwards the number 7859 in the usual manner. When he depresses the key 7 he energizes the relay 190 through the line 177, 192, what entails the closing of the contact unit 239 and the sending of a positive impulse into the electromagnet 201 through the switch 238. The ratchet 202 turns through 90° and seven positive pulses, transmitted by the output 253 of the sequence switch, produce the registration of 2 in the pulse counter P_2. The passage of the brush 204 on the contact stud 221 clears the sequence switch by the opening in 234 of the holding circuit of the relays R_1 to R_9 by means of the relay 235. The depressing of the key 8, which takes place immediately after, entails the registration of zero in the counter P_2. The depressing of the key 5 entails the registration of zero in the counter and finally the depressing of the key 9 causes the digit 9—5=4 to be registered in this counter. The lamp 158, which was lit just before the depressing of the key S, is now extinguished. The operator depresses now the key U, which remains depressed after releasing by means of a locking key of the pattern herein above mentioned. The output 253 of the sequence switch is now connected to the input terminal 264 of the pulse counter P_1. The operator types again the number 7859 and this counter finally registers the digit 2=7+8+5+9—27. In that condition the input 269 of the signalling unit R is connected to the terminal 110 of the resistor 105 and the terminal 109 of the resistor 100 is connected to the negative terminal 108 of the source by the connection 325, 326. The other input 275 of the unit R being connected to the upper terminal of the resistor 117, the relay 134 is deenergized and does not bring the signalling device 138 into action.

The checking being now over, the operator unblocks the key U and sets the change-over switch 306 into the upper position of closing, in which the terminal 306*b* is connected to the positive terminal of the source through the line 265, 266, 327. He could have as well let the key depressed and set the switch 306 into its lower position of closing, what would have caused the clearance of the counter P_1. The closed contact unit 276 in relay u_4 is now connected at 328 with the line 169, 170 and a positive pulse propagating towards 170 energizes the relay R_4. Simultaneously, through the terminal 306*b*, the relays 307, 308 and 309 are energized and the symbol register is set to zero. The said positive pulse propagates along the path 328, 169, 168, 240, 239, 238, 237 on the one hand to the electro-magnet 201, on the other hand to the output 254 of the sequence switch via the line 237, 256, 255. The ratchet 202 is put in rotation and three other positive pulses are set through the said output. Then six positive pulses are sent into the pulse counter P_2, in step with the passage of the brush 204 over the studs 215 to 220. This counter receives a pulse number equal to the complement to 10 of the digit therein registered. It registers therefore zero and the lamp 158 is again lit. As soon as the operator sees it lit he depresses the key U and puts the switch 306 in its lower closing position, for which the relay 282 is energized through the terminal 306*c* and opens the contact unit 281. Simultaneously the relays 301 and 305 are deenergized whilst the relay 302 remains energized. As a result the relays 307, 308 and 309 are again energized and the closed contact unit 288 of the relay v_2 of the counter P_1 is connected at 329 to the line 163, 164 through the connection 304, 296, 297. Two positive pulses propagating in opposite directions along this line and the therewith connected elements reach simultaneously the relay R_2 and the electromagnet 201, which are energized, and the output 254 of the sequence switch. The ratchet 202 is again put in rotation and one supplementary pulse traverses the said output 254. As the contact unit 281 is opened, only seven positive pulses are sent by the sequence switch output 252 into the pulse counter P_1. In other words this counter receives the complement to 9 of the digit therein registered and is reset to zero. The lamp 157 is then lit and indicates that the resetting of this pulse counter is done. The operator unblocks then the key S in the manner hereinabove disclosed and depresses then the key T, what energizes the relay 333 and opens

the holding circuit of the relay **241**. The checking device is now put again in its initial inoperative condition, but if other checkings are to be done it goes without saying that the key S must remain blocked. An appliance not shown permits to cut off automatically the connection **254**, **322** of the sequence switch with the printing device every time the signalling device **138** is brought into action.

