United States Patent [19]

O'Neal et al.

[11] **3,881,092**

[45] **Apr. 29, 1975**

[54] **VOTING MACHINE**

[76] Inventors: **Cothburn M. O'Neal,** 2511 Wedglea Dr., Dallas, Tex. 75211; **Alfred M. Mayo,** 11125 Ridgemeadow Dr., Dallas, Tex. 75218; **George William Childs, deceased,** late of Dallas, Tex.; **by Patricia M. Childs, executrix,** 4216 Calculus Rd., Dallas, Tex. 75234

[22] Filed: **May 28, 1974**

[21] Appl. No.: **473,921**

Related U.S. Application Data

[62] Division of Ser. No. 309,174, Nov. 24, 1972.

[52] **U.S. Cl.** ..... **235/54 R;** 235/51; 235/54 C

[51] **Int. Cl.** **G07c 13/00**

[58] **Field of Search** ..... 235/54 R, 54 A, 51, 54 C

[56] **References Cited**

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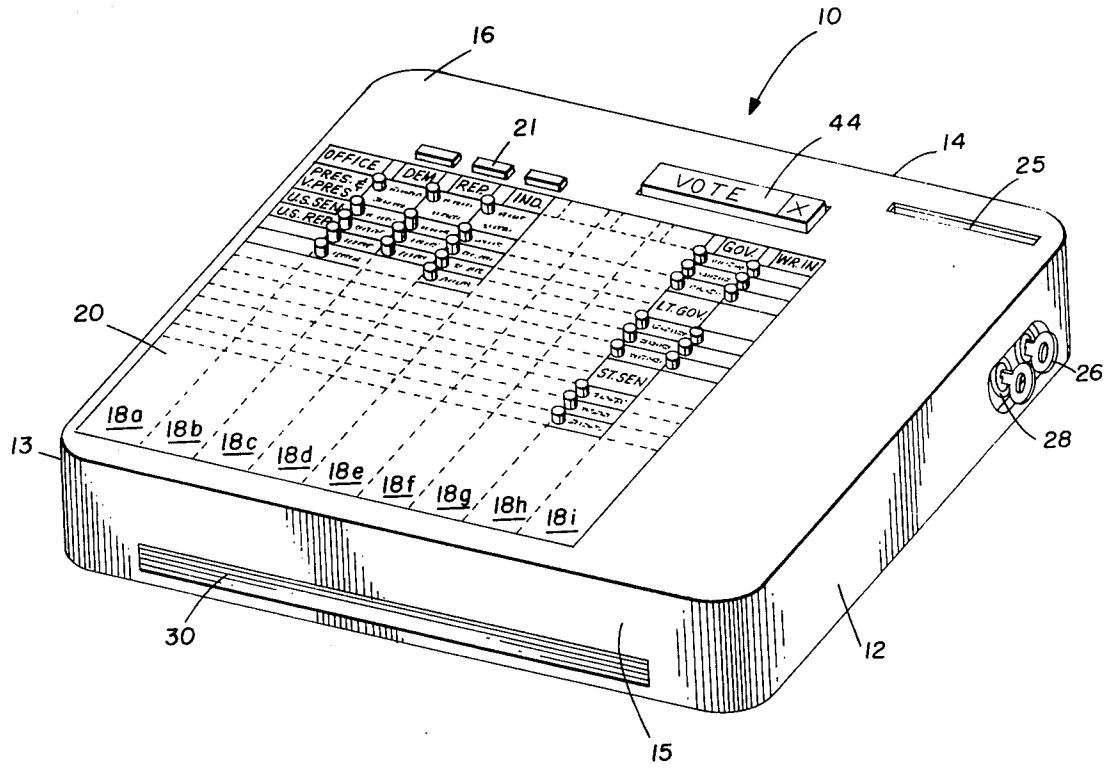
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Primary Examiner—Stephen J. Tomsky
Attorney, Agent, or Firm—Hubbard, Thurman, Turner & Tucker

[57] **ABSTRACT**

A compact, versatile voting machine is disclosed having adaptability for use with various vote registering devices such as tally counters and punch card apparatus. The voting machine includes a selector mechanism having a series of parallel columns housing voter operated key slides. A vertical interlock mechanism includes ball housing blocks which are alternately disposed between the key slides and house displaceable interlock balls in a tool line. The cam blocks are adjustable to limit the effective length of the tool line to establish groupings of candidates from which a single selection can be made. A magazine at the top of each column is adjustable to permit multiple selections from a grouping. Actuation of a key cams the interlock balls into the tool line, and when a predetermined number of voter selections have been made no additional keys can be actuated as they are blocked by the tool line. A row of adjacent horizontal keys can also be interlocked to established selection groups as typically found on a general election ballot. A bar is moveable to horizontally interlock adjacent columns by introducing locking pins into a position to be cammed by actuation of a key. A drive mechanism associated with each column permits the voter to vote straight party and clears the machine to ready it for another voter. The drive mechanism includes cam controlled clutches that operate four-bar linkage elements to depress or return the key slides. A judge controlled mechanism locks the machine between voters. For various voting requirements, judge operated cam arrangements are cooperable with the horizontal locking pins and the four-bar linkage to selectively lock out partial or entire columns or rows of key slides. The key slides are provided with a voter viewable button that registers a visible, luminescent X when a key is voted.

