

[54] ELECTRONIC VOTING MACHINE

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[73] Assignee: Frank Thornber Co.

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[51] Int. Cl. G07c 13/00

[58] Field of Search... 179/2 AS; 346/37, 1; 235/52, 235/54 F, 51

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Primary Examiner—Richard B. Wilkinson

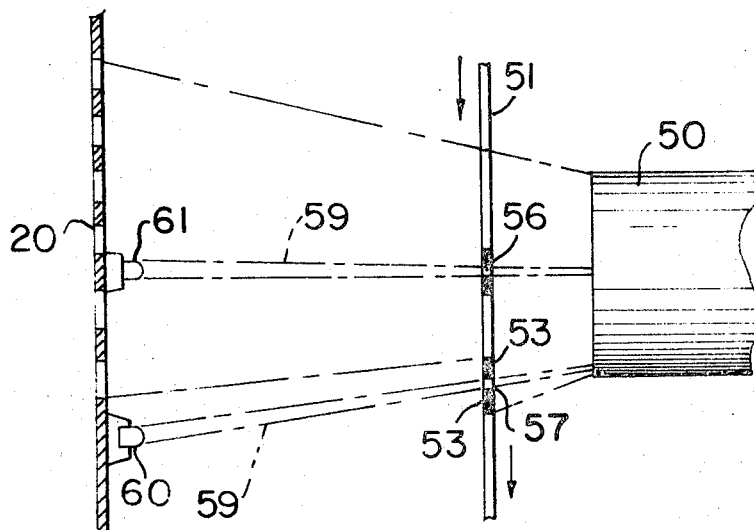
Assistant Examiner—U. Weldon

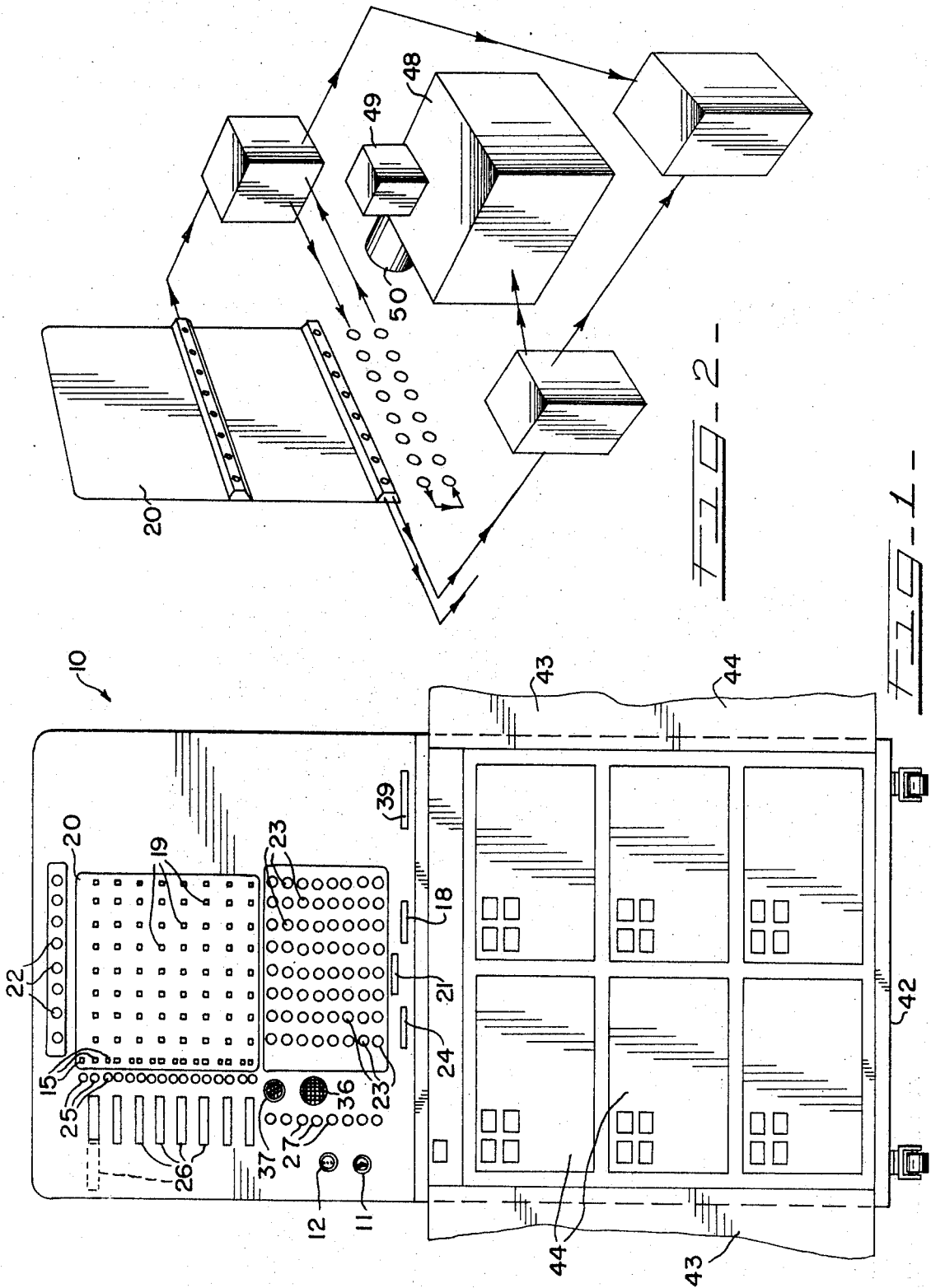
Attorney, Agent, or Firm—Mann, Brown, McWilliams & Bradway

[57] ABSTRACT

An electronic voting machine including a video screen containing the projected names of candidates or propositions being voted, utilizing a film strip containing individual frames having images projected onto the video screen by a light source, wherein photo-optical information transmittal circuits are actuated by the light source projecting the voting image and, by means of controlled light sensitive areas on the film strip, energizing phototransistor units in the system to activate voting buttons, check film alignment, operate vote counters and identify the vote, whether it be cumulative, a proposition or an ordinary vote, with the information furnished by the phototransistor units being read by photosensitive logic units which transmit information to the projector and counter units.