Fig. 6, which is composed of two parts *6a* and *6b* separated by the broken line X'X, shows an embodiment of a register which differs from that in Figures 1 and 4 in the point that it produces numerical impulses with its own means, without cooperating with a sequence switch as shown in Fig. *4d*. In other words Fig. 6 shows a self-contained register which has a storing capacity equal to 5 and is derived from the device of Fig. 1. The relays in Fig. 6 are shown at rest position and the elements performing in the register of Fig. 6 the same functions as in that of Fig. 1 bear the same reference numbers.

In Fig. *6b* keyboard **F6**, located in a rectangle **F6** marked in dash-and-dot pattern, is adapted to control the punching or the printing in a card of the partial symbol calculated by the register. This key-board permits also converting into positive pulses a number printed or listed by the accounting machine to be checked, as a result of its tabulation from an accounting document handled by this machine. This key-board comprises 9 digit keys, which act as contact units and are referenced **1** to **9**. It comprises moreover the keys A and B which, as will be shown hereafter, permit connecting and disconnecting from a source **341** the 9 electromagnets **G1** to **G9**. All the keys are connected to the positive terminal **340** of a D. C. source **341** by a connection **342**, **343**, **345** and the digit keys are connected in pairs to the register, by four input lines L_1, L_2, L_3, L_4. These lines are respectively connected to the relays E_1, E_2, E_3, E_4 which are of a well known pattern adapted to limit the duration of the pulses sent into the register, as is readily seen. The keys **1** and **6** which transmit pulses of value 1, are connected at **336** to the line **L1**. The keys **2** and **7** producing pulses of value 2 are connected at **337** to the line **L2**. The keys **3** and **8**, producing pulses of value 3, are connected at **338** to the line **L3**. The keys **4** and **9**, producing pulses of value 4, are connected at **339** to the line **L4**.

The relay R_s of the register controls the contact units **54**, **55**, **56**, **57**, **58** four of which, referenced **55** to **58**, are slow opening. The relay **R11** controls the contact units **11** to **18** the relay **R12** controls the contact units **21** to **28**, the relay **R13** controls the contact units **31** to **38**, the relay **R14** controls the contact units **41** to **48** and the relay **R0** controls the contact unit **10**. It is assumed that the delays in closing of the contact units **15** to **18**, **25** to **28**, **35** to **38**, **45** to **48** are substantially equal and smaller than the minimum time interval elapsed between two successive key depressings. The same assumption is done for the delays in opening of the contact units **55** to **58**. We shall assume to start with, that the successive impulses applied to the register come solely through line **L1**. It is readily seen that the operation is analogous to that indicated in Fig. 1. The register being assumed to be at rest, an initial impulse passes through **55**, closed, and excites **R11**, which is maintained energized by **14**, now closed, **23**, **32**, **41**; **55** opens with delayed action and **15** closes similarly. A second impulse passes through **15** and excites **R12** which opens **23**, which cuts the holding circuit of **R11**; **R12** is maintained energized by **24** closed, **33**, **42** and **11** now closed. The relays **R11**, **R12**, **R13**, **R14**, **R0** are thus each excited in turn, while the register registers one unit more at each impulse.

If we now assume that the successive impulses come solely through **L2**, the initial impulse passing through **56** excites **R12** which is maintained by **24**, **33**, **42**, **11**; **56** is opened with delayed action and **26** closes similarly. The following impulse, passing through **26**, excites **R14**, which by opening **42** cuts off the holding circuit of **R12**; **R14** is maintained by **44**, **13**, **22** now closed, **31**. Likewise, a subsequent impulse excites **R11**; another **R13**; another **R0**. The register registers two units more with each impulse.

It can similarly be shown that an impulse applied at **L3** causes the result obtained at **U0** to **U4** to advance three rows at a time; or four rows when the impulse comes through **L4**.

If the punching or printing in a card or the like of the number listed by the machine is wanted or if the partial symbol calculated in the register must be printed or punched in a document or card the key B is depressed, what energizes the relay **344**.

It remains energized after releasing the key B through the holding circuit **345**, **347**, **348** and closes the contact unit **350**. The latter connects all the electromagnets G to the negative terminal **346** of the source.