13 Claims, 37 Drawing Figures



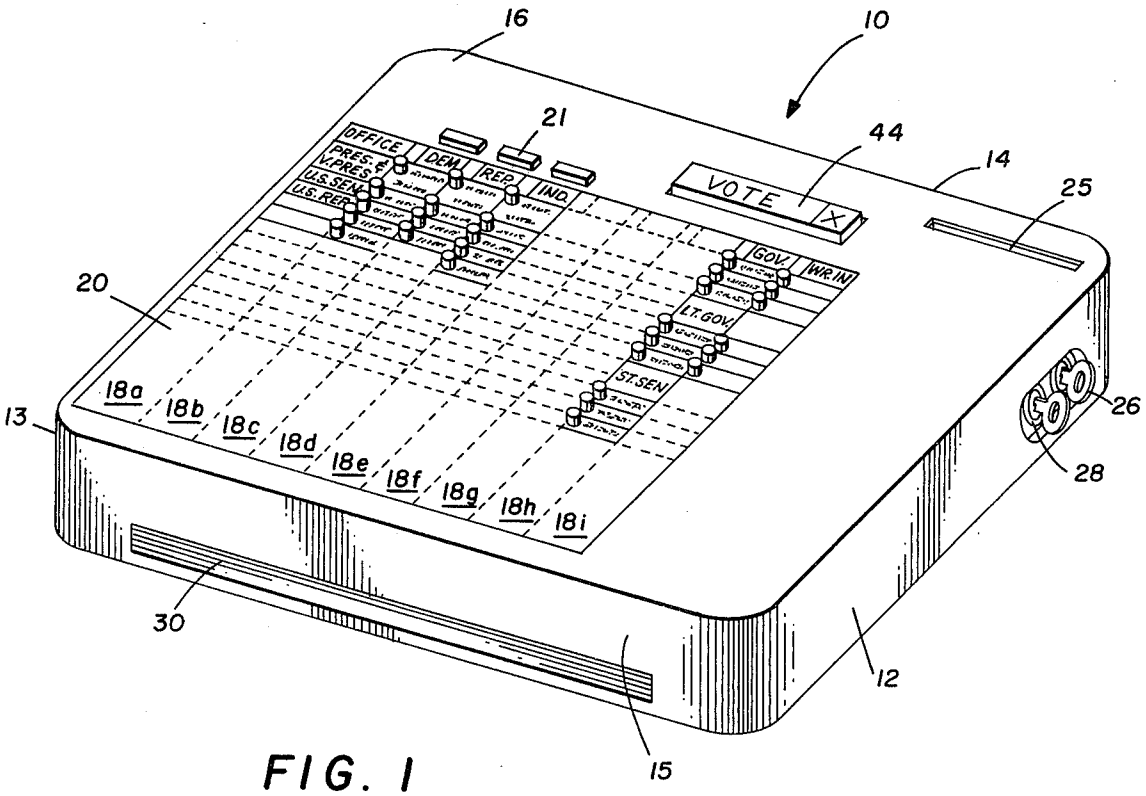

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FIG. 1

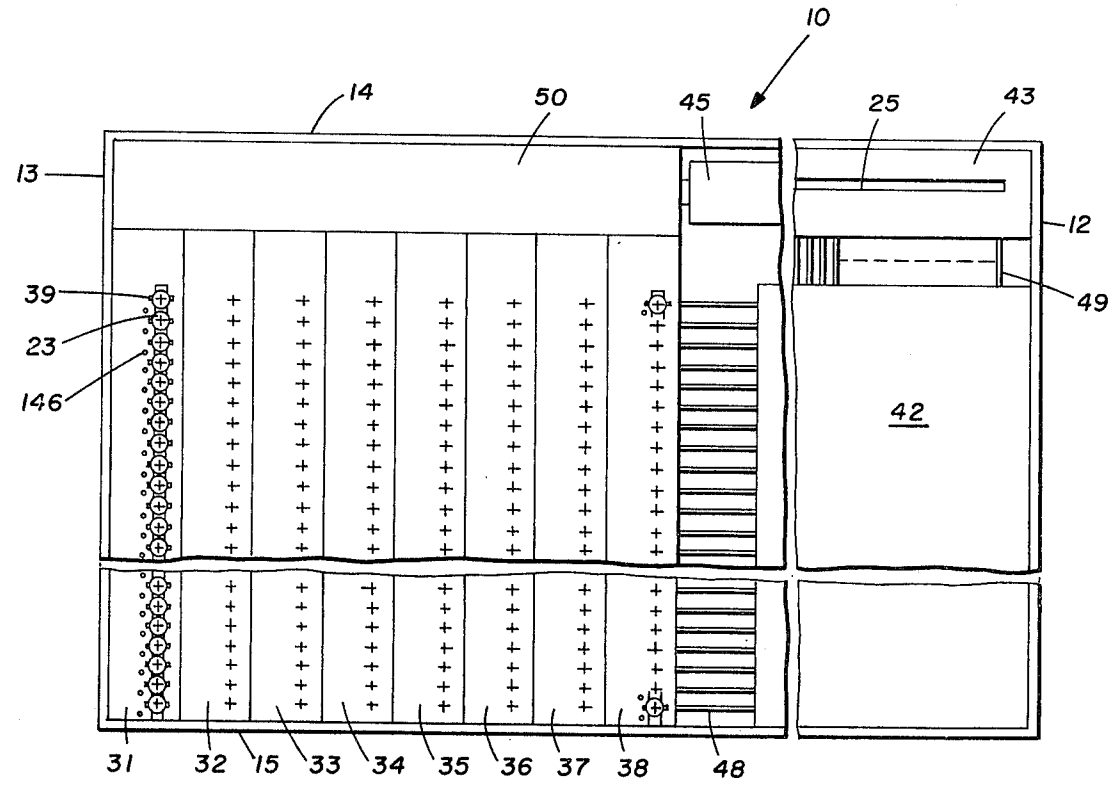

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FIG. 2

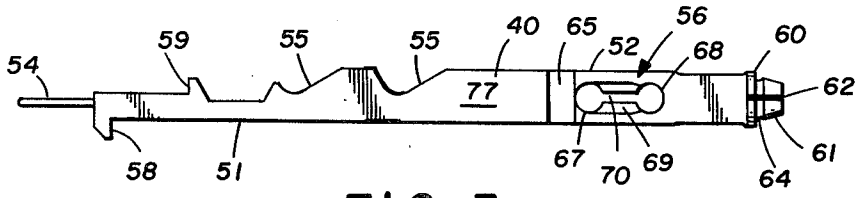


FIG. 3

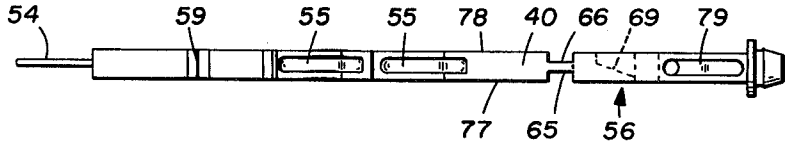


FIG. 4

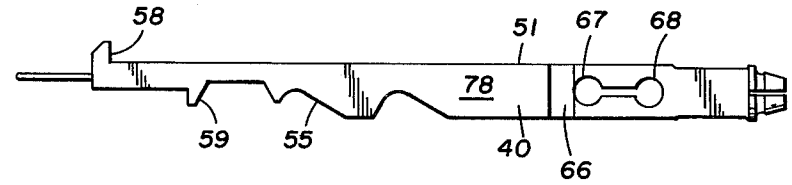


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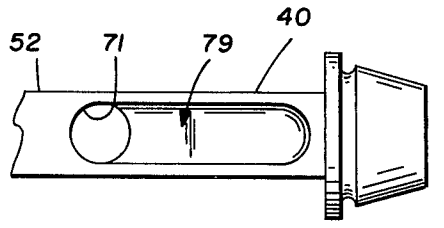