17 Claims, 14 Drawing Figures





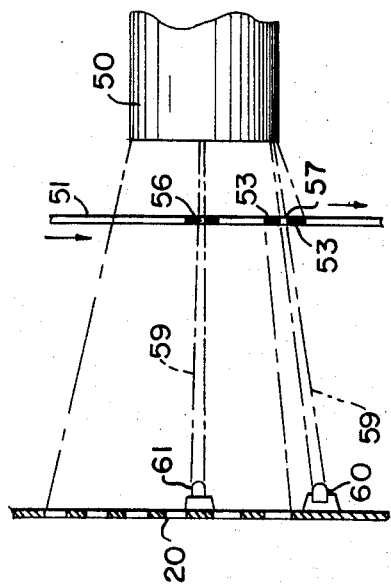


Fig. 3-

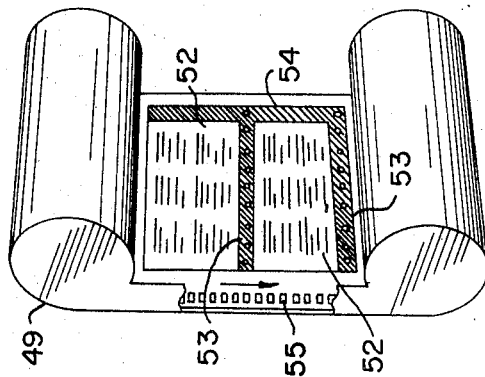


Fig. 4-

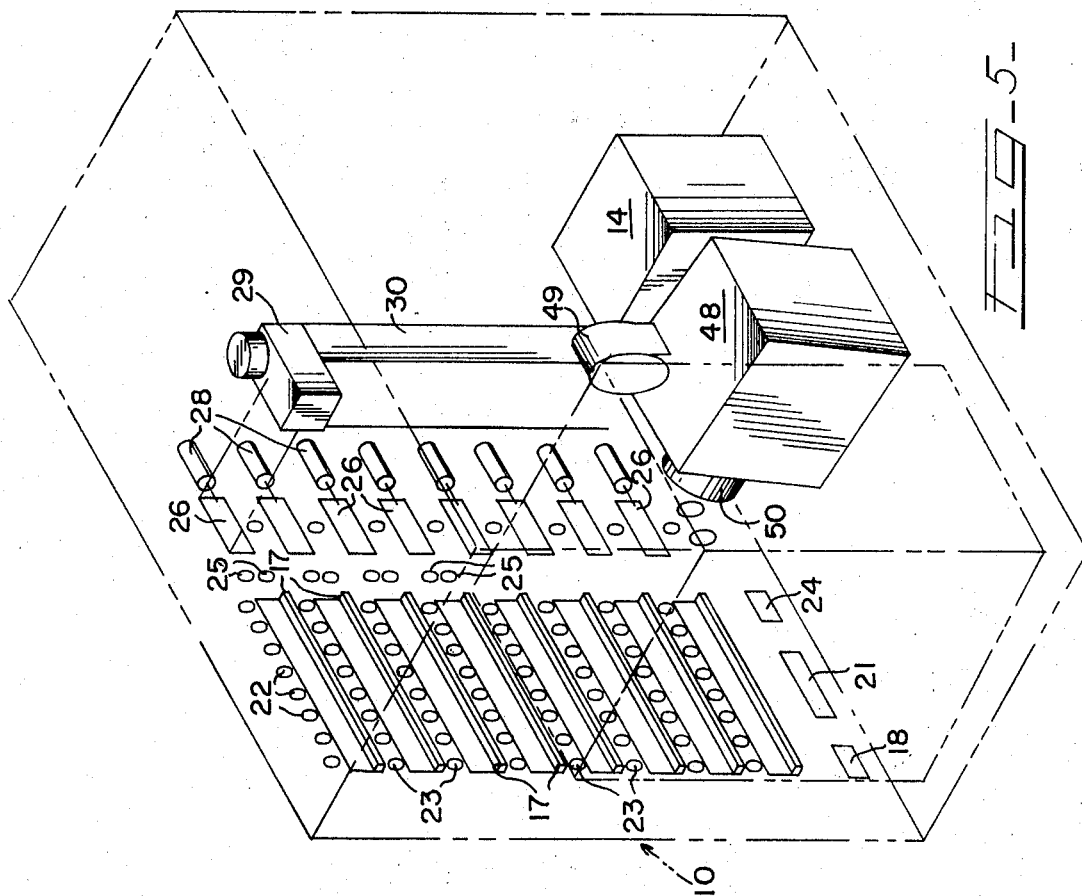
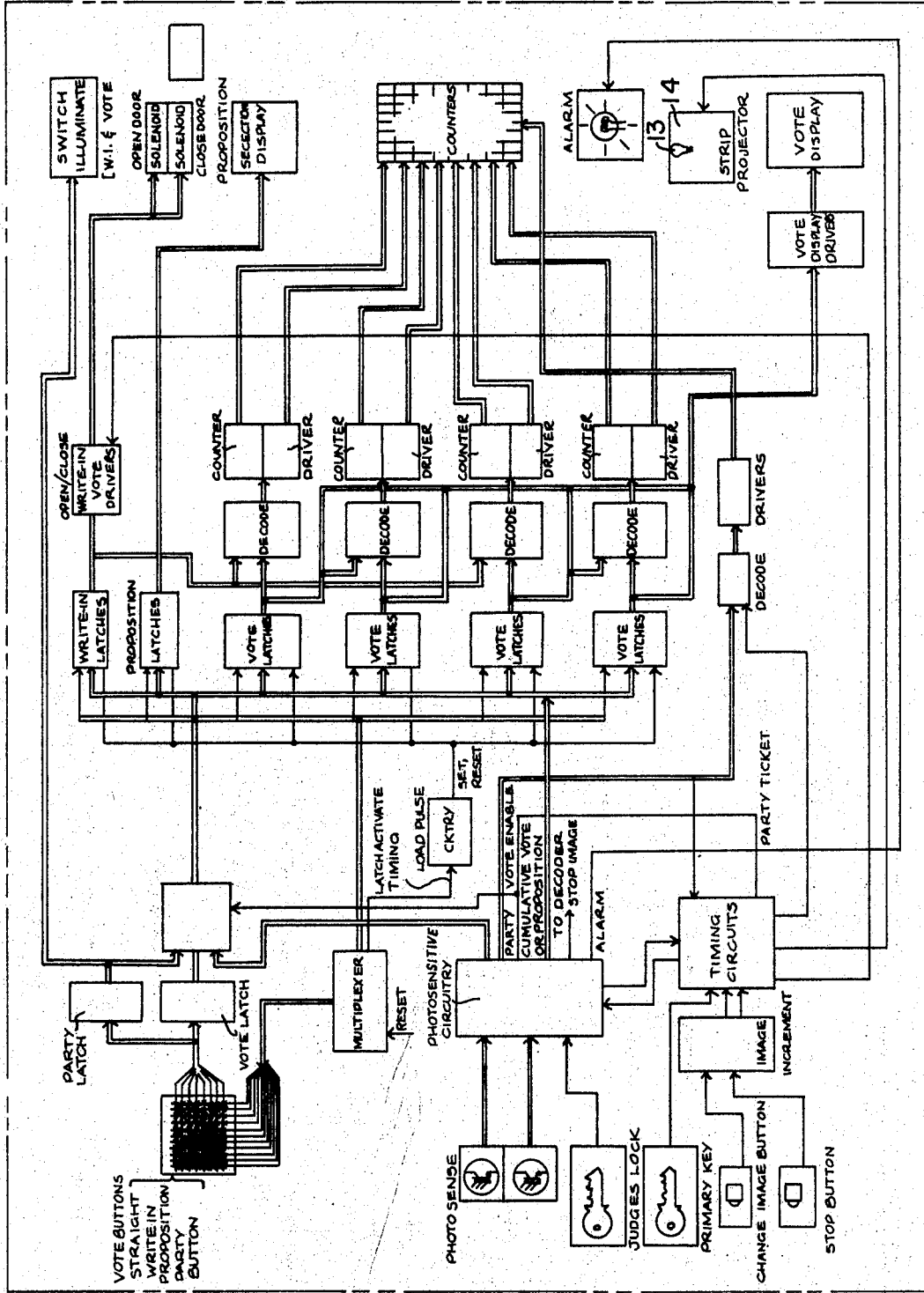


