June 12, 1956 H. R. KEITH 2,750,108

ELECTRICAL VOTE COUNTING MACHINE

Filed Oct. 12, 1953 6 Sheets-Sheet 1

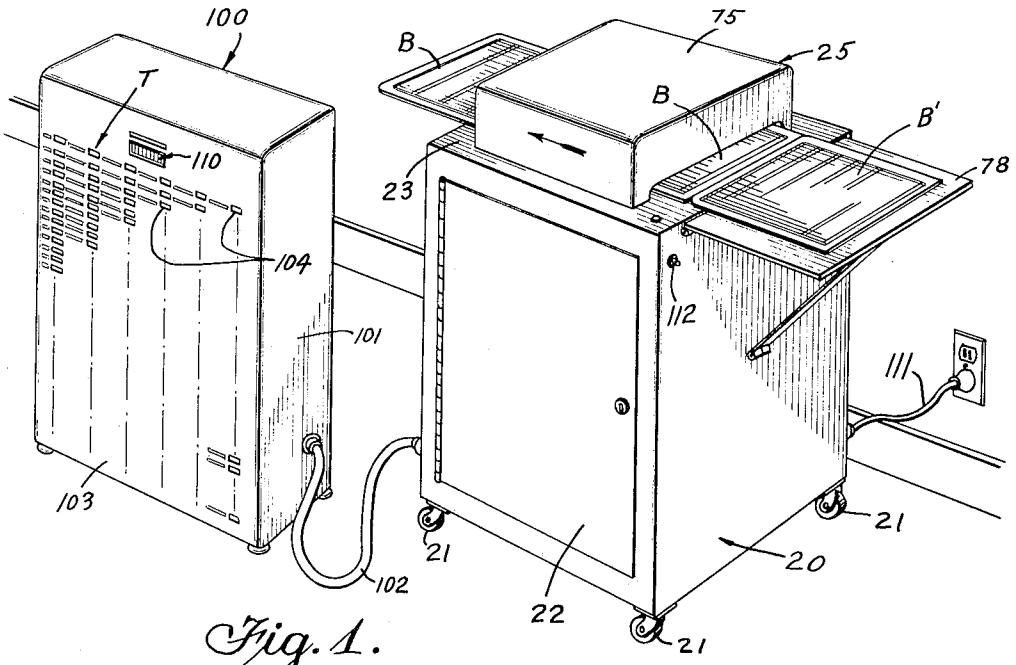



Fig. 1.

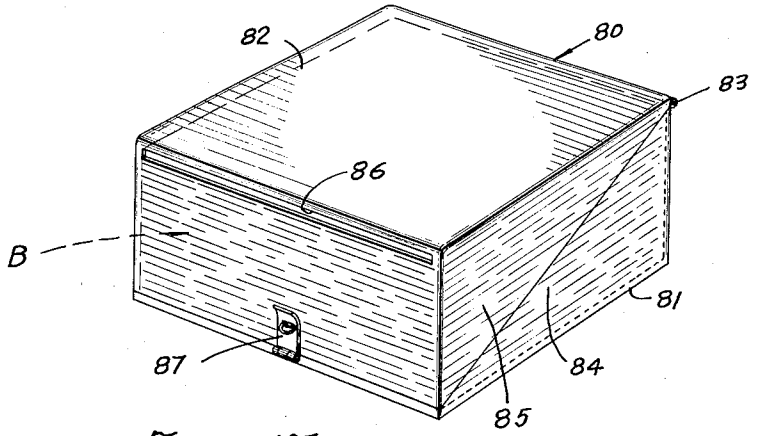



Fig. 17.

INVENTOR:
Hiram R. Keith
BY
N. J. Stevenson

June 12, 1956 H. R. KEITH 2,750,108

ELECTRICAL VOTE COUNTING MACHINE

Filed Oct. 12, 1953 6 Sheets-Sheet 2

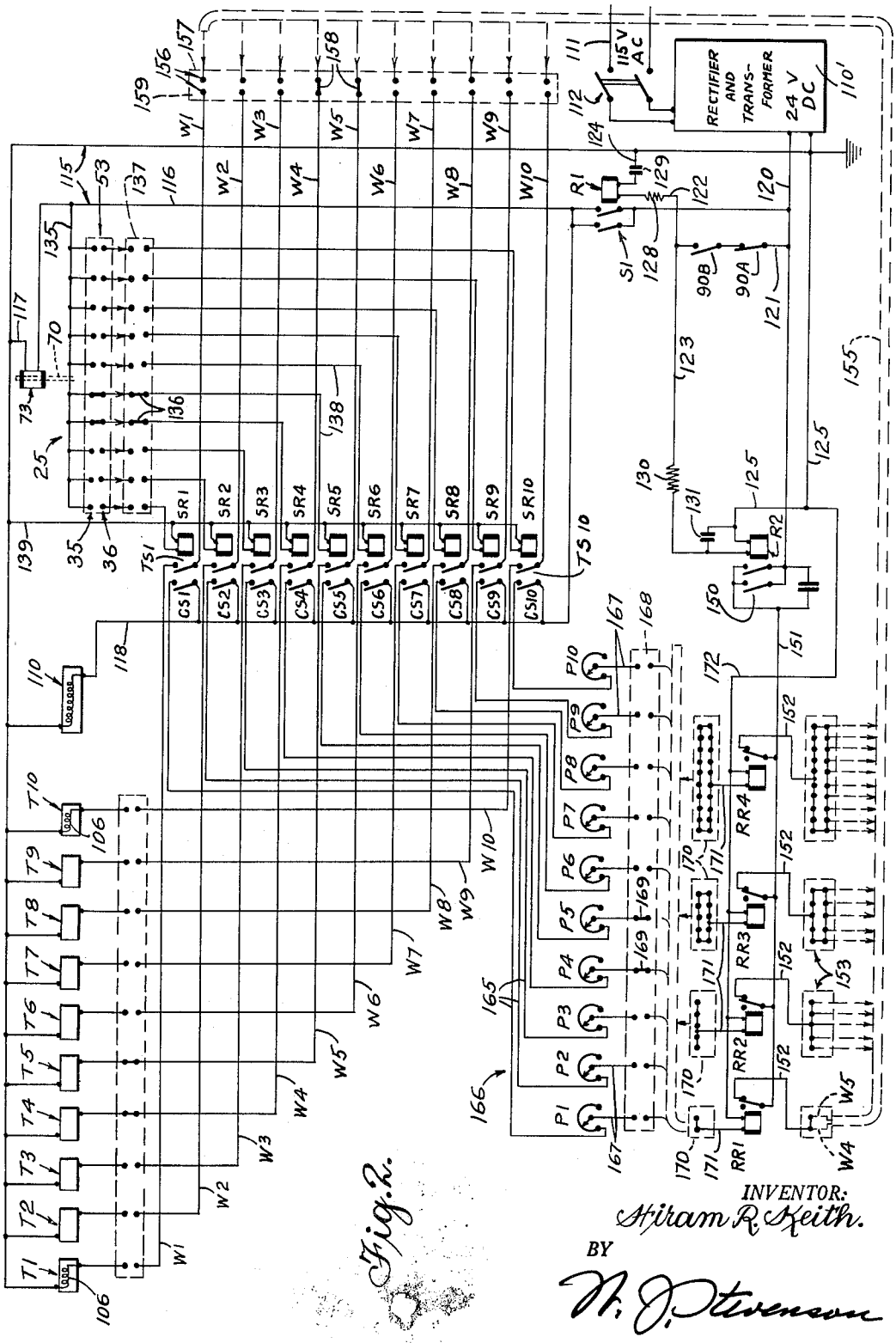



Fig. 2.

INVENTOR:
Hiram R. Keith.

BY

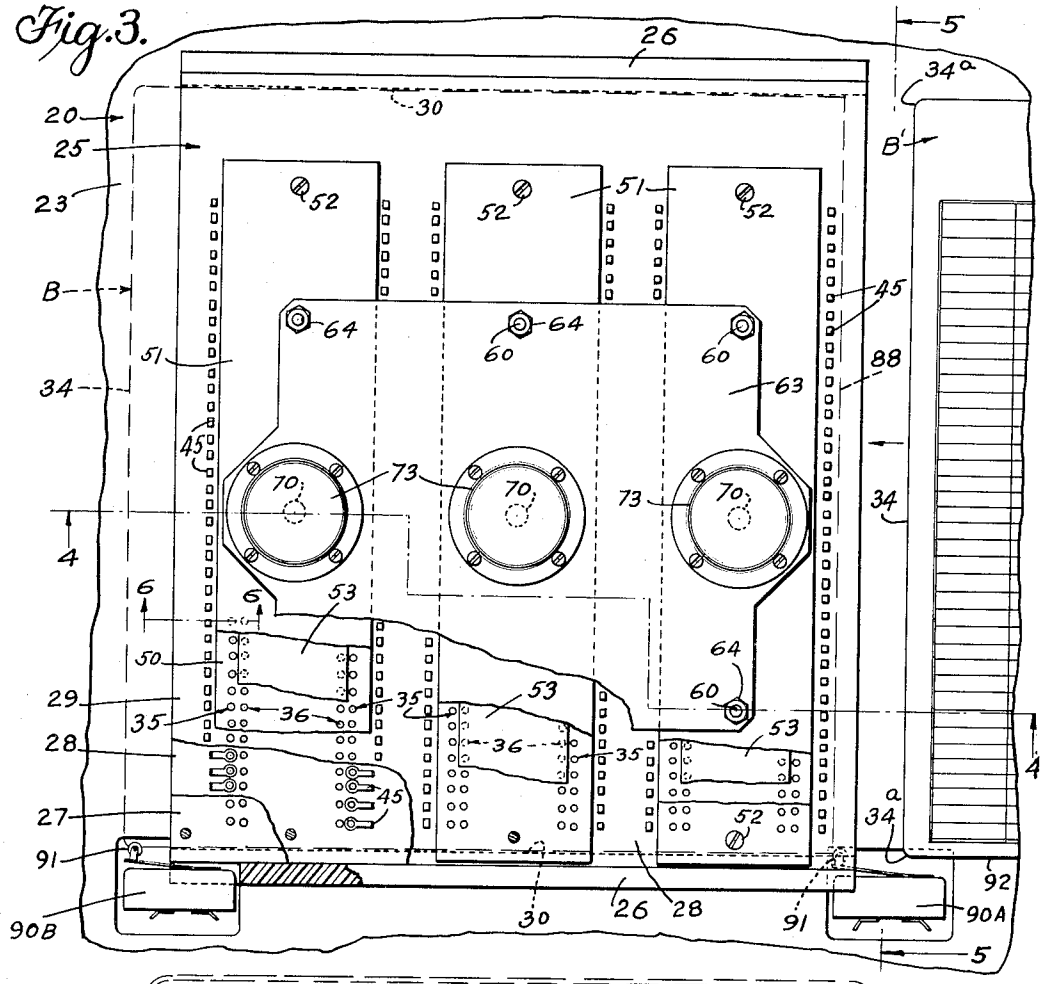
N. J. Stevenson

June 12, 1956 H. R. KEITH 2,750,108

ELECTRICAL VOTE COUNTING MACHINE

Filed Oct. 12, 1953 6 Sheets-Sheet 3

Fig. 3.