FIG. 6

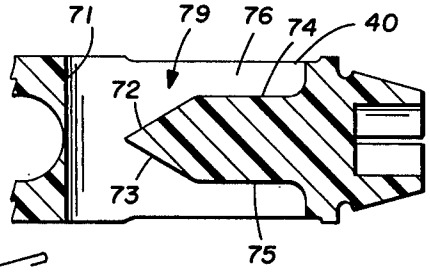


FIG. 7

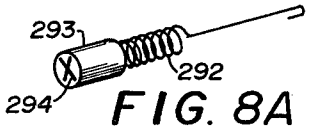


FIG. 8A

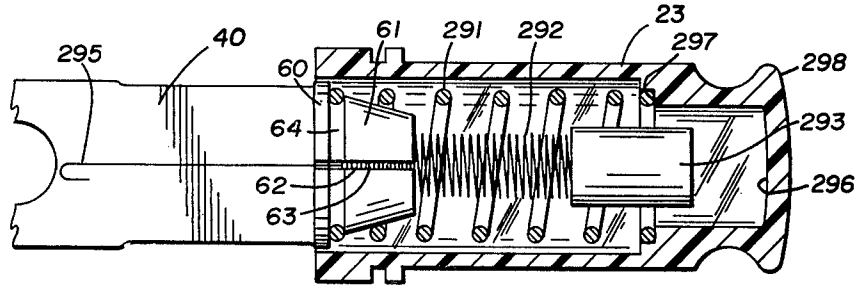


FIG. 8

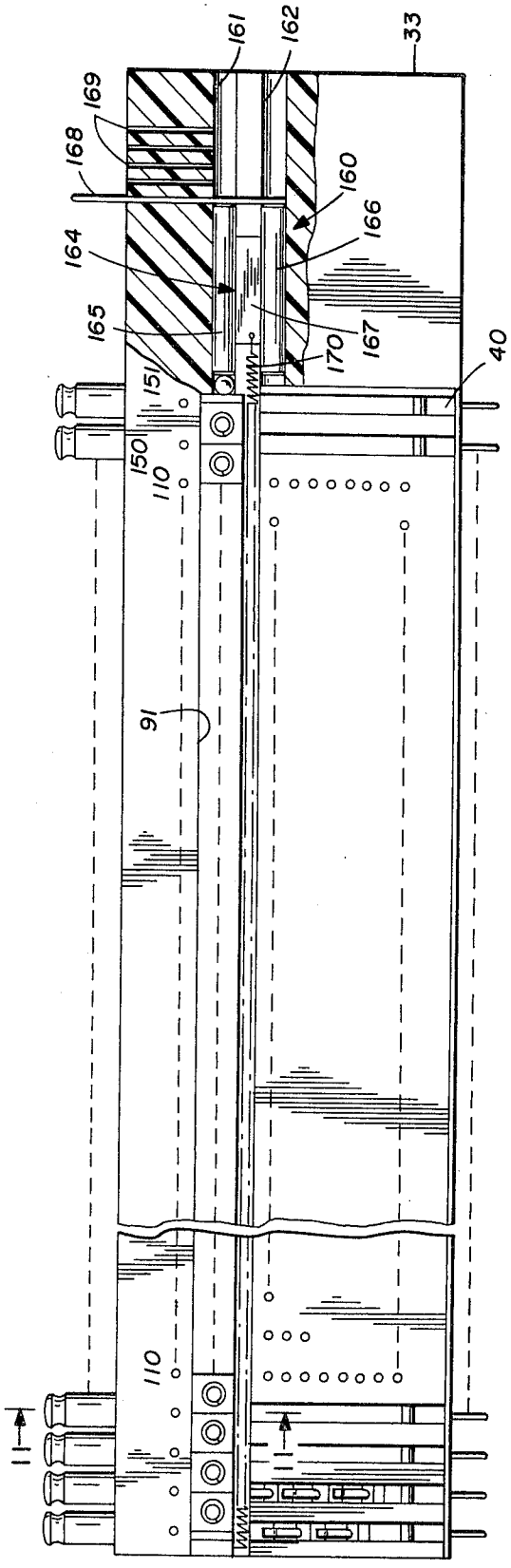

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FIG. 9

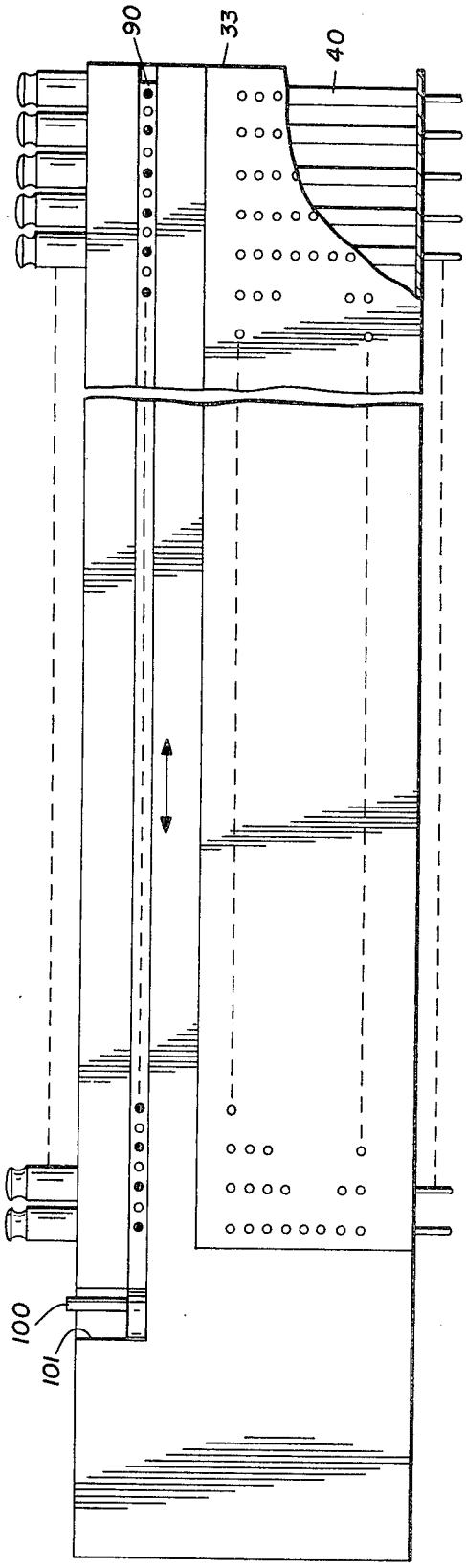

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FIG. 10

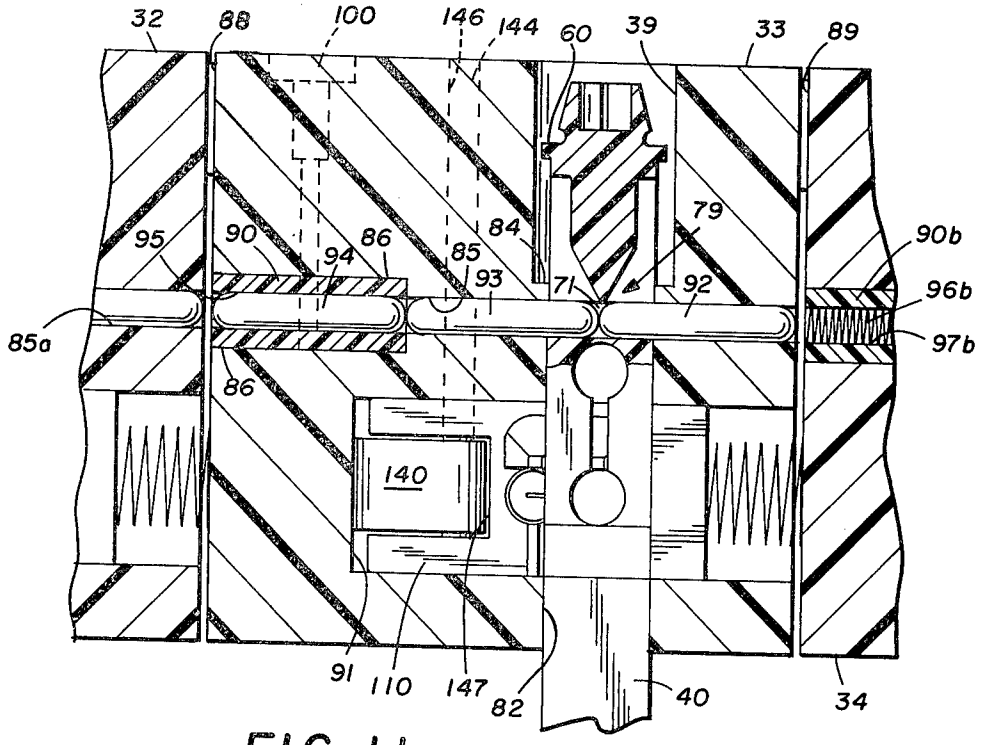


FIG. 11

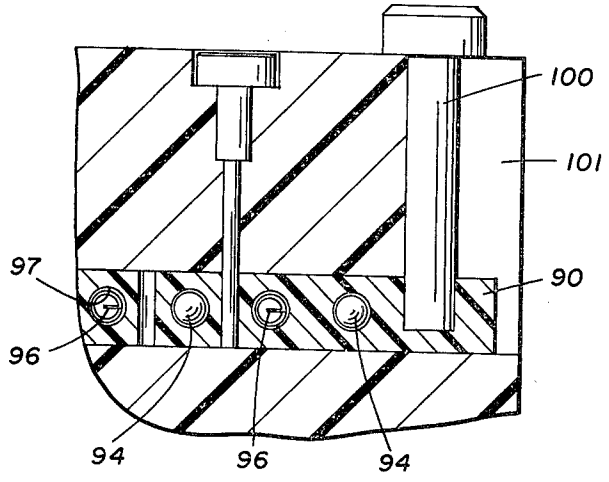


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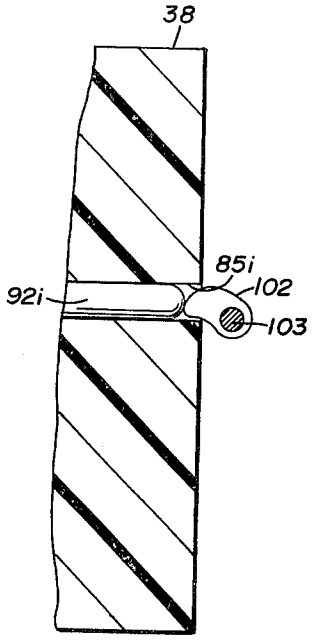