Fig. 5-



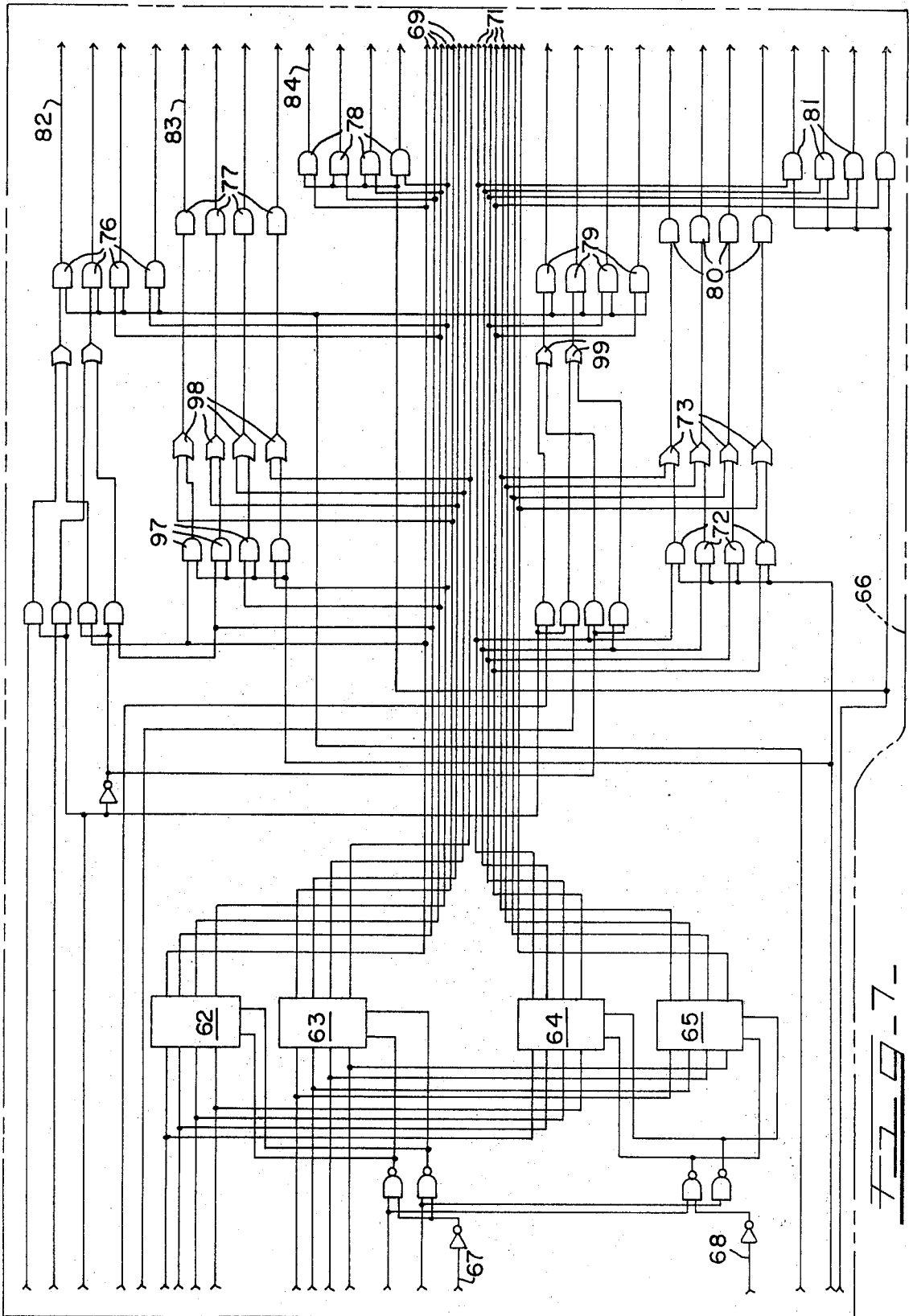
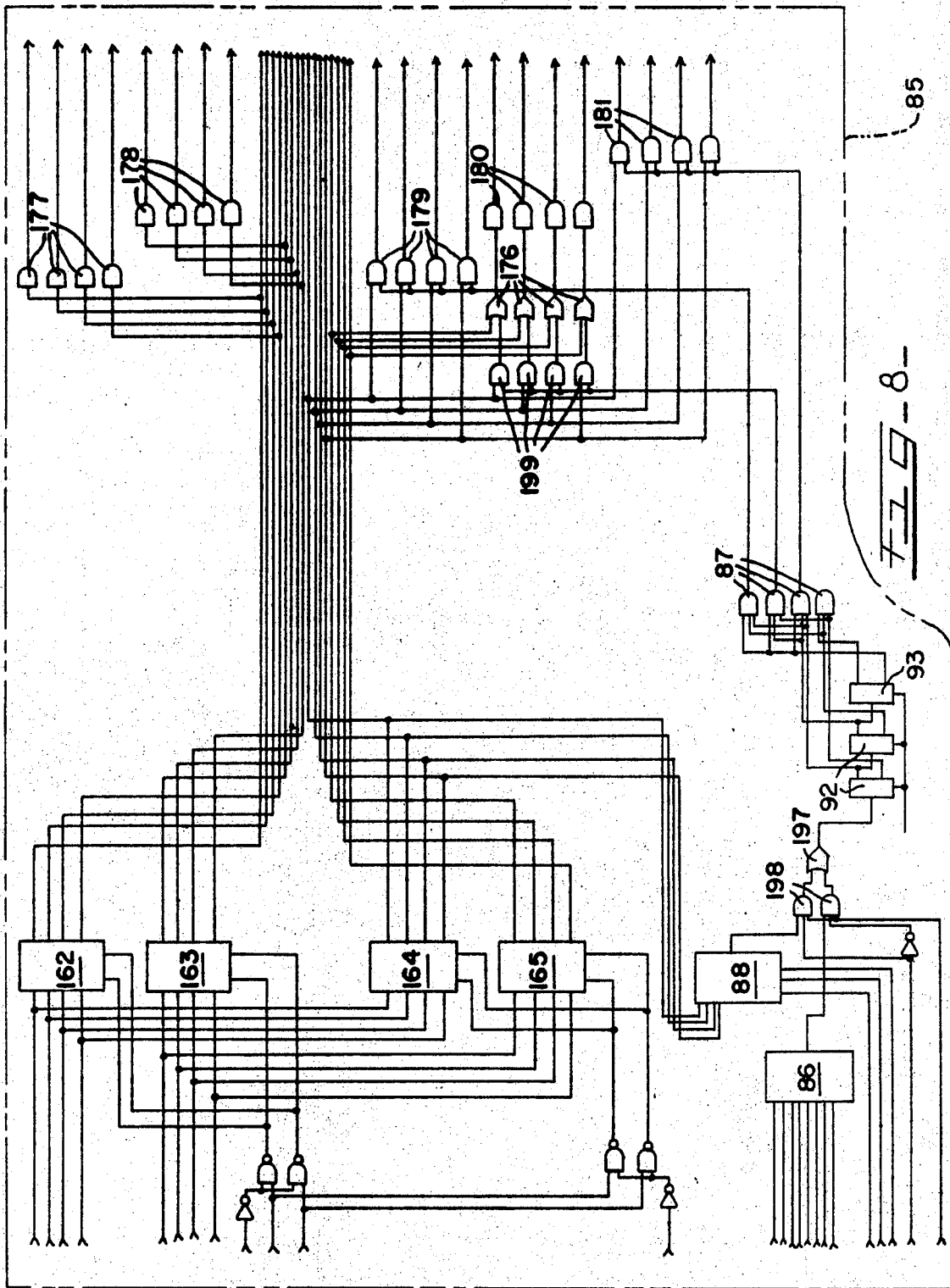
