Nov. 5, 1963 G. C. WOOD 3,109,925

ACCOUNTING APPARATUS

Filed Aug. 17, 1962 5 Sheets-Sheet 1

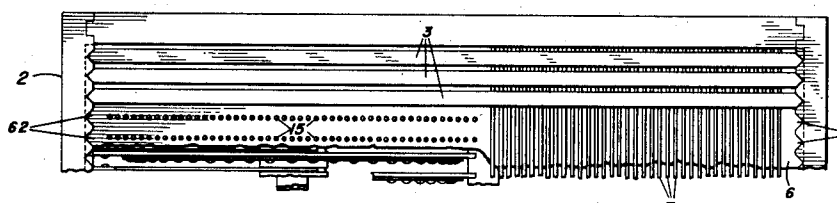


FIG. 2

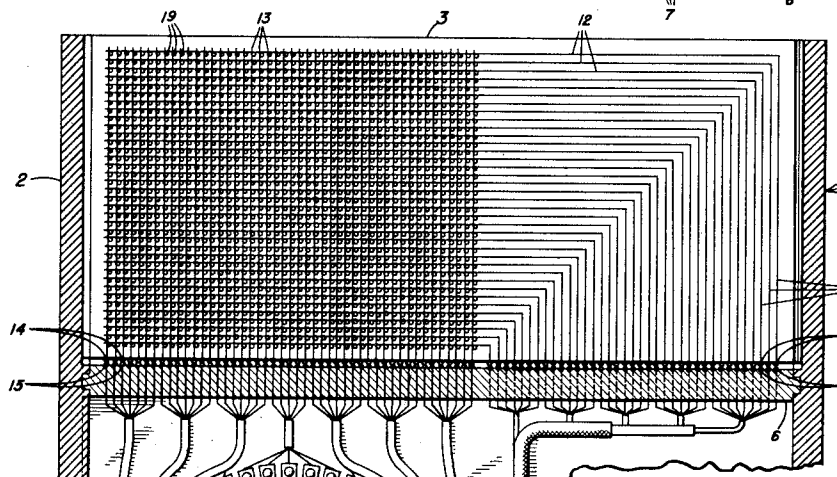
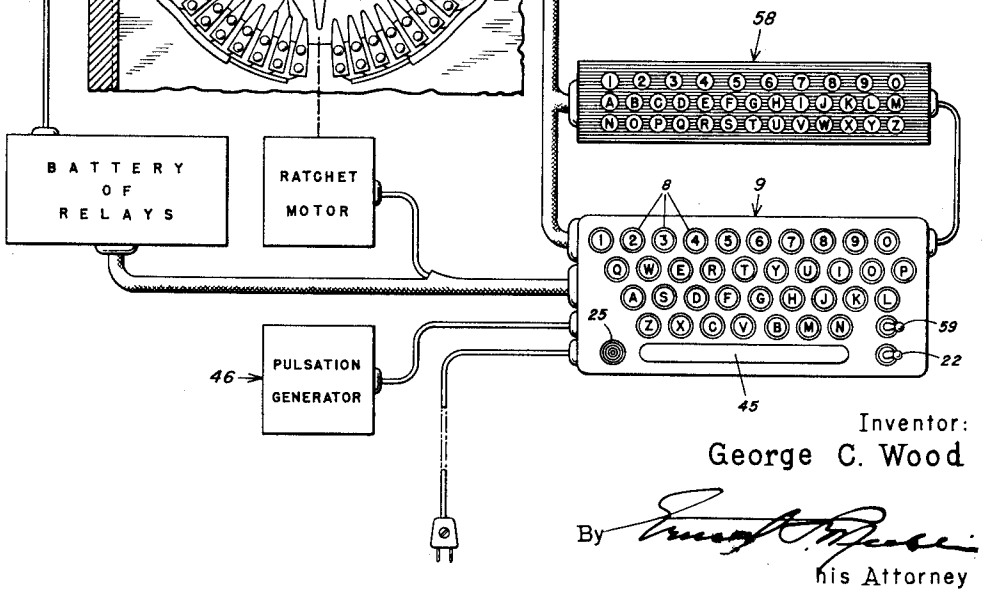


FIG. 1



Inventor:
George C. Wood

By

his Attorney

Nov. 5, 1963 G. C. WOOD 3,109,925

ACCOUNTING APPARATUS

Filed Aug. 17, 1962 5 Sheets-Sheet 2

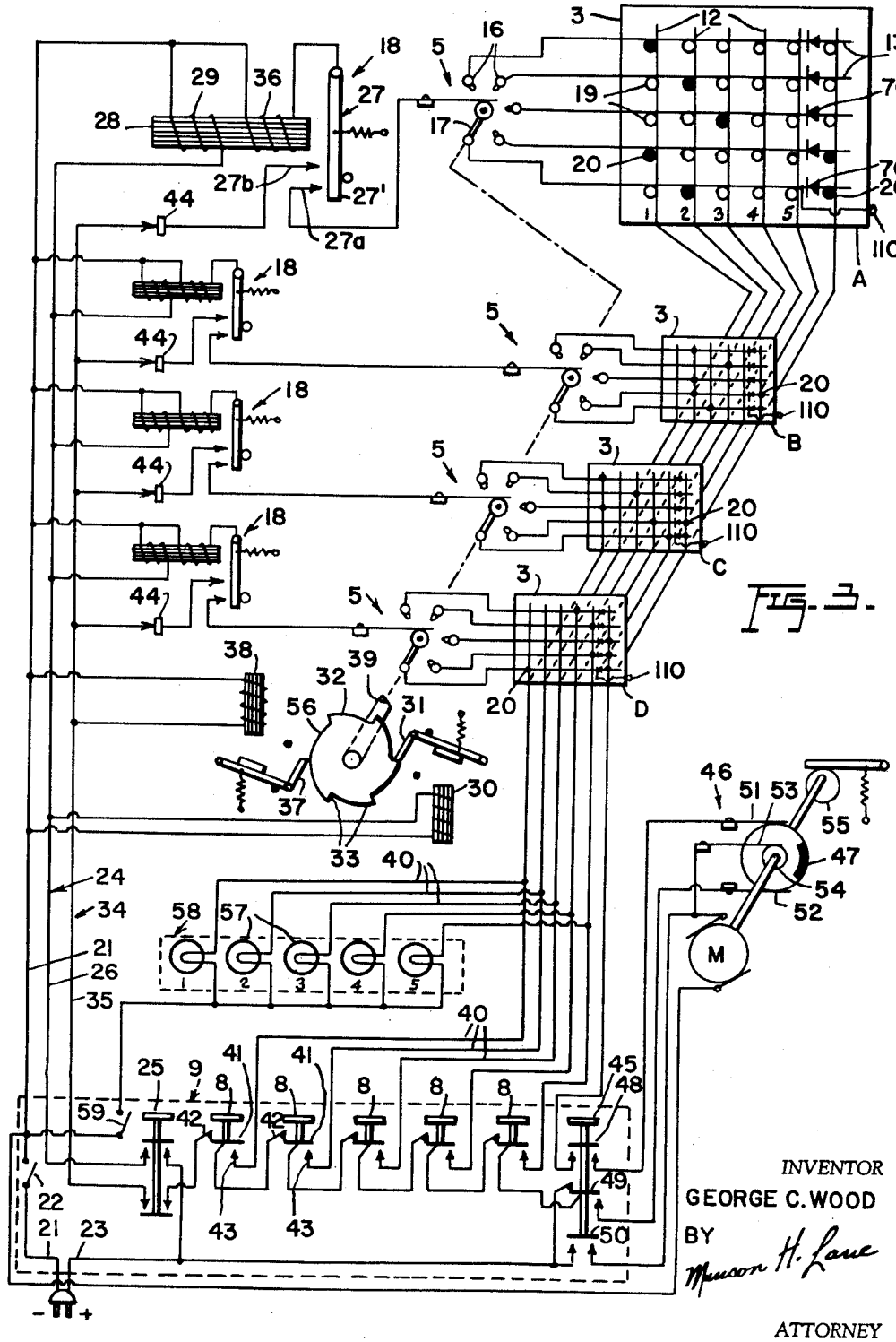


FIG. 3.

INVENTOR
GEORGE C. WOOD
BY Munson H. Lane
ATTORNEY

Nov. 5, 1963 G. C. WOOD 3,109,925

ACCOUNTING APPARATUS

Filed Aug. 17, 1962 5 Sheets-Sheet 3

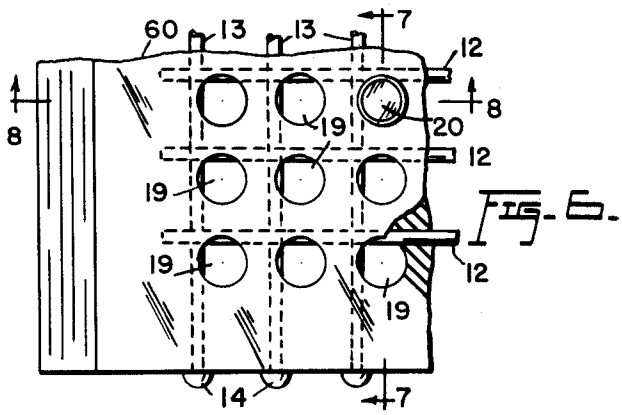


FIG. 6.

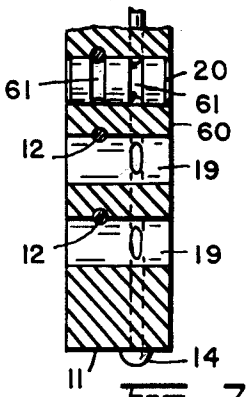


FIG. 7.

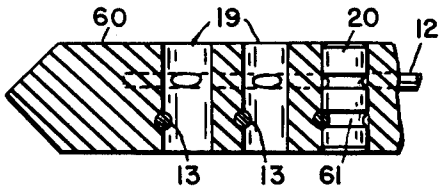


FIG. 8.

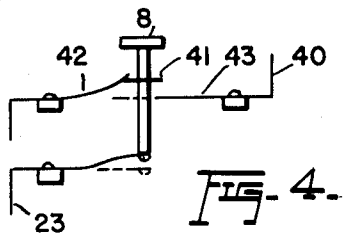


FIG. 4.

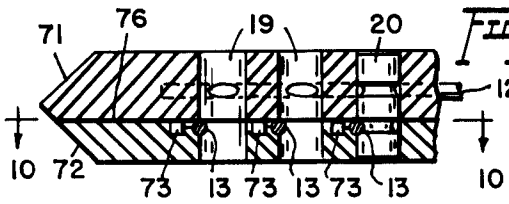


FIG. 9.

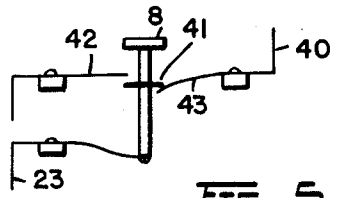


FIG. 5.