FIG. 13

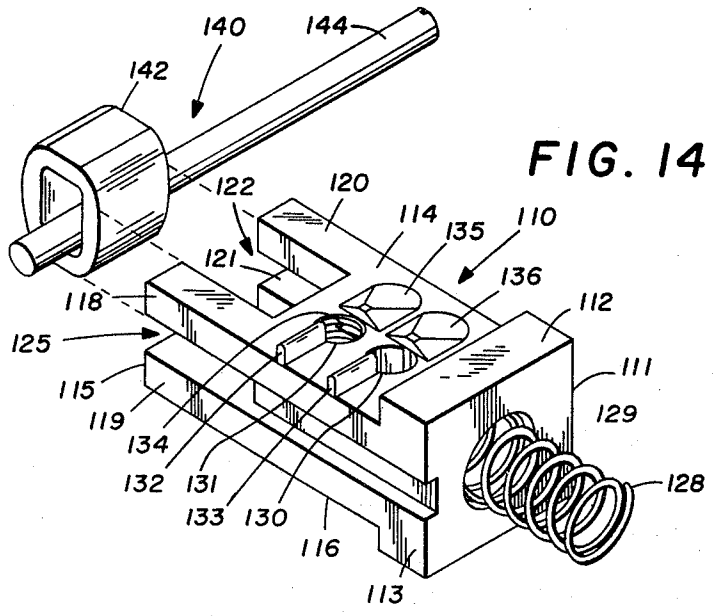


FIG. 14

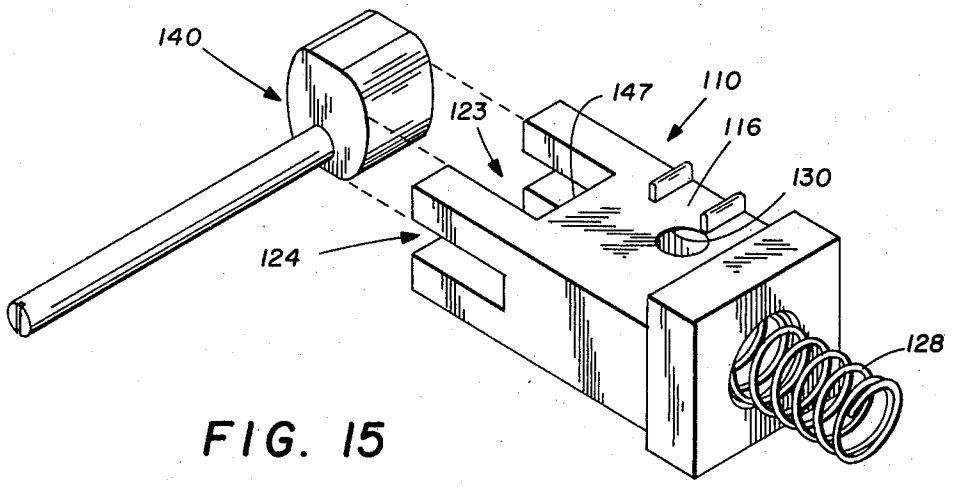


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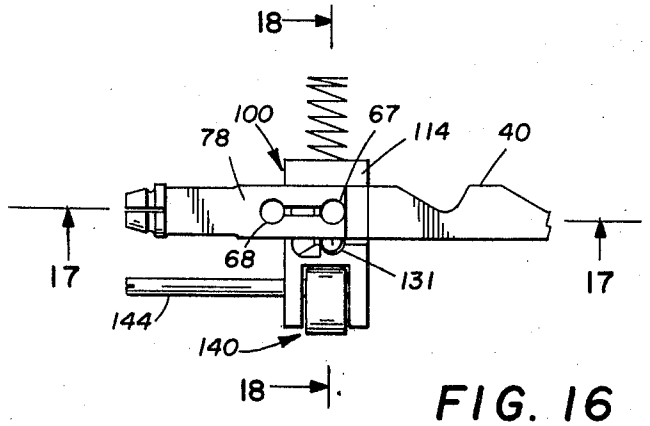


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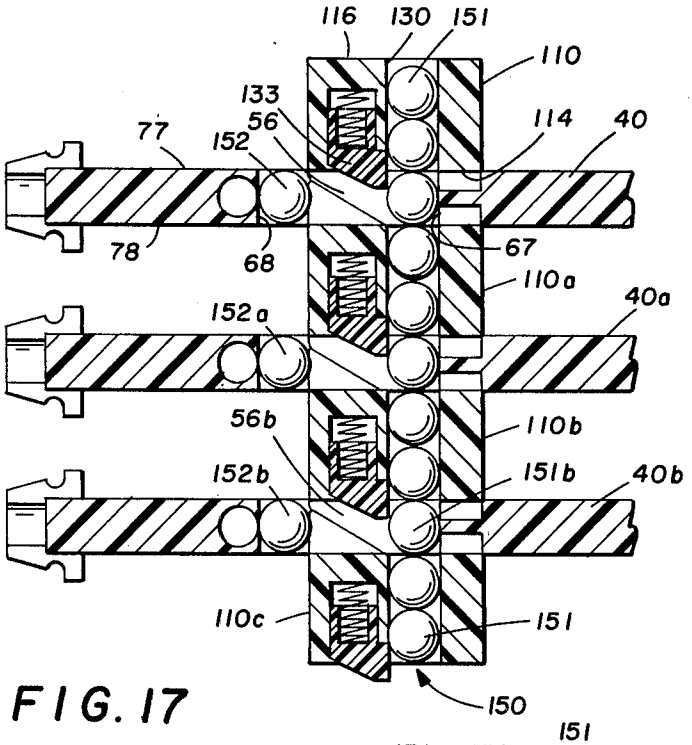

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FIG. 17

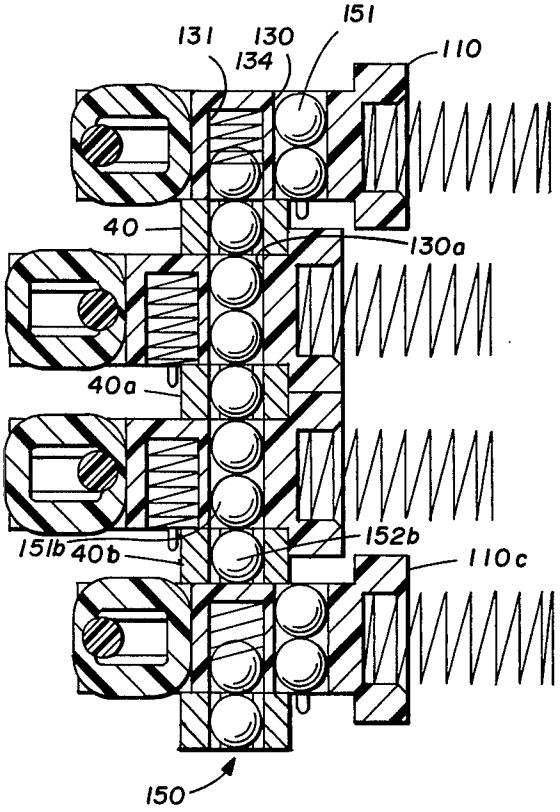
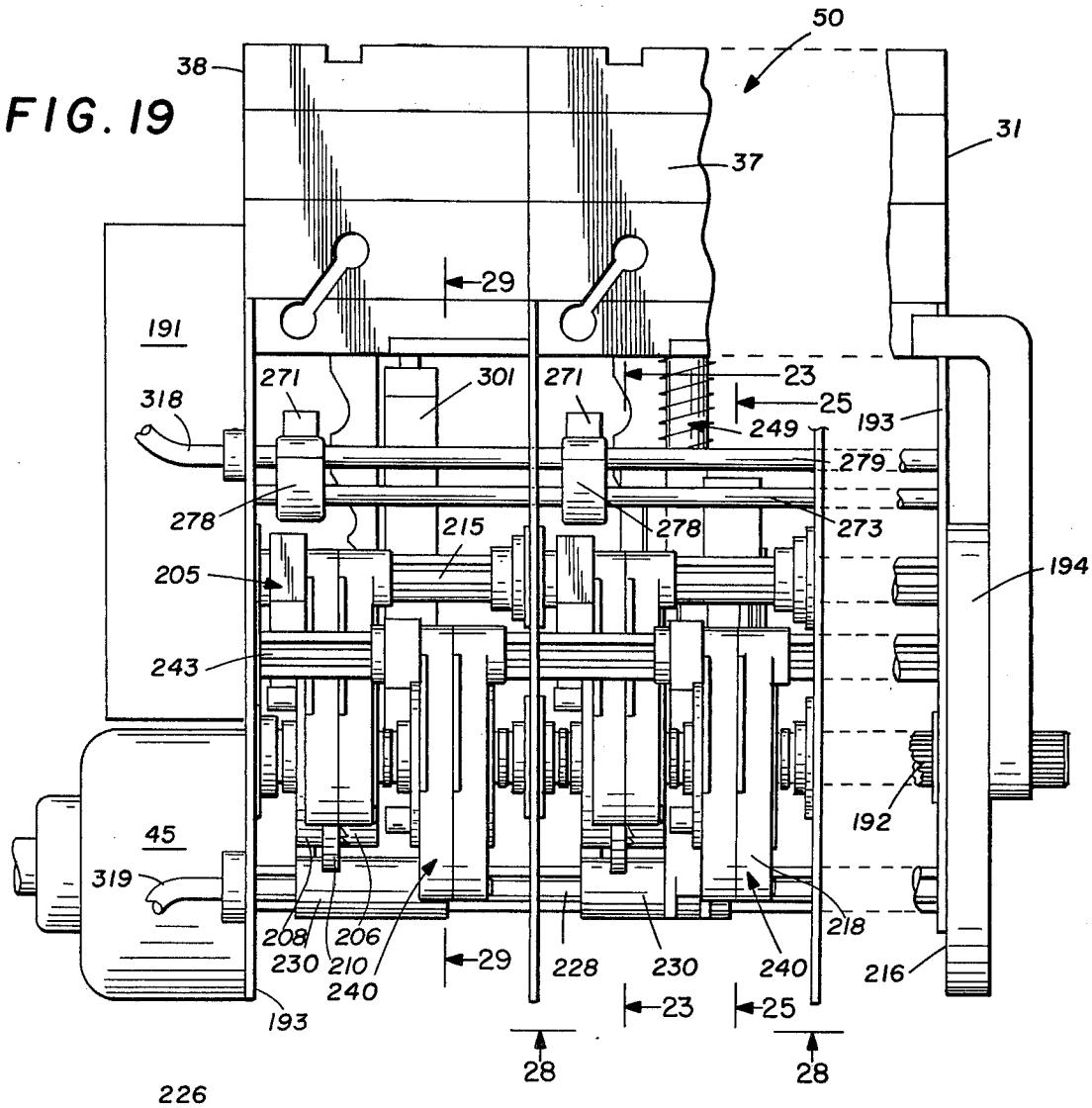