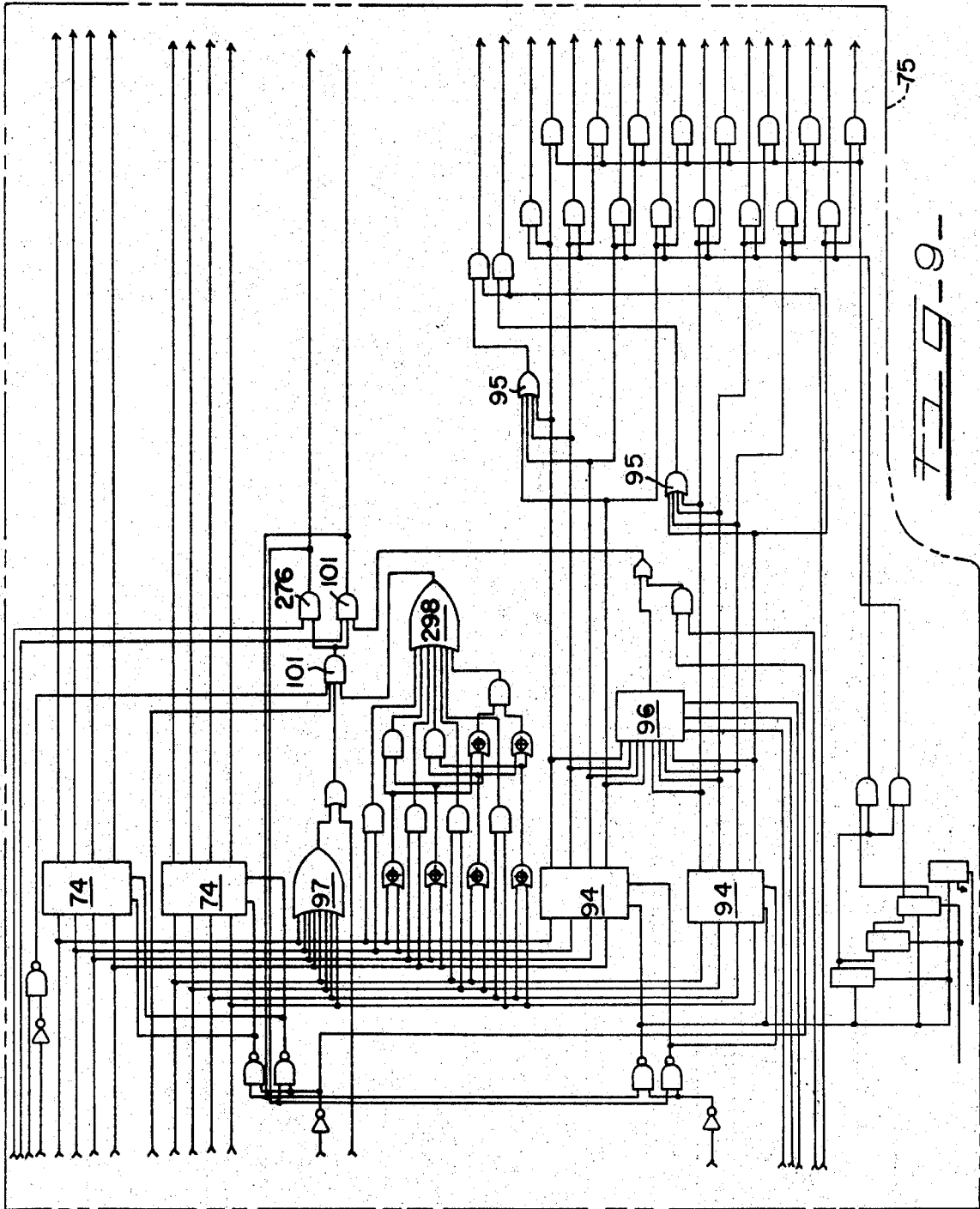
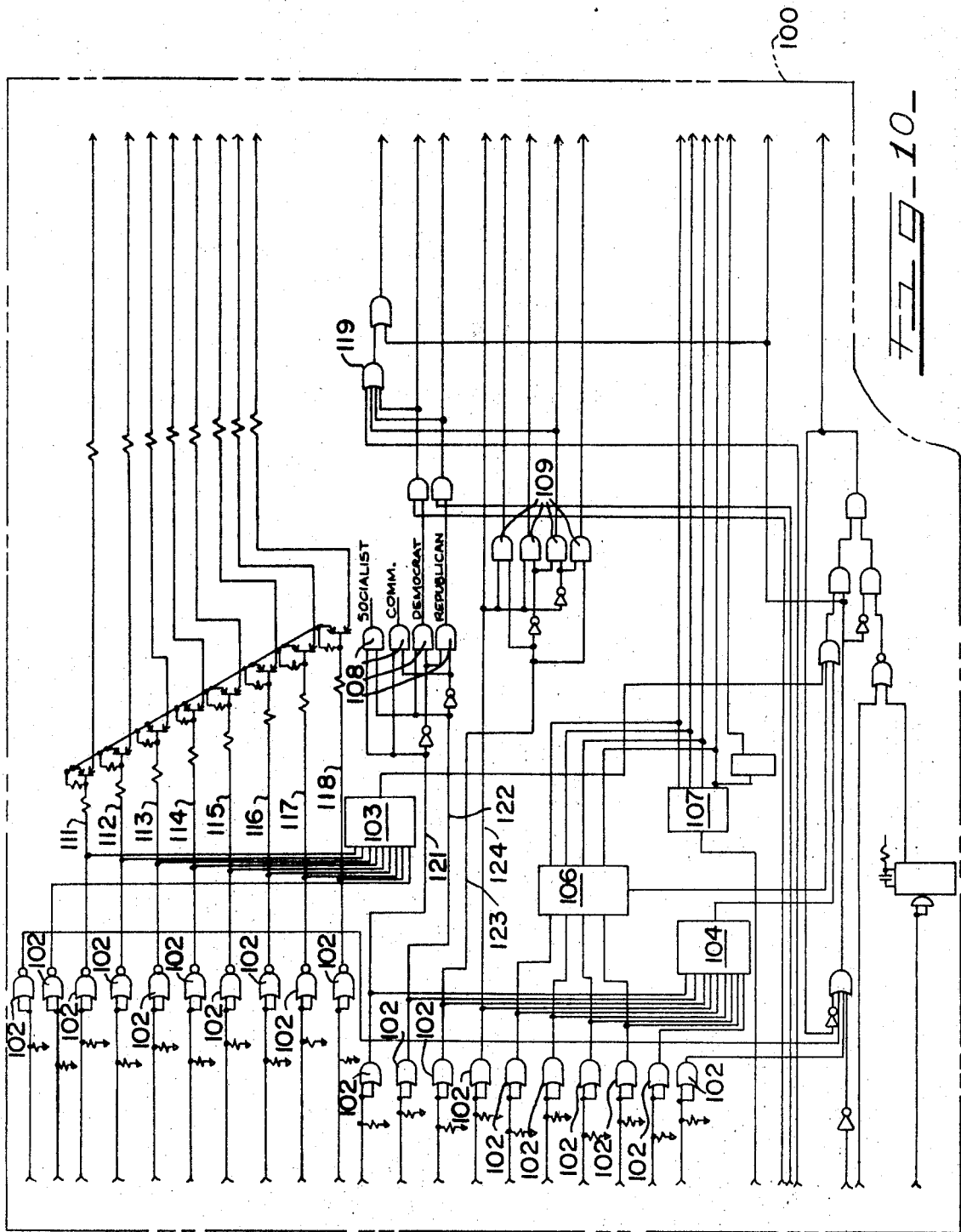
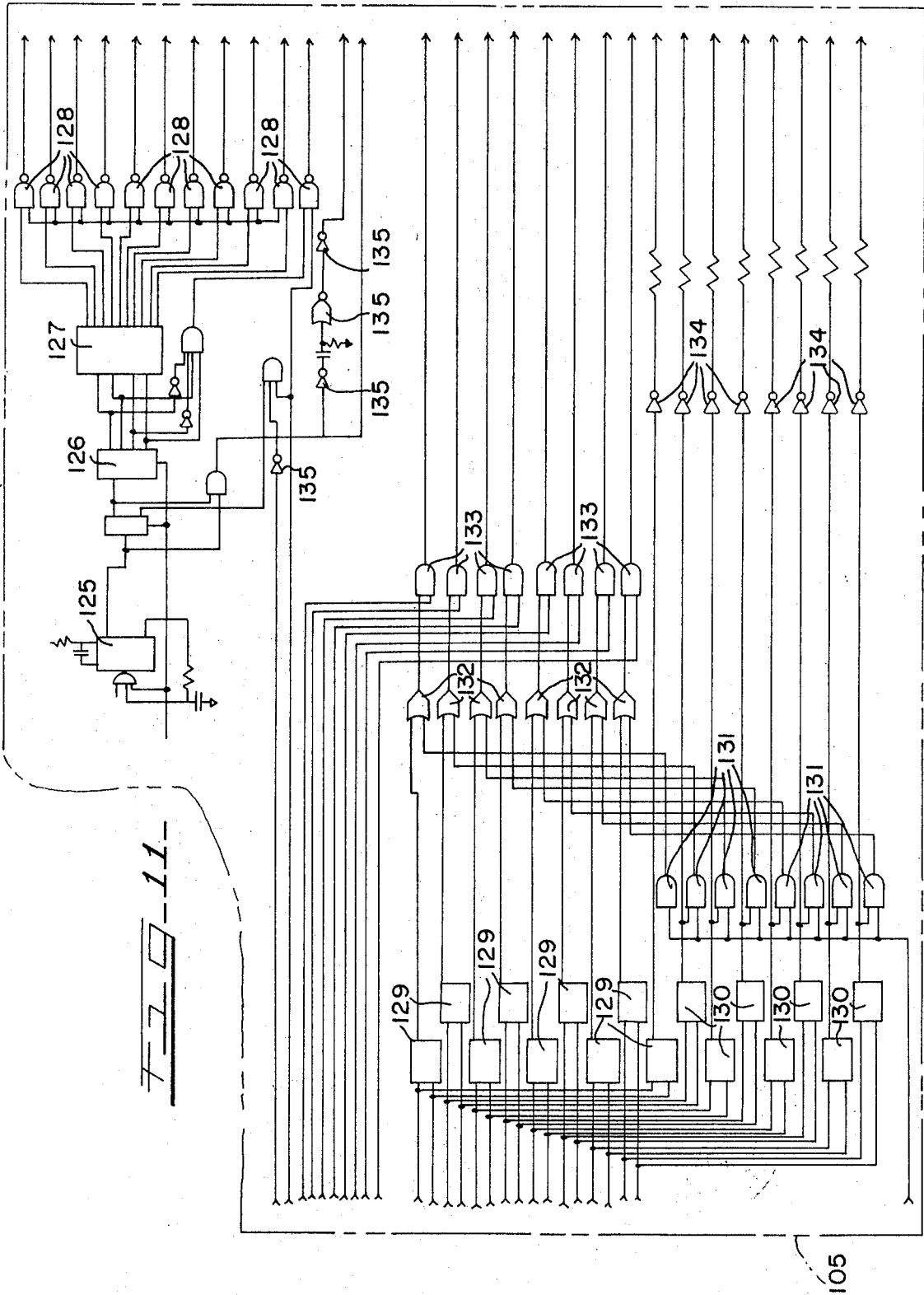