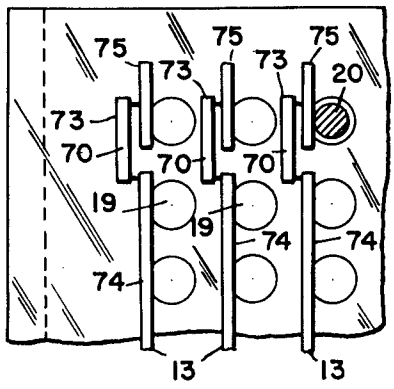


FIG. 10.

INVENTOR

GEORGE C. WOOD

BY Munson H. Lane

ATTORNEY

Nov. 5, 1963 G. C. WOOD 3,109,925

ACCOUNTING APPARATUS

Filed Aug. 17, 1962 5 Sheets-Sheet 4

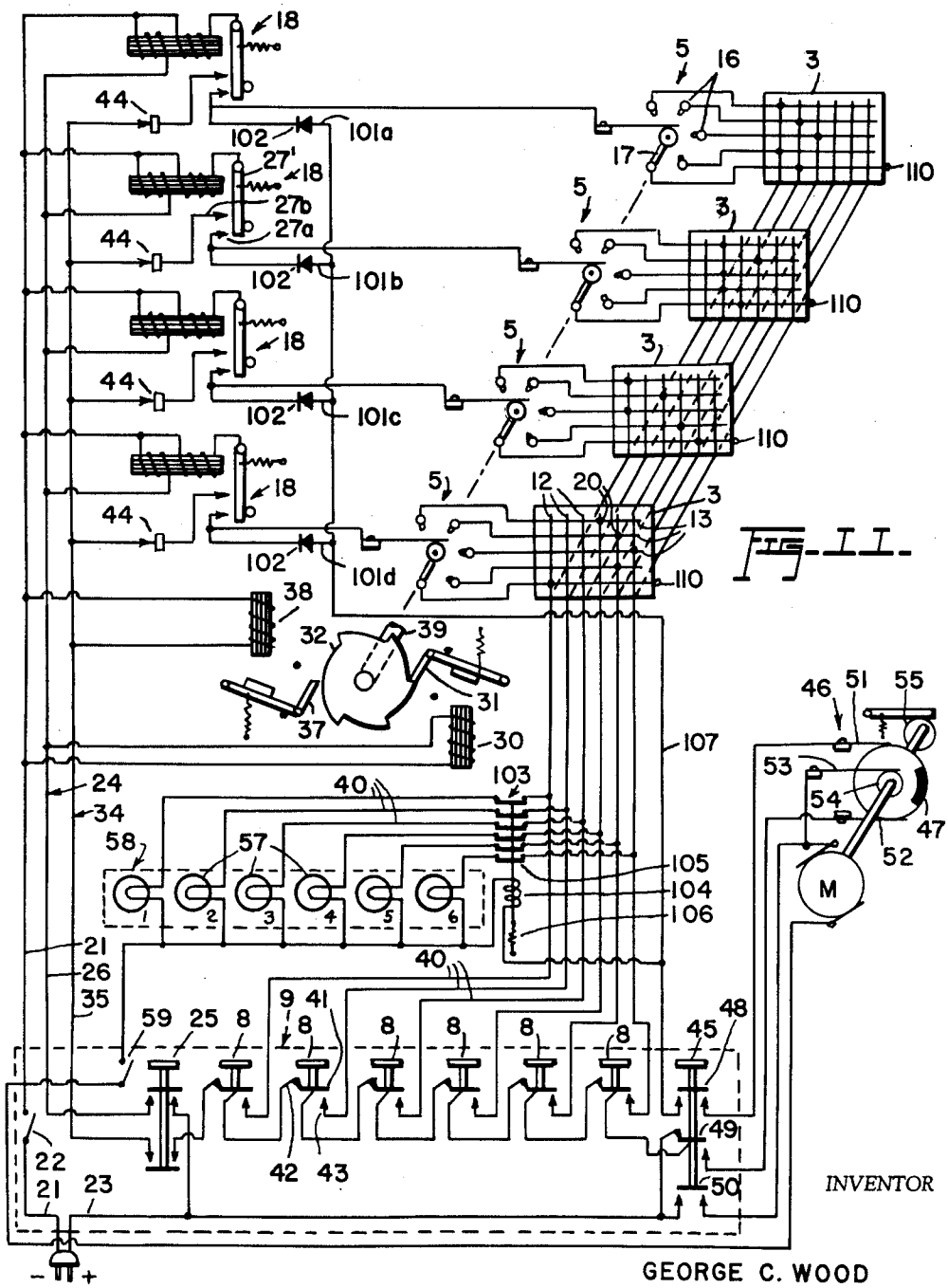


FIG. II.

INVENTOR

GEORGE C. WOOD

BY Munson H. Lane

ATTORNEY

Nov. 5, 1963 G. C. WOOD 3,109,925

ACCOUNTING APPARATUS

Filed Aug. 17, 1962 5 Sheets-Sheet 5

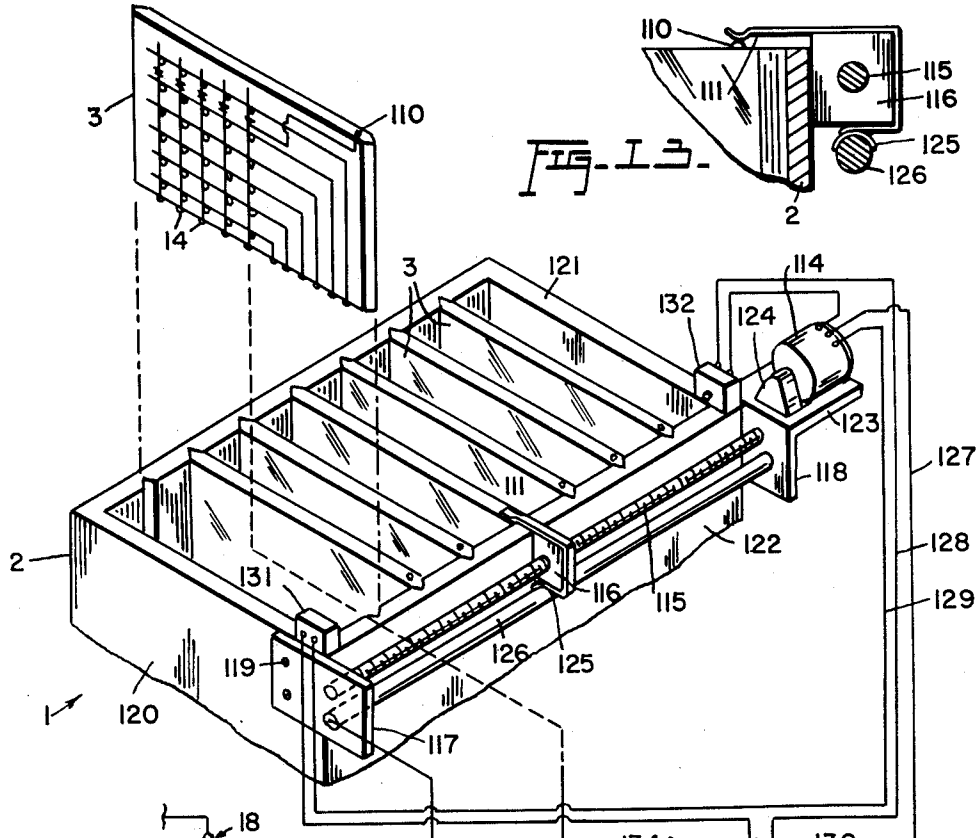


FIG. 13.

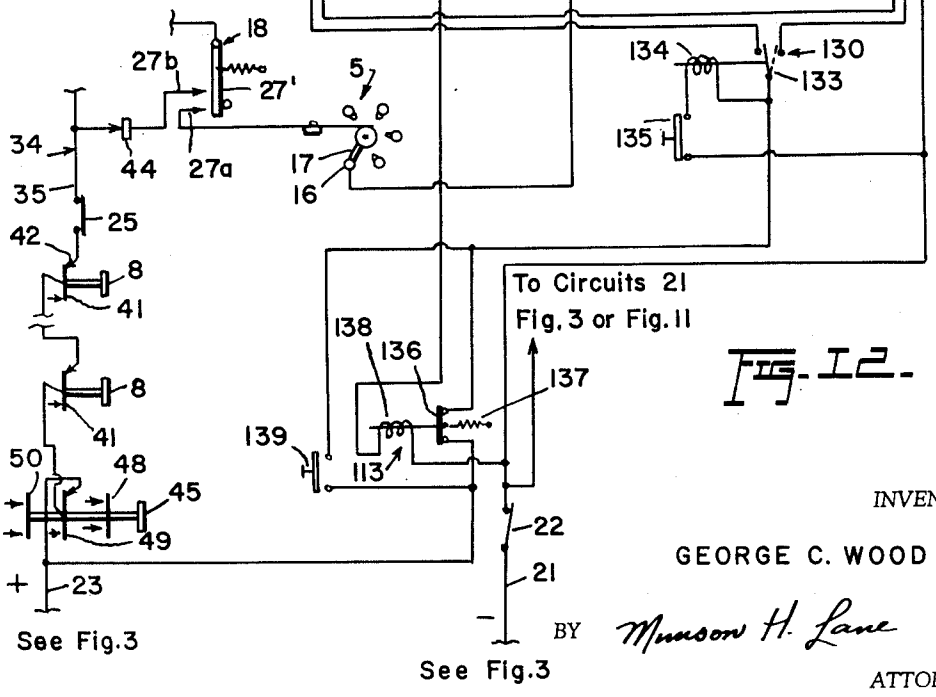


FIG. 12.

INVENTOR

GEORGE C. WOOD

BY Munson H. Lane

ATTORNEY

United States Patent Office 3,109,925 Patented Nov. 5, 1963

3,109,925
ACCOUNTING APPARATUS

George C. Wood, Edenton, N.C., assignor of one-fourth to Munson H. Lane, Sr., and one-fourth to Munson H. Lane, Jr., Arlington, Va.

Filed Aug. 17, 1962, Ser. No. 219,360
21 Claims. (Cl. 235—61.11)

This invention relates to accounting apparatus and has as its primary object the provision in such apparatus of an electrical system for selecting and reporting information from a file without physical contact.

The present application is a continuation-in-part of my application Serial No. 701,677, now abandoned, filed December 9, 1957, which is a continuation of my application Serial No. 121,779 (now abandoned), filed October 17, 1949.

Another object of the invention is to provide an improved filing system for electrically obtaining recorded information.

An additional object of the invention is to provide a permanent data-retaining device for an electrical filing system which is adapted to practically unlimited resetting.

A further object of the invention is to provide an electrical filing system in which information of any desired complexity may be recorded and from whence it may be selected and tabulated at will without removing the recording media from their filed positions.

Another object of the invention is to provide an electrical accounting apparatus which is efficient in operation and relatively simple in construction.