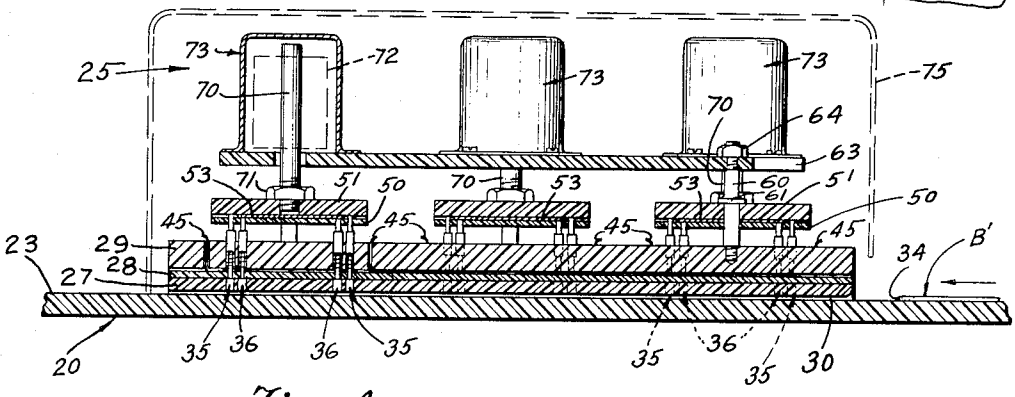




Fig. 4.

INVENTOR:
Hiram R. Keith.

BY
H. J. Stevenson

June 12, 1956 H. R. KEITH 2,750,108

ELECTRICAL VOTE COUNTING MACHINE

Filed Oct. 12, 1953 6 Sheets-Sheet 4

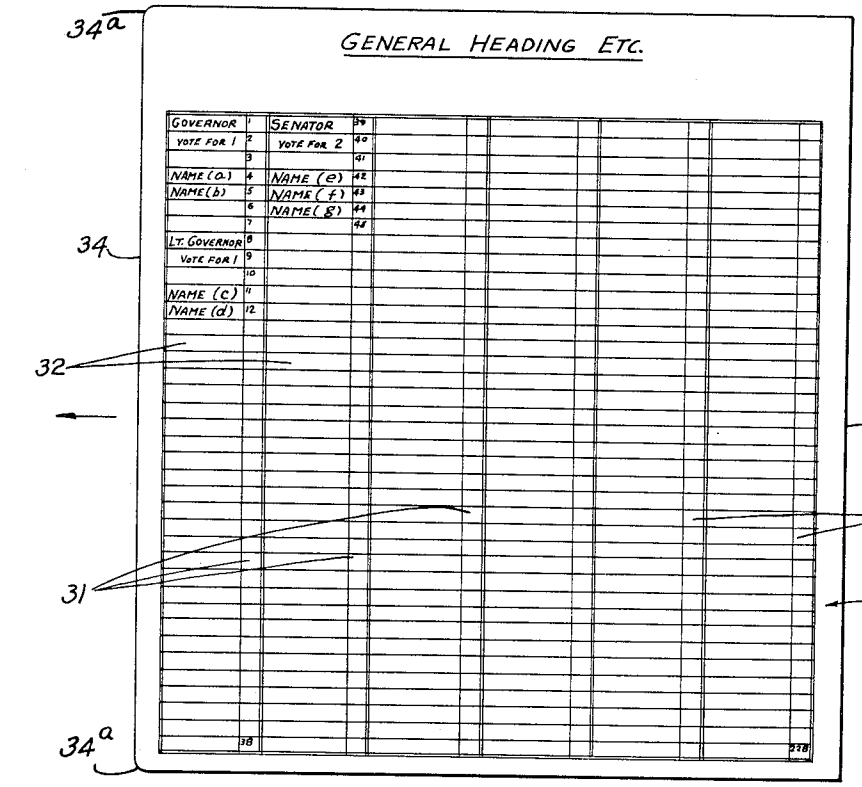



Fig. 7.

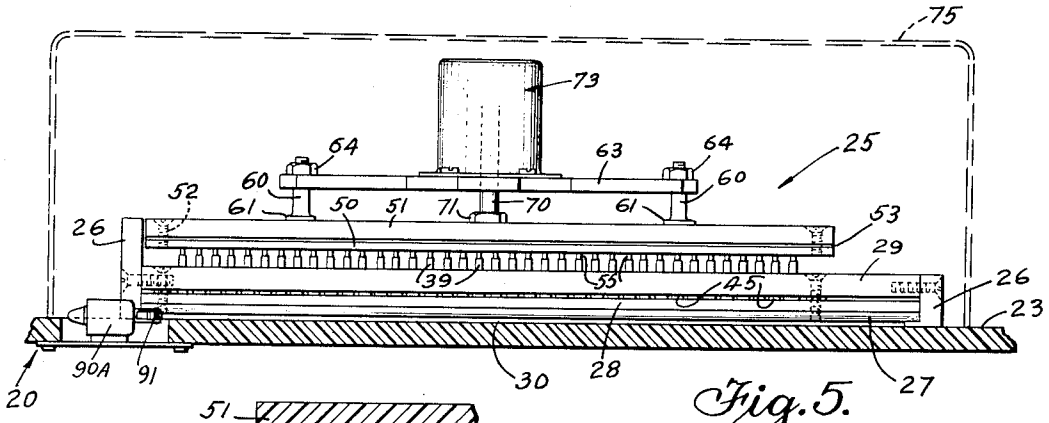



Fig. 5.

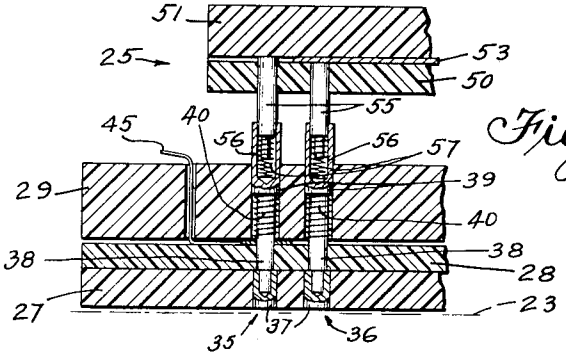



Fig. 6.

INVENTOR:
Hiram R. Keith.
BY
H. J. Stevenson

June 12, 1956 H. R. KEITH 2,750,108

ELECTRICAL VOTE COUNTING MACHINE

Filed Oct. 12, 1953 6 Sheets-Sheet 5

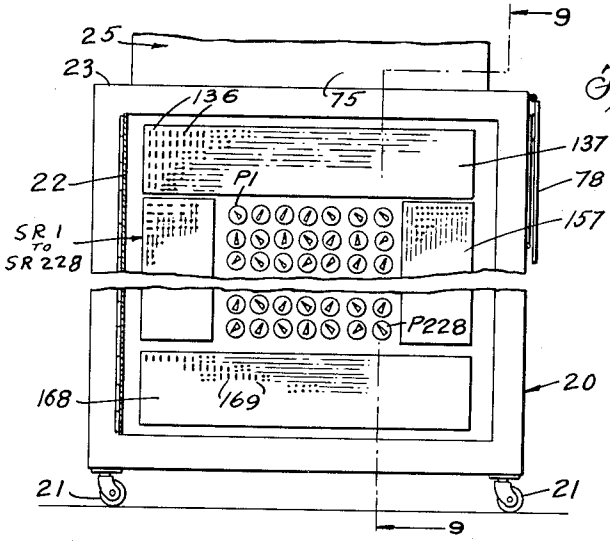



Fig. 8.

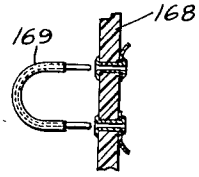
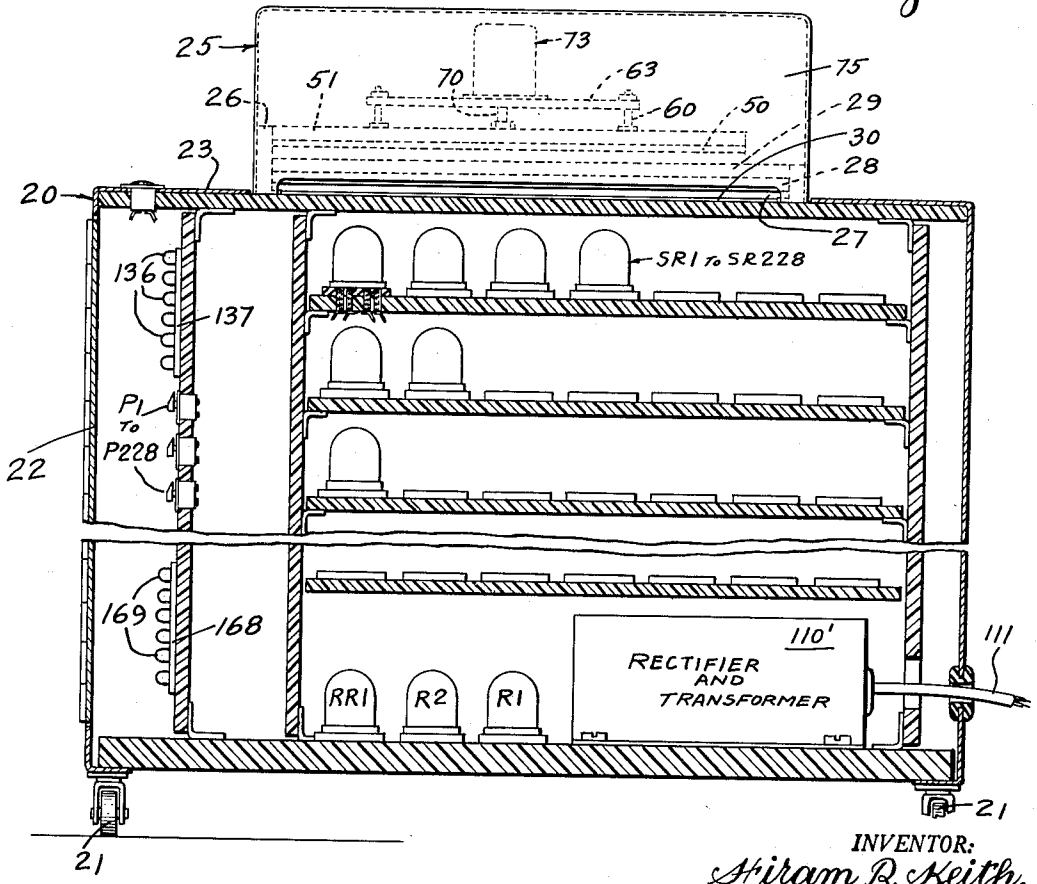



Fig. 10.