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FIG. 18

FIG. 19



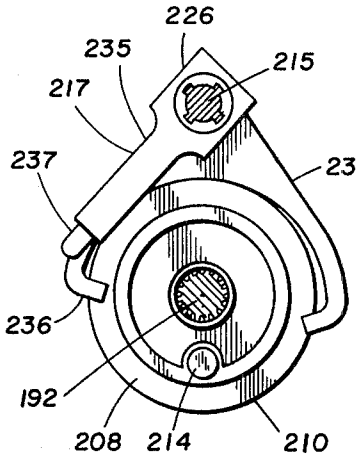


FIG. 20

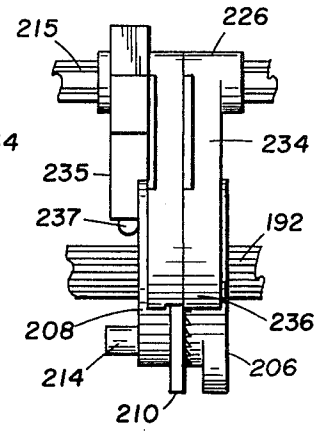


FIG. 21

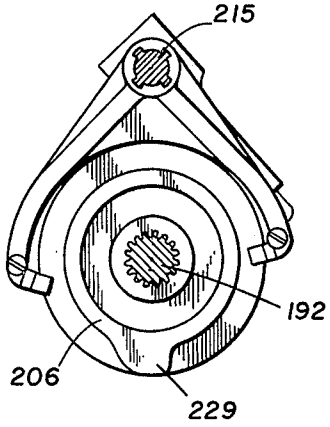


FIG. 22

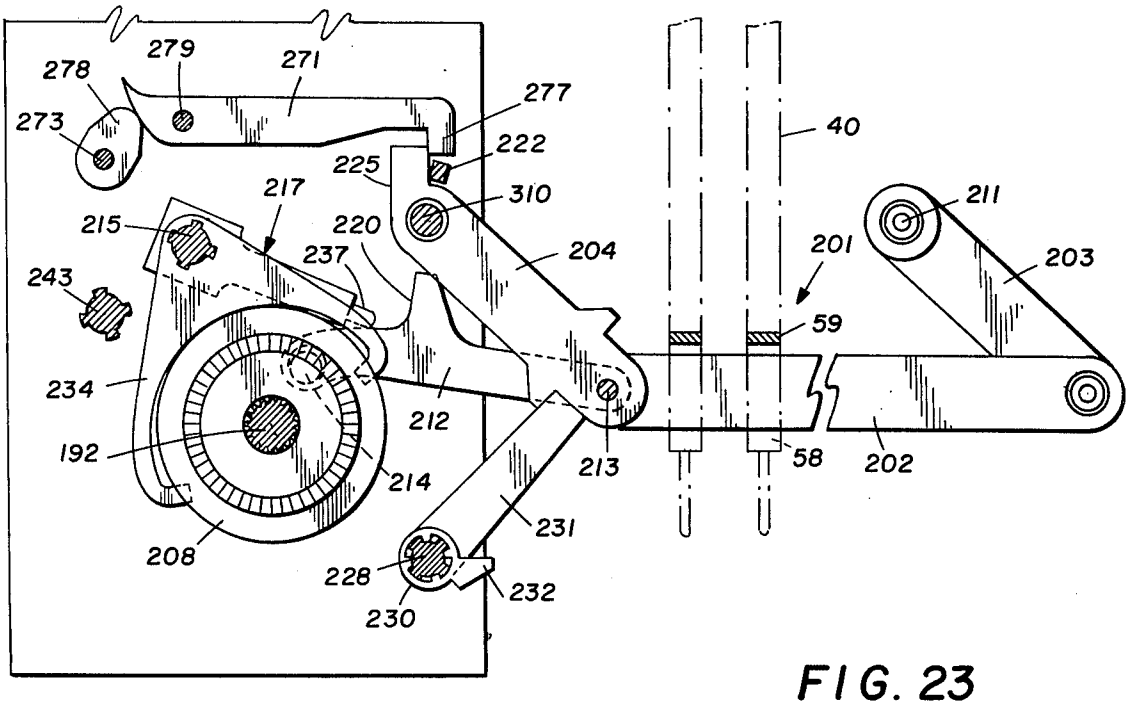

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FIG. 23

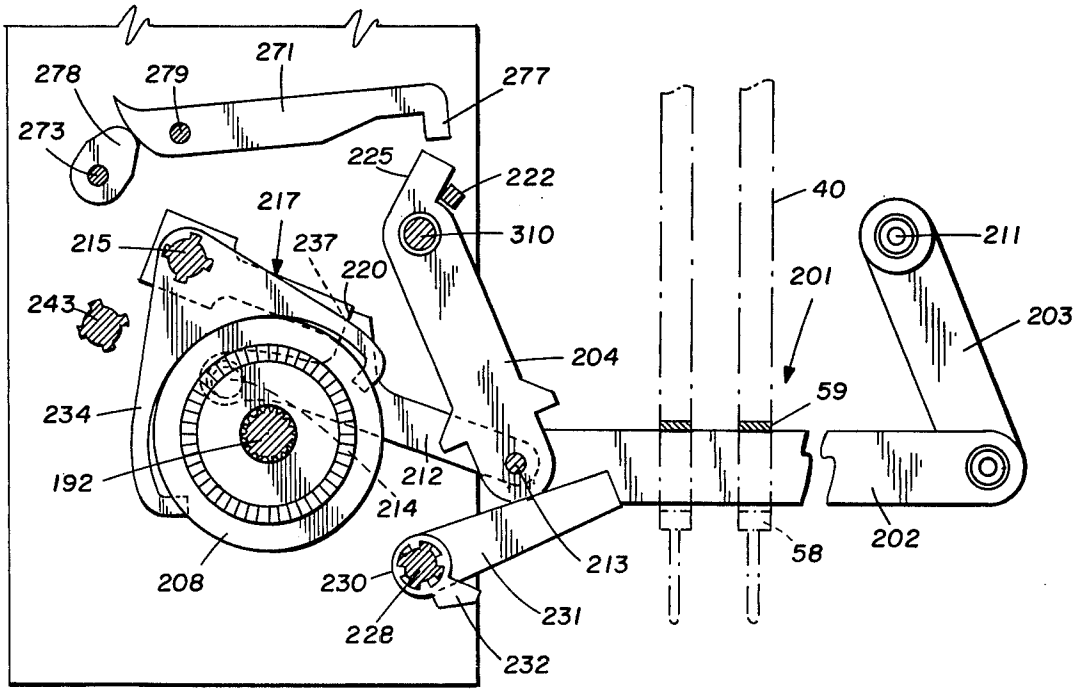