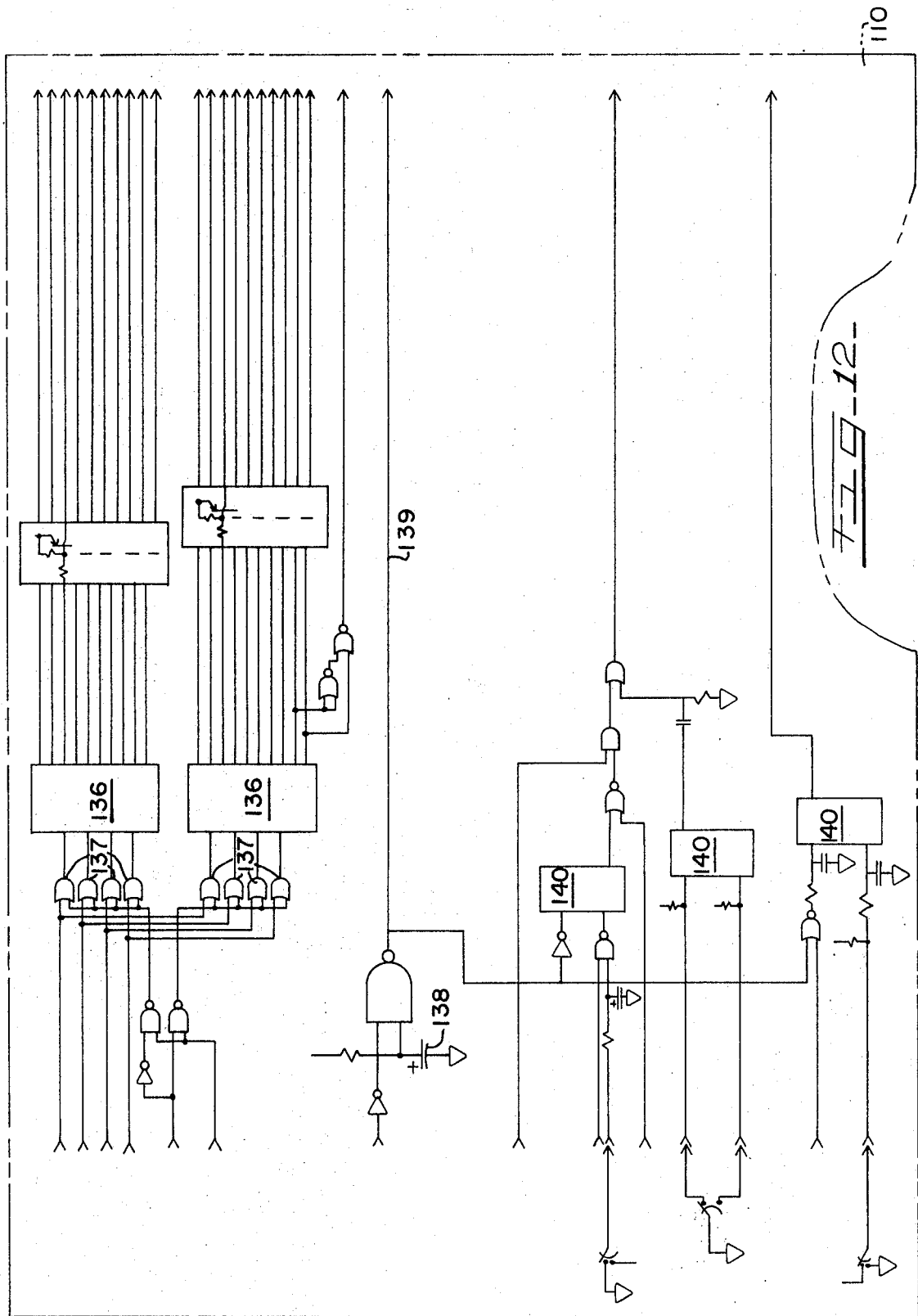
FIG. 7-

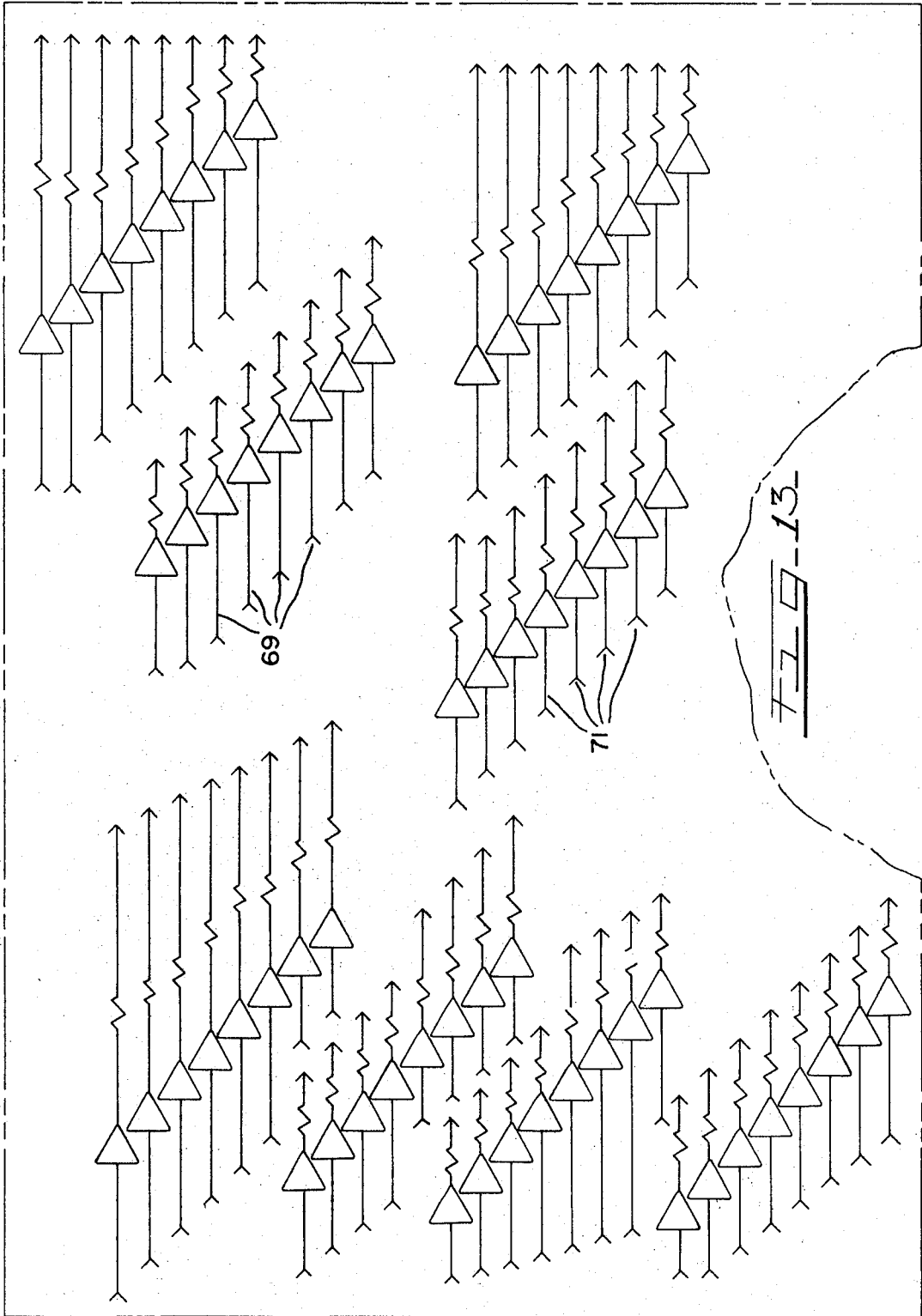












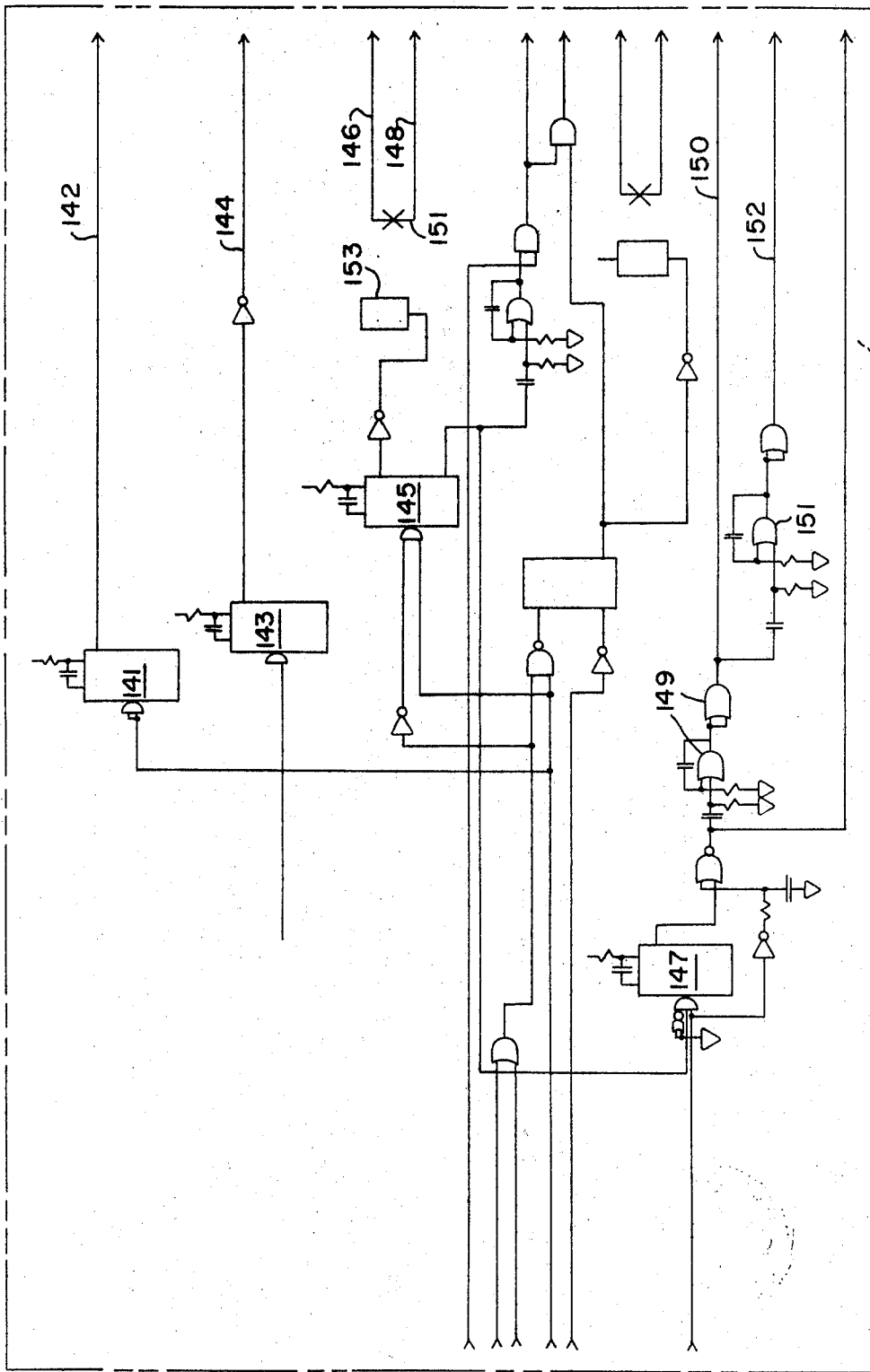


FIG. 14- 120

ELECTRONIC VOTING MACHINE**BACKGROUND OF THE INVENTION**

This invention relates to an electronic voting machine similar in many respects to that disclosed in pending application Ser. 269,558 filed July 7, 1972, but incorporates phototransistor information pick-up units energized through light sensitive areas of a film strip, which also projects voting images into a video-screen, and utilizes photosensitive logic units to feed information from the phototransistor units to a projector and to counter units.

Electrically operated voting machines of the prior art have included vote counting devices and some have included a scanning device for reading ballots that have been marked by voters. Various tabulating apparatus have been provided and, while certain of the prior disclosures have included push-button voting, with projecting arrangement where candidates and voting propositions are light projected onto a video screen for the voters choice and with the light source projecting one or more light beams through light sensitive areas of the film to activate phototransistor units which feed information through logic reading units to the light projector and to vote counting units.

Prior art information reveals use of selector buttons for voting on candidates or referendum issues, various interlock arrangements for restricting voting according to prescribed conditions, computer techniques which afford rapid cumulative results, central office recording of votes cast, photoelectric scanning of ballots for counting votes, electromechanical equipment for completing and summarizing vote results, data storage cards punched automatically by a machine for tabulation by standard computers, centralized voting systems, and machines for furnishing printed sheets of electron returns.

Voting machines have been proposed that utilized conventional ballots which are marked by the voter and the vote registered in the machine and counted. Various types of counting machines for counting manually marked ballots have also been proposed. Information retrieval systems have been disclosed in combination with remotely controlled voting systems such as those utilizing a telephone hook-up. Multiple totalizers have been proposed capable of counting and reading output or results from any machine and mechanical counters have been proposed in combination with electronic counters which check the results of the mechanical counter and total the results from a plurality of such counters. However, none of these prior devices has suggested the combination of features herein conceived, involving the information feeding and reading elements comprised of the film strip projecting voting images on a video screen and light beams through light sensitive areas of the film onto phototransistors, to activate voting buttons, and to align the film, and to identify voting categories, with the phototransistors feeding information through logic units to the light projecting means and to counter units.

OBJECTS OF THE INVENTION

It is the primary object of this invention to provide an electronic voting machine of the type utilizing a video screen, wherein light beams are used to activate voting elements.

Another object of the invention is the provision of an electronic voting machine of the type utilizing a video screen, wherein phototransistor units are activated by light beams from a light source projecting images onto the video screen.

Another object of the invention is to provide an electronic voting machine of the type utilizing a video screen, wherein light beams from a projector are used to activate phototransistors which control the operation of voting buttons selected in accordance with images appearing on the video screen.

Another object of the invention is the provision of an electronic voting machine of the type utilizing a video screen, wherein a light projector projects images from a film strip onto the video screen and light beams onto phototransistors through beam producing light spots on the film strip.

Another object of the invention is to provide an electronic voting machine of the type utilizing a video screen, wherein a film strip is used to project an image on the video screen and light dots on the film are associated with each image to project light beams onto light sensitive elements which activate voting elements, align the film strip and identifying voting categories.

Another object of the invention is the provision of an electronic voting machine of the type utilizing a video screen, wherein a film strip is used to project successive images onto the video screen and one or more series of light dots is disposed adjacent to an edge of each frame on the film strip to project light beams into correspondingly aligned light sensitive elements which activate voting elements, selected by voters relative to voting images appearing on the video screen.

Another object of the invention is to provide an electronic voting machine of the type utilizing a video screen, wherein a film strip is used to project images onto the video screen and a series of light dots is disposed on the film strip for projecting light beams onto light sensitive elements including a row of light dots which activate light sensitive elements controlling operation of voting buttons and film strip alignment and a row of light dots which activate light sensitive elements which control the operation of vote counters and identifies voting categories as well as to check film strip alignment.

Another object of the invention is the provision of an electronic voting machine of the type utilizing a video screen wherein a plurality of light sensitive electronic switches are actuated to "on" position by light beams projected through light dots in a blacked out area of a film strip with a light source projecting images on the film strip onto the video screen and the light beams onto the electronic switches.

Another object of the invention is to provide an electronic voting machine of the type utilizing a video screen, wherein a light projector projects images onto the video screen from a film strip and light beams onto phototransistor units through light dots in otherwise blacked out areas of the film strip with information from the phototransistor units being fed to logic units which transmit the information to voting selector buttons and to the light projector and to one or more counter units.

DESCRIPTION OF THE DRAWINGS

The foregoing and other and more specific objects of the invention are attained by the construction and ar-

rangement illustrated in the accompanying drawings wherein:

FIG. 1 is a general front elevational view of an electronic voting machine constructed in accordance with this invention;

FIG. 2 is a diagrammatic perspective view illustrating a generally block type diagram of the system of cooperating elements of the voting machine indicating the flow of information from the phototransistors to the logic units, to the projector and to a counter unit;

FIG. 3 is a diagram illustrating the relationship of the projector, film strip and video screen showing the light beams projecting through light dots of the blacked out area of the film to the phototransistors and the projection through the image area to the screen;

FIG. 4 is a detail perspective view of the film strip mounted in a typical cassette or cartridge type holder;

FIG. 5 is a perspective view of the basic layout of the inside of the voting machine upper cabinet;

FIG. 6 is a general block diagram of the various operating elements of the voting machine showing the overall flow of the total system;

FIG. 7 is a wiring diagram of a circuit board including latches and drivers;

FIG. 8 also is a wiring diagram of a circuit board including vote latches and drivers;

FIG. 9 is a wiring diagram of the circuit board including proposition and write-in vote latches;

FIG. 10 is a wiring diagram of a circuit board incorporating the photosense decode circuit;

FIG. 11 is a wiring diagram of the circuit board incorporating the vote switch multiplexer;

FIG. 12 is a wiring diagram of the circuit board incorporating the counter plane driver;

FIG. 13 is a wiring diagram of the circuit board incorporating the vote selection display drivers; and

FIG. 14 is a wiring diagram of the circuit board incorporating the various timing circuits.

SUMMARY OF THE INVENTION

The electronic voting machine of this invention will simplify machine voting by the average voter and provides apparatus that will supply accurate election returns rapidly and while affording substantially trouble free operation with minimum maintenance and giving foolproof results. The machine may be used in single party primary elections or in national or presidential elections where multiple parties are involved. The machine may be locked by an election official in a primary election, after a voter has indicated a party preference, whereby voting by that voter is restricted to a particular party and all voting elements other than those indicated by the voters preference are blacked out.