Fig. 9.




INVENTOR:
Hiram R. Keith.
BY
H. J. Stevenson

June 12, 1956 H. R. KEITH 2,750,108

ELECTRICAL VOTE COUNTING MACHINE

Filed Oct. 12, 1953 6 Sheets-Sheet 6

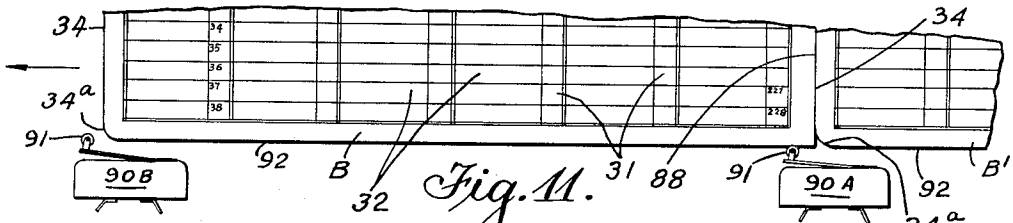



Fig. 11.

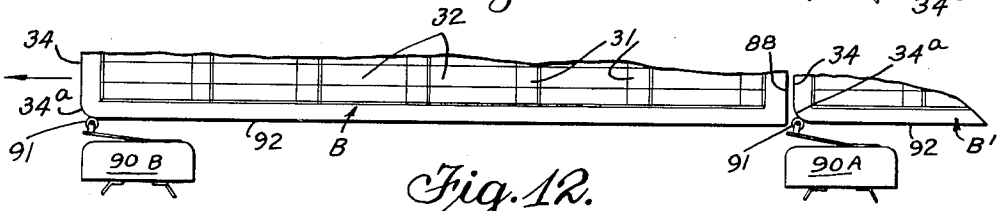



Fig. 12.

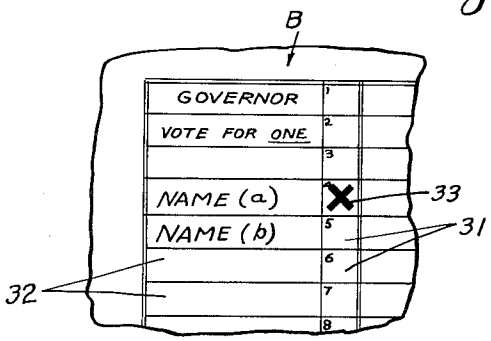



Fig. 13.

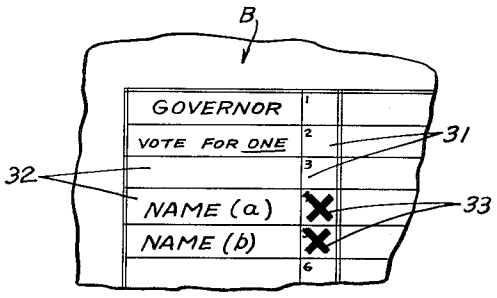



Fig. 14.

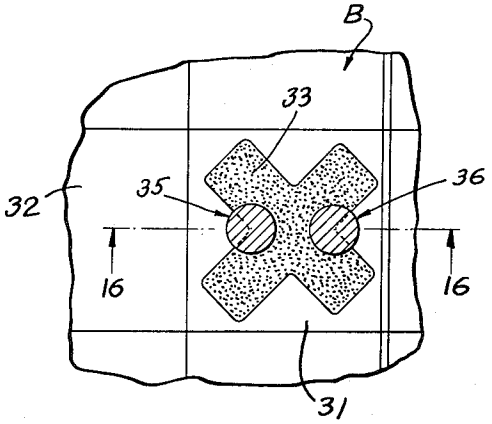



Fig. 15.

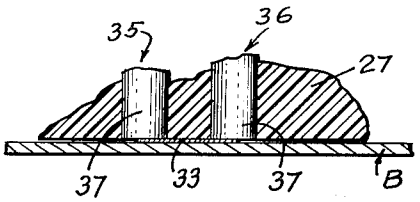



Fig. 16.

INVENTOR:
Hiram R. Keith.
BY
N. J. Stevenson

United States Patent Office 2,750,108 Patented June 12, 1956



2,750,108

# ELECTRICAL VOTE COUNTING MACHINE

Hiram R. Keith, Ventura, Calif.

Application October 12, 1953, Serial No. 385,561

18 Claims. (Cl. 235—56)

This invention relates generally to the counter or tabulator art and more particularly to a machine or apparatus for counting and totalizing simultaneously a plurality of marks appearing on a paper or like sheet. Specifically, the invention is concerned with a device or machine designed for use in counting individual votes or selections represented by marks placed in the appropriate squares or boxes of ballots and designating the choices of the voters for candidates for elective offices, charter and constitution amendments, various propositions and referenda, and other measures submitted to the electorate for approval or disapproval.

It is customary during municipal, county, state and national elections to sub-divide the voting areas into a large number of small districts, such as wards or precincts, each having a central polling place where the votes are cast. For example, the counties of a state may be divided according to population, into a number of precincts and the electorate of each precinct cast its votes at a designated polling place which is supervised by paid personnel, usually representing at least two political parties. It is the usual procedure for the workers at the polls to enter or check off each voter in the register of qualified voters, to provide each voter with a ballot, and to make certain that each marked ballot is deposited in a ballot box provided for this purpose.

At a predetermined time, the polls are closed to further voting and it is then the duty of the poll workers to count the votes cast for the individual candidates for each elective office, and the "yes" and "no" votes cast relative to various proposed charter or constitution changes, bond issues, and other measures appearing on the ballots. It is necessary that the workers be on the alert to detect invalid ballots, that is, ballots which are not marked in accordance with the rules established by law, and to discard such ballots, or the defective portions thereof, so as to comply with the legal rules of procedure. For example, the improper placing of a cross relative to a square or box will disqualify this vote of the ballot, and when the number of marked boxes is in excess of the number permitted for a particular office or proposition, this portion of the ballot is likewise rejected. That is to say, if it is required to vote for one candidate for the office of, for example, governor of the state, and a voter inadvertently votes for two candidates, the portion of the ballot concerned with this office is rejected by the poll workers.

The process of counting the individual votes of the ballots is indeed a long and tedious one which requires the concentrated efforts of the poll workers who must check and re-check the individual votes. It is customary to so locate the precincts that the polling place of each such voting district serves approximately 300 to 400 voters. Now, assuming that the ballot contains fifty possible choices or selections for candidates and other items, it is apparent that several thousand votes must be counted and totaled. It is a well recognized fact that the counting of votes in this manner involves several man-hours of work, and that errors frequently occur due to inaccurate



counting of the votes or totaling the same, or both, such inaccuracies resulting largely from fatigue on the part of the workers and their desire to expedite the counting so as to effect early election returns. Being cognizant of such human error, the voting officials generally regard such counting of votes as temporary tabulations, it being necessary to re-count the votes at a later date to establish the final, official results of the election.

Following the initial counting of votes, an affidavit is signed by the workers involved and the ballots of the precinct, together with the tally sheet, is delivered to the voting officials of the next higher division, for example the county, where the votes of the several county precincts are totaled and the result relayed to the voting officials of the state who then total the votes of the several counties to ascertain the entire number of ballots cast and the total number of votes cast for each candidate and measure appearing on the ballot.

It will be apparent from the foregoing discussion that the procedure currently practiced is not only expensive, due to the large number of workers employed at the polling and counting places, but results in such great delay in obtaining the final tabulation that in the case of a national election the final vote results of the far western states are tabulated and reported nationally many hours subsequent to the final election returns of the eastern states. In an effort to simplify the actual voting and to expedite the tabulation of the election returns, many states have adopted voting machines which automatically count the votes as they are cast and continuously total the ballots and the individual votes. While such machines are in wide use, they have the disadvantage of becoming inaccurate due to mal-functioning of the parts of their complicated mechanisms. In addition, it has been found that standard voting machines are of insufficient capacity to handle the large number of candidates and measures frequently submitted to the electorate. For these reasons, the use of such voting machines has been discontinued in some areas, it having been found that the conventional method of marking paper ballots is more satisfactory for various reasons.

The present invention is concerned with the conventional voting procedure in which paper ballots are used and marked by the voters, and contemplates means by which counting of the votes is greatly facilitated and expedited. It is therefore an important object of the invention to provide a machine or apparatus through which the ballots are fed and which functions automatically to count individual votes cast for the various offices and measures appearing on the ballots. A related object is to provide such a machine which is electrically operative to count the individual votes and to positively, instantaneously and simultaneously register the several marked choices or selections of each voter on electrically-operated counters or totalizers embodied in the machine.

Another object of the invention is to provide an automatic counting machine having pick-up or detector means operative to detect the presence or absence of crosses or other marks in the squares or boxes provided on the ballot for such marking, said means being in the form of a plurality of pairs of extensible, retractible contacts, one pair for each box of the ballot. In accordance with the invention, the contacts are shifted into engagement with the ballot by means of solenoids activated in response to insertion of the ballot into the machine. During the voting procedure, the selected squares are marked with a metallic crayon or other substance possessing excellent electrical conductive characteristics. Consequently, the gap occurring between the contracts of each pair of contacts is bridged by the metallic substance to establish electrical flow through a detector relay circuit in which the contacts are connected, there being such

an independent circuit for each pair of pick-up contacts. Also embodied in each of a plurality of counter relay circuits is the operating coil of an electrically-actuated counter device so that upon each closing of any circuit the number-discs of the counter device incorporated in that circuit are advanced and thus function to register the particular, appropriately marked vote of the ballot. In the event that a square or box of the ballot is unmarked, the pick-up contacts engaging this square will remain unbridged so that the particular counter device in circuit with these contacts will remain inactivated.