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FIG. 24

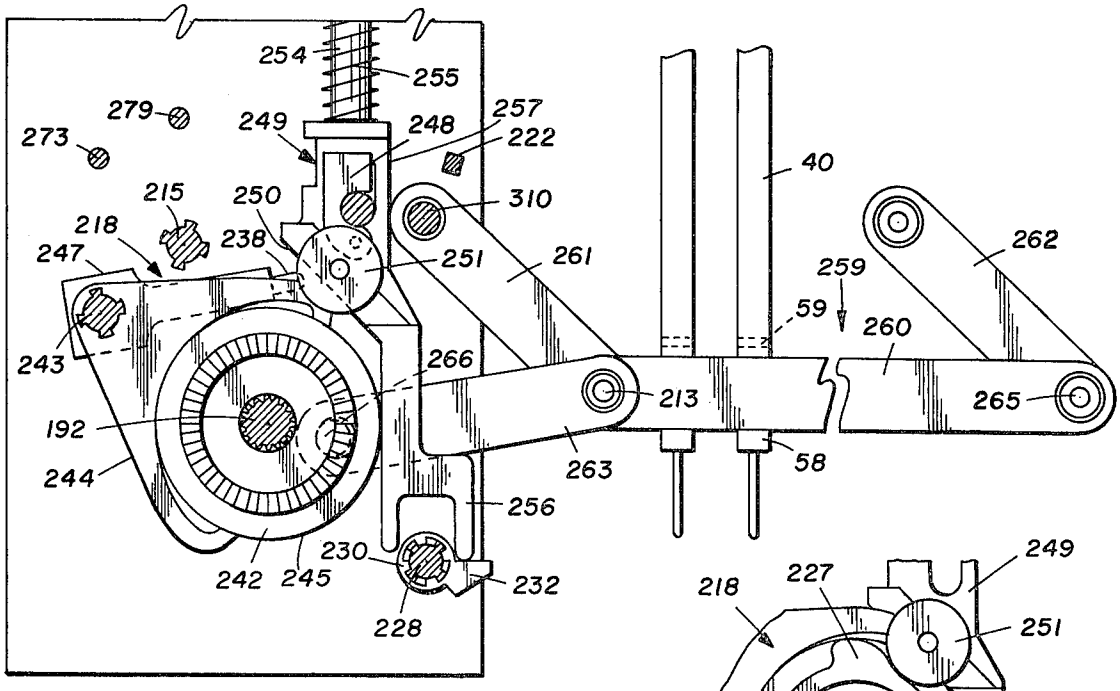


FIG. 25

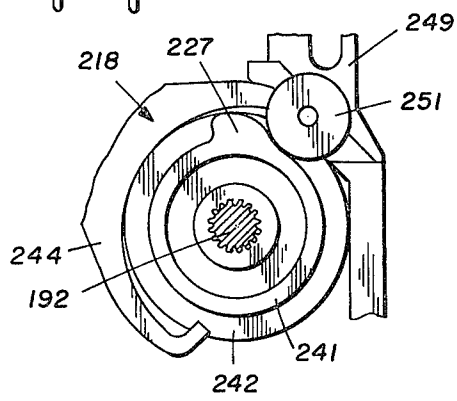


FIG. 27

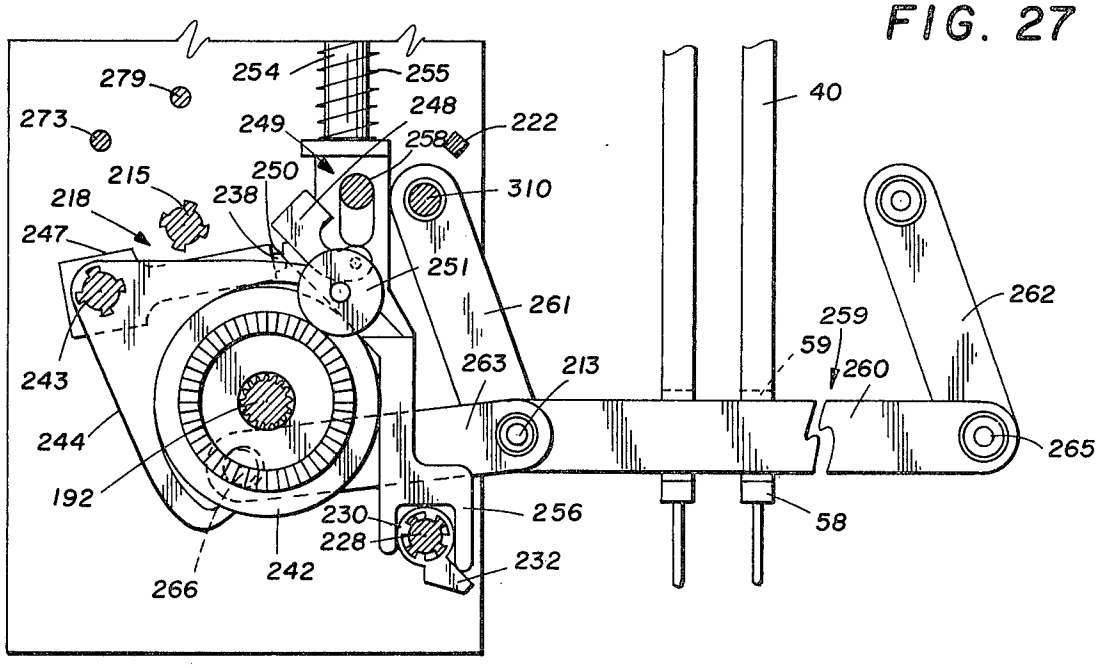


FIG. 26

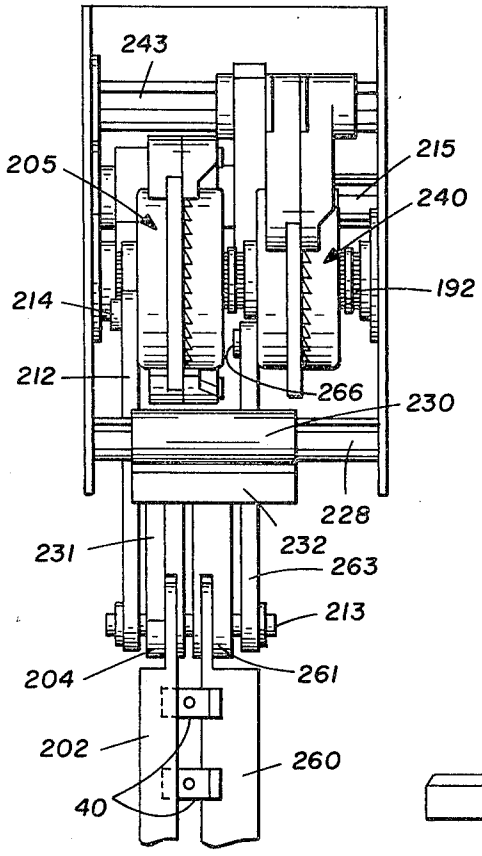


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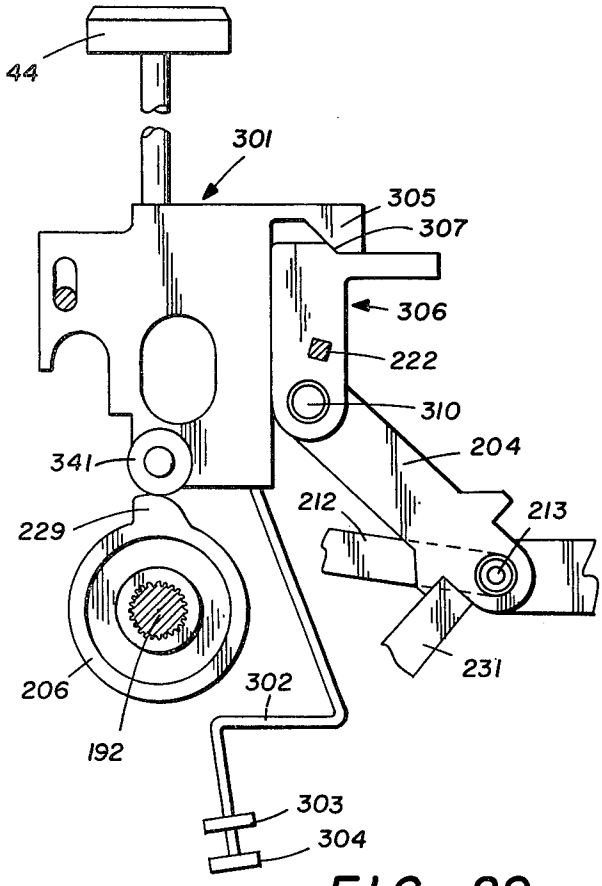


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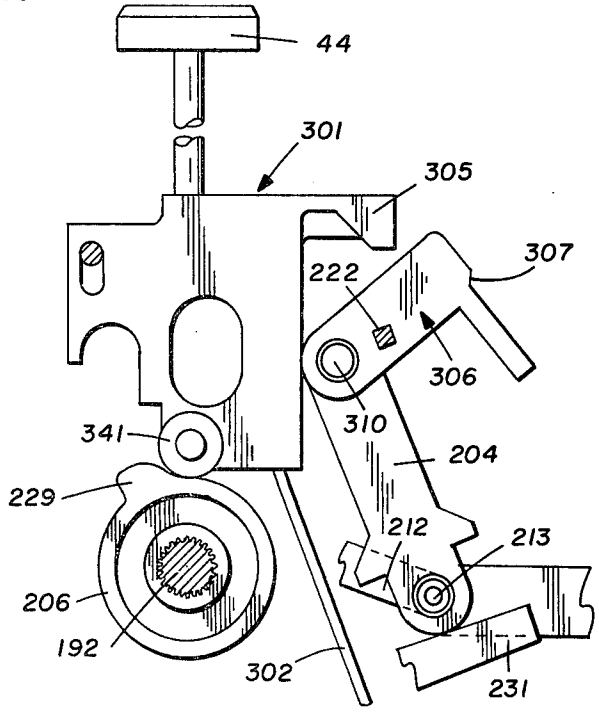


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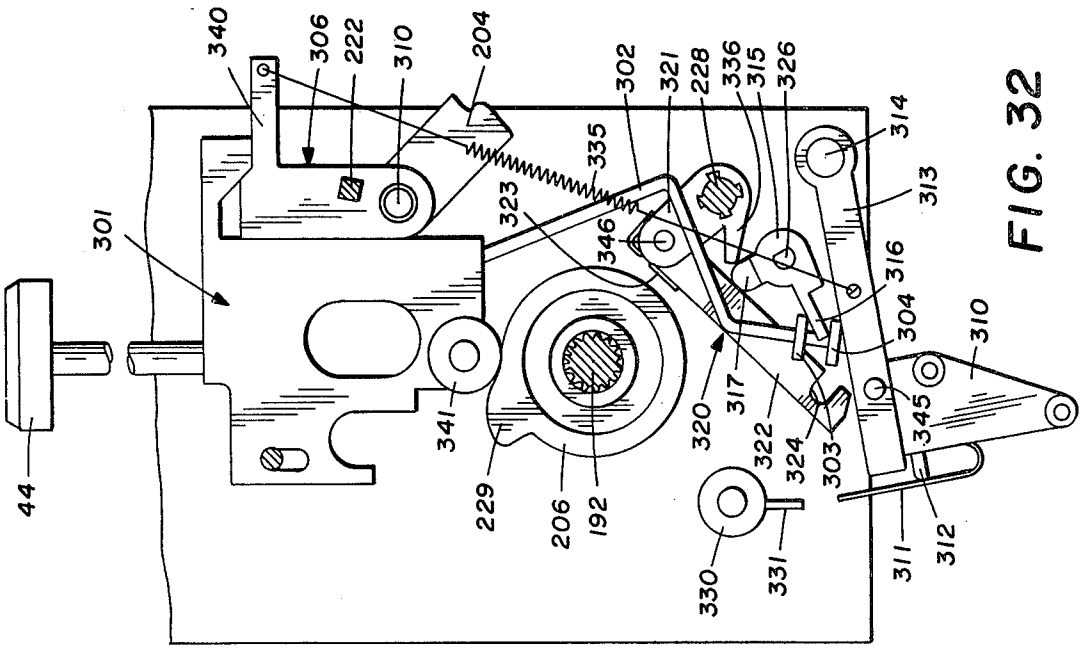