When a voter enters a polling place, usually the first step is to register with an election official. The voter is then assigned to a voting machine and with the present machine the official then actuates a master locking device to activate the machine for voting. The unlocking operation may be performed at the machine, as shown, by means of a key, or it may be under the control of an election official at a remote location through the use of suitable controls for rendering the voting machine operative. The voter must then insert a registration or identification card into a card sensing unit on the machine which, if the card is properly programmed for that machine, will turn the machine on for voting and enable the voter to cast a vote at that loca-

tion. The voter's card is programmed for such candidates or referendums as may be authorized for voting in the voter's district. If the voter enters any polling place other than in the proper precinct, the registration card will not activate the machine and it will be necessary to proceed to the precinct where the card is authorized.

When the machine has been turned on for voting the voter actuates a "change-image" button which causes a first image to be projected onto the video screen. This image includes a complete set of instructions for operating the machine and after viewing the first image and understanding the instructions the voter again presses the change-image button to advance the next image for projection onto the video screen. This first voting image may contain one or more groups of candidates from which voting selections are made by the voter. Where a straight party ticket is voted it is necessary to actuate a straight party vote button, whereupon all votes cast by this voter would go to the several candidates in the party chosen. Ordinarily this would have the effect of shutting off the machine by completion of the voting operation, but the voter may cast one or more crossover votes for candidates in another party while voting a straight ballot, in which event, controls provided in the machine prevent voting for directly opposing candidates for the same office and which will act to cancel any unauthorized vote inadvertently cast.

If the voter chooses to vote individually for particular candidates it will be necessary to press the several voting buttons for the respective candidates as chosen from their names appearing on the video screen. When the allotted voting buttons for candidates on the projected image have been actuated, the voter then presses the change-image button again to advance the next image for projection onto the video screen and subsequent voting. Each time the change-image button is actuated following a voting image on the video screen the vote of the voter is cast and the selections registered in the machine.

Where the list of candidates appearing on the video screen may contain the name of one for whom the voter does not care to vote the voter may write in the name of a preferred candidate to be substituted. It becomes necessary here to press a write-in button whereupon, through the medium of a suitable mechanism and associated controls, a write-in slot is opened to expose a write-in segment on a paper roll where the voter writes in the name of a substitute candidate. This vote is automatically advanced one turn on the paper roll when the voter again presses the write-in button to close the write-in slot. While the write-in slot is open, the circuits for other voting buttons are deactivated and the counters also are rendered inoperative.

An individual vote cast for a particular candidate may be canceled by pressing a "cancellation" button. This causes the light for the previously actuated voting button to go out while associated elements in the solid state circuitry cancel the vote cast, whereupon a new voting selection can be made by pressing the appropriate voting button.

After all voting selections have been made by the voter, the change-image button is actuated and the next frame containing the next image on the film strip is advanced for projection onto the video screen, the votes cast are registered in the machine and the vote counter is activated.

When a proposition or a referendum is included in an image projected onto the video screen and which requires a yes/no vote the voter utilizes the appropriate yes or no button for registering a desired preference. When these propositions are projected into the video screen all of the voting buttons for candidates are automatically cut out. After voting on the propositions the voter presses the change-image button to advance the next image for projection onto the video screen and at this time the yes or no votes cast are registered.

After all of the images on the film strip have been projected onto the video screen and the voting operation has been completed, the voting machine automatically shuts off when the votes are registered upon last pressing the change-image button and the voter is unable to utilize the machine to vote further. At this time the machine cannot be turned on again by the voter and only an election official can render the voting machine operative again.

In this invention the same light source utilized to project voting images from the film strip onto the video screen also projects light beams through light dots provided in otherwise blacked out areas adjacent to one or more edge portions of each frame or image on the film strip. These light beams are aimed to strike phototransistor units, each of which comprises an electronic type switch that is activated or placed in an "on" position when hit with such beam of light. Where a light dot on the film strip is blacked out the light beam will not pass and therefore the corresponding phototransistor unit will not be activated.

The phototransistor units, as they are activated, are effective to activate the system of voting buttons, check alignment of the film strip, operate the vote counters and identify the type of voting as to whether it may be cumulative, proposition voting or ordinary voting.

Each frame containing an image on the film strip includes a group of light dots for the passage of light beams to corresponding group of photo transistors comprising identification units and one light dot passing a light beam to a corresponding phototransistor comprising an alignment unit. The information from all of these phototransistor units is read by photosensitive logic units. These groups of light dots and phototransistors are disposed in two horizontal rows, as shown. The top row of light dots is for the purpose of operating the proper voting buttons in relation to each film frame and alignment of the film strip. The corresponding top row of phototransistors units activate the system of voting buttons and checks film strip alignment.

The bottom row of light dots on the film strip is for the purpose of operating the identification of the proper counter in relation to each image frame; and to identify the kind of vote, cumulative, proposition, or ordinary, and the alignment of the film strip. The corresponding bottom row of phototransistor units operate proper counters and identifies the vote and also operates the film strip alignment. The phototransistor identification units comprise the bottom row of phototransistors and are disposed in a group of five and a group of three with the five unit group identifying the film strip frame by number and having a capacity of 32 frames while the three unit group identifies the kind of vote.

DESCRIPTION OF PREFERRED EMBODIMENT

As shown in FIG. 1, the voting machine of this inven-

tion includes a console 10 including provisions whereby a voter may perform all authorized voting functions in that precinct in which the voting machine is located. A master locking arrangement is provided on the voting console which is under the control of an election official and includes a key actuated lock 11 for turning the voting machine on and off and a key operated switch 12 to set the machine for use in a primary election where its operation is thereby restricted to voting in a single party. The key, or keys, to the lock 11 and switch 12 is retained at all times by a proper election official in order to control use of the voting machine for authorized purposes only.

VOTING CONSOLE ARRANGEMENT

The console 10 is provided with a video screen 20 upon which images are projected, one after another, showing the various voting options available to the voter and from which the voting choices are made. The images projected onto the screen are changed successively by actuating a change-image button 21 which is pressed to bring the first image onto the video screen and is pressed again each time it is desired to change the image on the screen 20 after making voting selections from each image and each time the change-image button is actuated the vote selections made are registered in the machine.

A series of straight party push buttons 22 is provided on the face of the console located immediately above the video screen 20 and these enable a voter to vote a straight ballot in one party without the necessity for making individual selections of each candidate listed on the screen image. Cross-over votes, however, may be cast for particular candidates by pressing the appropriate pushbuttons provided for selecting individual candidates to be voted. Pressing an individual candidate voting button in an opposing party while straight party voting in the opposite party has the effect of locking out the opposite candidate so that the cross-over voting push button selected would cancel out the opposite candidate button in the straight party so that the casting of opposing votes is prevented. When a straight party voting button 22 is actuated, only the individual candidate buttons in another party can be actuated to cast one or more individual votes, but the voting push buttons for directly opposed candidates in the straight party cannot be actuated.

A "stop" button 18 on the face of the console 10 below the voting buttons is provided to enable the voter to close off the voting operation of the machine after completing a straight party vote without the necessity for any further actuation of the machine. Pressing the stop button 18 after a straight vote has been cast causes the vote to be registered in the machine and shuts down the voting machine so that no further voting can be accomplished until an election official resets the machine for voting by the next voter.

The individual candidate voting push buttons 23 are disposed in a group on the face of the console 10 and are located immediately below the video screen 20. When the voter makes a choice of candidates, selected from the list of candidates appearing in the image projected onto the video screen, the corresponding button 23 is pressed in according to such selection and when pressed, lights up and stays in the in position until the change-image button is pressed to advance the film and change the image, at which time the vote, or votes, cast

are registered in the voting machine. The voter knows exactly how he is voting when he presses one or more voting buttons 23 and this information appears on the screen 20 each time one of the voting buttons is actuated. The projected image on the screen includes a square or box 19 containing an "X" which is etched on the back of the screen adjacent to the name of each candidate listed and when a voting button 23 is pressed this X lights up in the square by means of a light bulb activated by the voting button 23. As best shown in FIG. 5 the X lights up in the box 19 on the screen through the vote light bars 17 at the back side of the screen 20. When voting on a particular image has been completed the voter presses the change-image button 21 which causes the projector apparatus to advance the film to the next image which is projected onto the video screen wherein the voter can then make voting selections from the image.

A "cancellation" button 24 is located on the face of the console 10 below the group of candidate voting buttons 23 and by means of which a vote for a candidate may be cancelled by the voter before such vote is registered in the machine. When this cancellation button is actuated the candidate voting button 23 to be cancelled out returns to the unvoted normal position and the light goes out, whereupon a different candidate selection may be voted. After the substitute voting selection is made and all candidate voting selections are completed, the voters presses the change-image button 21 to advance the next image for projection onto the screen 20 as heretofore described.

At one side of the video screen 20 a group of "yes" or "no" buttons 25 are located on the face of the console 10 for voting on propositions or referendums requiring a yes or a no vote on one or more issues. These buttons are disposed at the side of the video screen in directly correlated relationship to propositions contained in the image projected onto the screen so that the issues being voted upon are readily determined. In addition, each proposition appearing in the projected image includes a pair of boxes or squares 15 containing a "Y" and an "N" respectively which are etched on the back side pressed in the screen 20 in alignment with the respective propositions and when a yes or a no button 25 is pressed in to vote on a proposition, a light bulb for the respective squares activated by the yes or no buttons, respectively, is lighted to indicate exactly how each proposition has been voted.

At the outer side of the group of yes or no buttons 25, provision is made for casting write-in votes in the form of a series of individually movable panels 26 normally closing write-in spaces on a paper record. The individual panels 26 are operable by corresponding push buttons 27 to expose a particular write-in space on the paper record. The write-in panels 26 and the operating push buttons 27 are correspondingly numbered and when the voter encounters a candidate in the image projected onto the screen 20 where it is preferred to substitute a write-in candidate it is necessary merely to press the proper button 27 to make the proper write-in space available to record the vote. When the voter comes to the name of a candidate listed in the image appearing on the screen 20 where it is preferred to vote for a write-in candidate rather than the candidate listed in the screen image, the voter observes the numbered button 27 in horizontal alignment with that candidates voting button 23 and presses this write-in button which

causes the correspondingly numbered write-in panel 26 to open and expose the write-in paper record where the voter writes in the name of the preferred candidate.