As a particular feature and object of the invention, means are provided for deenergizing selected groups of the counter circuits in the event that excessive numbers of vote marks are present in the group of boxes of the ballot corresponding to the circuits of said groups. In other words, the machine functions to prevent the recording of votes cast for each office or proposition in excess of the permissible number. For example, when the voter is required to select one candidate from a listed group of, say, four candidates and he or she inadvertently marks two or more boxes in this group, all of the circuits controlled by the pick-up contacts for the several boxes of the group are rendered inactive so that advancement of the counter devices in these circuits is prevented and all the votes cast for this office are thus, in effect, discarded or "thrown out."

The last-named object is attained, according to the invention, by interposing in the lines leading to the counter devices relay switches normally operative to allow the flow of current to said devices when the pick-up contacts detect properly marked squares or boxes on the ballot, and by providing potentiometer means in individual control circuits for controlling the actuation of said relay switches, the number of control circuits and potentiometers connected to each relay switch being equal to the number of candidates or answers listed on the ballot for a particular office or proposition submitted to the voters. According to the invention, each relay switch is adapted to open in response to a certain current flow through its coil, and the potentiometers are so adjusted that upon flow of current through a permissible number of the detector circuits, the current flow will be insufficient to open the relay switches. However, when the number of the detector circuits is in excess of the permissible number, the voltage is sufficient to energize the relay switch so as to open and inactiviate the several lines leading to the counter devices corresponding to the squares of the ballot marked in excess of the allowable number.

Another object of the invention is to provide an automatic counting apparatus, of the class referred to, having means embodied therein by which any of the detector circuits and their potentiometers can be selectively connected to the relay switches, this means consisting of readily accessible jumpers connectible in and disconnectible from the lines leading to the relay switches. By this means, the detector circuits can be arranged in selected groups corresponding to the boxes or squares representative of the number of candidates or preferences listed for particular offices or propositions on the ballot, the vote counting apparatus or device thus being easily and quickly adjusted in accordance with the requirements, prior to an election.

Another object is to provide an electronic vote-counting apparatus which may be embodied in a portable unit to adapt it to be conveniently moved to the vote tabulating places to count the votes cast in a plurality of voting precincts or districts, and thereafter returned to storage to await the next election.

Another object of the invention is to provide a counter apparatus of the type indicated in which the counters or totalizers preferably are arranged in one or more cabinets located remotely from the ballot-actuated means and hidden from view so that the operators or attendants are unaware of the results until all ballots have been electronically counted.

A further object of the invention is to provide a vote counter, of the class specified, having guide means for facilitating insertion of the ballots into the mark-detector unit so as to expedite the counting of a large number of votes in a minimum period of time, and also having quick-acting switch means arranged to be engaged by the inserted ballot to initiate the action of the counter, thus making it virtually impossible to record the votes of a ballot until the latter has been properly and completely inserted into the detector unit.

A further object of the invention is to provide pairs of detector or pick-up contacts which are so proportioned and spaced relative to a square or box of the ballot that they positively contact the "X" or other metallic mark placed in the square by the voter.

A further object of the invention is to provide an improved ballot box into which the ballots, preferably of light-weight cardboard are inserted, face down, by the voter, the box having a side opening through which the ballots are removed to be inserted singly into the electronic counter.

A still further object of the invention is to provide an electronic vote counter apparatus which is relatively simple in construction and economical to produce, one which may be operated by a person not especially mechanically skilled, and one which is capable of tabulating all the votes cast in a precinct in a period of a few minutes as compared to a period of several hours when the votes are counted individually and visually by the precinct election personnel.

Further objects of the invention will appear from the following description and from the drawings which are for the purpose of illustration only, and in which:

Fig. 1 is a perspective view of the present electronic counter device;

Fig. 2 is an electrical diagram, showing the various cooperating circuits in which the various instrumentalities are connected;

Fig. 3 is an enlarged plan view of the detector unit into which the ballots are inserted and which initiates the action of the various relays to energize the counter circuits;

Fig. 4 is a cross-sectional view, taken on line 4—4 of Fig. 3;

Fig. 5 is an end view of the detector unit as observed in the direction indicated by the arrows 5 in Fig. 3;

Fig. 6 is a further enlarged cross-sectional view of a pair of the detectors or pick-up contacts, taken on line 6—6 of Fig. 3;

Fig. 7 is a face view of a typical ballot which may be fed through the counter apparatus;

Fig. 8 is a front view of the counter, showing the front door thereof opened to gain access to the adjusting potentiometers;

Fig. 9 is a vertical sectional view, taken on line 9—9 of Fig. 8 and illustrating the banked arrangement of the detector relays and other parts;

Fig. 10 is a view of one of the jumpers employed for opening or closing a circuit to one of the counters or recorders;

Fig. 11 is a fragmentary view of an edge portion of a ballot, showing it being fed into position to operate the control switches;

Fig. 12 is a view similar to Fig. 11, showing the ballot fully in place;

Fig. 13 is a full scale view of a portion of the ballot and showing a properly marked vote;

Fig. 14 is a view similar to Fig. 13, indicating the ballot as improperly marked;

Fig. 15 is a greatly enlarged view of one of the marked boxes or squares of the ballot, with the pair of detector elements or contacts superimposed over the metallic mark properly placed by the voter;

Fig. 16 is a cross-sectional view, taken on line 16—16 of Fig. 15; and

Fig. 17 is a perspective view of a ballot box recommended for use in connection with the present counter.

The present electronic vote-counter comprises, in general, a portable cabinet in which various electrical parts are enclosed. The vote-counter apparatus includes a detector unit which is mounted at the top of the cabinet to define a guideway through which a ballot may be slid, after selected boxes or squares of the ballot having been marked with a metallic, electric conducting material. The detector unit includes one or more vertically movable plates operatively connected to a plurality of pairs of yieldable contact pins or detector elements, one pair for each vote square of the ballot, the contacts of each pair being arranged in close side-by-side relation to adapt their lower ends to contact the ballot within a square thereof when the plate or plates are moved downwardly toward the ballot under the influence of one or more actuating solenoids.

Located within the path of movement of the ballot, as it is inserted into the detector unit, is a switch means in a solenoid circuit including the actuating solenoids, engagement of the fully inserted ballot with the switch means closing said circuit to energize the solenoids to cause lowering of the plates and detector pins carried thereby.

Interposed in said solenoid circuit between the said switch means and the actuating solenoids is a main relay which, when the switch means is closed, becomes energized to close simultaneously said solenoid circuit and a vote-controlled initiating circuit in which a main electric counting device or totalizer is connected. Energization of the coil of this counting device indexes or advances its number discs to progressively record each actuation of the solenoids and thus each ballot operated upon during the counting of the votes thereof.

The apparatus also includes a plurality of setting or vote-controlled detector circuits, one for each pair of the detector contacts, and a setting or initiating relay in each of these circuits for closing and opening a double switch, one pair of contacts being in a counter circuit for one of the electrically-actuated counters and the other pair of contacts being in a control circuit embodying means for controlling the flow of electricity through the first contacts to activate one of the counters or recorder devices.

The electrical means of the apparatus further includes a plural counter circuit leading from the source of power through the counter-activating contacts to the recorder devices and thence to ground. Interposed in said counter circuit is a plurality of reject relay switches which normally are closed to allow flow of current to the recorders, each relay switch being selectively connectible to one or more of the lines leading to the recorders so that selected recorder circuits may be grouped in accordance with the layout or pattern of the ballot.

In accordance with the invention, the control means of each control circuit includes an adjustable potentiometer through which current can flow to the actuating coil of one of said relay control switches. Since the voter is usually required to select at least one candidate from a list of candidates, the potentiometers for the several control circuits, representative of the particular series of vote boxes, are so adjusted as to allow the relay control switch to normally remain closed. The current flow through the potentiometers of the group is additive, however, so that in the event that a number of the control circuits in excess of a predetermined number are energized, as may occur when the voter marks a number of squares in excess of the number of selections permissible for a particular office, the control relay switch for this particular group of recorder circuits is opened. Thus, said circuits and the counters or recorders controlled thereby are inactivated so that recording of the illegal votes cast for the office or proposition is prevented and these votes are, in effect, rejected.

Referring to the drawings in detail, the present vote-counting apparatus includes a cabinet 20 in which various electrical components, to be later described, are mounted, the cabinet preferably having casters 21 to adapt it to be moved along a floor. The cabinet 20 has at least one key-controlled door 22 providing access to the interior of the cabinet.

Mounted upon the top 23 of the cabinet 20 is a detector unit 25 which is shown in detail in Figs. 3 to 6. Referring to these views, the unit 25 includes a pair of spaced, parallel guide bars 26 which extend transversely of the cabinet top 23. A series of plates 27, 28 and 29 extends between the bars 26, the lower plate 27 being spaced slightly above the top 23 of the cabinet, and defining with said bars and the cabinet top a relatively long slit or guideway 30. The guideway is adapted to receive a ballot card B of the type shown in Fig. 7 which is fed thereinto by the operator of the apparatus, in the direction indicated by the arrows in Figs. 1 and 3.

As shown, the ballot card B is of conventional rectangular outline and has a plurality of vote squares or boxes 31 printed thereon, the boxes preferably being arranged in six vertical rows of thirty-eight each, making a total of two-hundred twenty eight squares. Alongside each square 31 is a printed rectangle 32 in which the candidates competing for election to various offices, or in which various propositions submitted to the electorate may be printed. The upper portion of the ballot B serves as a space in which a heading or title, instructions, etc., may be printed. One vertical edge of the ballot, hereinafter referred to as the leading edge 34, preferably has rounded corners 34*a*. While it is possible to print the ballot with a greater or lesser number of squares 31, it has been determined that a ballot having 228 such squares is wholly suitable for the purpose and the present apparatus is designed to count all the votes indicated by marks placed in any of these squares by a voter. By providing such a comparatively large number of squares 31, sufficient space may be left vertically between groups of the active vote squares in which to print titles or headings and instructions, relative to voting for the listed candidates, as shown in Fig. 7.

Referring to Figs. 15 and 16, the ballot B is marked by placing crosses (X) in the squares 31 alongside the selected names or answers to propositions appearing on the ballot. In accordance with the present invention, the "X" marks 33 are composed of a metallic material possessing excellent electrical conductive characteristics, and being either of a semi solid nature and applied in the manner of a crayon, or of a quick-drying liquid nature and applied by means of a rubber stamp or other suitable marking means.