When one wants thereafter to render these magnets inoperative, one depresses the key A, what results in the opening of the contact unit **348** by the relay **349**.

Fig. 7, which must be juxtaposed to Fig. 6 so that the broken lines X'X of both of them be confounded and the line **L'4** of Fig. 7 is a colinear extension of line L_4 of Fig. 6, shows a four-pole reversing switch limited by a rectangle **J**. It connects the input lines of the register with the 4 output terminals **339** to **336** of the keyboard **F7**, which presents a 5th output terminal **350**; connected to a digit key **0**. As has been said hereinabove, the device represented by the part *6a* of Fig. 6 and by Fig. 7 permits computing the remainder of the division by 5 of a number equal to the algebraic sum of the sum of the digits of increasing denominational orders of the number to be checked, when said digits are alternatively given + and — signs, the lower order digit being positive. In the reversing switch J the line L'_1 is connected to the terminal **64***a* of the contact unit **64**, the line L'_2 is connected to terminal **63***a* of the contact unit **63**, the line L'_3 is connected to the terminal **62***a* of the contact unit **62** and the line L'_4 is connected to the terminal **61***a* of the contact unit **61**.

These 4 contact units are controlled by a relay **351**, whose energizing circuit **352**, **93**, **353** can be alternately closed and opened by a cam **92**, when the latter is given an intermittent rotating movement by the ratchet wheel **91**. The operation of this pawl-and-ratchet gear will be explained hereafter. The four relays E_1 to E_4 are respectively provided with four pairs of contact units e_1, e_2, e_3, e_4. One of the units of each pair, designated by the subscript *a*, is quick-acting, the other one being slow-acting and marked with a little cross. Each quick-acting contact unit is a part of the holding circuit of the corresponding relay. All holding circuits have the same negative terminal **354** and the same positive terminal **355**. This terminal is connected by the connection **365**, **356**, **357** both to the zero line and to relay I, whose energizing circuit **356**, **357**, **358** is completed by the closing of any quick-acting contact unit or by the depressing of the key **0**. It results therefrom that whenever a digit of the number to be entered in the register is typed on the keyboard the relay I is energized and puts in motion the pawl-ratchet gear combined with the cam **92**, which is shown in Fig. 1 of the hereinabove mentioned patent application Ser. No. 190,507 of October 17, 1950. The pawl **90***a* is rotatably mounted at the end of an armature **90**, which can rock about a pin **90***b* and is permanently drawn clockwise by a spring **94**. When the relay I is energized, it attracts the armature **90**, what tightens the spring **94**, and retracts the pawl **90***a*. When the relay is deenergized in consequence of the release of the key, the spring **94** pulls the armature **90** clockwise, causing the pawl to rotate the ratchet through 90°. Keyed on the shaft **359** is a cam **92** which, ac-

cording to its position, raises or lowers the movable spring of the contact unit **93** so as to close or open the latter. The rotation of the ratchet is limited by a stop **90***b*. It is supposed that the number to be entered into the register is **230**, and that in its rest position the contact unit **93** is open. The key **0** is first depressed, what causes the armature **90** to rotate from its rest position, shown in the figure. When this key is released the armature comes back in its rest position and the cam **92** takes the position shown. The key **3** is then depressed and a positive impulse impressed on the line L2, when it is released the cam **92** turns again through 90° and the relay **351** is deenergized. The key **2** is finally depressed and an impulse sent on the line L2. The register finally registers 2+2=4.

The register shown by Fig. 6 can obviously be made on identical principles for a base different from 5.