When a write-in button 27 is actuated, in addition to opening the panel 26, it also deactivates the row of candidate voting buttons 23 in horizontal alignment therewith so that a vote cannot be cast both by pressing a button 23 and by the write-in vote, but only the write-in vote record will be available and a vote by means of a button 23 in this row will not be registered in the machine. After writing in the name of a preferred candidate on the paper record where the panel 26 is open the voter again actuates the correspondingly numbered button 27 to close the panel 26 over the write-in vote. When voting on this projected image is completed and the vapor presses the change-image button 21 the votes cast by actuation of the buttons 23 are registered in the voting machine and the paper record is advanced one turn on the paper roll provided for that record which is removed from the machine after the election is completed and the paper record evaluated for inclusion of the totals in the election returns. The paper record is disposed in a write-in vote unit removably mounted in the console 10.

The console 10 also includes provision for indicating any malfunction that may occur in the solid state circuitry comprising the operating elements of the machine and should this occur the voting machine is either shut down and repaired or replaced by another machine. Any votes cast and registered in the machine prior to the malfunction may be counted. The malfunction, when one occurs, is clearly indicated by an audible beep through a speaker 36, which operates simultaneously with a blinking red light 37. The projection lamp utilized in the projector apparatus for projecting images onto the video screen 20 as well as the light beams through the film strip onto the phototransistor units, is automatically turned off if a malfunction occurs when the blinking red light becomes operative.

VOTER REGISTRATION CARD SENSING SYSTEM

The voting machine console 10 includes apparatus enabling the voter to render the machine operable and which also has the effect of preventing the voter from utilizing any voting machine other than in the voters own precinct and voting on any proposition or on any candidate other than those where the voter is authorized to vote. This is accomplished by furnishing each registered voter with an identification or registration card which is adapted to be inserted into the sensing device in the console 10 through the slot 39. This registration card contains complete coding related to all taxing bodies encompassing the voter's place of residence including sanitary districts, school districts or the like, and includes the precinct number of the voter for proper identification of the precinct. The card sensing device in the console is programmed to accept and read any combination of code numbers related to taxing bodies within the voter's particular precinct. When a card containing the necessary and proper coding is inserted in the slot 39, this sensing device will read the coding and, if such coding is correct, activate the voting machine. If the registration card is not properly coded for this particular voting machine the machine will remain in the "off" position. Where all of the information coded on the registration card is correct for the particular voting machine, the sensing device will read the

coded information and not only turn the machine on, but also cause the voting machine to bypass such candidates and referendums as the voter may not be authorized to vote, as determined by the precoded information included on the card.

LOWER CONSOLE

The upper console 10 is mounted on a lower console cabinet 42 which is provided with hinged doors 43 shown in the open position. The lower console cabinet contains the equipment for the voting machine including the counter units which in FIG. 1 are indicated generally by the reference character 44. The counters 44, in practice, are mounted in swing-out units for ready access thereto. The various circuits comprising the operating circuitry for the machine are disposed on circuit boards which are mounted behind the counter units 44 in the console cabinet 42. The circuit boards, in practice, are secured in mounting board sockets disposed in socket mounting units which are rendered operative in the system by one or more suitable plug-in connections. Certain circuit boards are similarly mounted in the upper console 10 together with the projector apparatus as well as all of the elements heretofore described in reference to the upper console. The power unit 14 for the machine is located in the upper console 10 and can be seen in FIG. 5.

PROJECTOR SYSTEM

The projector apparatus 48 is shown in the schematic illustration of FIG. 2 and includes a projection lens 50 and a cassette or cartridge 49 containing a film strip 51 (see FIG. 4) containing a plurality of voting images 52 which are projected onto the video screen 20 by means of the projection lamp 13 (see FIG. 6) which is mounted in the projector housing with the film strip between the lamp and the lens 50 so that the light rays from the lamp pass through the film 51 and transmit the image 52 onto the video screen one frame at a time the control of the voting machine circuitry. The projector bulb 13 together with the projector 48, is indicated in the overall diagram of FIG. 6.

This film strip 51, as indicated by the arrows in FIGS. 3 and 4, moves in a downward direction as it advances, one image 52 at a time, for projection onto the screen 20 and when the last image is reached and voting completed, the film reverses and rewinds in preparation for subsequent voting operations. At each completion of a voting operation whether by straight party vote, or by proceeding through all of the several images, the film strip 51 rewinds to provide a new start for the next voter. The film strip 51 contains blacked out areas 53 at the horizontal edge between adjacent images 52 and at a vertical edge 54. Film strip perforations 55 are disposed continuously along the opposite vertical edge of the film. The blacked out areas contain light dots 56 and 57 and which provide for the projection of light beam 59 through the film strip 51 from the projection lamp and the lens 50.

The light beams 59, as best shown in FIGS. 3, strike phototransistor units 60 and 61, as indicated also in FIGS. 2 and 5, where it will be seen that the phototransistor units are disposed in two rows. The upper row of transistor units 61 are utilized to activate the proper voting buttons to be used for a particular image projected onto the screen 20 while the bottom row of phototransistor units 60 are utilized for the purpose of

identifying the proper set of counters in relation to a particular image as well as for the type of voting. FIG. 3 shows the projection of the light beams 59 through the light dots 56 to both the top and bottom phototransistor units. The light emitted through these dots from the projection lamp is projected as a beam onto each of the phototransistor units and by blocking out the light dots so that only certain dots or groups of dots emit light beams, it is possible to operate or exercise control over any number of operations in accordance with the requirements dictated by the use to which the voting machine is to be put.

OPERATION

The general block diagram of FIG. 6 illustrates the overall operations of the voting machine and the total systems afforded by the electronic circuitry included in the machine, as incorporated in the several circuit boards shown in FIGS. 7 through 14 of the drawing and specifically described hereinafter.

The wiring of the various circuit boards used in the voting machine is illustrated in the wiring diagrams of FIGS. 7 through 14 and it is this circuitry that accomplishes the various functions indicated in the use of the machine. On the circuit board 66 of FIG. 7 the latches 62, 63, 64 and 65 are for the purposes of storing vote selections from two rows of vote selection switches 23 and since these switches are polled by each row, the latches 62, 63, 64 and 65 will load or accept the appropriate voting information only when the parallel energizing signal is activated at the proper time in the polling sequence. Timing is provided by the inputs 67 and 68. Output from the latches 62, 63, 64 and 65 goes to the circuit board 70 of FIG. 13 through the groups of lead wires 69 and 71 to illuminate the appropriate vote selection indicators 19. The gates 72 and 73 enable votes to be counted from either the vote selection latches 62 and 63, or from the proposition latches 74 on the circuit board 75 of FIG. 9.

The drivers 76, 77, 78, 79, 80 and 81 drive a solenoid to activate the electro-mechanical counters. For normal voting, drivers 76 and 77 will activate the counters for one row of vote selection buttons 23 and drivers 79 and 80 will similarly activate counters for one row of the buttons. For cumulative voting, drivers 76 and 79 will activate counters corresponding to the contents of latches 62 and 64 respectively, when only one vote is cast. Where two votes are cast drivers 77 and 80 will drive the appropriate counters. When three votes are cast, drivers 78 and 81 will activate the proper counters. To determine the total vote for a particular candidate, the sum of the count on the counters driven by the leads 82, 83 and 84 from one each of the drivers 76, 77 and 78 respectively, will necessitate calculation of these votes by the election judges.

Control of the number of votes cast and including provision to lock out overvoting is generated on the circuit board 85 of FIG. 8. The vote latches 162, 163, 164 and 165 on this circuit board as well as the counter drivers 177, 178, 180 and 181 are substantially identical in operation to the corresponding elements on the circuit board 66, but the drivers 177 and 178 will not be used in cumulative vote operations and will be used only in normal vote selection. As distinguished from the circuit board 66 however, the circuit board 85 incorporates a circuit including logic gates 86 and 87. This circuit is provided for the purpose of counting the

number of cumulative votes cast as well as to provide a cancellation feature which functions when the maximum number of cumulative votes cast on a particular ballot is exceeded. The logic circuit operates by sequentially counting the twelve latches used for cumulative votes, to determine the number of latches that are set. If none of the latches is set, no count will be recorded when the change image button 21 is pressed to advance the next image. If but one vote is cast, this vote is recorded on a different set of counters for single votes. Where three votes may be permitted, such votes are recorded on another set of counters, the proper sets of counters to record the various votes are selected by the decoding logic gates 87 which activate the gates 179, 180, and 181, at the proper time in the sequence. This count is made by sampling each of the twelve cumulative vote latches 162, 163, 164 and 165 in a discrete interval of time and each active latch will advance counters 92 and 93 by one increment. When the maximum vote allows is exceeded, the decoding circuit will reset the vote counters together with all of the associated latches, whereupon a new vote may be cast.

There are two circuit boards 66 in each voting machine and two circuit boards 85, but circuit board 75, illustrated in FIG. 9, contained the latches 74 for proposition votes and the latches 94 for write-in votes and but one of these boards is provided in each voting machine. Output from the proposition latches is utilized to light up the displays 15 on the screen 20 showing how propositions are voted. This output is also used to record the vote count and the counters utilized to record this vote are driven by drivers 76 and 77 on the circuit board 66 of FIG. 7. The regular vote buttons 23 are deactivated during proposition voting so that the counters for these votes are not used otherwise.

The output from the write-in latches is utilized to activate the solenoids 28 that open and close the panels 26 covering the write-in spaces, whereby the voter is enabled to cast a write-in vote on the roll of paper 30 disposed in the removable write-in vote unit 29, as indicated in FIG. 5. The output from the write-in latches is used also to deactivate the regular voting buttons 23 as well as the cumulative voting. Gates 95 are utilized to block cumulative voting while gate 96 blocks regular voting by deactivating the "set" lead of the appropriate vote latch. The deactivation of these vote latches is performed sequentially just as is the normal setting of each of the latches, and the setting and resetting of all of the vote latches of the several circuit boards 66, 85 and 75 is performed by the gates 97, 98; 176, 177, and 101 respectively.