The detector unit 25 includes a plurality of pairs of detector contact elements 35, 36, the number of pairs of elements being equal to the number of vote squares 31 of the ballot B. In accordance with the invention, the contact elements 35, 36 include small cylindrical tips or heads 37 slidable vertically in bearing holes formed in the lower plate 27, these tips being carried at the lower ends of plungers 38 which, in turn, are slidable in vertical holes provided in the upper and intermediate plates 29 and 28 (Fig. 6). It is to be noted at this point that the contact elements are metal while their supporting plates 27, 28 and 29 are constructed from plastic or other dielectric material. The plungers 38 have enlarged upper portions 39 and surrounding the plungers beneath said portions are coil springs 40 which normally function to urge the plungers upwardly to maintain the contact tips 37 within their bearing holes in the plate 27, the tips engaging the under side of the intermediate plate 28 to limit such upward, retractive movement. Sheet metal connectors or "pigtails" 45 have inner ends surrounding

the plungers 38 of the contact elements 35 only, the ends of the pigtails being interposed between the plates 28 and 29 and engaged by the lower ends of the springs 40. The pigtails 45 extend upwardly through slits in the upper plate 29 with their upper free ends in position to be soldered to wires of a detector circuit, to be later described.

When a cardboard ballot B has been inserted in the guideway 30 to a predetermined position, each pair of contact elements 35, 36 is located directly above one of the vote squares or boxes 31 of the ballot. Referring to Fig. 15, it will be observed that the contacts 35, 36 of each pair are of such diameter and lateral spacing that they are disposed completely within the boundary or confines of a vote square 31 and are therefore adapted, when shifted downwardly, to engage the metallic mark 33, when such a mark is present in the vote square.

The detector unit 25 also includes three laterally spaced pairs of rectangular actuating plates 50 and 51 made from dielectric material, the plates of each pair being held together in juxtaposition by means of screws 52. Each pair of plates is located above the plate 29, and normally in spaced relation thereto, and is of a size to overlie two rows or banks of the detector elements 35 and 36 as clearly shown in Figs. 3 and 4. Interposed between the lower and upper actuating plates 50 and 51 of each pair is a bus strip 53 which is of less width than the plates.

Held in apertures in the lower plate 50 are actuating pins 55, the lower ends of which are slidable in axial bores 56 in the upper ends of the plungers 39 of the detector elements 35, 36. Pocketed within the bores 56 and engaging the lower ends of the actuating pins 55 are coil springs 57 (Fig. 6).

Screwed into the fixed plate 29 are the lower ends of a plurality of mounting posts 60 which extend upwardly through holes in the actuating plates 50, 51 to guide the latter in their vertical reciprocatory movement toward and away from the plate 29, each post having a stop flange 61 (Figs. 4 and 5) for limiting the upward movement of the actuating plates. The upper reduced ends of the posts 60 extend through apertures in a solenoid-mounting plate 63, of dielectric material, to fixedly mount this plate above the actuating means 50, 51. Nuts 64 are screwed onto the upper threaded ends of the posts 60 and against the plate 63 to retain the latter in place.

Armatures or pole-pieces 70 have their lower threaded ends screwed into holes in the actuating plates 51, locknuts 71 retaining the armatures in place. The armatures 70 extend upwardly through holes in the fixed plate 63 with their upper ends disposed within the coils 72 of actuating solenoids 73 mounted on the plate 63, there being at least one solenoid for each actuating means 50, 51. As will be hereinafter explained in more detail, when the solenoids 73 are simultaneously energized, their armatures 70 and the actuating plates 50, 51 and the actuating pins 55 connected thereto are forced downwardly. Compressing of the springs 57 causes lowering of the plungers against the action of the springs 40, the plungers thus being propelled downwardly to project their contact tips 37 into engagement with the cardboard ballot B which is in position in the guideway 30.

Referring to Figs. 3 and 6, the bus strips 63 are adapted to be connected to a source of electric power, by means to be later described, the current flow then being from the bus strips, through the pins 55 and plungers 38 to the contact tips 37 of the detector elements 36. Now, when the tips 37 of a pair of the elements 35, 36 contact a metallic vote mark 33 (Figs. 15 and 16), the current flows through this metallic film, from the tip of the contact 36 to the tip of the contact 35. The electric current then flows from the plunger 38 of the contact element 35 to the pigtail 45, from which point it passes to a setting relay, to be later described.



As shown, the entire detector unit 25 is preferably enclosed by a cover 75 which has slits at the lower edges of its opposite sides through which the ballots B can enter and leave the guideway 30. Means are also provided for guiding the ballots B successively into the guideway 30, this means consisting of a shelf 78 (Fig. 1) providing a lateral continuation of the cabinet top 23, this shelf preferably being hinged to the cabinet 20 to adapt it to be retracted when the apparatus is not in use.

In order to handle the ballots more systematically and expeditiously, it is desirable that they be arranged in a uniform stack, that is, with their corresponding edges aligned, so that turning of ballots prior to insertion in the counter apparatus is unnecessary. The invention therefore contemplates the provision of a ballot box 80 having a tray-like base 81 and a cover 82, these parts being hinged at 83 and provided with matching inclined sides 84 and 85. The cover 82 has a slit 86 through which the marked ballots B can be slid into the box by the voters at a polling place. The parts 81, 82 may be locked together by the means indicated at 87. After marking a ballot, the voter is instructed to slide the ballot into the box 80 through its slit 86, for example with the heading of the ballot foremost and lowermost. The ballot may have a perforated corner tab at the trailing edge 88 opposite to the leading edge 34, this tab having a registration number thereon and being detached and retained by the voter as proof of voting.

Referring now to Figs. 11 and 12, a pair of initiating switches 90A and 90B of the micro-actuated, snap-action type are mounted on the cabinet top 23, respectively adjacent right-hand or insertion end and the left-hand or ballot ejector end of the guideway 30. Each switch has an actuator finger and roller 91 disposed in the path of movement of the bottom edge 92 of a ballot fed through the guideway 30. The switches 90A and 90B are respectively of the normally-closed and normally-open types. The switches 90A and 90B are connected in series in a circuit to be described in detail hereinafter. When the leading edge of a ballot B is first inserted into the guideway 30, it engages the actuator 91 of the first switch 90A to open the latter. As the ballot is slid further into the guideway 30, a rounded corner 34*a* of its leading edge 34 engages the actuator 91 of the second switch 90B to close this switch. At this juncture, the trailing edge 88 of the ballot will have moved to a point where it releases the actuator 91 of the first switch 90A to allow this switch to close. Consequently, both switches 90A and 90B are closed to allow flow of current through the initiating circuit in which these switches are connected and to the actuating solenoids 73. With the ballot B in place in the detector unit, the vote marks 33 are counted through instrumentalities to be later described.

Following such recording of the votes, a second ballot B′ is slid toward the entrance end of the guideway 30. As the leading edge 34 of the ballot B′ approaches the trailing edge 88 of the first ballot B, its rounded corner 34*a* engages the actuator 91 of the switch 90A (Fig. 12) to open this switch and the actuating solenoid circuit. With the solenoids 73 thus deenergized, the detector contacts 35, 36 are released and allowed to move upwardly under the influence of their springs 40 to free the first ballot B so that this ballot may be withdrawn from the ejector end of the guideway 30 or pushed therefrom by the succeeding ballot B′. As the second ballot B′ is slid into the guideway 30, its trailing edge 88 eventually rides beyond the switch 90A and its leading edge 34 engages the switch 90B so that both switches 90A and 90B are closed to again activate the solenoid circuit to count the votes on this ballot B′. This sequence of operations is continuous, the operator simply feeding the ballots through the detector unit 25 to count the individual votes marked thereon.

It is within the concept of this invention to employ other types of initiating switch means, in lieu of the specific switches 90A and 90B herein disclosed. For example, a single, normally closed, switch having a sensitive spring element engageable by a ballot may be employed, the spring element being located within the guideway 30 and arranged to open the initiating circuit until the ballot is properly positioned to be acted upon by the detector unit.

As another alternative, photo-electric cells may be employed for closing the initiating circuit in response to proper positioning of each ballot in the guideway, although such cells require relays which may complicate the overall circuit and require additional servicing.

The electronic counting apparatus also includes an electric counter or totalizer unit 100 which preferably is embodied in a separate, portable cabinet 101 and electrically connected to the counter circuits within the cabinet 20 by means of a disconnectible, multi-wire cable 102. The front wall 103 of the cabinet 101 provides a panel having windows or openings 104. A plurality of electrically operated counter devices, T1, T2, T3, etc., are mounted against the rearward side of the panel 102. These devices are conventional and are, therefore, not described in detail. Suffice it to state that each device has a series of numeral discs which are progressively indexed or advanced by means of solenoids 106 (Fig. 2). The devices T in the totalizer unit correspond to the vote squares or boxes 31 on the ballot, each device thus functioning to total all the vote marks present in the corresponding squares of all the ballots processed through the apparatus.

The totalizer unit also includes a main or master counter or totalizer device 110 which functions to record progressively the number of ballots fed through the apparatus. At the completion of the vote counting procedure, the total number of ballots processed, as recorded by the totalizer 110, must agree with the number of ballots recorded in the precinct register. Since the present apparatus is designed for use in counting the votes of several precincts, wards or other voting districts, it is desirable that the counter devices, particularly the device 110, be of the conventional re-set type which may be initially re-set at zero at the start of the counting of each group of ballots. In actual practice, the counting machine has three of the counter or totalizer units 100. That is, the counter devices T1, T2, etc., are mounted on three of the cabinets 101, instead of the single cabinet 101 shown in the drawings. By this arrangement, only the cabinet or cabinets having the required number of counter devices need be employed. While the ballot preferably has 228 available vote squares, many of these squares will ordinarily be inactive, even during an election involving a relatively large number of candidates, measures, etc., the spaces alongside such inactive squares being utilized for the printed titles, instructions, etc. Consequently, it has been determined that 150 counter devices, T1 to T150, provide a total number which ordinarily is sufficient to meet the requirements. In this case, each of the three cabinets 101 may contain 50 counter devices or totalizers T.

Referring now to Fig. 2, the electronic counter embodies several interrelated electrical circuits which cooperate in relaying the findings of the detectors or pick-up elements 35, 36 to the illustrated counter devices or totalizers T1 to T10. In the electrical diagram of Fig. 2, the number of detectors, counter devices and associated switches, relays, conductors, etc., has been reduced to ten in order to simplify the disclosure but it is to be understood that a larger number will be provided. In the apparatus as exemplified thus far a maximum of two-hundred twenty eight of these parts may be provided.

Enclosed within the cabinet 20 is a rectifier and transformer unit 110' which receives electricity by way of a power line 111, a manually-operable switch 112 being connected in this line. It has been explained that the actuating solenoids 73 are connected in a solenoid circuit. This circuit, which is indicated generally by the reference



numeral 115, includes a line 116 leading from the power unit 110' to the solenoids 73 and a line 117 leading from these coils to ground. Connected in the line 116 is the normally open switch S1 of a main relay R1. When the relay R1 is energized to close the switch S1, current flows through the coils of the solenoids 73 to ground, whereupon the energized solenoids actuate the detector means to cause the pick-up contacts 35, 36 to engage a ballot B and thus detect the presence or absence of metallic marks 33 in the vote squares thereof.

The main counter device 110 is connected in a line 118 extending from the line 116 to ground so that upon each energization of the solenoids 73, this counter is activated to count each successive ballot fed into the apparatus.

An initiating circuit includes conductors 120, 121, 122 and 123 through which current can flow to the main relay coil R1 and to the coil of a second relay R2, hereinafter referred to as a "throw-out" relay. Lines 124 and 125 lead from the respective relay coils R1 and R2 to ground.

Connected in series in the conductor 121 are the two micro-actuated switches 90A and 90B, previously referred to as actuated by a ballot fed into the machine. When these switches are closed in response to complete insertion of a ballot B, the circuits are closed to the relays R1 and R2. Upon energization of R1, current flows through switch S1 to the solenoids 73 and to the main counter device 110 to simultaneously actuate the same. Included in the circuit 122, 124 of the relay R1, as shown, is a resistor 128 and an electrolytic capacitor 129. Arranged in the line 123 is a resistor 130 and shunted across the relay R2 is an electrolytic capacitor 131. The capacities of the elements 128, 129, 130 and 131 are such that when the initiating switches 90A and 90B are closed, the relay R1 closes immediately and opens automatically, shortly thereafter. At the same time, closing of the relay R2 is delayed for a predetermined period, this relay then remaining energized until the switch 90A is opened in response to insertion of the next ballot B' into the apparatus. By this provision, flow of current to the switches of the reject relays RR1, RR2 etc., is detained momentarily to allow current flow through the detector means of the unit 25, setting relays SR1, SR2, etc., to thus permit current flow through the control circuit, including the switches CS1, CS2, etc., lines 165, potentiometers P1, P2, etc., lines 171 and the coils of the reject relays RR1, RR2, etc., to ground. In other words, by this sequential closing of the control and totalizer circuits, ample time is afforded to allow actuation of the detector elements 35, 36 and components of the control circuits, including the appropriate reject relays, before current is transmitted to the switches of the reject relays. Inadvertent flow of current to all of the active counter devices to actuate the same, irrespective of the marks appearing on the ballot, is thus positively prevented. Consequently, the machine is fool-proof in that it positively limits the registering of votes to those properly marked on the ballot.

Connected to the line 116 are the detector elements 35, 36, the elements 36 receiving current from the line 116 through a line 135 which is connected to the bus strips 53. Current passing from the elements 36 through the metallic films 33 to the elements 35 then flows through the pigtails 45 and jumpers 136 to the connectors of a bar 137. Electric current is transmitted through conductors 138 from these connectors to the coils of setting relays SR1, SR2 to SR10 which have a common ground 139. In practice, two hundred twenty eight of the setting relays SR may be provided, that is, one for each pair of detector contacts 35, 36. The setting relays SR1, SR2, etc., have respective control switches CS1, CS2 to CS10, and totalizer switches TS1 to TS10, each adapted to be closed in response to energization of its respective setting relay.

Referring now to the relay R2, this element has contacts 150 which, when closed, allow transmission of current from the conductor 120 through a line 151 to the

normally closed contacts of a plurality of rejector relays RR1, RR2, RR3 and RR4. The current then flows through wires 152 to multiple pairs of connectors 153 from which wires W1, W2, W3, etc., extend in a multi-wire cable 155 to the terminals 156 of one or more connector bars 157. The wires W1, W2, etc., include removable jumpers 158 on a terminal plate 159 and extend from the terminals to the respective totalizer switches TS1 to TS10. Thus, with the relay switch 150, the contacts of the relays RR1 to RR10 and the switches TS1 to TS10 all closed, current flows through the wires W1 to W10 and the switches TS1 to TS10 to the coils 106 of the counters or totalizers T1 to T10 to energize said coils and thereby advance their number discs.

It has been explained that any of the squares or boxes 31 of the ballot B may be utilized during an election, the large number of squares making it possible to locate groups of active squares at selected areas of the ballot. If the election is for the purpose of selecting national, state, county and city or town officers, and is also for the purpose of determining the choices of the electorate relative to various referenda, constitution or charter changes, bond issues and other propositions, these selections or "slates" are preferably arranged on the ballot in the order named, that is, with the federal offices listed in the first column of the ballot, state offices in the second column, and so forth across the ballot. In a state election, the candidates for office may be listed in the columns in the order shown in Fig. 7. In such event, the title and instructions pertaining to each slate are printed immediately above each list or group of candidates so as to inform the voter as to the number of votes permissible in each case. In the event that propositions requiring either "yes" or "no" votes are submitted to the electorate, these questions are printed alongside "yes" and "no" voting squares.

Considering the typical example illustrated in Figs. 7, 13 and 14, it is seen that two candidates are listed for the office of governor, two for lieutenant governor and three for senator. In the voting procedure contemplated by this invention, the voting squares or boxes of the ballot are assumed to be numbered consecutively, starting at the upper left-hand corner of the ballot and reading downwardly to the bottom of the first column, then continuing downwardly from the upper end of the next column and so forth across the entire ballot. Consequently, in the typical example outlined in Fig. 7, candidates (*a*) and (*b*) for the office of governor are listed at squares numbered 4 and 5 and candidates (*c*) and (*d*) are arranged at squares numbered 11 and 12. In a like manner, the three candidates for the two offices of senator may be considered to be listed at squares numbered 42, 43 and 44.

As previously pointed out, metallic marks placed in any of the vote squares, to be detected by the contact pins 35, 36, serve to close circuits to the appropriate counters T1, T2, etc., so as to record the votes registered by such marks. It has also been explained that in certain cases where a voter is required to select one or more candidates from a group of several names, he or she may inadvertently vote for a number of candidates in excess of the permissible number and in such event, the present counting apparatus functions to withhold all the counters T, corresponding to the several squares, from actuation to thus disqualify or reject all the votes cast for this particular slate. For example, assuming that the voter is required to vote for one of the candidates (*a*) or (*b*) for the office of governor, if the voter marks either the square 4 opposite candidate (*a*) or square 5 alongside candidate (*b*), (Fig. 13), the mark so placed will be recorded by the counters T4 or T5, as the case may be. However, when a voter places metallic marks in both squares 4 and 5, as indicated in Fig. 14, then the voter has obviously designated a number of choices in excess of the legally sanctioned number and the present apparatus is so constructed and arranged as to restrain both counters T4 and T5 from actuation, the means for effecting this highly desirable and necessary result being as next described.

Referring again to the electrical diagram of Fig. 2, one contact of each switch CS1, CS2, etc., is connected to the power line 118 so that when the main relay switch S1 is closed, current flows to these contacts. The other contacts of the switches CS1, CS2, etc., are respectively connected, by wires 165, to corresponding ends of the windings of adjustable potentiometers P1 to P10 of a control circuit 166.

Wires 167 lead from the rotors of the potentiometers P1, P2, etc., to terminals on a bar 168, jumpers 169 preferably being detachably connected between the terminals so that any of the individual circuits, such as CS1, 165, P1, 167, may be included in or disconnected from the control circuit 166 as a whole, depending upon the particular squares 31 employed on the ballot B.

For example, considering the particular arrangement of the ballot as indicated at the extreme upper left-hand corner in Fig. 7, and in Figs. 13 and 14, it will be observed that squares 1, 2 and 3 of the ballot are inactive ones while squares 4 and 5 are employed to register votes and thus may be regarded as active squares. In such a case, the individual circuits in which the potentiometers P1, P2 and P3 are arranged may be inactivated. In the typical example shown in Fig. 7, the control circuits for squares 6 through 10 and 13 through 41 would be inactivated while the circuits for squares 11, 12, 42, 43 and 44 would be activated by installing the appropriate jumpers 169 adjacent the corresponding potentiometers P11, P12, P42, P43 and P44, this setting of the various control circuits being effected prior to the election, after the pattern of the ballot has been established by the voting officials.

In the limited embodiment illustrated in Fig. 2, including only ten of the control circuits, control circuits 4 and 5 corresponding to the active squares 4 and 5 of the ballot are shown as activated by the jumpers 169 while the remaining eight circuits are indicated as inactive. The jumpers 169 are connectible in lines leading to terminals 170 where the active control circuits for any group of active vote squares of the ballot are combined. Wires 171 lead from the terminals and are joined to the relay coils of the reject relays RR1, RR2, etc., these coils being grounded through a wire 172.

In the example shown, the control circuits including the potentiometers P4 and P5 are connected to the coil of the reject relay RR1. With such a hook-up, when the ballot of Fig. 7 has been marked by a voter as indicated in Fig. 13, that is, to designate the selection of one of the candidates (*a*) or (*b*), as instructed on the ballot, and the ballot so marked is later fed through the apparatus, the pick-up pins 35, 36 for square 4 of the ballot detect the presence of the metallic mark 33 in this square of the ballot to thus effect energization of the setting relay SR4. Such energization allows flow of current through control switch CS4 and through potentiometer P4 to the coil of reject relay RR1. Now, assuming that a current of, say, 24 volts is required to activate the coil of the relay RR1 and that the potentiometer is so adjusted that the current flow is held at approximately 12 volts, it follows that the current flow through the single control circuit CS4, P4 is of insufficient magnitude to activate the relay RR1. Thus, the switch contacts of the relay RR1 remain closed so that current flows from the power source through the line 152 and thence through wires W4 and W5 to the respective switches TS4 and TS5. Since switch TS5 is now open, the current flow is only to the counter device or totalizer T4. Thus, the apparatus records only the vote represented by the vote mark 33 appearing in square Number 4 of the ballot.