Other objects and advantages of the invention will appear hereinafter in the detailed description, to be particularly pointed out in the appended claims, and illustrated in the accompanying drawings in which:

FIGURE 1 is a view taken in part through a section of a file drawer to which a preferred embodiment of the invention has been applied, showing in elevation the filing section of the apparatus and, somewhat schematically and on a reduced scale, the external components;

FIGURE 2 is a fragmentary plan view of the filing section of FIGURE 1;

FIGURE 3 is a schematic view in relatively simple form of the electrical circuit employed in the apparatus;

FIGURE 4 is a side elevational view on an enlarged scale of one of the selector keys and its associated structure;

FIGURE 5 is a side elevational view of the key of FIGURE 4 in a different position;

FIGURE 6 is a fragmentary front elevational view on an enlarged scale of the card of FIGURE 1;

FIGURE 7 is a vertical sectional view taken along the lines 7—7 of FIGURE 6;

FIGURE 8 is a horizontal sectional view taken along the lines 8—8 of FIGURE 6;

FIGURE 9 is a fragmentary horizontal sectional view on an enlarged scale of another form of the card of FIGURE 1;

FIGURE 10 is a vertical sectional view taken along the line 10—10 of FIGURE 9;

FIGURE 11 is a schematic view showing a modification of the electrical circuit employed in the apparatus;

FIGURE 12 is a partial perspective view of a card filing drawer employed in the apparatus with automatic card locator means mounted thereon, and showing portions of the electric circuit of FIGURES 3 or 11; and

FIGURE 13 is a detailed sectional view through a portion of the apparatus shown in FIGURE 12.

As set forth in the objects, the principle of this invention is the utilization of electrical means to select and report data recorded on cards or other information-bearing devices. In conventional apparatus for selecting and tabulating data, it is necessary to remove the data cards or other data-retaining devices from their file and pass each card by a designation point in the apparatus at which the data is taken either mechanically or electrically. To avoid the loss of time and effort incident to such physical handling of the cards, there have been designed forms of accounting apparatus employing electrical scanning devices which are adapted to be installed in the compartment containing the filed cards. In apparatus of this type, the cards, themselves, direct certain electrical circuits which, when completed by mechanically moving a scanner into contact with each card, enable the card bearing the desired data to be selected and read. While a considerable improvement over conventional apparatus, the movable scanner required of the present drawer-type apparatus renders it both cumbersome and space-consuming. The present invention improves upon the previous drawer-type apparatus by eliminating the necessity of a mechanically movable scanner through the utilization of electrical circuits which enable the passage of current alone to discriminate between the cards in the file and select that card bearing the desired data. In essence, the invention utilizes cards each having a network of crossed wires through the connection of certain of which, in process of recording data, current passed along the file is selectively directed through the cards until the desired card is found. By making provision for this selective direction in successive stages and electrically holding the circuits of cards selected at each stage, the search can be continued until only the card bearing the desired data is in an energized circuit. Thereupon the selected card may be caused electrically to report the desired data or otherwise processed, depending on the purpose of the selection.

Referring now in detail to the drawings in which like reference characters designate like parts, the improved accounting apparatus of the present invention has been shown applied to a drawer **1** of a filing cabinet or like device, not shown. In the illustrated embodiment, the drawer has been divided into two sections or compartments, one an upper section **2** in which file cards or other data devices or recording media **3** are filed, and the other a lower section **4** for housing a plurality of contactors or contact members **5**, the sections being separated by a shelf or partition **6** forming the base or bottom of the data or card-filing compartment.

Longitudinally along a side or, as shown, the base **6** of the filing section **2**, run a plurality of spaced, electrically-insulated bus bars or conducting rods **7**, each of which is electrically connected to one of a series of selector keys, buttons or actuating members **8** on a selector panel or control assembly **9** (FIG. 3). Corresponding terminals **10**, each adapted to engage or electrically contact one of the bus bars **7**, are provided in the confronting or lower edge **11** of each of the cards **3**. Each of these terminals is the extension of one of a plurality of selecting, sensing or detecting conductors, or conducting wires or lines **12** which extend along the card. In the illustrated embodiment in which the terminals **10** are at the bottom edge of the card, these sensing wires **12** are first led vertically and then horizontally or longitudinally of the card, there to provide a series of longitudinal, vertically spaced wires each electrically connectable to a key of the control panel. Crossing these wires but spaced and normally electrically insulated therefrom are a plurality of spaced sensed, selected or detected conductors, or conducting wires or lines **13** which are shown as extending vertically of each card. The sensed wires **13** in turn terminate in a plurality of terminals **14** separated from those of the sensing wires and here shown as projecting from or below

the same lower edge 11 of the card. Each card or device thus has a network of conductors divided into a pair of crossed or overlapped but spaced grids, groups of sets.

In the base or confronting face of the filing section 2 of the drawer there is provided for each of the sensed wire terminals 14 one of a set of contacts 15, a set being provided for each card, these sets, unlike the continuous bus bars 7, extending transversely of the drawer and being electrically insulated or separated from each other. Each of the contacts 15 of each set is electrically connected to one of the contact elements 16 of the aforementioned contactors 5, housed in the lower section of the drawer, one contactor being provided for each card position. For illustrative purposes, as well as simplicity of construction, each of the contactors has been shown as a rotary multiple contactor or multi-position switch having a contact arm 17 adapted sequentially, successively or seriatim to make contact with each of the contact elements 16. For each of the contact arms 17 there is provided a relay 18 and the several arms are connectable in parallel, either through their relays 18 or directly, in one of the several circuits to be hereinafter described. The relays may either be mounted within the drawer 1, or in the illustrated separate battery.

It has been mentioned that the selecting wires 12 and selected wires 13, respectively, while crossing, are spaced and normally insulated from each other. So insulated, it is possible, by providing for predetermined or selective electrical connections between each wire of one group and any of the wires of the other group, to utilize such connections as the characters or elements of the data recorded on the card. For this reason, the number of selected wires employed will be determined by the extent of the data to be recorded. In the illustrated embodiment, the desired electrical connections are made through a series of holes or slots 19 in or punched through the card, each positioned at or adjacent the intersections or points of overlap of the wires and extending between the grids to form index or designation points. The connections are made by removable connectors, pins or plugs 20 insertible in the holes, the connections on each card being determined by the data there recorded.

The cards 3 are adapted to store two types of information: first, information necessary for the selection of the card; and second, information which is to be read from the card after a particular card has been selected. Information for the card selection is stored along the conducting wires 13 which are sensed successively by the rotor 17 during the first portion of each cycle. Information which is to be read from the card is stored along conducting wires 13 which are sensed by the rotor 17 successively after it has sensed the conductors 13 designated for card selection information. The rotor 17 therefore senses first the card selection information storage section of the card and successively the read-out data storage section of the card during one cycle of operation. The number of conductors 13 required for each type of information depends on specific accounting situations. If only four digits are required for card selection only four conductors 13 on the card need to be designated for the card selection information section; the remaining conductors 13 are available for read-out information.

The information which may be stored in the cards may be of various characters. For example, the card selection data may comprise numerical digits and the read-out data may comprise alphabetical letters, or vice versa. Each of the conductors 12 represents a specific character element which corresponds to the character element represented by the selector key 8 to which the conductor 12 is electrically connected by depression of the key 8. The information to be read out from the selected card 3 may be conveyed to the machine operator by any suitable means which can be energized electrically by energization of the read-out circuit including conductors 12. One such means as illustrated in FIG. 3 and subsequently to be described, comprises flashing lights. Other read-out means could be adopted within the scope of my invention.

A wiring diagram of a relatively simple form of an electrical circuit suitable for the accounting apparatus of the present invention appears in FIGURE 3. The elements of this figure are basically the same as those of FIGURE 1 except that the number of selecting conductors 12 of each of the cards 3 has been reduced to six and the selected conductors 13 to five, the former being shown as extending vertically and the latter horizontally of the cards. With this reduction in number of wires, a corresponding reduction has been made in their associated elements, including the number of the keys 8 and the contact elements 16 of the multiple contactors 5. While in simplified form, the main components of the accounting apparatus are retained in the diagram and will now be described.

As shown, the apparatus is intended to utilize direct current, to the negative lead 21 of which is connected one terminal of each of the relays 18. This lead is shown as interrupted within the control panel 9 by a master switch 22 by which flow of current to the apparatus is cut on and off as desired. It is therefore only necessary to operate switch 22 when placing the machine in operation or taking it out of operation for a long period of rest, as at the end of the day. The opposite or positive lead 23 from the source of electrical energy is connected to the apparatus through one of a number of circuits, all sharing the common negative lead or ground 21. The closing of the switch 22 is without apparent results for while it does energize relay 38 the ratchet wheel 32 has a space 56 which always comes to rest opposite the pawl 37 at the completion of each cycle. Therefore, the energizing of relay 38 raises pawl 37 without any other effects, except to place the machine in condition to make the further operation on the keyboard effective, as the machine is now prepared to utilize the other major circuits effectively responding to the pattern of depressions on the keyboard. In order of their appearance the first of these major circuits is a starting or energizing circuit 24 comprised of a starting switch 25 and a conductor or lead which, for purposes of distinction, will be termed a starting lead 26, across which and the ground 21 the several relays 18 are all connected in parallel. The purpose served by the starting circuit is to render each of the cards 3 initially receptive to searching. To this end, each of the relays 18 may be comprised of a normally open switch 27 actuated by an electro-magnet 28, the latter being energized to close its switch by a winding 29 connected across the starting circuit. The only other function performed by the illustrated starting circuit is to energize an electro-magnet 30 operating a starting pawl 31 to cause a ratchet wheel 32 to turn through the distance of one of its teeth 33, which in turn places the rotors 17 of the contactors 5 halfway between the contact element 16 for the last character position of the wires 13 and the contact element 16 for the first character position of the wires 13. The downstroke of starting switch 25 breaks the connection between lead 23 and lead 35 deenergizing relay 38 with subsequent release of pawl 37. Once having performed these functions, the starting circuit has served its purpose and the starting switch 25 is released, breaking the circuit 24 on the upstroke by disconnecting lead 26 from lead 23, thereby deenergizing relay 30 and electro-magnets 28 from current that passes through their coils 29.

The switch 27 has a pivoted contact 27′ made of electrically conducting material and fixed contacts 27*a* and 27*b*. The pivoted contact 27′ is normally biased away from engagement with contacts 27*a* and 27*b* by a spring or other suitable means and is attracted to engage contacts 27*a* and 27*b* when the electro-magnet 28 is energized. The pivot end of pivoted contact 27′ is electrically connected through the electro-magnet coil 36 to the negative lead 21. Switch contact 27*a* is electrically connected to the rotor 17 of the multiple contactor associated with a

particular switch 27; switch contact 27*b* is electrically connected through a diode 44 to the holding circuit lead 34. Switch contact 27′ is adapted to engage contacts 27*a* and 27*b* simultaneously.

On the breaking of the starting circuit, the current is directed through a holding circuit 34, in which the keys 8 are connected in series, when in up or normal position, and from whence the current flows through a bus bar or conductor termed a holding conductor 35, through the then closed switch 27 of each of the parallel connected relays 18, and through the magnets 28 by a second winding 36 to the ground 21. Since the starting switch 25 on its upstroke closes the holding circuit 34 before it breaks the starting circuit 24, it will be seen that the primary purpose of the holding circuit 34 is to hold the contacts 27 closed when the keys 25, 8 and 45 are in a released or raised position. This holding circuit is also employed to actuate a second or selecting pawl 37 by energizing its related electro-magnet 38 for turning the aforementioned ratchet wheel 32 through the distance of a second of its teeth 33. By affixing the ratchet wheel to a shaft 39 carrying the rotary arms or rotors 17 of the several contactors 5, a ratchet drive is obtained enabling each movement of the selecting pawl 37 to cause all of the rotors to make contact successively or sequentially with its several contact elements 16 and, through each element, with the corresponding of the selected wires 13, one such movement occurring each time the holding circuit 34 is closed. Therefore, the movement just described at the beginning of each operating cycle placed the rotors 17 in contact with the contact elements 16 associated with character position wires 13 in the first character position of the card. The next step in the operation of the machine is to depress the first of the selector keys 8 that corresponds with the character in the first character position of the information designated for selection. With each depression of the selector key 8 rotors 17 are moved to contact element 16 of the next character position wire 13 so it continues, crossing each character position in that portion of the card that has been predetermined to be used as the card selection section. That is to say, when a system utilizing these cards is adopted it will be determined how many of the total spaces for information storage with which the card 3 is provided, can be used to cause the machine to distinguish one set of stored information (one card) from another, and then that portion remaining dictates how much information can be stored on the card-reading or information-giving section; for example, on a card capable of storing 80 characters of information any one of the numbers 0 to 9 or letters A to Z could be put on the card 80 times or any combination of both could be put on to designate the name and address of, say, an automobile owner. If it is estimated that 40 digits would be required for this information, and if it is desired to store the make of the car, license number and model of car for readout, then the latter information may be stored in the other 40 character spaces, which would be called the "reading" or "information-giving" section of the card. How this information is read from the card will be discussed in a later portion of this explanation.

So long as all of the keys 8 remain in their normal positions, current will continue to flow through the holding circuit 34 holding the switches 27 closed. However, the keys being connected in series, any one of them is enabled to break the holding circuit and is designed to produce this result when depressed or actuated. The holding circuit 34 will be broken only after an associated searching circuit 40 is closed. For this purpose, there is carried by each of the keys a double-acting switch arm or blade 41 which is electrically connected to the positive lead 23 (FIGS. 4 and 5) and alternately connectable to brushes or terminals, 42 and 43, of the holding and searching circuits, respectively. Since, as will be seen, the selection of one of the cards 3 is dependent upon its relay 18 remaining closed, it is necessary that the holding and searching circuits both be closed momentarily during shift of the actuating key. This, as in the illustrated embodiment, may be accomplished through making the terminals 42 and 43 of flexible material and so positioning them relative to the switch arm 41 that each will remain in engagement with the arm until after it has made contact with the other terminal.

After one of the selector keys 8 has been actuated, an impulse of current will flow in the associated one of the several searching circuits through its conductor rod 7 to the corresponding of the selecting wires 12. This current will be presented to the same wire of all of the cards. If in any of the cards the particular character designation wire 12 is electrically connected by plug 20 to the character position wire 13 whose contact element 16 is engaged by the arm or rotor 17 of its contactor 5, current will flow through that card and its associated relay 18 to ground, thus maintaining its relay switch 27 closed by continued energization of its magnet 28 through the second winding 36. On the other hand, any cards in which the particular designation wires are not electrically connected in this character position will stop or interrupt the transmission or flow of current therethrough deenergizing the relay 18 associated with the cards, because that card does not correspond with desired card being indicated on the keyboard 9. The holding circuit 34 then being open, no current flows through the associated relays 18, de-energizing their magnets 28, with consequent release of their switches 27 and opening of the relays. When the actuated key is then released, closing in turn the holding circuit, current can flow only through those relays which remained closed during the searching stage, since the holding circuit, having access to the windings 36 only through the associated switches 27, is incapable of re-energizing a de-energized magnet. A relay switch 27, once opened by the failure of a searching impulse to reach electric magnet 28, will thus remain open, barring transmission of succeeding impulses through its card until a new operation of the apparatus is started by closing of the starting switch 25. To prevent current of the searching circuit from flowing not only through the relay of the associated card but, via the positive side of the holding circuit 34, through the relays of other cards and so negative selection, there is interposed between each of the relays and the positive side of the holding circuit a selenium rectifier or other one-way electrical valve 44.

Actuation of the first of the selecting keys having eliminated, by opening their relays, those of the cards not having electrical connections in the first character positions, that correspond to the designation wire 12 being offered the impulse by the depressed key 8 of the keyboard 9, the actuation of a second key 8 and the closing of its associated searching circuit will eliminate a further group of cards lacking electrical connections in the designation wire 12 determined by that key and the second of the character position wires 13. Accordingly, it is only necessary to actuate sufficient of the keys to cause all but the desired card or data-retaining device to be eliminated. This is accomplished by successively depressing keys 8 whose designations correspond to the card sought; i.e., depression of keys 8 directs impulses to correspond designation wires 12 and de-energize holding circuit 34 thereby de-energizing relay 38, which drops pawl 37; but on the upstroke of key 8 the holding circuit 34 and relay 38 are energized causing pawl 37 to rotate contactor 17 to the next adjacent contact element 16 associated with the next successive character position wire 13 insuring that the designation impulse of keys 8 traverse the selection section of the card successively character position by character position.

In the card desired, there may well be blanks in data elements before the contact arm 17 has successively sampled the conductors 13 in the selection position of card 3. For example, in selecting a card having five character spaces available for storage of information required for

card selection, only the first three of said spaces may be required. For such a contingency, there is provided a blank or finish key 45. This key is provided with a searching and holding circuit of the same type as those provided for the selecting keys 8. In the disclosed embodiment, the desired automatic action is obtained by the provision of a pulsation generator, such as the motor-actuated interrupter 46. As shown, the interrupter may be in the form of a disc made of conducting material except for an insulating insert 47 interrupting its periphery. To enable the finish key 45 to cause actuation of the interrupter, the key may carry three switch arms, the upper arm 48 in its searching circuit, the intermediate arm 49 in the holding circuit and the lower arm 50 interposed between the positive lead 23 and both the interrupter and its motor. It will be seen that the intermediate of these arms in normal position of the key is connected in the holding circuit in series with the switch arms of the selector keys and, while remaining in the holding circuit when depressed, then obtains its current through the interrupter circuit. In the latter circuit, there may be employed spaced sliding contacts 51 and 52 disposed on either side of the commutator and connectable respectively to the upper and intermediate of the switch arms of the finish key 45. A third sliding contact 53 engaging the hub 54 of the disc is connectable through the lower switch arm 50 to the positive lead. Thus, as the commutator is rotated by its rotor, current flow through the searching circuit of the finish key 45 and the holding circuit will be alternately interrupted, the insulating insert 47 being limited in extent such that both circuits will be closed during part of the cycle. The interrupter therefore cyclically duplicates the dual functions of the double-acting switches 41 of the selector keys 8, so long as the finish key is held down. To avoid contact of the dead spot of the disc with either of the outer sliding contacts when the key is first depressed, the insulating insert is normally held in an intermediate position by suitable means such as the spring-pressed cam 55.

Depression of the finish key 45 as described in the foregoing paragraph puts in operation an automatic means to complete sampling by contact rotor 17 of the selection portion of the card 3 in the event that there are blanks remaining in the selection portion of the card after the required information has been fed to the apparatus by manual depression of keys 8. The automatic means actuated by depression of the finish key also actuates the rotor 17 to cause it to sample the read-out portion of the card immediately upon completion of the searching portion of a cycle. A card having been selected, the holding coil 36 of relay 18 must remain energized to hold the selected card during completion of the searching portion of a cycle and during the read-out portion of a cycle. When blanks occur at the end of the selection portion of a card plugs 20 must be placed in holes 19 where conductors 13 crisscross the conductor 12 associated with the finish key 45. These plugs associated with the finish key conductor 12 correspond to blanks and do not represent any character of information. They provide a path for the flow of current through the holding coil 36 when the insulator 47 on the periphery of commutator 54 interrupts current flow through the holding circuit 34. Plugs 20 must similarly be provided in holes 19 to connect all of the conductors 13 in the read-out portion of the cards 3 with the finish key conductor 12. Additional plugs are provided at designation points 19 where information is stored.

Having selected the desired card or other data-recording device, the data desired therefrom can be obtained in any suitable manner. Thus, as above outlined in the illustrated embodiment, a simple form of reporting means has been disclosed for illustrative purposes. The reporting means employed is a bank of lamps 57 mounted in an information recorder 58, each lamp corresponding to one of the characters or elements of the control panel 9. Each of these lamps is connected at one terminal to the searching circuit 40 of the corresponding of the selector keys and through a common opposite terminal to the negative lead 21. Between these lamps and the negative lead 21 is interposed a switch 59, termed a reporting switch, which is intended to be closed after the selection of a card has been completed for reporting the desired data therefrom. On closing of this switch, the current established while the holding circuit is energized is enabled to flow to the negative lead, not only through the holding circuit 34 and relay 18 of the selected card, but through the card as well. The current through the card may flow from the positive lead 23 through finish key switch 50, commutator contact 53 and the interrupter disc sliding contact 51, finish key contacts 48, associated conductor 12, plug 20, conductor 13, contactor 5, relay switch 18, and holding coil 36 to the negative lead 21. Where information is stored in the card by a plug 20 in a designation point 19 along the conductors 13, current will also flow from the designation point through the conductor 12 and the read-out lamp associated therewith to the negative lead 21. When rotor 17 is in contact with one of the elements 16 current may also flow from the holding circuit 34 through contactor 5, conductor 13, a plugged designation point 19 and the read-out lamp 57 associated therewith. To insure that current will flow through the card and thus maintain its relay magnet 28 energized, the selecting wire 12 of the blank or finish key 45 is electrically connected or plugged to those of the selected or designating wires 13 beyond the number employed for selection. Thus, if in the embodiment illustrated in FIGURE 3, the first three of the selected wires were required for selection, the selecting wire of the finish key would be connected to the last two of these wires. So connected, current is enabled to flow through the card from the circuit of the finish key during completion of the searching portion of the cycle, maintaining the relay closed.

Consider now the operation of my accounting apparatus after selection has been performed by manually depressing keys 8. Only the selected card is available for reporting because its relay 18 remains energized, and all of the other relays 18 associated with other cards are deenergized. The up-stroke of the last key 8 to be manually depressed during the selection portion of the cycle energized relay 38. Attraction of the pawl 37 by relay 38 rotated the rotor 17 from the contact 16 connected with the last conductor 13 required for selection and moved it to the next succeeding contact 16. This contact may either be associated with the first conductor 13 in the read-out portion of the card, or may be associated with a conductor 13 in a blank or unused part of the selection portion of the card. Whichever the case may be, the next steps in operation of the accounting apparatus are closure of reporting switch 59, followed by depression of finish key 45. Prior to depression of finish key 45 the interrupter disc 46 is held in the position shown in FIGURE 3 by the spring-pressed cam 55. Both contact slides 51 and 52 engage conducting portions of the commutator. Depression of key 45 closes switch 50 which applies positive potential to the commutator rotor and to the interrupter disc. It also closes switch 49 and establishes a new current path to holding circuit 34 through contact 49 and sliding contact 52 to the positive potential which is now applied to interrupter disc 46. Since sliding contacts 51 and 52 are both contacting conducting portions of the interrupter disc when the finish key is first depressed, current can flow to the relay 18 through the relay holding circuit 34, and also through a path including switch 48, conductor 12, plug 20, conductor 13 and contactor 5. As described previously all of the holes along the conductor 12, which is associated with the finish key 45, are plugged with the exception of those holes in the section of the card used for selection. A positive potential is therefore available to all conductors 13 in any unused part of the selection portion of a selected card

and also in the read-out portion of the card at such time as finish key 45 is depressed and contact slide 51 is in contact with a conducting portion of the interrupter disc. A positive potential is also available to a single one of the conductors 13 through the holding circuit 34 and contactor 5 when the finish key is depressed and sliding contact 52 engages a conducting portion of the interrupter disc. It should therefore be apparent that current will flow through any of the lights 57 which are connected to conductors 13 by way of plugs 20 in the designation points 19 when positive potential is applied to the conductors 13 as above described provided the reporting switch 59 is closed. The visual indication of read-out information which an operator will observe will be one of flashing lights.

With the reporting switch closed, the finish key depressed, and interrupter disc 46 in the position shown in FIGURE 3, all of the reporting lights connected to conductors 13 through plugs 20 will be on. When the interrupter disc rotates so that insulator 47 is positioned under sliding contact 51 current to the conductors 13 by way of the associated finish key conductor 12 is interrupted. The only path through which current can flow to any of the conductors 13 is by way of the holding circuit 34, contact rotor 17 and a contact element 16 on which the contact rotor rests. If the contact rotor 17 rests on an element 16 connected to a conductor 13 which is in a blank part of the selection portion of a card all of the reporting lamps will go out when the circuit through sliding contact 51 is broken. The reason is that none of the designation points 19 are plugged to connect lamps with conductors 13 positioned within the blank part of the selection portion of the card. Therefore, as the blank part of the selection portion of a card is sampled by the contactor rotor 17 the operator will observe a bank of flashing lights. All lamps connected to conductors 13 through plugs 20 will go on and off together when the circuit through contact 51 is broken.

After the contactor rotor 17 reaches an element 16 associated with the first conductor 13 appearing in the read-out portion of the card a single light will remain on when interrupter disc 46 opens the circuit through sliding contact 51. The light will indicate to the operator the first character in the read-out information. Current to the single light is supplied through the holding circuit 34, contact rotor 17, element 16, conductor 13, a plug 20 in a designation point 19, and a conductor 12. Each succeeding rotation of the interrupter disc after the read-out section of the card has been reached will cause the lamps connected to conductors 13 through plugs 20 to be alternately all on or all off except for a single lamp which represents a character of read-out information.

A detailed description of the operation of my accounting apparatus by way of example will follow, referring particularly to FIG. 3. As has been explained previously, FIG. 3 shows a relatively simple form of an electrical circuit suitable for the accounting apparatus of the present invention, there being only four data retaining cards 3 shown connected in the apparatus. The data retaining cards 3 are respectively designated by the letters A, B, C and D. For purposes of this example the first five vertically disposed conductors 12 on each card 3, counting from left to right, represent, respectively, the numerals 1 through 5. The last or sixth conductor 12 does not represent any character but is a blank conductor which may be plugged in accordance with the foregoing description. The portion of each card containing the first three horizontal conductors 13 counting from the top to the bottom of the card will be designated the card selection information section, and the portion of each card containing the last two horizontal conductors 13 will be designated the read-out information section. There will therefore be available for card selection three character spaces, and for read-out data two character spaces. Since the conductors 12 have been selected to represent numerals 1 through 5 the information stored on each card must be in the form of a numeral code. It must be understood, however, that the form of information stored on the cards has been selected in this example only by the desire to present a simple illustration. In actuality the cards will contain many more conductors 13 which may represent all of the letters of the alphabet as well as numerals.

The data retaining cards A. B, C and D will be plugged prior to insertion in the card filing drawer 2 (FIG. 1) in accordance with the information which is to be stored thereon. For purposes of this example the cards contain in number code given in the schedule below:

Card	Card Selection	Read-out
A	123	12
B	242	23
C	131	45
D	45	51

It will be apparent from inspection of FIG. 3 how each of the cards is plugged in accordance with the information contained thereon.

Taking card A as illustrative, the card selection information section is plugged to contain the code number 123 as follows:

The first horizontal conductor 13 (counting from top to bottom) representing the first character position is connected by a plug 20 with the first vertical conductor 12 (counting from left to right) representing the numeral 1.

The second horizontal conductor 13 representing the second character position is connected by a plug 20 with the second vertical conductor 12 representing the numeral 2.

The third horizontal conductor 13 representing the third character position is connected by a plug 20 with the third conductor 12 representing the numeral 3.

The read-out portion of the card A is plugged to contain the code number 12 as follows:

The fourth horizontal conductor 13 representing the first character position of the read-out section of the card is connected by a plug 20 to the first vertical conductor 12 representing the numeral 1.

The fifth horizontal conductor 13 representing the second character position of the read-out section of the card is connected by a plug 20 to the second vertical conductor 12 representing the number 2.

Each of the horizontal conductors in the read-out section of the card are also connected by plugs 20 to the sixth or blank vertical conductor 12 for the purpose of providing a circuit connection from the power lead 23 through the interrupter disc 46, the finish key 45 and associated switch 48 to the horizontal conductors 13 in the read-out section.

As will be obvious to one skilled in the art, unidirectional devices, such as crystal diodes 70, may be interposed in all conductors 13 between designation points 19 on the last or blank conductor 12 and the next adjacent conductor 12 on each card to permit current to flow in the direction from the switch 48 through the blank conductor 12 to the connected conductors 13, but will prevent current flow from a single conductor 13 to other conductors 13 by reason of their connection to the blank conductor 12.

Cards B and C are plugged in like manner to card A but each in accordance with the information stored thereon.

Card D is designated for purposes of card selection by the code number 45. Since the number 45 fills only two character spaces the third character position is blank. The card selection information section of card D is plugged as follows:

The first horizontal conductor 13 representing the first character position is connected by a plug 20 with the fourth vertical conductor 12 representing the numeral 4.

The second horizontal conductor 13 representing the second character position is connected by a plug 20 with the fifth vertical conductor 12 representing the numeral 5.

The third horizontal conductor 13 representing the third character space is connected by a plug 20 with the sixth or blank vertical conductor 12.

The read-out section of card D is plugged in like manner to the cards A, B and C.

After the data retaining cards have been properly plugged and filed in the drawer 2, the operator of the accounting apparatus may at any time select one of the cards and have the information stored thereon read out. In this example the operator wishes to select the card bearing the code number 45 and obtain the information thereon.

To select a card the operator performs the following sequence of steps:

He closes the master switch 22; depresses momentarily the starting switch 25; releases the starting switch and sequentially and momentarily depresses selector key 8 corresponding to the character numerals 4 and 5, respectively. The selector keys 8 (counting from left to right in FIG. 3) represent the numerals 1 through 5 corresponding to the numerals represented by the particular conductor 12 with which each key is associated.

Upon closure of master switch 22 electromagnet 38 is energized, lifting ratchet pawl 37 wthout producing any effect on the ratchet wheel 32, as has previously been described.

Depression of starting key 25 conditions the apparatus for card selection by deenergizing electromagnet 38; by energizing electromagnet 30 which attracts ratchet pawl 31 and thereby moves the ratchet wheel 32 so that blank space 56 on the ratchet wheel is moved out from under the ratchet pawl 37; and by energizing coils 29 of the electromagnets 28 which closes the normally open switches 27 of relays 18.

Release of starting key 25 further conditions the apparatus for card selection by deenergizing electromagnet 30; by energizing electromagnet 38 thereby attracting ratchet pawl 37 and advancing the ratchet wheel 32 to position the rotors 17 in engagement with the contacts 16 corresponding to the first character position of the conductor 13; and by maintaining the relays 18 energized through holding circuit 34 and holding coils 36.

Depression of selector key 8, which corresponds to the character numeral 4 in the first character position of the selected code number 45, deenergizes the holding circuit 34 and deenergizes all relays 18 except those which are associated with a data retaining card 3 having the numeral 4 in the first character position of the code number. Since card D is the only one which has the number 4 in the first character position of the code number, the relay 18 associated therewith is the only one which will remain energized.

The relay 18 associated with card D is kept energized upon depression of the key 8 corresponding to the character numeral 4 through the circuit traced from the positive lead 23, closed contact 49 of switch 45, switch arm 41 of the depressed selector key 8, searching circuit 40 associated with the depressed selector key 8, vertical conductor 12 representing the character numeral 4, plug 20 connecting the conductor 12 with the conductor 13 in the first character position of the card, switch contact 16 and rotor 17 of rotary contact member 5, the fixed contact 27a of switch 27 which has been kept closed by the holding circuit 34, holding coil 36, to the negative lead 21.

Electromagnet 38 is deenergized upon depression of key 8, whereupon ratchet pawl 37 is released and conditioned to advance the ratchet wheel 32 and rotors 17 to the next succeeding contacts 16 when the electromagnet is reenergized.

On release of the depressed key 8 the relay 18 associated with the card D is kept energized by reenergizing the holding circuit 34. It will be apparent from previous description of the apparatus that switch contact arm 41 never breaks the holding circuit 34 before it engages the searching circuit 40, and vice versa. Reenergizing the holding circuit 34 also reenergizes electromagnet 38 to advance the rotors 17 to the next contact 16 which is connected with the conductor 13 corresponding to the second character position.

Depression and release of the selector key 8 corresponding to the character numeral 5 will maintain the relay 18 which is associated with the card D energized in the same manner as has just been described. The searching circuit connected with the depressed key 8 will in this instance be completed through the fifth vertical conductor 12 corresponding to the numeral 5 and plug 20 connecting the conductor 12 to the second character position conductor 13.

The relays 18 associated with the other cards A, B and C will remain deenergized since they can only be reenergized by depression of starting key 25 for the start of a new selection and read-out cycle.

Release of the selector key corresponding to the character numeral 5 causes the contact rotor 17 to be advanced to engage the contact element 16 connected to the third character position conductor 13.

After the operator sequentially and momentarily depresses and releases the selector keys corresponding to numerals 4 and 5, he then prepares the apparatus for read-out by closing reporting switch 59, thereby connecting the lamps 57 to the negative power lead 21. None of the lamps will light at this time since neither of the two alternative current paths from the positive power lead 23 to the lamps is complete.

The next operation of the apparatus performed by the operator is the depression of the finish key 45. This act closes switches 48 and 50 and moves switch contact 49 from direct connection to the power lead 23 and reconnects it with the power lead 23 through interrupter disc 46 and switch 50. Closure of switch 50 starts the interrupter disc drive motor.

At the instant that finish key 45 is depressed all lamps 57 which are connected with conductors 13 in the read-out section of the card D and all other cards by means of plugs 20 will light. Specifically, considering only the lamps connected to card D, in this example the lamps corresponding to the numerals 5 and 1 will light, the current paths to the lamps having been completed through the interrupter disc 46, switch 48, the sixth conductor 12, plugs 20 in each of the designation points 19 connecting the last conductor 12 with conductors 13 in the read-out section, and plugs 20 in designation points 19 connecting the fourth and fifth conductors 13 respectively with the conductor 12 representing the numeral 5 and the conductor 12 representing the numeral 1.

The first revolution of the interrupter disc 46 advances the insulation insert 47 first beneath sliding contact 52 and secondly beneath sliding contact 51. When the insulation segment 47 is under sliding contact 52 the holding circuit 34 is interrupted and electromagnet 38 is deenergized. No other effect of the interruption of the holding circuit 34 is observed, since the holding relay coil 36 remains energized by current passing through the sliding contact 51, switch 48, the sixth conductor 12, third conductor 13, and contactor 5. When the insulation insert 47 passes from under the contact 52 the holding circuit 34 is reenergized, electromagnet 38 is reenergized and rotor 17 is advanced to engage the contact element 16 connected to the fourth conductor 13 corresponding to the first character position of the read-out section of card D.

When the interrupter disc 46 opens the circuit through sliding contact 51, an alternative current path to the fourth conductor 13 of card D is available through the holding circuit 34. The single light connected to the fourth conductor 13 by plug 20 will remain on and all other lights will go off. In this example the first single

lamp to remain on is the lamp corresponding to the numeral 5. The operator observes this lamp and records the number which it represents as the first character in the read-out information. When the insulation insert 47 passes from under the contact 51 all the lamps will again be lighted.

The next revolution of the interrupter disc 64 causes in succession the advancement of the rotor 17 to the contact element 16 connected to the fifth conductor 13 and the extinguishing of all lamps except the single lamp connected to the fifth conductor 13 by plug 20. In this example the lamp which remains on corresponds to the numeral 1. The operator again observes this lamp and records the number which it represents as the second character in the read-out information.

Since the illustrated cards each have only five conductors 13, engagement of the contact rotor 17 with the fifth contact element 16, marks the end of the sampling of the read-out portion of the selected card. In moving the rotor arms 17 into contact with the fifth contact element 16 the ratchet wheel 32 has been moved so that the space 56 is under the ratchet pawl 37. Reneergizing of the electromagnet 38 and lifting of the pawl 37 on succeeding revolutions of the interrupter disc 46 will be ineffective to move the rotor arms 17 from contact with the last of the contact elements 16. The operator will observe that the contact rotor 17 ceases to rotate and that the same single lamp remains on during each rotation of the interrupter disc and will know that read-out has been completed. He then releases the finish key 45 which opens switches 48 and 50, thereby deenergizing the lamps 57 and the interrupter disc motor. A complete card selection and read-out cycle is thus completed. The operator has observed and recorded in sequence the numerals 5 and 1.

The card or other data-retaining or recording device has previously been referred to in some detail as having crossed grids composed of selecting or character-designating conductors 12 and selected or position-designating conductors 13, between particular conductors of which electrical connections can be established by inserting connecting pins or plugs 20 into one of the several holes 19 connecting the wires at their several points of overlap or intersection. The preferred form of card has been illustrated in FIGURES 6, 7 and 8. As there shown, the network of conductors is embedded in, applied to or otherwise carried by a body 60 of molded plastic or other material suitable both for insulting the wires from each other and for forming a relatively permanent card. The conductors proper may be of wire or conducting paint. As illustrated, the connecting plugs may be provided with axially spaced circumferential grooves or notches 61, one for receiving a wire of each grid. By making the plugs slightly smaller than the openings in the card they may be readily inserted, and after insertion will be held in place by the engagement of the contacted wires with the grooves.

The cards 3 may be made of laminated construction as shown in FIGURES 9 and 10, comprising one ply 71 of synthetic resin or other non-conducting material having conductors 12 embedded therein, and a second ply 72 having conductors 13 embedded therein. The two plys may be joined by suitable adhesive 76 or other securing means. Included in the ply 72 containing conductors 13 are recesses 73 in which are housed asymmetrical devices such as selenium rectifiers or crystal diodes 70 which connect separated segments 74 and 75 of conductors 13. The purpose and function of the diodes 70 and their position in the cards 3 has previously been described with reference to FIGURE 3.

It is not intended that the structure of the cards 3 be limited to the structure herein described except as such structure is required for the functioning of the entire apparatus hereinbefore described. With the rapid advance in the technology of printed circuits and miniaturized circuit elements it is contemplated that several forms of cards having insulated sets of conductors 12 and 13 can be used that will be satisfactory for the functioning of the entire accounting apparatus of this invention.

With the cards made of insulating material it is possible to insert them face to face in the filing compartment and, by employing cards of uniform thickness, to space the separate sets of contacts 15 and their associated contactors 5 along the bottom of the drawer such that each card will engage one of the sets. However, this system has the disadvantage that it requires the drawer to be completely filled. Consequently, it is preferred to provide slots 62 extending vertically of either side of the filing compartment, opposite pairs of which are adapted to receive and seat the corresponding edges of each card. These slots and the card edges may be triangular, as shown, or of other suitable shape and serve the purpose of positioning the cards both longitudinally and transversely of the drawer to insure alignment of each of the position-designating wires 13 and its corresponding contact. Although, as previously pointed out, the terminals of the selecting and selected wires need not be on the bottom edge of the card, the latter will normally be preferred, particularly for a large number of wires, since a card will then automatically adjust itself in proper alignment, merely on being dropped into one of the slots.

FIGURE 11 shows a modification to the apparatus shown in FIGURE 3. The modification differs in function from the apparatus shown in FIGURE 3 by requiring that a selector key 8 be actuated for each of the character position wires 13 that are in the selection portion of a card 3. If there are three character position wires 13 in a selection portion of a card, then a key 8 for each of the characters of the three character data required for selection must be actuated. The finish key is not depressed until after the key 8 corresponding to the last character position available in the selection portion of a card has been actuated and released. The finish key 45 when depressed will actuate apparatus for automatically reading out the information in the read-out portion of a card.

The apparatus in FIGURE 11 does not require that more than one plug 20 be positioned in designation points 19 along a single character position 13 and therefore negates the necessity for isolation diodes 70 to be positioned in the cards 3 as shown in FIGURES 3, 9 and 10.

Holding circuits 101 *a*, *b*, *c* and *d* from the finish key 45 are provided for each of the relays 18. The purpose of the holding circuits 101 *a*, *b*, *c* and *d* is to keep the relay 18 for a card selected during the selection portion of a cycle energized at intervals during the read-out cycle when the insulating insert 47 on the interrupter disc is under the slide contact 52. The holding circuits 101 *a*, *b*, *c* and *d* are parallel branches connecting the finish key switch 48 to contacts 27*a* of respective relays 18. Unidirectional valves 102, such as selenium rectifiers, are positioned in each of the holding circuits 101 *a*, *b*, *c* and *d* to permit current to flow in a direction from the finish key 45 toward relay 18, but not in a reverse direction.

Also included in the apparatus of FIGURE 11 is a relay switch 103 having switch bars 105 in each of the circuits for the reporting lights 57. Switch 103 is normally biased closed by a spring 106 or other suitable means when the relay coil 104 is deenergized. The relay coil 104 is connected in series circuit with the reporting switch 59 from the lead 107 (connected to the finish key switch contact 45) to the negative lead 21.

The operation of the apparatus in FIGURE 11 is similar to the operation of the apparatus in FIGURE 3 through the completion of the card selection portion of a cycle, except that in the apparatus of FIGURE 11 a key 8 must be actuated for every character position in the selection portion of a card. After the operator has selected a card by actuating the keys 8, he then closes the reporting switch 57 and depresses the finish key 45.

Depression of the finish key 45 applies energy to the interruptor motor M through switch arm 50. At the instant the finish key 45 is depressed positive potential is applied from the positive lead 23 through the lower switch arm 50, sliding contact 53, to the commutator disc hub 54. Positive potential is fed from the commutator disc to conductor 107 through slide contact 51 and the upper switch arm 48; and to conductor 35 through slide contact 52, intermediate switch arm 49, the series connected selector keys 8, and the lower switch arm of the starting key 25.

As the interrupter disc rotates upon energization of the motor M, positive potential is removed alternately from the conductor 107 and the conductor 35.

Closing of the reporting switch 59 in addition to connecting the lights 57 to the negative lead 21 also connects the relay coil 104 to the negative lead 21 so that the relay coil is energized at intervals when positive potential is applied to the lead 107 through the interrupter 46 and finish key switch upper arm 48.

Energizing of relay switch 103 opens the reporting lamp circuits and keeps them open whenever potential is applied to the conductor 107. By this arrangement the reporting lamps will be illuminated singly and momentarily at intervals when the insulator segment 47 of the interrupter 46 is under the slide contact 51. At such intervals positive potential is removed from conductor 107 but is still applied through slide contact 53, interrupter disc 54, slide contact 52, switch 49, the selector keys 8, and starting switch 25 to the holding circuit 34. As contactor 5 successively connects the holding circuit 34 with successive conductors 13 in the read-out portion of a selected card, and potential is being applied to conductors 13 only from the holding circuit 34 at intervals when the insulation segment 47 is under slide contact 51, the reporting lamps 57 which are connected to the conductors 13 in the read-out section of the selected card by means of conductors 12 and plugs 20, will be successively and momentarily energized. The operator who is observing the reporting lamp recognizes the character represented by each lamp as it is illuminated and records the character in successive character positions from left to right.

It is within the scope of this invention that instead of reporting lamps 57, electromagnetic or other means may be substituted therefor to automatically operate recording means, such as typewriter keys which will successively write on paper the characters being read out from the cards 3.

FIG. 12 shows apparatus for physically locating a card 3 in a file drawer 1 of a filing cabinet. While the important function of the apparatus of this invention is to electrically search out a card and read the information stored in the selected card without physically locating the card, it is at times necessary to physically locate a card and change the information stored thereon. The apparatus disclosed in FIGURE 12 is provided to perform the latter function.

FIGURE 12 shows the upper portion 2 of the file drawer 1 (shown in FIGURES 1 and 2) in which are located a plurality of cards 3 positioned in vertical grooves 62 of the drawer walls. The drawer 2 may be connected in either of the electrical circuits as shown in FIGURES 3 or 11. However, only such portions of the circuits shown in FIGURES 3 or 11 as are necessary to show the operation of the card locating apparatus are shown in FIGURE 12.

Before describing the apparatus in FIGURE 12 in detail it is necessary to explain that for the purpose of automatic card location the cards 3 are each provided with an electrical locator contact 110 on their upper horizontal edge near one longitudinal side wall of the upper drawer portion 2. The contact 110 is electrically connected to the conductor 13 appearing in the last character position on the read-out portion of a card. In the cards shown in FIGURE 3 contact 110 is connected by a wire embedded within the card to the lowermost conductor 13 at a point along the conductor 13 to the left of the diode 70. In the cards shown in FIGURE 11 the lowermost conductor 13 is extended through the card 3 to the right hand vertical edge and there connected to contact 110. Both FIGURES 3 and 11 show the cards 3 rotated 90 degrees clockwise from the position the cards would physically have when placed in a drawer portion 2. By rotating the cards 3 appearing in FIGURES 3 and 11 90 degrees counterclockwise it will be apparent that contacts 110 are aligned along the upper right hand edge of the cards positioned within the drawer portion 2.

When a card 3 has been selected and the information thereon has been read out the rotor 17 of the contactors 5 remains in engagement with the contact 16 connected to the conductor 13 appearing in the last character position in the read-out section of the cards (the lowermost conductor in FIGURES 3 and 11). Upon release of the finish key 45 the rotor 17 does not move, as has been explained herebefore. Positive potential is applied to the contact 110 from positive lead 23, through the intermediate switch arm 49, the series connected selector keys 8, starting switch 25, conductor 35, rectifier 44, contacts 27*b*, 27′ and 27*a* of relay 18, rotor 17 of the contactor 5 associated with the selected card, and the contact 16 and the lowermost conductor 13. The positive potential appearing on an energized contact 110 of a selected card can be detected by a screw driven slide contact 111 and used to energize a locator circuit 112 for actuating a relay 113 to deenergize a locator motor 114 driving the screw 115 on which the slide contact insulator block 116 is mounted. Deenergization of the locator motor 114 stops the slide contact 111 in position over the selected card 3. If the motor tends to overdrive the slide contact past the selected card a brake (not shown but well known in the art) can be used to stop the screw at the instant the motor 114 is deenergized. The position of the slide contact 111 can be readily observed by an operator looking in the open drawer portion 2. The card under the slide contact 111 can then be flagged for removal by the operator.

The card locator apparatus is readily mounted on the file drawer portion 2 by means of bracket plates 117 and 118 attached by suitable fasteners 119 to opposite end walls 120 and 121, respectively, of the file drawer portion 2. The brackets 117 and 118 include portions extending in a vertical plane to the right beyond the right side wall 122 of the drawer portion 2. The bracket 118 also includes a horizontal portion 123 on which is mounted the locator motor 114 and gear housing 124 for driving the screw 115.

The screw shaft 115 is mounted in bearings in the vertical portions of the brackets 117 and 118 so that it extends parallel and approximate to the upper edge of the side wall 122.

The slide block 116 is made of non-conducting material and is mounted on the screw shaft 115 by means of screw threads so that as the shaft 115 rotates the slide block 116 moves parallel to the side wall 122. The top horizontal surface of the slide block 116 is approximately coplanar with the upper horizontal edge of the drawer portion 2. A flexible spring contact 111 is mounted on the top surface of the slide block 116 so that it will successively contact the locator contact 110 on the cards 3 as the slide block moves. The spring contact 111 is bent downwardly about the narrow width of the slide block 116 and is connected to the curved spring contact 125 mounted on the bottom surface of the slide block 116.

The curved spring contact 125 is adapted to bear in electrical contact with the metal conductor rod 126 mounted parallel to and beneath the screw shaft 115. The conductor rod 126 is fixedly mounted within insulator portions such as plastic grommets located in openings within the brackets 117 and 118.

The conductor rod **126** is electrically connected to the locator circuit **112**.

The locator motor **114** is shown to be a reversible electric motor having a common negative lead **127** and a pair of parallel reversing leads **128** and **129** alternately connected by means of a reversing switch **130** to positive lead **23**. Included within the reversing leads **128** and **129** are limit switches **131** and **132**, respectively.

The reversing switch **131** is mounted on end wall **120** and reversing switch **132** is mounted on end wall **121** in such a way that either switch will open upon slide block **116** reaching its limit of travel. The opening of either limit switch breaks the reversing lead in which it is located and deenergizes the motor **114**.

The reversing switch **130** is shown to be a solenoid operated switch of a type which will alternately make one circuit while breaking another each time the switch is actuated. Switches of this type are well known and one is illustrated in FIGURES 7 and 8 of Patent No. 2,661,450 issued December 1, 1953 to Charles C. Moler, and assigned to Overhead Door Corporation. The switch blade **133** is actuated upon energization of the solenoid winding **134**. The solenoid winding **134** is in circuit with a normally open manual switch **135** across the positive and negative leads to the motor circuits.

The reversing switch **130** is provided so that whenever one of the reversing leads **128** or **129** is opened upon opening of one of the limit switches the motor may be reenergized in a reverse direction. The manual switch **135**, when depressed, energizes the solenoid winding **134**, which actuates the switch blade **133** to break circuit **129** and close circuit **128** (see dotted position of switch blade **133**), or vice versa.

The relay **113** is positioned in the positive potential lead to the motor **114** ahead of the reversing switch **130**. The switch blade **136** is normally biased closed by a spring **137** or other suitable means. The relay coil **138**, positioned in the locator circuit **112**, when energized opens the positive lead to the motor circuit, thereby deenergizing the motor **114**. In order that the motor **114** may be reenergized to move the slide contact **111** out of engagement with a selected card **3**, and to move the slide contact block to one end of the file drawer portion **2**, a manual switch **139** is provided to by-pass the relay **113**. Depression of the manual switch **139** restores positive potential to the locator motor **114** and reenergizes the motor.

Consider now that a card **3** has been selected and information has been read therefrom by operations as described in connection with FIGURES 3 and 11. The operator wishes to physically locate the selected card and change information thereon. The slide block **116** is positioned at one end of the drawer portion **2**, and for purpose of illustration let it be assumed that the block **116** is adjacent the end wall **120**. The locator circuit **112** is deenergized because the slide contact **111** does not engage an energized card. A card **3'** is the selected card somewhere in the middle of the drawer. Its locator contact **110** is connected with positive potential through contactor **5** and relay **18** in circuit, as previously described. The reversing switch **133** is in the position shown by solid lines. The operator first depresses switch **135** and energizes the reversing switch **130**. The reversing switch moves to its alternate position as shown in dotted lines, thereby closing the reversing lead **128** to the motor **114**. The motor is then energized through the normally closed relay **113**, reversing lead **128** and common lead **127**, and rotates the screw **115** in a direction to move slide block **116** toward the end wall **121**. The motor continues to turn the screw **115** until the slide contact **111** is brought into engagement with the contact **110** on the selected card **3'**. The locator circuit **112** is then energized through the slide contact **111**, and conductor rod **112**, to actuate relay **113**, which breaks the positive circuit to the motor **114**. The motor **114** stops immediately either because of frictional forces in the gear train driving screw **115** or by means of a brake (not shown). The slide contact **111** remains in engagement with the contact **110** of the selected card **3'** and the locator circuit **112** remains energized. The operator notes the position of the slide contact **111** and flags the selected card. The operator then depresses the manual switch **139** and thereby reenergizes the motor **114** which drives the screw **115** until slide block **116** reaches the end wall **121** and opens the limit switch **132**. The opening of the limit switch **132** opens the motor circuit **128** and the motor will remain deenergized until the reversing switch is reenergized upon depression of manual switch **135**. It will be apparent from the above description that card locating may be accomplished irrespective of which end of the drawer portion **2** the slide block **116** is positioned when it is desired to locate a card. Once having located a card and flagged it the operator can remove the card from the drawer and change the information thereon.

From the above detailed description it will be apparent that there has been provided an improved accounting apparatus which is particularly adapted for application to drawers or other containers wherein data-bearing devices are filed, and is enabled to select cards bearing the desired data entirely by electrical means, thereafter reporting the data contained thereon. It should be understood that the described and disclosed embodiment is merely exemplary of the invention and that all modifications are intended to be included which do not depart either from the spirit of the invention or the scope of the appended claims.

Having described my invention I claim:

1. In an accounting apparatus the combination of a plurality of stacked data-retaining devices each having a network of normally insulated conductors arranged in at least first and second groups, conductors of said first group being angularly disposed relative to conductors of said second group and overlapping said conductors of said second group at index points, means for connecting selected ones of said conductors at said points, conducting means connecting corresponding conductors of said first group of all of said devices, an electric power source having leads, means for transmitting current from one lead of said power source to selected of said conductors of said first group of all of said devices, and contact means connected to each of said devices for successively connecting said conductors of said second group to the other lead of said power source and offering said last named conductors for connection to said conductors of said first group, flow of current through each of said devices being determined by the connections made at said index points.

2. In an accounting apparatus the combination of a plurality of stacked data-retaining devices, each having a network of normally insulated conductors arranged in groups, conductors of one of said groups being angularly disposed relative to conductors of another of said groups and overlapping said conductors of said other group at index points, means for connecting selected ones of said conductors at said points, conducting means connecting corresponding conductors of one of said groups of all of said devices, an electric power source having leads, means for transmitting current from one lead of said power source successively to selected ones of said conductors of one group of all of said devices, and contact means associated with each of said devices for successively connecting conductors of said other group of said device to the other lead of said power source and offering said last named conductors for electrical connection to said conductors of said one group, thereby permitting flow of current through said device over circuits predetermined by the connections made at said index points.

3. In an accounting apparatus the combination of a plurality of stacked data-retaining devices, each having a plurality of normally insulated conducting wires arranged

in a pair of overlapping grids, conductors connecting the corresponding wires of one of said grids of all of said devices, means for connecting selected ones of said wires of said grids, an electric power source having leads, contact means connected to one lead of said power source and associated with each of said devices for successively contacting wires of said other grid, and circuit completion elements for transmitting electrical impulses from the other lead of said power source to selected ones of said conductors for completing circuits through any of said devices, depending upon the electrical connections made between the conductor contacting wires and the contacted of the wires of said other grid.

4. In an accounting apparatus the combination of a data-retaining device having a first set of spaced conducting lines and a second set of spaced conducting lines crossing said first set, means for selectively connecting said lines of said sets, an electric power source having leads, circuit completion elements connected to one lead of said power source for transmitting impulses successively to selected ones of said lines of said first set, contact means connected to the other lead of said power source for offering succeeding ones of said lines of said other set to each of said impulses, and normally closed circuit-breaking means openable on interruption of any of said impulses for blocking transmittal of subsequent impulses through said device.

5. In an accounting apparatus the combination of a data-retaining device having a first set of spaced conducting lines and a second set of spaced conducting lines crossing said first set, means for selectively connecting said lines of said sets, an electric power source having leads, circuit completion elements connected to one lead of said power source for transmitting impulses successively to selected ones of said lines of said first set, contact means connected to the other lead of said power source for offering succeeding ones of said lines of said other set to each of said impulses, normally closed circuit-breaking means openable on interruption of any of said impulses for blocking transmittal of subsequent impulses through said device, and means for preventing change of the condition of said circuit-breaking means intermediate said successive impulses.

6. In an accounting apparatus the combination of a data-retaining device having a first set of spaced conducting lines and a second set of spaced conducting lines crossing said first set, means for selectively connecting said lines of said sets, an electric power source having leads, control circuit completion elements connected to one lead of said power source for transmitting successive impulses to selected ones of said lines of one of said sets, contact means connected to the other lead of said power source for offering succeeding ones of said lines of said other set to each of said impulses, circuit-breaking means for blocking transmittal of subsequent impulses through said device on interruption of any of said impulses, and means actuated by said control circuit completion elements for maintaining energization of said circuit-breaking means between said impulses.

7. In an accounting apparatus the combination of a data-retaining device having a pair of crossed grids each formed of a plurality of spaced conducting lines, means for selectively connecting lines of one of said grids to lines of said other grid, an electric power source having leads, circuit completion elements connected to one lead of said power source for selectively transmitting a series of impulses to selected ones of said lines of ones of said grids, means connected to the other lead of said power source for offering successive ones of said lines of said other grid to each of said impulses, and means for breaking the circuit of said device and blocking transmittal of succeeding impulses therethrough on interruption of any of said impulses.

8. In an accounting apparatus the combination of a data-retaining device having a pair of crossed grids each formed of a plurality of spaced conducting lines, means for selectively connecting lines of one of said grids to lines of said other grid, an electric power source having leads, circuit completion elements connected to one lead of said power source for selectively transmitting a series of impulses to selected ones of said lines of one of said grids, contact means connected to the other lead of said power source for offering successive ones of said lines of said other grid to each of said impulses, and reporting means comprising a plurality of data indicating means, each connected to a respective one of said plurality of spaced conducting lines of said one of said grids, and connectable to said other lead of said power source through a reporting switch, and means connecting said contact means to said one of said power leads for reversing the direction of flow of current through said device for reporting data thereon when said reporting switch is closed.

9. In an accounting apparatus the combination of a data-retaining device having a pair of crossed grids each formed of a plurality of spaced conducting lines, means for selectively connecting lines of one of said grids to lines of said other grid, an electric power source having leads, circuit completion elements connected to one lead of said power source for transmitting a series of impulses to selected ones of said lines of one of said grids, contact means connected to the other lead of said power source for offering successive ones of said lines of said other grid to each of said impulses, means for breaking the circuit of said device and blocking transmittal of succeeding impulses therethrough on interruption of any of said impulses, reporting means comprising a plurality of data indicating means, each connected to a respective one of said plurality of spaced conducting lines of said one of said grids, and connectable to said other lead of said power source through a reporting switch, and means connecting said contact means to said one of said power leads, means for reversing the direction of flow of current through said device for reporting data thereon when said reporting switch is closed, and means for maintaining said circuit-breaking means closed during said reporting.

10. In an accounting apparatus the combination of a plurality of cards filed in a compartment, each of said cards having a first set of spaced conducting lines and a second set of spaced conducting lines crossing said first set at index points, means for selectively connecting said lines at said index points, a plurality of conductors extending longitudinally of said compartment across said cards and each contacting the corresponding lines of one of said sets of all of said devices whereby said cards are connected in parallel to be sensed simultaneously, an electric power source having leads, a plurality of spaced groups of contacts each associated with one of said cards, each group extending transversely of said compartment and the contacts of each group contacting one of the lines of said other set, circuit completion elements connected to one lead of said power source for transmitting a series of impulses to selected ones of said conductors, means connected to the other lead of said power source and associated with said cards and fixed in position relative thereto for successively contacting said contacts of said groups in timed relation to said impulses, and means controlled by the transmittal of impulses through said cards for breaking the circuit of any thereof on interruption of the transmittal of any of said impulses therethrough.

11. In an accounting apparatus the combination of a plurality of cards filed in a compartment, each of said cards having a first set of spaced conducting lines and a second set of spaced conducting lines crossing said first set at index point, means for selectively connecting said lines at said index points, a plurality of conductors extending longitudinally of said compartment across said cards and each contacting the corresponding lines of one of said sets of all of said devices whereby said cards are connected in parallel to be sensed simultaneously, an electric power

source having leads, a plurality of spaced groups of contacts each associated with one of said cards, each group extending transversely of said compartment and the contacts of each group contacting one of the lines of said other set, circuit completion elements connected to one lead of said power source for transmitting a series of impulses to selected ones of said conductors, means connected to the other lead of said power source and associated with said cards and fixed in position relative thereto for successively contacting said contacts of said groups in timed relation to said impulses, and circuit-breaker means associated with each of said cards and fixed in position relative thereto, said circuit-breaker means being energized by said impulses and breaking the circuit of any of said cards on interruption of the transmittal of any said impulses therethrough.

12. In an accounting apparatus the combination of a plurality of cards filed in a compartment, each of said cards having a first set of spaced conducting lines and a second set of spaced conducting lines crossing said first set at index points, means for selectively connecting said lines at said index points, a plurality of conductors extending longitudinally of said compartment across said cards and each contacting the corresponding lines of one of said sets of all of said devices whereby said cards are connected in parallel to be sensed simultaneously, an electric power source having leads, a plurality of spaced groups of contacts each associated with one of said cards, each group extending transversely of said compartment and the contacts of each group contacting one of the lines of said other set, circuit completion elements connected to one lead of said power source for transmitting a series of impulses to selected ones of said conductors, means connected to the other lead of said power source and associated with said cards and fixed in position relative thereto for successively contacting said contacts of said groups in timed relation to said impulses, means controlled by the transmittal of impulses through said cards and breaking the circuit of any thereof on interruption of the transmittal of any of said impulses therethrough, and means for maintaining energization of said circuit-breaking means between said successive impulses.

13. In an accounting apparatus the combination of a plurality of cards filed in a compartment, each of said cards having a first set of spaced conducting lines and a second set of spaced conducting lines crossing said first set at index points, means for selectively connecting said lines at said index points, a plurality of conductors extending longitudinally of said compartment across said cards and each contacting the corresponding lines of one of said sets of all of said devices whereby said cards are connected in parallel to be sensed simultaneously, an electric power source having leads, a plurality of spaced groups of contacts each associated with one of said cards, each group extending transversely of said compartment and the contacts of each group contacting one of the lines of said other set, circuit completion elements connected to one lead of said power source for transmitting a series of impulses to selected ones of said conductors, contact means connected to the other lead of said power source and associated with said cards and fixed in position relative thereto for successively contacting said contacts of said groups in timed relation to said impulses, means controlled by the transmittal of impulses through said cards and breaking the circuit of any thereof on interruption of the transmittal of any of said impulses therethrough, means for maintaining energization of said circuit-breaking means between said successive impulses, and means for transmitting impulses to the circuit-connected of said cards through said contact means for reporting data thereon.

14. In an accounting apparatus the combination of a data-retaining device having a pair of crossed grids each formed of a plurality of spaced conducting lines, means for selectively connecting said crossed lines, a plurality of searching circuits, there being a searching circuit connected to each of the lines of one of said grids, an electric power source having leads, circuit completion elements connected to one lead of said power source for transmitting successive impulses to selected ones of said circuits, a holding circuit alternating with said searching circuits, contact means to the other lead of said power source actuated by said holding circuit for offering successive ones of said lines of said other grid to said impulses, and circuit-breaking means common to said searching and holding circuits, said circuit-breaking means on interruption of any of said impulses preventing transmittal of succeeding impulses through said card.

15. In an accounting apparatus the combination of a plurality of stacked data-retaining devices, each having a pair of crossed grids each formed of a plurality of spaced conducting lines, means for selectively connecting said crossed lines, a plurality of searching circuits connecting corresponding lines of one of said grids of all of said devices, an electric power source having leads, circuit completion elements connected to one lead of said power source for transmitting successive impulses to selected ones of said circuits, a holding circuit alternating with said searching circuits, contact means connected to the other lead of said power source actuated by said holding circuit for offering successive ones of said lines of said other grid of all of said devices to said impulses, and circuit-breaking means common to said searching and holding circuits, said circuit-breaking means on interruption of any of said impulses by any of said cards preventing transmission of succeeding impulses through that card.

16. In an accounting apparatus the combination of a plurality of stacked data-retaining devices, each having a pair of crossed grids each formed of a plurality of spaced conducting lines, means for selectively connecting said crossed lines, a plurality of searching circuits connecting corresponding lines of one of said grids of all of said devices, an electric power source having leads, circuit completion elements connected to one lead of said power source for transmitting successive impulses to selected ones of said circuits, a holding circuit alternating with said searching circuits, contact means connected to the other lead of said power source actuated by said holding circuit for offering successive ones of said lines of said other grid of all of said devices to said impulses, circuit-breaking means common to said searching and holding circuits, said circuit-breaking means on interruption of any of the said impulses by any of said cards preventing transmission of succeeding impulses through that card, and means for automatically alternating said searching and holding circuits.

17. In an accounting apparatus the combination of a plurality of stacked data-retaining devices, each having a pair of crossed grids each formed of a plurality of spaced conducting lines, means for selectively connecting said crossed lines, a plurality of searching circuits connecting corresponding lines of one of said grids of all of said devices, an electric power source having leads, circuit completion elements connected to one lead of said power source for transmitting successive impulses to selected ones of said circuits, a holding circuit alternating with said searching circuits, contact means connected to the other lead of said power source actuated by said holding circuit for offering successive ones of said lines of said other grid of all of said devices to said impulses, circuit-breaking means common to said searching and holding circuits, said circuit breaking means on interruption of any of said impulses by any of said cards preventing transmission of succeeding impulses through that card, means for automatically alternating said searching and holding circuits, and means associated with said automatic means for transmitting current from said holding circuit through the connected of said cards and reporting data thereon.

18. In an accounting apparatus the combination of a plurality of stacked cards each having a body of insulating material carrying a pair of grids each formed of a plurality of spaced conducting lines crossing lines of said other grid at index points, perforations in said body extending between said lines of said spaced sets at said points, plugs removably insertible in said perforations for electrically connecting selected of said crossed lines, a plurality of conductors crossing and common to said cards and each connected to the corresponding lines of one of said grids, an electric power source having leads, control circuit completion elements connected to one lead of said power source for transmitting a succession of impulses to certain of said conductors, a plurality of sets of spaced contacts, the contacts of each of said sets being connected to the lines of said other grid of each of said cards, a plurality of rotary contactors connected to the other lead of said power source, there being a rotary contactor associated with each of said sets of contacts for successively contacting said lines of the operatively associated grid, ratchet means actuated by said control circuit completion elements for driving said contactors in unison, and a relay connected to each of said contactors and energized by said impulses for holding the electrical circuit of any of said cards on interruption of the transmittal of any of said impulses therethrough.

19. In an accounting apparatus the combination of a data-retaining device having a first set of spaced conducting lines and a second set of spaced conducting lines crossing said first set, means for connecting selected ones of said lines of said sets and insulating the remainder of said lines, an electric power source having leads, circuit completion elements connected to one lead of said power source for transmitting impulses successively to selected ones of said lines of said first set, contact means connected to the other lead of said power source for offering succeeding ones of said lines of said other set to each of said impulses, and circuit breaking means for blocking transmittal of subsequent impulses through said device on interruption of any of said impulses.

20. The apparatus as set forth in claim 15 together with a second holding circuit, reporting means including a plurality of data indicating means each connected to corresponding lines of one of said grids of all of said devices, and connectable to said other lead to said power source through a reporting switch, automatic means for alternately sending impulses through said holding circuit and said second holding circuit when said reporting switch is closed for reading out information from a selected one of said data retaining devices, said holding circuit and said second holding circuits alternately directing impulses sent therethrough to said circuit breaking means for preventing said circuit breaking means from blocking transmission of succeeding impulses through said selected data retaining device, and also directing succeeding impulses through said contact means and offering successive ones of said lines of said other grid of said selected data retaining device to said impulses, automatic switching means for interrupting the connection of said data indicating devices to said corresponding lines of one of said grids only when impulses are being sent through said second holding circuit, and permitting the impulses from said holding circuit to pass through said selected data retaining device to energize said data indicating devices singly in succeeding sequence according to the pattern in which said lines of said one grid are connected to the lines of said other grid of said selected data retaining device.

21. The apparatus as set forth in claim 15 together with automatic means for indicating the position of a selected one of said plurality of stacked data retaining devices.

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