Figure 8 offers a variant embodiment of the part **6***b* of Fig. 6. The relays of this embodiment are represented at rest position. Here the 4 relays E1 to E4 have been replaced by a single relay E with 4 contacts **71** to **74** (a fifth contact **70** serving to actuate the reverser unit each time that a 0 or a space is introduced) and two sets of stop cells *c* and *c*1 serving to prevent the impulse on one line from crossing to another by the connections established. Relays T and **351** of Fig. 6 have, for their part, been replaced by a group of 3 relays R'**0**, R'**11**, R'S connected to form a totalizer of the type of Fig. 1 but operating with a base 2. On the analogy of relays R_0 to R_{14} and R_8 of Fig. 1, these relays are respectively designated by the reference letters R'_0, R'_{11}, R'_8. The relay R'_{11} controls the contact units **360** and **361**, the relay R'_0 controls the contact unit **362**. The relay R'_{11} is of well-known slow-operating and slow-releasing type, the relay R'_0 is quick-acting, and the relay R'_8 slow-releasing only, so that the duration of the attraction of the latter's armature is equal to about the pulse repetition period. These features can be obtained, for example, by the use of a copper slug fitted over an end of the relay core. The trigger unit **363** inserted in the time **364–360** permits transmitting the relay R'_{11} every two positive pulses. This trigger unit is similar to that disclosed in Fig. 1 of the patent application Ser. No. 171,684, filed on July 1, 1950, by K. A. Knutsen. The input **363***a* of this trigger unit is a symmetrical point of the input circuits of the two triodes included in this unit. The output **363***b* is a tap of the resistive load of the output circuit of one of these triodes. The two relays R'_{11} and R'_8 can be replaced by a single one of the slow-operating and slow-releasing type, which controls the contact units **61** to **64**, **360** and **361**. The arrangement comprising these 3 relays is thus equivalent to a reversing switch. It is necessary, for the register unit of Fig. 6, or that of Fig. 7 and part **6***a* of Fig. 5, or that of Fig. 8 and part **6***a* of Fig. 6 to operate conveniently, that the delays in opening of the contact units inserted in the lines L1 to L4 and controlled either by the relays E_1 to E_4 in case of Figs. 6 and 7, or by the relay E in case of Fig. 8, are less that those of the contact units controlled by the relays R of the totalizer proper. In fact any numerical pulse must die away as soon as it has energized any of these relays R, R_n for example, so that it cannot energize a second relay, whose energizing circuit is established by the slow-acting contact which is controlled by this relay R_n.

Obviously, such a register, which has been described for a 5 base, can be carried out on identical principles for any base. Furthermore, if, for example, a 7 is registered in a 3 base register, the circuits (not shown) will be such that the digit will be introduced at the terminal **1** as if it were a 1; if it is an 8, on terminal **2**, etc.

It will be seen that a register of the type of Fig. 6 operates on the following principles:

For each output position of the register there is a corresponding relay and for each digit that can be introduced a line of excitation;

The relays exert reciprocal control always in the same direction, i. e. each relay prepares the excitation of the relay located one position ahead through the line corresponding to the digit 1, that of the relay located two positions ahead through the line corresponding to the digit 2, etc.

The excitation of a relay assures its holding and cuts off all the others;

The admission of a digit in subtraction is obtained by exciting the line corresponding to the digit which is complementary to the base figure, by the action of a reverser.

To complete the description of a control device pursuant to the invention, there remains to be explained the operation of a comparer device; for this purpose, by way of example, Fig. 2 may be examined. At the top appear the output devices (0, 1 and 2 within a square) of a 3 base register and also those (0, 1, 2, 3, 4 within a square) of a 5 base register. It is easy to arrange for a contact to be closed in said device when a voltage there appears, by means of a relay or under the direct action of relays R**0**, R**11**, etc. (see Fig. 1). Below, the reading terminals LE collect the voltage according to the result read, corresponding to the symbol registered on the document, which actuates a contact corresponding to that of the relays D**0** to D**6**, which is excited. Above and below are high resistances acting as potentiometers **100** to **105** and **112** to **117**, **100** to **105** are placed in series with a resistance **106** and **112** to **117** with a resistance **118**. It is preferable if **118**=**106** and if, to simplify and to obtain a symmetrical arrangement, that each resistance **112** to **117** is to be equal to each resistance **100** to **105**. Thus, for example, **118**=**106**=10,000 ohms and each element of one of the potentiometers=100 ohms. In these circumstances, for a voltage of 100 volts applied between "*s*" and "*t*," the fall of voltage at the terminals of an element of any potentiometer will be about equal to 1 v., or 6 v. for 6 elements. The closing of one of the contacts of the counter P1, brings into circuit the corresponding element or elements of the potentiometer of P1, which is tantamount to increasing by so many units the picked up voltage. Furthermore, the closing of a contact of the counter P2 likewise permits the employment of a number of elements corresponding to the figure indicated by the counter, so that between **132** and *t* there is obtained practically the sum of the voltages corresponding to the sum of the partial symbols supplied by the counters P1 and P2. This total voltage must be equal to the voltage corresponding to the registered symbol, which appears between points **135** and "*t*." If there is an error, a current will pass into one of the relay coils **134** and **534** placed in series with a resistance, each relay coils being mounted in series with an unidirectional element; at the terminals, two dry rectifiers **145** and **136** set up in opposition, or any other limiter, such as two diodes, permit limitation of the current when the error is important. The relay actuates a contact which itself releases any suitable available utilization device **138**: a light, sound or block signal, etc., according to any of the known methods.

Of course, the details of execution can be modified in numerous ways, such as doubling the relays and contacts, adding known elements, etc., without exceeding the scope of the invention. Specifically, the comparer device may be made to consist, on the one hand, of a totalizer of a known model and any known combination of comparison, for example by relays and alternating contacts, actuating the devices for utilization of the comparison; it can also, following a principle of analogous to that of Fig. 2, operate on alternating current which permits of conveniently adding the voltage supplied by separate transformers for each register, voltage which afterwards may be rectified; the compared voltages may be applied to different grids of the same electronic tube, etc. Finally, it is possible to generalize further the principle of the invention by forming the definitive symbol, not by addition of partial symbols, but by virtue of any previously

established correspondence provided, for example, on a switchboard; the comparer device, in this case, will be required, on the one hand, to effect the said correspondence by combinations of contacts and, on the other, to compare the symbol thus obtained with the symbol registered on the accounting document.

I claim:

1. Device for detecting erroneously transcribed data accompanied by a checking item on a record for accounting machines, comprising a plurality of differently operating calculating apparatuses, means for successively entering into each of said apparatuses numbers corresponding to the distinct items to be controlled except said checking item, means for detecting the result of each apparatus, calculating means receiving the results so detected to calculate in a predetermined manner a single value characteristic of the entered numbers, and means for comparing said single value with the checking item and for operating utilization means according to the results of such comparison.

2. Device for detecting mistranscription in a series of figures including a checking figure on a record for accounting machines, comprising a plurality of differently operating calculating apparatuses, electric means for successively entering into each apparatus the figures of the series except said checking figure to obtain a representative voltage for each apparatus, means to transform into a resulting single voltage the voltages furnished by the different apparatuses, said single voltage being representative of a resulting figure according to a pre-determined relation, and means for comparing such resulting figure with the checking figure and for evidencing an error in case of a discrepancy between the last two figures.

3. Device for detecting mistranscription in a series of figures accompanied by a checking figure, on a record for accounting machines, comprising a plurality of differently operating calculating apparatuses, means for successively entering into the apparatuses all the figures of the series except said checking figure, means for adding together the results furnished by the different apparatuses, and means for comparing the figure resulting from such addition with the checking figure and for evidencing an error in case of a discrepancy between the last two figures.

4. Device for detecting erroneously transcribed data accompanied by a checking item on a record for accounting machines, comprising a plurality of cyclic counters of different counting capacity, means for successively entering into said counters numbers corresponding to the distinct items of the data to be controlled except said checking item, alternately in true value and in complement to the capacity of the respective counter according to the order of succession of said distinct items, means for detecting the result of each apparatus, calculating means receiving the results so detected to calculate in a predetermined manner a single value characteristic of the entered numbers, and means for comparing said value with the recorded values of the checking item and for operating utilization means according to the result of such comparison.