Considering a situation where a voter inadvertently marks both squares 4 and 5 of the ballot, instead of the required one selection, upon subsequent insertion of this incorrectly marked ballot into the detector unit 25, the

contacts 35, 36 of the detectors for both squares 4 and 5 of the ballot detect the presence of the two metallic marks 33 so that both setting relays SR4 and SR5 are energized to close both switches CS4 and CS5. Thus, current is caused to flow through both potentiometers P4 and P5 to the coil of the reject relay RR1. Now, since flow of electric current is unrestricted by the current limiting means or potentiometers P4 and P5, the flow of current to the relay RR1 is limited to approximately 24 volts, which is sufficient to energize this relay to open its normally closed contacts. Consequently, the flow of electric current through wires W4 and W5, and now closed switches TS4 and 5 to the totalizers T4 and T5, is disrupted so that the counter devices T4 and T5 remain inactive and neither vote, as designated by the metallic marks 33 in the squares 4 and 5 of the ballot, is recorded by the counters. The incorrect and illegal vote thus, in effect, is thrown out or rejected. After all the ballots have been processed through the apparatus, the number of "rejects" can readily be determined by simply adding the numbers appearing on counters T4 and T5 and subtracting this sum from the total number of ballots indicated by the master counter or totalizer 110.

It will be readily understood from the foregoing description that by means of the various jumpers 136, 169 and terminal blocks, any of the circuits for the counters T1, T2, etc., may be selectively made available in accordance with the particular vote squares to be utilized on the ballot. Also, the control circuits corresponding to the several listed candidates may be grouped at 170 in any selected combinations. For example, the control circuits for the three candidates (*e*), (*f*) and (*g*) of squares 42, 43, 44 of the ballot may be grouped at a terminal block having three or more sets of terminals. In this case, the potentiometers in these circuits may be adjusted to limit the flow of current to, for example, 6, 8 and 10 volts. Thus, if the voter marks two squares of the ballot to cast votes for (*e*) and (*f*) or (*e*) and (*g*) or (*f*) and (*g*), the current flow to the reject relay RR2 may be 6 plus 8, or 6 plus 10, or 8 plus 10 volts. Since any of these sums is less than the 24 volts necessary to activate the relay RR2, current flows through the wire 152 to the wires W42, W43 or W42, W44 or W43, W44, depending upon which two candidates of the group (*e*), (*f*), (*g*) are selected by the voter. The counter devices T42 and T43, or T42 and T44, or T43 and T44 are thus activated to record the votes for the two selected candidates.

In the event that the voter erroneously marks all three squares 42, 43 and 44, the potentiometers will allow current flow to the reject relay RR2 in the order of 6 plus 8 plus 10 or 24 volts which, as explained before, is sufficient to trip the relay RR2 to prevent current flow through the wires W42, W43 and W44 to the counter devices T42, T43 and T44. These counter devices are therefore inactivated so that registering of all the votes illegally cast for the three candidates (*e*), (*f*) and (*g*) is prevented and the votes are rejected or disqualified.

The above examples are merely typical, it being understood that many other combinations of control circuits are possible. As a further example, the pairs of circuits representative of the "yes" and "no" answers to propositions submitted on the ballot may be grouped so that a "yes" or "no" answer will be recorded on the corresponding counter device, whereas both counter devices will be inactivated at the reject relay in the event that the voter inadvertently marks both the "yes" and "no" squares.

Referring now to Figs. 8 and 9, the various relays, jumpers, potentiometers and other electrical components may be arranged within the cabinet 20 substantially as shown, so as to be readily accessible for the purpose of activating and inactivating any of the individual circuits and for adjusting the potentiometers in accordance with the grouping of the circuits as determined by the pattern or layout of the ballot.

It will be observed from the foregoing that the present invention provides a relatively simple, yet highly practical and efficient means for counting the individual votes cast for candidates, referenda, etc., upon a plurality of ballots fed successively through the counter following the voting at the polls. By this electric machine or apparatus it is possible to count all the ballots and individual votes thereof in a fraction of the time usually expended in visually counting the votes and recording them upon the conventional tally sheets, and with greater accuracy. Consequently, a single machine embodying this invention may be employed for counting the votes of all the ballots cast in several precincts, wards or like voting places. By so expediting the counting of the voes, the final results or returns of the election can be made known at a much earlier time than has heretofore been possible.

The present counter is operative upon conventional ballots, the vote squares or boxes of which are actually marked by the voter, it being only necessary that the votes be marked with a metallic, electric conductive substance. Consequently, it is unnecessary to employ ballots which deviate to any extent from the conventional.

As a feature of the instant counter, the ballot and vote counting operation is initiated solely and automatically by the insertion of each successive ballot into the machine, it being unnecessary for the operator or attendant to re-set the machine prior to each operation and consequently impossible for an unscrupulous person to "fix" the count in any way. In addition, since the various circuits and their components are fully enclosed, tampering therewith is prevented, the counter thus being foolproof in operation.

As another feature of the invention, the counter embodies a unique detector unit which is electrically actuated for fast action, the unit including a plurality of pairs of contact elements arranged in circuit, each pair of elements being movable into engagement with a ballot fed into the machine, within the confines of a vote square of the ballot, and into contact with the metallic mark thereon, the metallic substance closing the circuit between the elements of the pair, this principle of detection having been found highly satisfactory. In the embodiment of the detector unit disclosed herein, the contact elements are lowered into engagement with the ballot, this procedure having been found most practical in that it avoids the accumulation of fine fibrous particles of the paper ballots on the contact elements to interfere with their operation.

The counter is readily adjustable to adapt it for counting the vote marks of any of the vote squares employed on the ballot, such adjustment being made in accordance with any selected grouping of the vote squares.

As an extremely important feature of the invention, the counter embodies a simple, practical and fully adjustable means by which all the votes cast for any particular office or proposition are rejected or discarded, that is, withheld from recording on the electric counter devices in the event that the number of votes cast by the voter is in excess of the permissible, legal number.

In accordance with the provisions of the patent statutes, I have described the principle of operation of the electric counter apparatus, together with the construction which I now consider to represent the best embodiment of the invention. I wish it to be understood, however, that the counter shown is only illustrative and that the invention may be carried out by modified means within the spirit and scope of the invention, as defined by the appended claims.

I claim as my invention:

1. An electrical counting machine for counting the individual votes denoted by marks placed upon the vote squares of a ballot by a voter, comprising: a plurality of electric counter devices, each corresponding to a vote square of the ballot and each connected in a separate

electrical counter circuit; a normally open switch in each said counter circuit; a plurality of electrical detector means each having a pair of independently actuable contact elements arranged in side-by-side relation, each of said contacts consisting of a hollow plunger, a spring pocketed in one end of the plunger and a reciprocable actuating pin having an end disposed within said end of said plunger and operative to compress the spring so as to actuate said plunger by spring action, said plunger having a tip at its other end engageable against the ballot to detect the presence of marks appearing in the vote squares of a ballot placed in proximity to said detector means; a plurality of detector circuits in which said contact elements are included; relay means in each detector circuit and operative, upon detection of marks by said contact elements, to close the switches in said counter circuits corresponding to the marked squares of the ballot so as to activate the appropriate counters and cause the latter to record the votes designated by said marks; a main electrical circuit in which said contacts are connected; and a normally open switch in said main circuit and adapted to be closed by a ballot placed in said position of proximity to said detector means so as to initiate the action of said detector means.

2. An electrical counting machine for counting the individual votes denoted by metallic marks placed upon the vote squares of a ballot by a voter, comprising: a plurality of electrically actuable counter devices, each corresponding to a square of the ballot; an electrical counter circuit for each of said devices; a first, normally open switch in each counter circuit; a detector unit having a plurality of pairs of independently movable contact elements arranged in spaced, side-by-side relation, each pair being registrable with a vote square of a ballot placed in proximity to the unit, said elements being normally spaced from the ballot, said unit also including electric actuating means operative, when energized, to move each pair of contact elements into engagement with a square of the ballot and the metallic mark thereon; a plurality of detector circuits in which said contact elements are connected; a first relay in each detector circuit and operable, when activated, to close a said first switch associated therewith; a power line to supply electric current to said detector circuit, to said counter switches and to said detector actuating means; a second, normally open switch in said power line, closing of said second switch allowing current flow to said actuating means and also through said contact elements, by way of a said metallic mark, so as to activate each detector circuit so closed by a said metallic mark and thus energize the relay in a said closed detector circuit to close a said first switch associated therewith; a second, main relay to close said second switch, said second relay being in a branch line connected in parallel with said power line; and a third normally open switch in said branch line, said third switch being engageable with and closed by the ballot placed in proximity to said detector unit so as to effect activation of said main relay.

3. An electrical counting machine for counting the individual votes denoted by metallic marks placed upon the vote squares of a ballot by a voter, comprising: a plurality of electrically actuable counter devices, each corresponding to a square of the ballot; an electrical counter circuit for each of said devices; a first, normally open switch in each counter circuit; a detector unit having a guideway into which a ballot is insertable and a plurality of pairs of independently movable contact elements arranged in spaced, side-by-side relation, each pair being registrable with a vote square of the ballot inserted into the unit, said elements being normally spaced from the ballot, said unit also including electric actuating means operative, when energized, to move each pair of contact elements into engagement with a square of the ballot and the metallic mark thereon; a plurality of detector circuits in which said contact elements are connected; a first relay in each detector circuit and operable, when activated, to close a said first switch associated therewith; a power line to supply electric current to said detector circuit, to said counter switches and to said detector actuating means; a second, normally open switch in said power line, closing of said second switch allowing current flow to said actuating means and also through said contact elements, by way of a said metallic mark, so as to activate each detector circuit so closed by a said metallic mark and thus energize the relay in a said closed detector circuit to close a said first switch associated therewith; a second, main relay to close said second switch, said second relay being in a branch line connected in parallel with said power line; and a third switch in said branch line, said third switch being engageable with and closed by the ballot placed in proximity to said detector unit so as to effect activation of said main relay.

4. An electrical counting machine for counting the individual votes denoted by metallic marks placed upon the vote squares of a ballot by a voter, comprising: a plurality of electrically actuable counter devices, each corresponding to a square of the ballot; an electrical counter circuit for each of said devices; a first, normally open switch in each counter circuit; a detector unit having a guideway into which a ballot is insertable and a plurality of pairs of yieldably mounted, independently movable contact elements arranged in spaced, side-by-side relation, each pair being registrable with a vote square of the ballot inserted into the unit, said elements being normally spaced from the ballot, said unit also including electric actuating means operative, when energized, to move each pair of contact elements into engagement with a square of the ballot and the metallic mark thereon; a plurality of detector circuits in which said contact elements are connected; a first relay in each detector circuit and operable, when activated, to close a said first switch associated therewith; a power line to supply electric current to said detector circuit, to said counter switches and to said detector actuating means; a second, normally open switch in said power line, closing of said second switch allowing current flow to said actuating means and also through said contact elements, by way of a said metallic mark, so as to activate each detector circuit so closed by a said metallic mark and thus energize the relay in a said closed detector circuit to close a said first switch associated therewith; a second, main relay to close said second switch, said second relay being in a branch line connected in parallel with said power line; a third switch and a fourth switch in said branch line, said third and fourth switches being adapted to establish current flow to said second relay in response to full insertion of a ballot into said guideway in position to be acted upon by said contact elements.