Gate 97 serves to activate the reset/set sequence if any button on the voting panel is depressed and this sequence is activated in synchronism with the polling sequence that is used to sample the voting buttons, row by row. This polling procedure is described more in detail hereinafter in relation to circuit board 105 illustrated in FIG. 11. The reset/set sequence is activated only when one voting button in each row is depressed and gates 98, 73, 99, 76 and 77 on panel 66, will deactivate the sequence if more than one button is depressed in the same row so that multiple voting selections are thereby prevented where only one vote is permitted. Circuit board 105, includes provision for the timing for the reset/set sequence. A memory circuit for the solenoid 28 opening and closing the write-in panels, is provided by the gates 86, 88 and 178 on panel 85 and to

control the paper drive mechanism. It is this circuit that makes certain that the paper 30 for the write-in votes is advanced one increment when a write-in vote has been cast.

There is but one circuit board 100 in the voting machine and it is this circuitry that serves to check the image photo-transistor information for accuracy and also provides for the decoding of this information. The accuracy of the image phototransistor information is checked four ways:

1. Two of the phototransistor units are utilized as alignment units to insure proper positioning of the film image
2. Parity check for the upper row of phototransistors
3. Parity check for the lower row of phototransistors
4. Comparison of image counter output with three units of image number encoded on the film.

All of these checks must be satisfied prior to the triggering of a two-second timer and in the event that the film should become jammed, or stop without the alignment units in proper position, or if the projector bulb should burn out, this insures that the alarm 36, 37 indicate a malfunction.

The gates 102 in this circuitry convert the signals emanating from the phototransistor units 60 and 61 to the proper logic level of 0 to 5V. The gates 103 and 104 serve the purpose of checking the parity of each of the two rows of phototransistor units. The gate 106 compares the image identification count and the count contained in the image count register 107. The leads 111 through 118 are used to determine the column of vote switches that should be actuated so that they will be available for possible actuation if selected. Transistor drivers utilized for the purpose of supplying the current necessary to illuminate the appropriate columns of light emitting diodes in the vote selection switches.

The group of gates 108 acts to decode signals from phototransistor leads 121 and 122 into four major political parties, Republican, Democrat, etc., while the group of gates 109 decodes signals from phototransistor leads 123 and 124 as follows:

1. Proposition vote
2. Cumulative vote
3. Cumulative vote with a maximum of two selections
4. Cumulative vote with a maximum of three selections and also activates the circuit to make the party ticket selections available. The counter 107 contains the number of the image being shown and gate 119 indicates the image that should be automatically advanced one or more increments.

The voting machine contains one circuit board 105, which is illustrated in FIG. 11, and the primary purpose of this circuit board is to sample the switches. A basic clock signal is provided in the circuit by means of an astable multivibrator 125. A counter 126 counts from zero to ten and then resets and this count is decoded at 127 into selected one-of-ten signals and one of such signals is stepped through to activate each row of vote switches 23 whereby a latch is activated in the appropriate interval.

The gates 128 drive the center pole of each vote switch in a row, and there are eleven rows of such switches, eight rows of regular vote switches, one row of write-in vote switches, one row of proposition vote switches and one row of straight party ticket vote switches. The buffer latches 129 act temporarily to store the signal as to the status of the positions of the

switches in each row. Buffer latches 130 store the signal with respect to straight party ticket selection, if any. The gates 131 and 132 make the choice as to whether to present the straight party ticket or the regular vote to the vote selection latches on the circuit boards 66, 85, and 75. The gates 133 make certain that only applicable voting switches will be able to register a voting selection. The drive to illuminate the straight party ticket buttons 22 is provided by drivers 134 when that selection is available and if a straight party vote is cast the illumination of the selection will continue throughout this voting procedure. The shape of the reset/set sequence pulse, which is used extensively to load latches on the circuit boards 66, 85 and 75, is determined at 135.

The circuit board 110 is used one to each voting machine and incorporates decoders 136 which utilize the count of the image counter to drive the appropriate vote counter plane. Discrete transistor drivers are utilized to increase the current drive capability of the decoders 136. The gates 137 deactivate the vote counter plane drivers until the appropriate timing pulse activates the drivers. A request for a new image is made at 138 while resetting of the voting machine is accomplished through the output line 139. This reset circuit is activated when the power is turned on and again when the entire voting procedure has been completed. The three latches 140 are utilized respectively by the stop button 18, the change image button 21 and by the election judges locking circuit 11.

The circuit board 70, one in each voting machine, is utilized solely for the purpose of converting voting selection signals from the logic level low current of 0 to 5V to high current capability leads at 30V and 300Ma, that are capable of triggering the electromechanical counters.

Circuit board 120 comprises the timing circuits for the machine and the various timing operations and pulses are as follows:

FCN	Time	Gate	Output
Counter drive timer	50 msce	141	142
Paper drive timer		143	144
Projector increment timer	500-800 msce	145	146 148
Image approval delay	200 msce	147	
Party ticket activator	10 msce	149	150
Automatic increment timer	1 msce	151	152

The relays 153 and 154 are utilized to drive the projector 48.

From the foregoing it will be seen that an electronic voting machine has been provided utilizing a film strip for projecting individual images onto the video screen from a source of light which also sends light beams through light sensitive areas of the film to phototransistor units which transmit photo-optical signals through the various circuitry to perform all of the functions involved in the voting machines operation.

What is claimed is:

1. An electronic voting machine including a video screen containing a light projected image, light means projecting said image from a transparency onto said screen, voting elements operatively mounted in the machine, and means activated by light beams from said light means disposed in the path of said light beams between said light means and said video screen and enabling said voting elements to operate.

2. An electronic voting machine as set forth in claim 1 wherein said means activated by light beams comprises a plurality of phototransistor units.

3. An electronic voting machine as set forth in claim 2 including a plurality of voting buttons operative to effect a vote when said phototransistor units activate said voting elements upon actuation of said voting buttons.

4. An electronic voting machine as set forth in claim 2 including a film strip from which said light projected image is projected onto said video screen, said film having a blacked out area containing light dots, and said light projecting means projects light beams through said light dots onto said phototransistor units.

5. An electronic voting machine as set forth in claim 4 wherein said photo transistor units are disposed in two or more groups, and said groups of photo transistor units include means to effect activation of said voting elements, alignment of said film strip and identification of voting categories for cumulative, proposition and ordinary voting.

6. An electronic voting machine as set forth in claim 4 wherein said blacked out area is disposed adjacent to an edge of an image on the film strip, and said phototransistor units are disposed in alignment with light dots located in said blacked out area of the film strip.

7. An electronic voting machine as set forth in claim 4 wherein said film strip includes a plurality of images projected successively onto said video screen, an electronic circuitry, said light beams activating said phototransistor units in said circuitry in accordance with vote selections made from each of said images, and means including a plurality of voting buttons operable in said circuitry to make said vote selections.

8. An electronic voting machine as set forth in claim 4 wherein said light dots include a series of such dots to project light beams onto phototransistor units to control operation of voting buttons and alignment of said film strip, and a series of such light dots directing light beams onto phototransistor units to control operation of vote counters and identify voting categories and alignment of said film strip.

9. An electronic voting machine as set forth in claim 4 including a plurality of voting buttons and a logic unit, certain of said phototransistor units feeding information to said logic unit, and a counter unit, said logic unit transmitting information to said voting buttons and to said counter unit.

10. An electronic voting machine as set in claim 9 including a second logic unit and a projector, certain of said phototransistor units feeding information to said second logic unit, and said second logic unit transmitting information to said projector and to said counter unit.

11. An electronic voting machine as set forth in claim 1 wherein said means activated by light beams is disposed adjacent to said video screen.

12. An electronic voting machine as set forth in claim 11 wherein said means adjacent to said video screen is located at the back side of the video screen.

13. An electronic voting machine as set forth in claim 4 wherein said light dots are disposed adjacent to an edge of said film strip and said phototransistor units are aligned with respective light beams from said light dots.

14. An electronic voting machine as set forth in claim 8 wherein said light dots include a row of light dots which activate phototransistor units which control voting buttons, and a row of light dots which activate phototransistor units which control operation of vote counters.

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15. An electronic voting machine as set forth in claim 1 wherein said means activated by light beams comprise light sensitive electronic switches actuated by said light beams.

16. An electronic voting machine as set forth in claim 15 including a film transparency having a blackedout area with light dots in said area and said light beams are

projected through said dots.

17. An electronic voting machine as set forth in claim 3 wherein said phototransistor units feed information to logic units which transmit the information to said voting buttons and said light means.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,793,505 Dated February 19, 1974

Inventor(s) Richard H. Mckay et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 18, after the word "with add --means to record and accumulate votes, they have not provided a film--;

Column 1, line 33, "e ectromechanical" should be electro-mechanical--;

Column 1, line 37, "electron" should be --election--;

Column 2, line 24, "identifying" should be --identify--;

Column 2, line 31, "alighed" should be --aligned--;

Column 3, line 58, delete the word "locking";

Column 3, line 68, "case" should be --cast--;

Column 5, lines 2 & 3, "requies" should be --requires--;

Column 5, line 5, "into" should be --onto--;

Column 5, line 25, "beans" should be --beams--;

Column 5, line 61, "goup" should be --group--;

Column 5, line 63, "capacility" should be --capability--;

Column 6, line 48, "fact" should be --face--;

Column 6, line 59, "fact" should be --face--;

Column 6, line 66, "ans" should be --and--;

PO-1050
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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,793,505 Dated February 19, 1974

Inventor(s) Richard H. McKay et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 7, line 10, "coting" should be --voting--;

Column 7, line 17, "wherein" should be --whereupon--;

Column 8, line 16, "vapor" should be --voter--;

Column 9, line 39, add --under-- afet the word time;

Column 10, line 42, "activat" should be --activate--;

Column 10, line 47, "drovers" should be --drivers--;

Column 10, line 68, "cirucit" should be circuit--;

Column 11, line 20, "allows" should be --allowed--;

Column 11, line 25, "containd" should be --contains--;

Column 11, line 53, "seuquence" should be --sequence

Column 12, line 22, "37 indicate" should be --37 will indicate--

Column 12, line 32, "actuvated" should be --activated--;

Column 12, line 33, "available fo" should be -- available for --

In the Claims:

Column 14, line 26, "scre" should be --screen--;

Column 14, line 46, "as set in claim" should be --as set forth in claim--;

PO-1050
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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,793,505 Dated February 19, 1974

Inventor(s) Richard H. McKay et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 14, line 63, "caim" should be --claim--.

Signed and sealed this 17th day of September 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents