Aug. 3, 1943. C. D. LAKE ET AL 2,325,960

DIGIT TRANSMITTING SYSTEM

Filed April 1, 1942 4 Sheets-Sheet 1

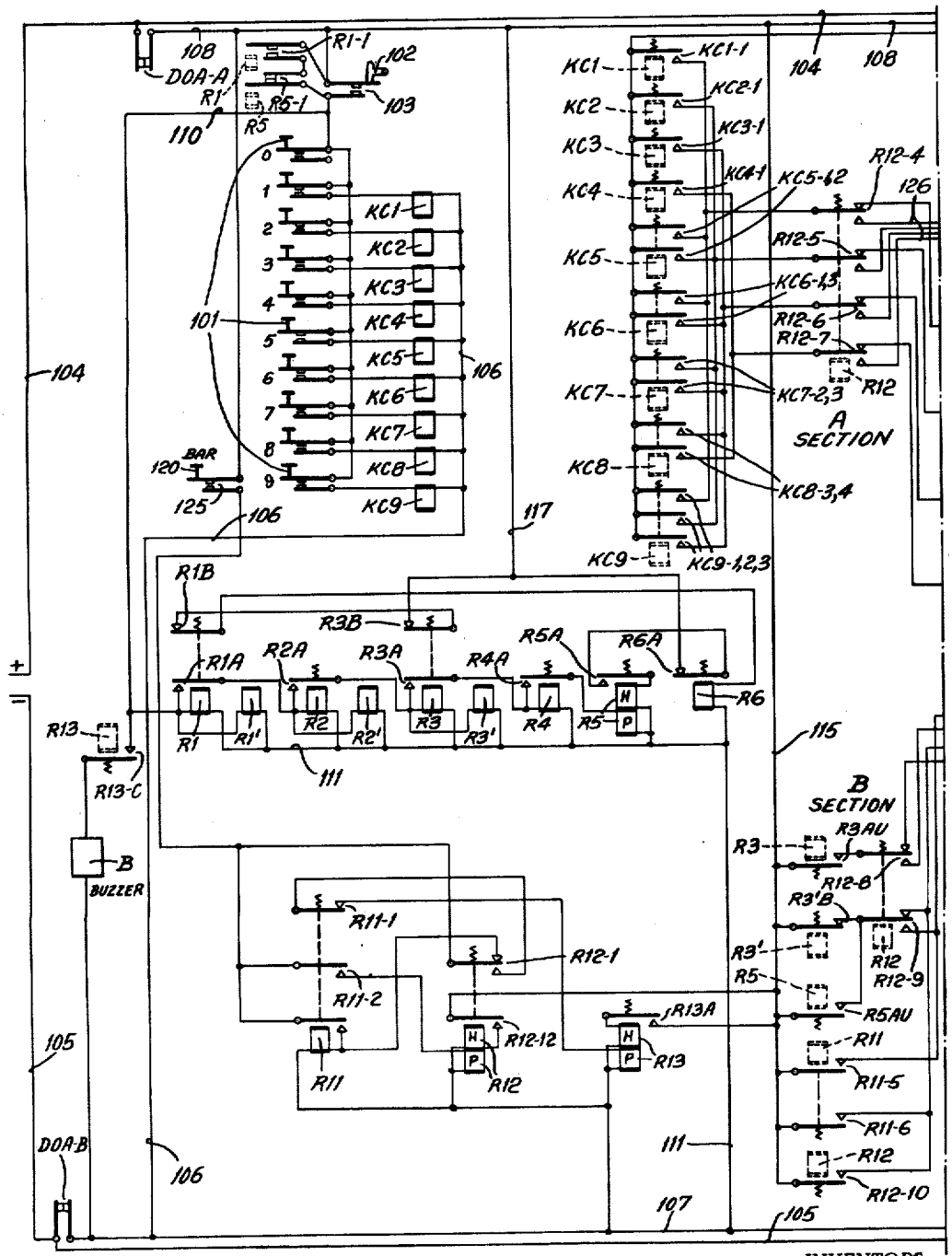


FIG. 1a.

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Filed April 1, 1942 4 Sheets-Sheet 2