5. An electrical counting machine for counting the individual votes denoted by metallic marks placed upon the vote squares of a ballot by a voter, comprising: a plurality of electrically actuable counter devices, each corresponding to a square of the ballot; an electrical counter circuit for each of said devices; a first, normally open switch in each counter circuit; a detector unit having a guideway into which a ballot is insertable and a plurality of pairs of movable contact elements, each pair being registrable with a vote square of the ballot inserted into the unit, said elements being normally spaced from the ballot, said unit also including electric actuating means operative, when energized, to move each pair of contact elements into engagement with the squares of the ballot and the metallic marks thereon; a plurality of detector circuits in which said contact elements are connected; a relay in each detector circuit and operable, when activated, to close a said first switch associated therewith; a power line to supply electric current to said detector circuit, to said counter switches and to said detector actuating means; a pair of initiating switches connected in series in said power line and having movable actuator fingers

adjacent said guideway to be engaged directly by the ballot inserted therein, said actuator fingers being operated respectively by the leading and trailing edges of the ballot inserted into said guideway, closing of both initiating switches allowing current flow to said actuating means, to said master counter circuit, and also through said contact elements, by way of a said metallic mark, so as to activate each detector circuit so closed by a said metallic mark and thus energize the relay in a said closed detector circuit to close a said first switch associated therewith; and a master counter connected in said power line and activated in response to current flow therethrough as effected by the closing of both of said initiating switches.

6. An electrical counting machine for counting the individual votes denoted by metallic marks placed upon the vote squares of a ballot by a voter and for rejecting all such marked votes cast in excess of a permissible maximum number for a particular office, comprising: a plurality of electrically actuable counter devices, each corresponding to a square of the ballot; an electrical counter circuit for each of said devices; a normally open switch in each counter circuit, certain of said counter circuits being grouped at a point between a power source and said counter switches; a detector unit having a guideway into which a ballot is insertable, and a plurality of pairs of movable contact elements, the elements of each pair being arranged in spaced, side-by-side relation and registrable with a vote square of the ballot inserted into the unit, said elements normally being spaced from the ballot, said unit also including electric actuating means operative, when energized, to move each pair of contact elements into engagement with the squares of the ballot and the metallic marks thereon; a plurality of detector circuits in which said contact elements are connected; a relay in each detector circuit and operable, when activated, to close a said counter switch associated therewith; a power line to supply electric current to said detector circuits, to said detector actuating means and to all of said grouped counter circuits; a reject relay switch interposed in said power line and normally closed to allow current flow to the counter switches of all of said grouped counter circuits; a normally open main switch means in said power line, closing of said main switch means allowing current flow to the above-referred to circuits, and through said contact elements, by way of said metallic marks, so as to activate each detector circuit so closed by said metallic marks and thus energize the relays of said closed detector circuits to close the counter switches associated therewith; and control circuits for controlling the opening and closing of said reject relay switches, each of said control circuits including an adjustable current flow limiting means electrically connectible to the winding of a said reject relay and activated in response to energization of a said detector circuit relay corresponding to the counter circuit in which said current flow limiting means is connected, selected groups of said current flow limiting means being connectible to a said reject relay, said selected group of current flow limiting means being operative in response to energization of a predetermined number of said detector relays to allow flow of electric current to said reject relay which is insufficient to actuate the same, thereby allowing current flow through the counter circuits corresponding to the marked vote squares, said current flow limiting means also being operative in response to energization of a number of said detector relays in excess of said predetermined number to allow flow of current of sufficient magnitude to actuate said reject relay so as to open all of said counter circuits of said group of counter circuits.

7. An electrical counting machine as defined in claim 6, in which said current flow limiting means consists of a plurality of potentiometers, corresponding in number to the number of counter circuits in a said group of counter circuits.

8. An electrical counting machine as defined in claim 6, in which said current flow limiting means consists of a plurality of potentiometers, corresponding in number to the number of counter circuits in a said group of counter circuits, each potentiometer being connectible to said power line in response to energization of a said detector relay.

9. An electrical counting machine as defined in claim 6 in which said control circuit means includes a plurality of control circuits connectible to said power line and a normally open control switch in each control circuit, each control switch being associated with a said detector relay to be closed upon energization thereof so as to allow current flow to said current flow limiting means, and in which said current flow limiting means consists of a plurality of potentiometers, each connected in a said control circuit.

10. An electrical counting machine as defined in claim 11 in which said control circuit means includes a plurality of control circuits connectible to said power line and a normally open control switch in each control circuit, each control switch being associated with a said detector relay to be closed upon energization thereof so as to allow current flow to said current flow limiting means, and in which said current flow limiting means consists of a plurality of potentiometers, each connected in a said control circuit, said machine also including removable jumpers in said detector, counter and control circuits by which any of these circuits can be initially and selectively activated and inactivated in accordance with the particular vote squares of the ballot utilized for voting.

11. An electrical counting machine for counting the individual votes denoted by metallic marks placed upon the vote squares of a ballot by a voter and for rejecting all such marked votes cast in excess of a permissible maximum number for a particular office, comprising: a plurality of electrically actuable counter devices, each corresponding to a square of the ballot; an electrical counter circuit for each of said devices; a normally open switch in each counter circuit, certain of said counter circuits being grouped at a point between a power source and said counter switches; a detector unit having a guideway into which a ballot is insertable, and a plurality of pairs of movable contact elements, each pair being registrable with a vote square of the ballot inserted into the unit, said elements normally being spaced from the ballot, said unit also including electric actuating means operative, when energized, to move each pair of contact elements into engagement with the squares of the ballot and the metallic marks thereon; a plurality of detector circuits in which said contact elements are connected; a relay in each detector circuit and operable, when activated, to close a said counter switch associated therewith; a power line to supply electric current to said detector circuits, to said detector actuating means and to all of said grouped counter circuits; a reject relay switch interposed in said power line and normally closed to allow current flow to the counter switches of all of said grouped counter circuits; a normally open main switch means in said power line, closing of said switch means allowing current flow to the above-referred to circuits, and through said contact elements, by way of said metallic marks, so as to activate each detector circuit so closed by said metallic marks and thus energize the relays of said closed detector circuits to close the counter switches associated therewith; and control circuit means for controlling the opening and closing of said reject relay, said control circuit means including a plurality of control circuits, one for each detector circuit, each control circuit having a normally open control switch actuable by a said detector relay and having one side connected to said power line and the other side connected to an end of the winding of a potentiometer, the rotors of the potentiometers of the control circuits corresponding to the grouped counter circuits being connected to the winding of the reject relay controlling current flow through said grouped counter circuits, said potentiometers being operative in response to energiza-

tion of a predetermined number of said detector relays to limit flow of electric current to said reject relay to a rate insufficient to actuate the same, thereby allowing current flow through the counter circuits corresponding to the marked vote squares, said potentiometers also being operative in response to energization of a number of said detector relays in excess of said predetermined number to allow flow of current of sufficient magnitude to actuate said reject relay so as to open all of said counter circuits of said group of counter circuits.

12. An electrical vote counting machine as defined in claim 11 including: an initiating circuit having a main relay operative, when activated, to close said switch means in said power line; an auxiliary, take-out relay in said initiating circuit; a normally open switch connected in the power line to said reject relay and adapted to be closed in response to activation of said auxiliary relay.

13. An electrical vote counting machine as defined in claim 12, including: a line connected between said power line and said initiating circuit; and initiating switch means connected in said line and adapted, when closed, to allow current flow from said power line to said main and take-out relays.

14. An electrical vote counting machine as defined in claim 13 in which said initiating switch means is located adjacent said detector unit and engageable with and actuated by the ballot inserted into said detector unit.

15. An electrical vote counting machine as defined in claim 14 in which said initiating circuit includes capacitor means associated with said main and take-out relays and operative, upon closing of said initiating switch means, to cause immediate activation of said main relay and delayed activation of said take-out relay.

16. An electrical vote counting machine as defined in claim 15 in which said capacitor means are of the electrolytic type.

17. An electrical counting machine for use in counting the individual votes denoted by metallic marks placed upon the vote squares of a ballot by a voter, comprising a plurality of electric counter devices and electric circuits therefor, each associated with a vote square of the ballot, and a detector unit operative to activate each counter circuit associated with a vote square in which a metallic mark appears, said detector unit including: means defining a guideway into which the ballot is insertable; stationary plate means associated with said guideway and provided with a plurality of pairs of bearing holes extending normal to the plane of said guideway, the holes of each pair being arranged in spaced, side-by-side relation; contact elements slidable in said holes; spring means incorporated in said plate means and engaging said contact elements and operative to normally urge said elements in a direction to dispose their ends at a distance from said guideway; an actuator plate reciprocable toward and away from said guideway in a path normal to the plane of the ballot; electric actuating means for reciprocating said actuator plate; and connector means by which electric current can flow to one of the detector elements of each pair of elements and from the other of the detector elements of each pair, movement of said contacts through an operative stroke under the influence of said actuator plate causing the ends of the elements of each pair of said elements to engage the ballot, said contact elements being of such cross sectional size and spacing that they are together placeable within the confines of a vote square thereof, a said metallic mark in a square bridging the gap between the contact elements of a pair of said elements to establish an electrical connection allowing current flow between said elements.

18. An electrical counting machine for use in counting the individual votes denoted by metallic marks placed upon the vote squares by a voter, and for counting the ballots placed successively in the machine, comprising: a plurality of electric vote counter devices, each associated with a vote square of the ballot; a vote counter circuit for each vote counter device; an electric ballot counter device; a ballot counter circuit for said ballot counter device; a first detector means operative to detect the presence of metallic marks appearing in the vote squares of a ballot disposed in proximity to said detector means; relay actuated means operative in response to detection of said marks by said detector means, to close the circuits of the counter devices corresponding to the marked squares of the ballot; and a second relay actuated means operative, in response to the placing of a ballot in proximity to said detector means, to close said ballot counter circuit.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 1,997,157 | Tauschek | Apr. 9, 1935 |
| 2,107,008 | Lasker | Feb. 1, 1938 |
| 2,124,410 | Cockrell | July 19, 1938 |
| 2,154,316 | Simek | Apr. 11, 1939 |
| 2,275,590 | Johnson | Mar. 10, 1942 |
| 2,479,681 | Handley | Aug. 23, 1949 |
| 2,591,448 | Lorenz | Apr. 1, 1952 |
| 2,598,155 | Betts | May 27, 1952 |