5. Device for detecting erroneously transcribed data accompanied by a checking item on a record for accounting machines, comprising two differently operating calculating apparatuses, means for successively and simultaneously entering into both said apparatuses numbers corresponding to the distinct items of the data to be controlled except said check item, means for detecting the result of each apparatus, calculating means receiving the results so detected to calculate in a predetermined manner a single value characteristic of the entered numbers, and means for comparing said value with the recorded value of the checking item and for operating utilization means according to the result of such comparison.

6. Device for detecting mistranscription in a series of digits accompanied by a checking item, on a record for accounting machines, comprising a plurality of cyclic counters of different counting capacity one at least of these capacities being of a numeral value differing from the numeration basis of said series of digits, electrical means for successively entering all of said digits of said series into each of said counters, alternately in true value and in complement to the capacity of the respective counter according to the order of succession of said digits to obtain a representative voltage for each counter, means for detecting the representative voltage for each counter, means to transform the voltages so detected into a resulting single voltage, said single voltage being representative of a resulting digit according to a pre-established relation, and means for comparing the value of said resulting digit with the recorded value of the checking item and for operating utilization means according to the result of such comparison.

7. Device for detecting erroneously transcribed data accompanied by a checking item on a record for accounting machines, comprising data entry means to enter each datum into a plurality of differently operating calculating apparatuses each including a number of electrical devices adapted to indicate any entry of a datum by a change of voltage on an output connection, said entry means controlling said electrical devices in a different manner for each different datum value, means cooperating with said electrical devices for maintaining each voltage, means for suppressing the maintained voltage for every change of voltage, an adding and comparing electrical apparatus for comparing the sum of the final voltages maintained on the output connections of each of said calculating apparatuses with a voltage representative of the value of said checking item, and utilization means operating according to the result of such comparison.

8. Electrical device for detecting erroneously transcribed data accompanied by a checking item on a record for accounting machines, comprising a plurality of electromagnetic differently operating calculating apparatuses, means for successively applying to each said apparatus a voltage on a distinctive one of a plurality of input terminals of said apparatuses, corresponding to all the different items of the data to be controlled except the checking item, means for detecting a result in the form of a voltage, the value of which is in relation with the distinctive one of the output terminals of the apparatus on which it appears, means for comparing a voltage proportional to the value of the checking item with the sum of the voltages related to the results furnished by the different calculating apparatuses, and means for operating utilization means according to the result of such comparison.

9. Device for detecting erroneously transcribed data accompanied by a checking item for accounting machines, comprising a plurality of differently operating calculating apparatuses, means for successively entering numbers corresponding to the different items of the data to be controlled into each of said apparatuses, means for combining together the results furnished by the different apparatuses according to a pre-established correspondence when all the numbers corresponding to the different items of the data to be controlled have been entered into the apparatuses, means for comparing a voltage proportional to the value of the checking item with the sum of the voltages proportional to the results furnished by the different calculating apparatuses, and means for operating utilization means according to the result of such comparison.

10. A control device for detecting errors made by an accounting machine when storing data which are readable on a document together with a check single symbol, this device comprising in combination means for entering each successively stored datum into an electrical switching unit to transform each datum into representative electrical pulses, a pulse-responding cyclic counter connected to the switching unit output to calculate and de-

liver a partial symbol of said data in the form of a voltage; at least another differently pulse-responding cyclic counters similarly connected; an electrical network, arranged in the form of predetermined circuits connected to the outputs of said counters, transforming the voltages finally delivered by said counters into a resulting voltage on the network output; means for entering said resulting voltage and a voltage representative of the value of said check symbol into a comparing unit giving a signal when said resulting voltage is different from said representative voltage.

11. A control device as claimed in claim 10, wherein each partial symbol is the remainder of the division, by an integer smaller than ten, of the sum of the digits of the readable data.

12. A control device as claimed in claim 10, wherein each partial symbol is the remainder of the division, by an integer smaller than ten, of the algebraic sum of the successive digits of the readable data, when said digits are alternately given + and — signs.

13. A control device as claimed in claim 10, wherein the check symbol is the sum of the partial symbols.

References Cited in the file of this patent

UNITED STATES PATENTS

1,283,293 Poole ---------- Oct. 29, 1918