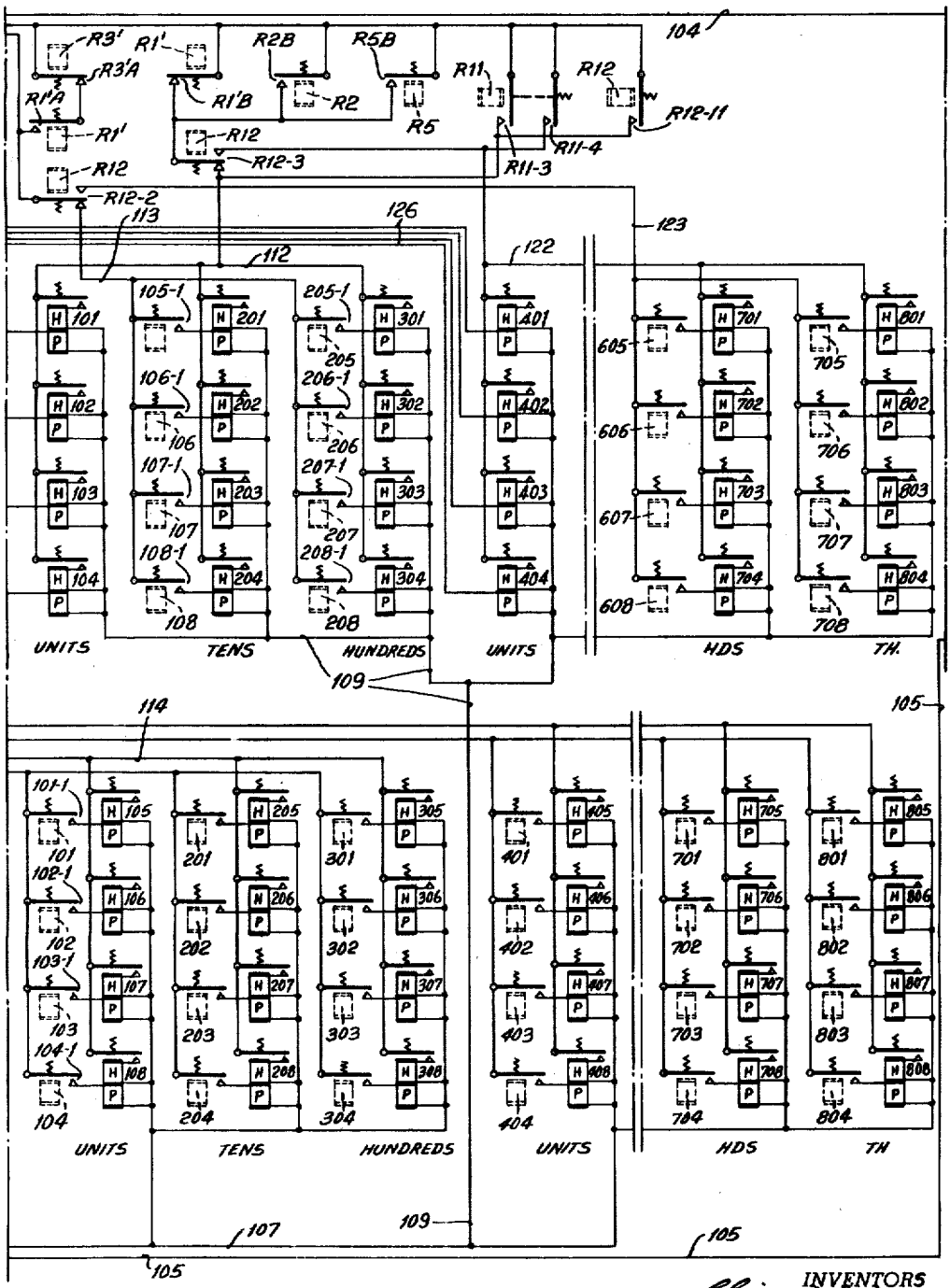


FIG. 1b.

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DIGIT TRANSMITTING SYSTEM

Filed April 1, 1942 4 Sheets-Sheet 3

FIG. 1c.

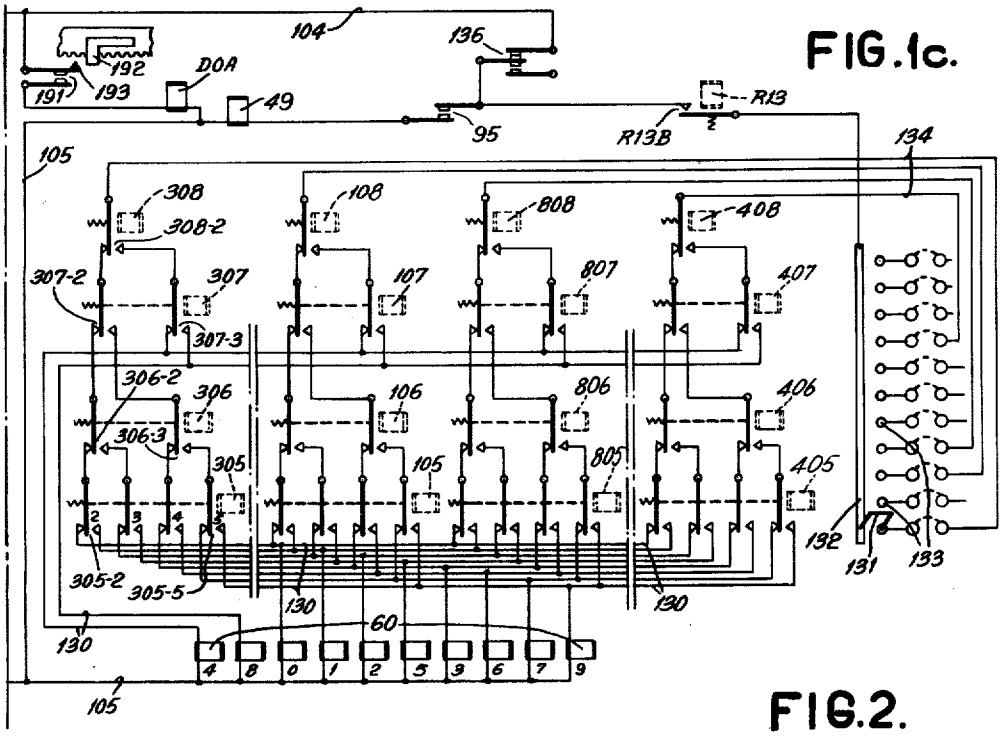
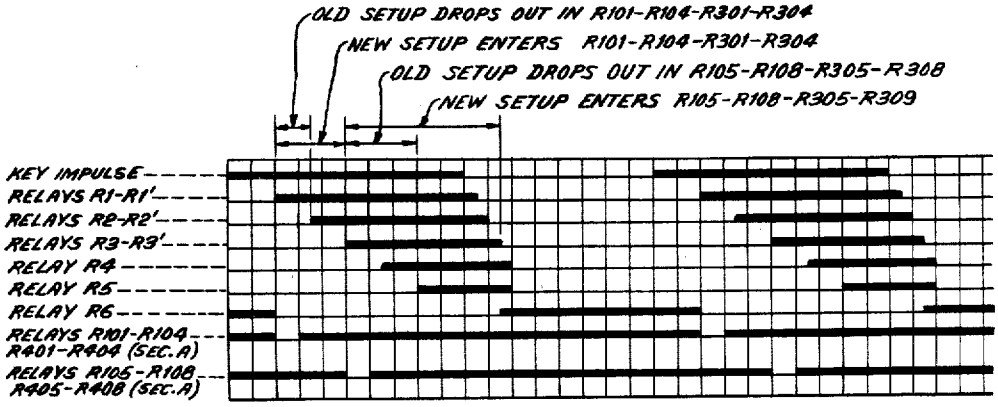


FIG. 2.



CODING	
0	0
1	1
2	2
3	3
4	4
5	1-2
6	1-3
7	2-3
8	3-4
9	1-2-3

FIG. 3.

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Filed April 1, 1942 4 Sheets-Sheet 4

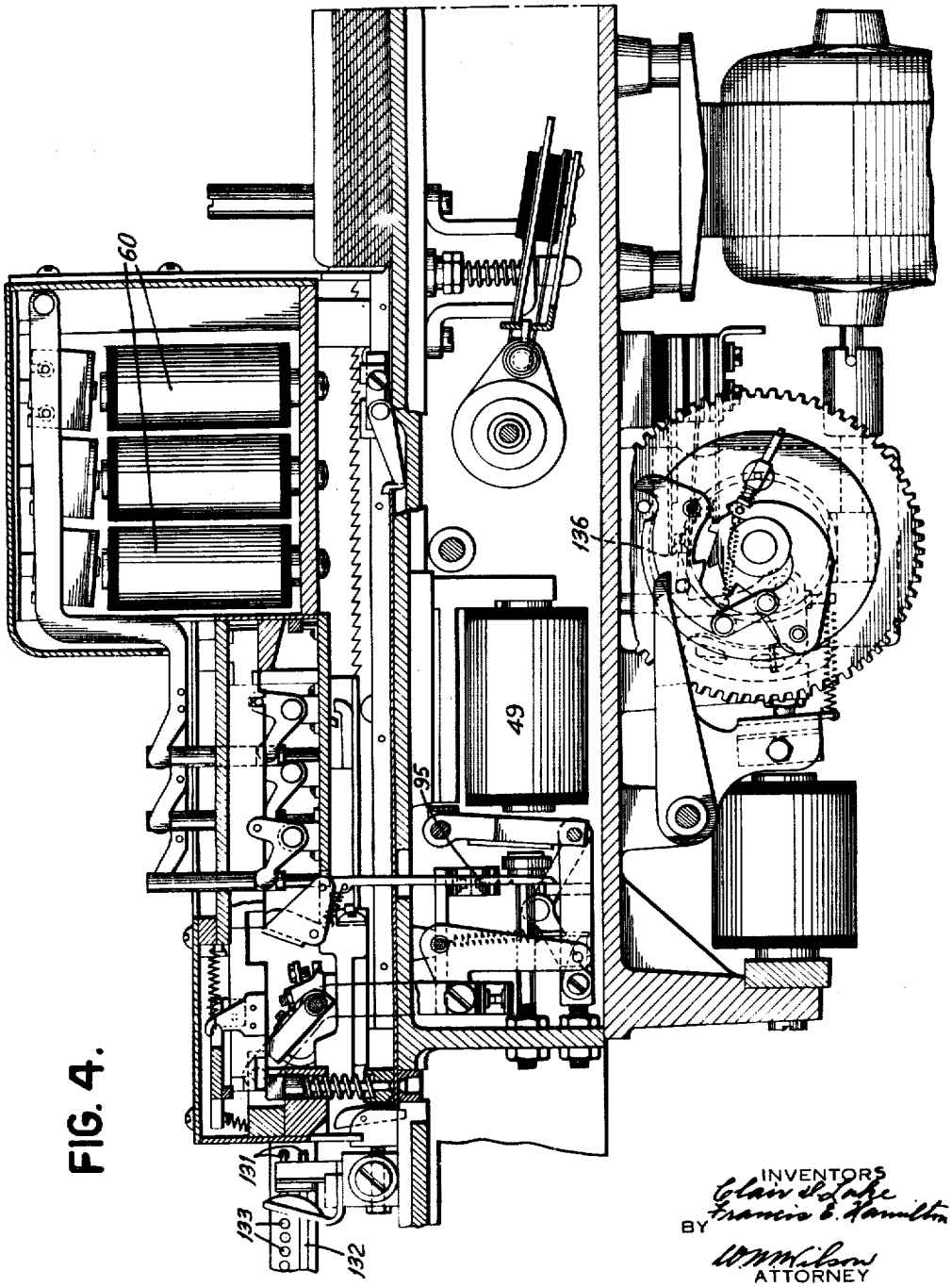


FIG. 4.

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UNITED STATES PATENT OFFICE

2,325,960

DIGIT TRANSMITTING SYSTEM

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Application April 1, 1942, Serial No. 437,116

19 Claims. (Cl. 164—113)

This invention relates to data transmitting machines and more particularly to the type in which storage devices are utilized to store the entry for controlling subsequent receiving operations.

The main object of the present invention is to provide an improved arrangement which enables the digit set up to be made in the storage devices in correct denominational position and as they are set up, while a subordinate object of the invention is to enable the storage devices to be set up denominationally without recourse to zero stroke operations to get them to proper denominational relationship.

As explanatory, in former devices such as, for example, illustrated in Patent No. 2,021,811, dated November 19, 1935, when a storage device of four denominational orders is set up under control of a ten key keyboard, the entries are successively made and, if four digits are entered, the order will be left to right to enter 6246, for example. Recording mechanisms controlled thereby will be correctly controlled with regard to denominational relationship. For numbers less than the full capacity, zeros must be entered accomplished by zero strokes of the keys in order to get the proper denominational relationship with regard to the recording mechanism. This is obvious in setting up the number 0062.

Storage devices of this nature are arranged to have a capacity equal to the greatest amount that can be entered, requiring for lesser amounts repeated zero key strokes, and since the lesser amounts are usually more frequent, the setting up operations are slowed down. The zero key strokes add to the fatigue of the operator and decrease the efficiency.

It has heretofore been contemplated in another arrangement, as for example, in Patent No. 2,158,101, dated May 16, 1939, to set up the digits in the storage devices as they occur, no zero strokes at all being used, and subsequently change the denominational relationship with regard to the recording elements, so that a variation in the number of digits will be proportionally compensated and, as a result, the units set up in the storage device will control unit digit recording, the tens, the tens digit recording, etc. Such denominational shift is usually made subsequent to the actual entry procedure. The present arrangement differs principally in that the entry is made in the storage devices in proper denominational order as the digits are entered, no later shift to the recording elements being used and no zero strokes being required, and further, such storage devices will automatically control zero recording for higher orders without requiring zero key strokes.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Figs. 1a, 1b, and 1c, when placed in the order mentioned, provide a complete wiring diagram of the electrical embodiment of the present invention.

Fig. 2 is a timing diagram disclosing the timing of the relays.

Fig. 3 is a diagram of the code used for setting up the relays singly or in combination to represent digits.

Fig. 4 is a sectional view of a well known form of punching machine used herein to effect the recording operations.

The data recording is controlled by a keyboard consisting of ten keys 101 (Fig. 1a) for the digits 0–9 inclusive which are in the usual ten key keyboard arrangement. Each key when depressed closes its related contact 0–9, as the case may be. Underneath all of the key levers is a bail 102 to be operated thereby and thus close bail contacts 103. This is a common keyboard construction so that a diagrammatic showing is believed to be sufficient to understand the present keyboard.

In the preferred arrangement, upon the initial depression of a key 101 the related key contact is first closed and thereafter the bail contact 103 is closed. When any 1–9 key 101 is depressed, it will energize its related relay KC1—KC9 but no relay is energized when the 0 key 101 is depressed. The circuit for energization of the KC relays is from line 104 through contacts DOA—A now closed, the bail contacts 103, the closed key contact, the related KC relay, to a wire 106, through contacts DOA—B, to line 105. Lines 104, 105 are the power supply lines, positive and negative, respectively.

In the "A" section of the storage relays three sets are used for setting up data to be punched on one field of the record and consists of a units set 101—104, a tens set 201—204, and a hundreds set 301—304. The hundreds digit of the above numbers designates by "1" the units order, the digit "2" the tens, the "3" digit the hundreds order, etc. In other words, the relays are numbered with the lowest prefix "1" representing the lowest denominational order and the higher pre-

fix digits representing the higher denominational orders in consecutive numerical order. The units digit of the above numbers represent the coding designation of the relay. For example, in the numbers 101, 102, 103, 104, units digits 1, 2, 3 and 4 represent the coding designation of relays and from the code in Fig. 3 it will be seen that the storage of a digit is effected by the energization of the relays in each storage unit, either singly or in combination.

If it be assumed that a key is depressed to cause a storage of the "6" digit, closure of the "6" key contact energizes relay KC6 to close contacts KC6—1 and KC6—3, thus closing a circuit to energize relays 101, 103 as follows: from 108 wire connected to line 104, through DOA—A contacts now closed, through contacts R3'A now closed, relay contacts R1'A now closed in a manner to be explained, to one side of relay contacts KC6—1 and KC6—3, through such relay contacts, and thence through relay contacts R12—4, R12—6 now in position shown to the pickup windings of relays 101, 103 and thence by a line 109 to the wire 107 connected to negative line 105, through DOA—B contacts now closed.

In the same manner, depression of the other keys 101 will selectively energize the relays 101—104 according to the code to set up a digit representation therein. It will be noted that each key depression will initially set up the digit representation in the units order of section A by relays 101—104, but, as will be later explained, if such relays were retained energized to represent a previous digit entry, they would have been cleared out, or deenergized, to receive the new digit entry.

In the circuit diagram relays (Fig. 1a) R1, R1', R2, R2', R3, R3', R4 and R5 are sequence relays, it being noted that the relays with the prime designations are in shunt with other relays of the same digit designation, but if so desired a single relay may suffice. The circuit arrangement is such that the relays are energized in sequence as each key 101 is depressed, as indicated in the timing diagram, Fig. 2. When a key is depressed, the bail contact 103 closes to close a circuit from line 108, through contacts 103, by line 110 to relay coils R1, R1', the circuit being continued by line 111 to the wire or line 107. Relay coil R1 closes its contact R1A to energize relay coils R2, R2'. Relay contact R2A closes to energize relay coils R3, R3', etc. Relay contact R3A closes sequentially energizing relay R4, and in the same manner relay R5 is sequentially energized. The relays R1—R5 are energized in succession one after the other after a period of .075 sec. To insure full energization of relays R1—R5 upon quick key strokes, bail contacts 103 are preferably shunted by relay contacts R1—1 and R5—5 in series. Relay R1 closes this shunt circuit and relay R5 opens it. Relay contacts R5A are timed to close before contacts R5—1 open.

Relay coils R1, R1' being first energized, it will be seen that contacts R1'B (Fig. 1b) will open to break the stick circuit line 112. It should be pointed out that each of the relays 101—104, 201—204, 301—304 consists of a pickup winding "P" and a holding winding "H" with related hold contacts which are connected to the stick circuit line 112.

When relay coil R1' energizes, it will open its contacts R1'B (Fig. 1b) breaking the stick circuit 112, it being noted that such circuit extends through relay contacts R12—3 now in position shown, through relay contacts R1'B to the positive line 108. Opening of this stick circuit will deenergize the previously energized relays 101, 104 if there had been a previous digit representation, but in the first digit entry it has no effect. Contacts R1'A also close so that the circuit to the KC relay contacts is closed to energize the relays 101, 104 singly or in combination according to the key depressed. Shortly after such relay contacts R1'A close and R1'B open, relay contacts R2B close, and being in shunt with relay contacts R1'B now open, will connect the stick circuit 112 to the positive line 108, thus retaining the relays 101—104 energized, and in the assumed first digit entry of "6," relays 101—103 will be held energized.

From the circuit diagram, it will be noted that provision is made to transfer a digit representation from each order of the A section to the related order of the B section. Considering the units order, the hold relay coils 101—104 of the A section energize to close related contacts 101—1 to 104—1 (Fig. 1b) which upon closure energize the related coils 105—108 of the units order of the B section. Coils 201—204 of the tens order of the A section close related "1" contacts to energize relay coils 205—208 of the tens order of the B section, and in a similar manner for the hundreds order.

In the example assumed, relay coils 101, 103 closed contacts 101—1 and 103—1 to energize the pickup windings of relay coils 105, 107, respectively.

The closure of relay contacts R2A energizes relay coils R3, R3' with several effects by the latter. It will be noted that the stick circuit for the holding windings of relay coils 105, 108—305, 308 is through the related stick contacts back through a stick circuit line 114, through relay contacts R12—9 in the position shown, through relay contacts R3'B which are connected to a line 115 leading to the positive line 108. This will clear out any previous entry in the units order of section B.

At the same time relay contacts R3'B open, relay contacts R3AU (Fig. 1a) close to close the pickup circuits to relay coils 105—108 through the previously closed relay contacts 101—1—104—1, the circuit extending from the positive line 108, line 115, relay contacts R3AU, relay contacts R12—8 in the position shown, the closed contacts 101—1, 103—1 in the example assumed, the pickup windings of relay coils 105, 107, and by a line 116 to the negative line 107.

The concurrent opening of contacts R3'A (Fig. 1b) will open the pickup circuits to the A section so that no further entries can take place in the A section, and thus misoperations cannot occur in this respect.

Upon closure of contacts R3A (Fig. 1a), relay R4 is energized which closes its contacts R4A to energize the relay R5. The function of relay R4 is to give a time delay for the energization of relay R5. The latter, after this suitable time delay, closes its contacts R5AU (Fig. 1a) while contacts R3'B are open, to thus provide a holding circuit for the energized relays of the units order of the B section. In the same manner relay contacts R5B (Fig. 1b, top) close to maintain a holding circuit for the relays of the B section following the entry of the new digit.

Relays R1 through to R5 are now energized and remain energized as long as any key is held depressed.

When relay R1 energized, the related contacts R1B (Fig. 1a) opened to deenergize relay R6

since the latter is normally energized because it is connected through these contacts and R3B contacts to the positive and negative lines 108, 101. The deenergization of relay R5 will enable its contacts R5A to close so that, when contacts R5A close, a circuit is extended from the positive line 101, through wire 111, holding coil of relay R5, relay contacts R5A, relay contacts R5A, wire 117 to the positive line 108.

When the depressed key is released, the relays R1—R3 and R1'—R3' as well as R4 will deenergize; thus enabling R1B and R3B contacts to close to energize relay R6 which will open its contacts R6A to deenergize the holding winding of relay R5 which will open its contacts R5B and R5AU. It will be clear then contacts R5B and R5AU only open after relay contacts R3'B and R1'B close, the holding circuits for the energized relays will be maintained, and relay R5 will be maintained energized for the period shown in Fig. 2. Hence, relay R5 is present as an interlock to prevent opening of contacts R5AU and R5B in the A and B section holding circuits until contacts R1'B and R3'B are completely closed to maintain the holding circuits.

As soon as relays R1 and R3 are completely deenergized so that contacts R1B and R3B are closed, relay R6 energizes permitting relay R5 to deenergize preparatory to the following setup cycle.

Summarizing, the representation "6" in the units order of section A is transferred at transfer time to the units order of section B, but if there was a representation in both the tens and hundreds order of section A, transfer of such digits would be made to the tens and hundreds order of section B.

Translated—the following is set up:

U
006 A section
U
006 B section

In the drawings, however, the setup is as follows:

600 A section
600 B section.

It will now be assumed that a "2" is to be entered so that upon the complete depression and restoration of the "2" key the representation will have been effected in the tens column of the B section. During the initial key depression, it is obviously necessary to eliminate amounts previously entered in the A section of the relays before entering new amounts in the same relays. It will be recalled that "6" is still represented in the units order of the A section, effected by previously holding relays 101 and 103 energized, the stick circuit being through relay contacts R1'B. Upon the initial "2" key depression, relay R1' energizes to open these contacts to deenergize relays 101, 103 and closure of contacts R1'A then enables the "2" key to energize relay KC2, and its contacts KC2—1 close to energize relay 102 which represents "2" (see Fig. 3).

There is also a transfer of the "6" representation in the units order of section B to the tens order of section A so that the latter will represent "6" in the tens order, enabling the cleared out units order of section A to receive the new "2" representation.

It will be recalled that in the units order of the B section relays 105 and 107 are held energized to represent "6" and the holding windings of such relays will close their pickup contacts 105—1 and 107—1 in the tens order of the A section. When relay contacts R1'A close, the pickup circuit 113 will be closed to energize relays 205, 203. The stick circuit for such relay is effected by line 112 and contacts R2—B and R5—B operating in the manner previously described so as to temporarily store up the "6" representation in the tens order of the A section. The units order has received the "2" representation so that the A section represents 260.

The units order of the B section still represents "6" but, when relay R3' energizes, relay contacts R3'B open to break the holding circuits for the B section and, since relays 105, 107 were previously energized, the previous stored up "6" digit in the units section will be cleared out so that the new digit representation from the A section may be transferred and received.

In the B section contacts 102—1 are closed in the units order, and contacts 203—1 and 201—1 in the tens order because of the "2" and "6" digit representation by the corresponding relays in the A section so that, when relay contacts R3AU close, the pickup circuit 115 will be closed to energize relay 105 in the units order, and relays 205 and 207 in the tens order which thereby represent 26 the amount entered and in the proper denominational order at the completion of the key stroke.

Relays R4, R5, R3 are energized and deenergized as previously described so that repetition of this description is unnecessary.

Summarizing.—The entered digits are in their proper denominational order and no zero key depression was necessary to bring them to the proper denominational relationship. If no further digit was to be entered, the amount would be recorded as 026 and, as will be later described, the 0 is automatically recorded.

Supposing the next digit 3 was to be entered, and in this case the 3 key will be depressed.

First, relays R4, R1' will energize and R1'B will open to clear out the 2 and 6 digit representation in the units and tens order, and R1'A will close to enable the "3" digit representation to be entered in the units order, and to effect a transfer under control of the units and tens order relays of the B section of the 6 and 2 representation to the tens and hundreds orders of the A section, so that in the first half of the cycle 623 will be the amount stored in the B section.

Thereafter, relay contacts R3'B open to clear out the units and tens order of the B section, and when relay contacts R3'AU close there will be a transfer of 623 under control of the storage relays in the A section to the storage relays of the B section, which will now represent 623 in the units, tens and hundreds order respectively. The entry is, therefore, in the proper denominational orders, and in such orders at the completion of the last key stroke.

While a storage unit of three orders is shown by way of example, it may comprise an indeterminate number of orders but with the present arrangement the entry will be in proper denominational order with regard to the recording elements. For higher orders not receiving a significant digit, 0, will be recorded and this will be effected automatically and without the necessity of "0" key strokes for such orders. However, intermediate zeros such as in the number 603 are registered by key strokes and in this case no relays of the KC group are energized.

In the above example, if "6" was first, reg-

istered, the depression of the 0 key 101 would energize the sequence relays R1, R1', R2, R2', R3, R3', R4 and R5 in the manner now described. The 6 would be cleared out of the units order of the A section and for the 0 entry no relay 101—104 would be energized. The 6 would be transferred from the units order of the B section to the tens order of the A section and then back to the tens order of the B, as described. The 0 representation in the units order of the A section would not energize any relays in the units order of the A section. As will be evident later on, this order will be recorded as 0, even though no relays are energized in this order. The next "3" digit is entered in the manner previously described, so that at the end of the entry, 603 will be represented in the A section.

Obviously, if the number was 60, or 690, the zeros need not be registered because in orders following a significant digit the 0 will be automatically recorded, and the normal 0 representation for the A section eliminates the necessity of zero key strokes for numbers like the above. When the arrangement is such that to effect a zero recording, relays must be energized, the 0 key strokes will be necessary for numbers like the above, as well as when they occupy intermediate positions as 603, 206, etc.

While the machine so far described is complete and operative, it is desirable to record data in more than one field, and to this end provision has been made for entry of amounts in two sets of storage devices for recording in two fields. That is, the first field consists of three columns with three orders of relay storage devices into which an amount from one to three orders may be entered. After this entry a manually operated bar is depressed which will correlate the relay storage devices of the other field with the keys. Preferably, these relay storage devices may receive an entry up to five orders to receive an amount up to that capacity, but this capacity is not fixed and may be varied like the relay storage devices associated with the first field.

To cause entry in the second set of storage devices, a bar 120 (Fig. 1a) is depressed. Referring to Fig. 1b, the relay storage devices of the A section for the second field consists of the sets 401—404 to 801—804, although only three of the five sets are shown. Similarly, for the B section only the sets 405—408, 705—708, 805—808 of the five sets are shown.

Reference numeral 123 (Fig. 1b) is the pickup transfer circuit line for the second field corresponding to the pick-up transfer circuit line 113 for the first field, and 122 represents the transfer stick circuit line for the relay storage devices of the A section for the second field, corresponding to the previously mentioned transfer stick circuit line 112.

When bar 120 (Fig. 1a) is depressed, contacts 125 are closed to energize relay R11 which closes its R11—2 contacts to energize relay coil R12. The latter closes its contacts R12—3 (Fig. 1b) and thus line 122 is correlated for control by the contacts R1'B, R2B, and R5B which function in the same manner previously described. Relay contacts R12—2 (Fig. 1b) close to correlate transfer pickup line 123 with the relay contacts R1'A, and R3'A which function as previously described. The group of relay contacts R12—4—7 (Fig. 1a) now close to connect the KC relay contacts with the relay magnets 401—404 of the units order of the second field through a group of four lines 126. Hence, these relays will be energized upon key depression.

In a similar manner the functional relay contacts R3AU, R3'B and R5AU (Fig. 1a) are associated with the pickup and holding circuits of the relay storage devices of the B section, second field. The control by relay contacts R3AU is effected by closure of relay contacts R12—8, and for relay contacts R3'B and R5AU by relay contacts R12—9.

It is, of course, necessary to prevent the holding circuit 112 (Fig. 1b) for the relays of the A section, first field, from being opened which would be effected by the transfer of relay contacts R12—3, and to this end relay contacts R11—3 and R11—4 are provided. Relay R11 energizes before R12 so, when the blade of contacts R12—3 transfer, line 112 will be continued through relay contacts R11—3 to the positive line 108, and when the blade of contacts R12—3 is at the other contact position, line 112 is continued through relay contacts R11—4. The later release of the bar 120 opens contacts 125 to deenergize relay R11 to open contacts R11—3 and R11—4, but relay R12 remains energized after R11 deenergizes because of the stick circuit through stick contacts R12—12 (Fig. 1a). Hence, when R11—3 and R11—4 open, line 112 is continued through relay contacts R12—11 (Fig. 1b) to the positive line 108. In this manner the relays of the A section, first field, are held energized for subsequent recording operations.

Relay contacts R11—5, R11—6 and R12—10 (Fig. 1a) function in a similar manner to hold the storage relays of the B section, first field, energized for subsequent recording operations.

The keys 101 are successively depressed to set up the relays for the second field in precisely the manner previously explained, setting up the digits in proper denominational order in the B section. After the entry for the second field, bar 120 is again depressed to initiate the punching operations.

During the first depression of bar 120, relay R12 was energized and held energized indefinitely through its stick contacts R12—12 as stated. The energized relay R12 shifts to contacts R12—1, but before such contacts close relay contacts R11—1 have previously opened so that a circuit cannot be closed from the positive line 108, through the contacts 125 closed by the bar 120, closed relay contacts R11—1, relay contacts R12—1, to the pickup winding of relay R13 because relay contacts R11—1 are opened. Hence, in the first motor bar depression relay R13 is not picked up, but the second operation of the bar 120 completes a circuit through relay contacts R12—1 because these transferred as a result of the previous bar depression and as a result relay R13 is now energized. A stick circuit for the relay R13 is provided by its stick contacts R13A closed by the holding winding of the relay R13.

Punching mechanism

Any suitable type of punching mechanism may be provided for amount recording, and other forms of recording machines may be utilized but preferably a punching machine of the type shown in the patent to F. Lee et al., No. 1,976,618 is utilized. The punching machine is generally shown in Fig. 4 but in full detail in this patent to which recourse may be had for full information.

The punching machine shown in this patent punches cards according to the Hollerith system and for this reason the combinational setting of the relays must be translated to a single digit representation. Such forms of translators are well known, and briefly, for the hundreds order, determined by the selective energization of the relays 305—308, related contacts (Fig. 1c) are closed thereby in combination so as to select one of a series of digit lines 130 which lead to a series of punch magnets 60 (see Fig. 4) corresponding to magnets 60 of the aforementioned Patent No. 1,976,618. It will be noted that the "2" relay contacts are normally closed to select the zero line 130 to energize the 0 punch magnet 131. Hence, whether the relays represent 0 in higher orders, or an intermediate 0, this digit will be automatically perforated, and for higher orders without the necessity of zero key strokes.

In the problem assumed "6" was entered in the hundreds order energizing relays 306 and 307 and, by following the circuits made by the closure of the related contacts, the 6 digit line 130 is selected and the "6" punch magnet is energized.

After punching the "6" in the hundreds order, the card carriage spaces to the next column position and 2 will be punched, then 3 for the units column. After punching the first field, punching is successively effected for the second field in the same manner, the card carriage being stepped column by column.

The means for successively reading out the translators comprises a column read-out consisting of a brush 131, a common conducting strip 132 and contact points 133 engageable by the brush 131 as the card carriage is stepped (see also Fig. 4). From the contact points 133 there are wire connections 134 to the related translator unit, although not all are shown. By such an arrangement the translators are read out in succession but an initial impulse is directed to the punch to start its operation, after which card punching automatically ensues.

The column read-out device is well known and is fully shown in Fig. 3 of the patent to G. F. Daly et al., No. 2,016,706 and reference may be had thereto for further details.

The specific circuit for punching one column will now be traced. From the line 104 a circuit extends to contacts 136 similar to the contacts shown in Fig. 15 of Patent No. 1,976,618 (see also Fig. 4), thence to relay contacts R13B now closed to give the initial impulse, to the common strip 132, the brush 131 now in contact with the contact point 133 of the first column, by a wire 134 leading to the hundreds order translator, through the closed translator contacts, to the "6" digit line 130 leading to the "6" punch magnet 131, then to the line 105. As is fully described in the Patent No. 1,976,618, the energization of the punch magnet 131 will select a punch, and then the interposer selecting the punch will close contacts 95 to energize a punch solenoid 49 which will depress the selected punch. The aforesaid elements 49 and 95 as well as the operation of the punch is fully explained and described in the patent above, and shown in Fig. 4.

The carriage then escapes one column bringing the next column of the card to the punches and the brush 131 will then cause the next column to be punched under control of the next order translator unit.

Upon completion of punching for the second card field, the carriage skips to the last column as is well known, and thereafter the punched card is ejected and at the same time the energized relays of the present arrangement are deenergized by the opening of relay contacts DOA—A and DOA—B (Fig. 1a) which are opened by the energization of relay DOA (Fig. 1c).

This is preferably effected upon the skipping of the card carriage to the last column position, as is fully described in Patent No. 1,976,618 for the type punching machine coordinated with the present invention. At this time as stated in the patent, a bracket 192 movable with the card carriage strikes an insulating block 193 to close contacts 191, the above elements having similar designations in the patent. Closure of contacts 191 will energize relay DOA to open contacts DOA—A and DOA—B to release the holding circuits for all energized storage relays which are then brought to a normal deenergized condition preparatory for a new setup operation.

The holding circuit for relay R13 is through relay contacts R13A which is broken only by the opening of DOA—A, DOA—B contacts at the termination of punching operations. Hence, since relay R13 is energized during punching operations, relay contacts R13C (Fig. 1a) will be closed, and if any attempt is made to depress any of the keys 101 during the punching operation, a circuit will be closed from the positive line 103, bail contact 103, the line 110, relay contacts R13C, buzzer B, to negative line 105. The signal given by the buzzer B will warn the operator of the incorrect operation. The ejection of the card in the punching machine will be a visual indication to the operator to initiate the next setup.

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

What is claimed is:

1. In a digit set up system, the combination of a ten key keyboard, a set of storage devices, means controlled by said keyboard to invariably set up the first digit in an initial order of the storage devices, and means effective upon set up of the next digit in the initial order of the storage devices to transfer the set up of the first digit on the initial order of the storage devices to a successive higher order of the storage devices, whereby the digits set up in the initial order and successive order of the storage devices are represented in correct denominational order upon the second digit entry.

2. In a digit set up system, the combination of a ten key keyboard, a set of storage devices, means controlled by said keyboard to invariably set up the first digit in the units order of the storage devices, and means rendered operative by said keyboard in effecting the second digit set up in the units order of the storage devices to transfer the set up from the units order to the next higher denominational order, whereby the second digit entry is always effected in the units order.

3. In a digit set up system, the combination of a first group of storage devices which are set up in one or more denominational orders to represent digits, a second group of storage devices, and means under control of the first group of storage devices to transfer the digit representa-

tions from the first group of storage devices to the second group of storage devices in successive higher orders thereof.

4. In a digit representing system, the combination of a first group of storage devices in which each digit is set up in an initial order thereof and successively transferred to one or more denominational orders of said storage devices, a second group of storage devices, means under control of the first group of storage devices to transfer the digit representations from the first group of storage devices to the second group of storage devices in successive higher orders thereof, and means for setting up a digit in an initial order of the first group of storage devices and for causing an operation of said transfer means.

5. In a digit representing system, the combination of a group of storage devices of successive different denominational order, means for setting up a digit in an initial order of said storage devices, and means responsive to the set up of the next digit in the initial order by the repeated operation of said setting means for clearing out the initial order to enable the set up of the next digit and under control of the storage devices of the initial order, when it represents the first set up digit, for causing the next higher order of the storage devices to be set up to represent the first digit.

6. In a digit representing system, the combination of a group of storage devices of successive denominational order, means comprising a ten key keyboard, for setting up said storage devices to represent a digit in the storage devices in the initial order thereof, and means responsive to the entry of a next digit in the initial order by the repeated operation of the keyboard for clearing out the initial order to enable such order to represent the next digit and under control of the setup storage devices of the initial order, when it represents the first set up digit, for causing the successive order of the storage devices to be set up to represent this next digit.

7. In a digit representing system, the combination of a group of storage devices of successive denominational order, means comprising ten digit keys for setting up said storage devices to represent the first digit, and means rendered effective by the repeated operation of said digit keys for causing the storage devices representing the first digit to effect the transfer of the digit representation thereon to the successive higher order of the storage devices and then be cleared of its digit first representation, whereby said cleared out storage devices can be set up for the second digit representation.

8. In a digit representing system, the combination of a group of storage devices of successive denominational order, means for invariably setting up the initial order of said storage devices to represent the first and thereafter successively entered digits, and means responsive to each repeated operation of said setting means for causing the initial order of said storage devices representing the first digit to effect the transfer of the digit representation thereon to another order of the storage devices and then be cleared of its digit representation, whereby said cleared out initial order of said storage devices successively receives the second and each successive digit representation.

9. In a digit representing system, the combination of a group of storage devices of successive denominational order, means for setting up said storage devices in the cleared out first order thereof to represent the initial digit and each successive digit, other orders thereof successively representing cleared out digits set up in the initial order, means for resetting said storage devices to clear them of their digit representations, and means responsive to the repeated operation of the setting means to set up a successive digit in the initial order to effect the transfer of the digit representations in all orders of the storage devices under control thereof to successive higher orders of the storage devices, and for causing the operation of the resetting means whereby said cleared out initial order receives the successive digit representation and the other orders represent the cleared out digits set up in the initial order.

10. In a digit representing system, the combination of a group of storage relays of successive denominational order, means for energizing said storage relays in the initial order thereof to represent the first and successive digits, said other orders being held energized for successively representing digits set up in said initial order, means for deenergizing said storage relays to clear them of their digit representations, and means responsive to the repeated operation of the setting means to set up a successive digit to effect the transfer of the digit representations in all orders of the storage relays under control thereof to successive higher orders of the storage relays, and for causing the operation of the deenergizing means whereby said cleared out initial order is energized to receive the successive digit representation and the other orders are energized to represent the digits successively set up in the initial order.

11. In a digit representing system, the combination of a first group of digit storage devices which are set up to represent one or more digits of different denominational order, a second group of digit storage devices, and means for transferring under control of the first group of digit storage devices the digit representations from the first group of digit storage devices to the second group and then under control of the second group of storage devices back to the first group of storage devices but in successively higher denominational orders thereof.

12. In a digit representing system, the combination of a first group of digit storage devices which are set up to represent one or more digits of different denominational order, a second group of storage devices, means to transfer the setting of the digit representations from the first group of storage devices to the second group of storage devices and clearing the first group of storage devices of all digit representations, means to transfer under control of said second group of storage devices the digit settings thereof to transfer the digit representations thereon back to the cleared out first group of storage devices but in successive higher orders, leaving the initial order of the first group of storage devices clear of a digit representation, and means to invariably set up a successive digit representation in said initial order of the first group of storage devices.

13. In a digit representing system, the combination of two groups of denominationally ordered storage devices, means for setting up an initial order of the storage devices in the first group thereof to represent a digit and for setting up under control thereof an initial order of storage devices of the second group, means un-

der control of the storage devices of the second group to set up storage devices of the first group in successive higher orders if the storage devices of the second group have been set up to represent other digits of the amount, and means under control of the first group of storage devices to set up storage devices in the second group to represent transferred digits in like orders, whereby after the transfer said second set of storage devices represents the digits of an amount in proper denominational order.

14. In a digit representing system, the combination of a ten key keyboard, a group of digit storage devices, means controlled by said keyboard for setting up said storage devices in an initial order to represent a digit and for retaining the setting, a second group of storage devices, means under control of the storage devices of initial order of the first named group to set up the storage devices of the initial order of the second group, and for retaining the setting, means responsive to a second operation of said key for initially clearing out the initial order of the first group of storage devices and to cause said second entered digit to be set up therein, and means for transferring the first digit representation from the initial order of the second group of storage devices to a successive higher order thereof, and for clearing out the first digit representation, whereby said initial order of the second group of storage devices is set under control of the initial order of the first group of storage devices to represent the second entered digit.

15. In a digit representing system, the combination of a ten key keyboard, two groups of denominationally ordered storage devices, one group of which may have previously been set up to represent digits of an amount previously entered, means for causing under control of the previously set up storage devices the setting up of the digits thereon upon said other group of storage devices in successive higher orders and clearing the previously set up storage devices, and means under control of said other group of storage devices to cause the setting up of the cleared out storage devices in like denominational order, whereby one order of such storage devices remains clear to be set up to represent a successive digit representation under control of said ten key keyboard.

16. In a digit representing system, the combination of a ten key keyboard, two groups of denominationally ordered storage devices, one group of which may have previously been set up to represent digits of an amount previously entered, means for causing under control of the previously setup storage devices the setting up of the digits thereon upon said other group of storage devices in successive higher orders and clearing the previously setup storage devices, means under control of said other group of storage devices to cause the setting up of the cleared out storage devices in like denominational order, whereby one order of such storage devices remains clear to be set up to represent a successive digit representation under control of said ten key keyboard, and means for causing said other group of devices to be cleared out for another transferred digit setting.

17. In a digit representing system, the combination of a first group of digit storage devices which have been previously set up to represent one or more digits of different denominational order in correct denominational position, a second group of storage devices, means to transfer the digit representations from the first group to the second group of storage devices and clearing the first group of storage devices of all digit representations, means to transfer under control of said second group of storage devices the transferred digits back to the cleared out first group of storage devices shifted to successive higher orders and clearing the second group of storage devices, said transfer shift leaving the first order of the first group of storage devices still clear of any digit representation, and means to cause a successive digit set up in the cleared out order of the first group of storage devices prior to the next transfer from the first to the second group of storage devices.

18. In a digit set up system, the combination of a ten key keyboard, a plurality of sets of storage devices for representing digits of successive denominational order, means controlled by said keyboard for invariably setting up an initial order of each set of storage devices to represent each digit, means controlled by said keyboard for causing the previous setup in each of the storage devices to be transferred to successive denominational orders of the same storage device upon set up of a digit in the initial order thereof, to thereby set up an amount on each storage device in correct denominational position, and selective means effective after setting up a plurality of digit representations in one set of storage devices to coordinate the means controlled by the keyboard for operative control of the other set of storage devices to set up the initial order thereof and to cause the transfer means to be effective for the other set of storage devices, whereby the latter is also set up to represent the entered digits of another amount in correct denominational position.

19. In a digit setup system, the combination of a ten key keyboard, a plurality of sets of storage devices for representing amounts of successive denominational order, means controlled by said keyboard for invariably setting up an initial order of each set of storage devices to represent each digit, means controlled by said keyboard for causing the previous setup in each of the storage devices to be transferred to successive denominational orders of the same storage device upon set up of a digit in the initial order thereof, to thereby set up an amount on each storage device in correct denominational position, selective means effective on its first operation after setting up a plurality of digit representations in one set of storage devices to coordinate the means controlled by the keyboard for operative control of the other set of storage devices to set up the initial order thereof and to cause the transfer means to be effective for the other set of storage devices, whereby the latter is also set up to represent the digits of another amount in correct denominational position, a recording mechanism, means for effecting the operation of the recording mechanism under control of the sets of storage devices, and means whereby the second operation of said selective means initiates the operation of the recording mechanism to cause the latter to record the amounts set up on the sets of storage devices.

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