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FIG. 32

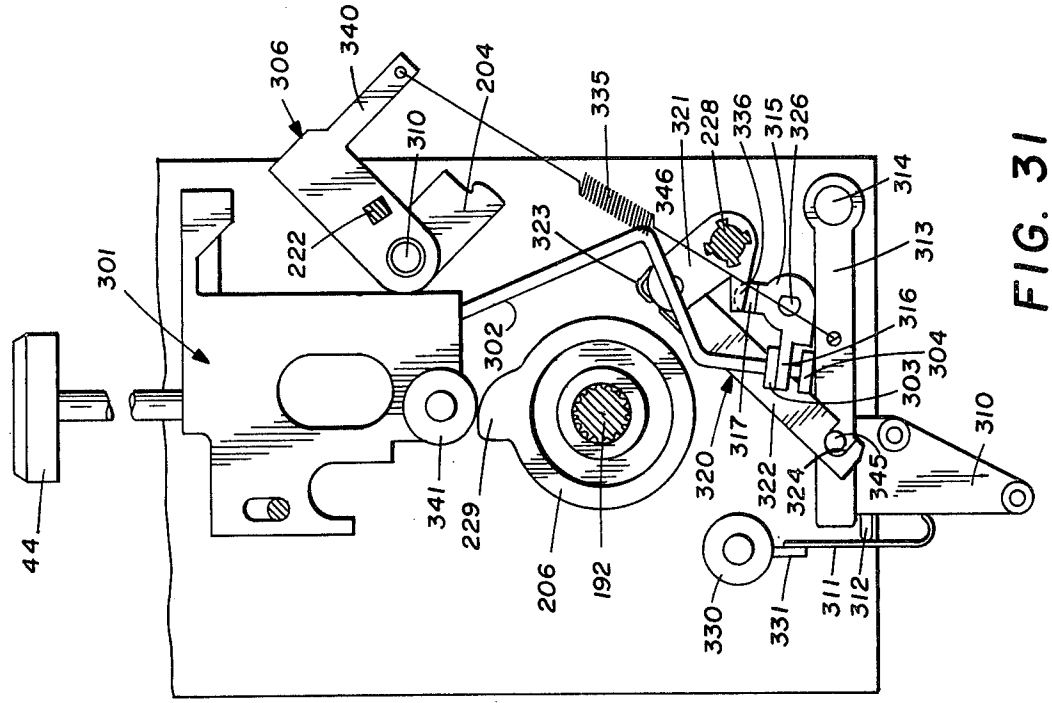

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FIG. 31

FIG. 34

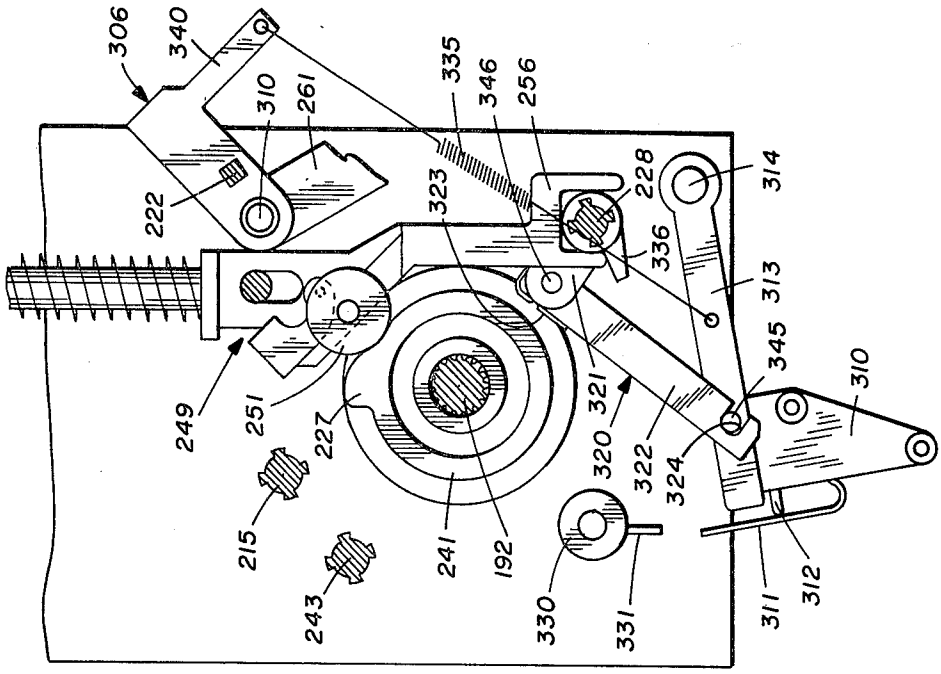
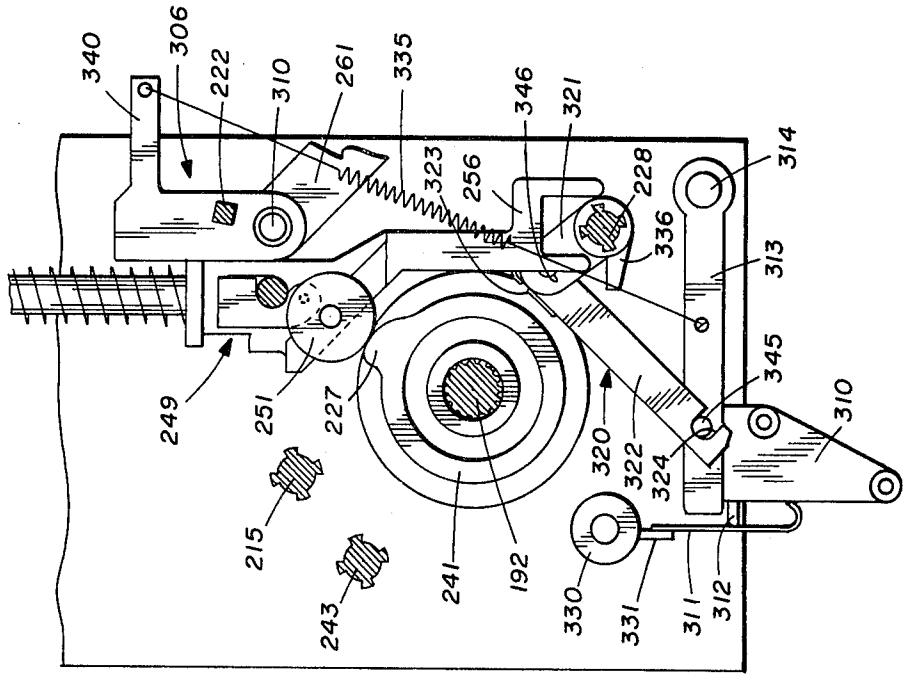

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FIG. 33


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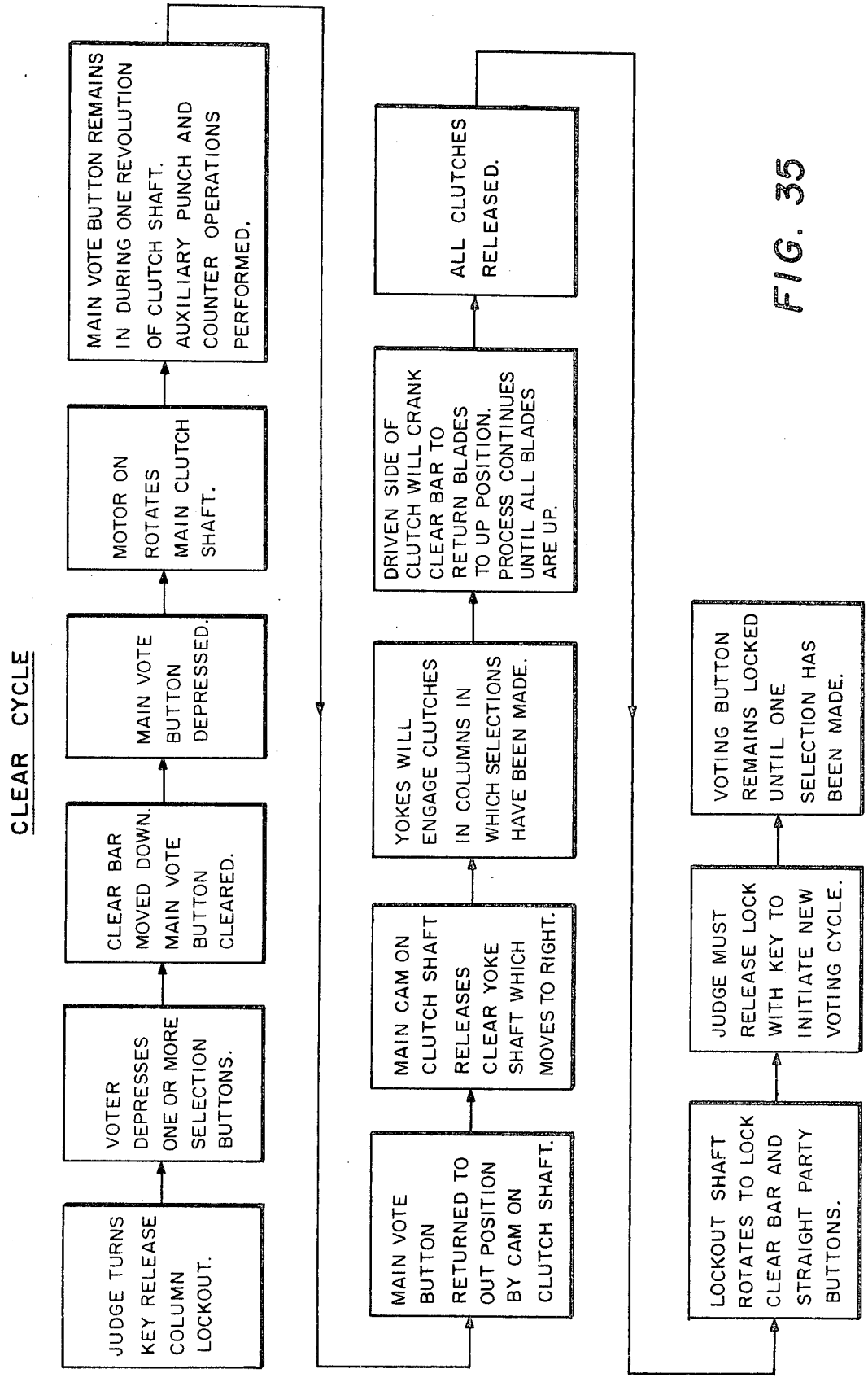

CLEAR CYCLE
JUDGE TURNS KEY RELEASE COLUMN LOCKOUT.
VOTER DEPRESSES ONE OR MORE SELECTION BUTTONS.
CLEAR BAR MOVED DOWN. MAIN VOTE BUTTON CLEARED.
MAIN VOTE BUTTON DEPRESSED.
MOTOR ON ROTATES MAIN CLUTCH SHAFT.
MAIN VOTE BUTTON REMAINS IN DURING ONE REVOLUTION OF CLUTCH SHAFT. AUXILIARY PUNCH AND COUNTER OPERATIONS PERFORMED.
MAIN VOTE BUTTON RETURNED TO OUT POSITION BY CAM ON CLUTCH SHAFT.
MAIN CAM ON CLUTCH SHAFT RELEASES CLEAR YOKE SHAFT WHICH MOVES TO RIGHT.
YOKES WILL ENGAGE CLUTCHES IN COLUMNS IN WHICH SELECTIONS HAVE BEEN MADE.
DRIVEN SIDE OF CLUTCH WILL CRANK CLEAR BAR TO RETURN BLADES TO UP POSITION. PROCESS CONTINUES UNTIL ALL BLADES ARE UP.
ALL CLUTCHES RELEASED.
LOCKOUT SHAFT ROTATES TO LOCK CLEAR BAR AND STRAIGHT PARTY BUTTONS.
JUDGE MUST RELEASE LOCK WITH KEY TO INITIATE NEW VOTING CYCLE.
VOTING BUTTON REMAINS LOCKED UNTIL ONE SELECTION HAS BEEN MADE.

FIG. 35

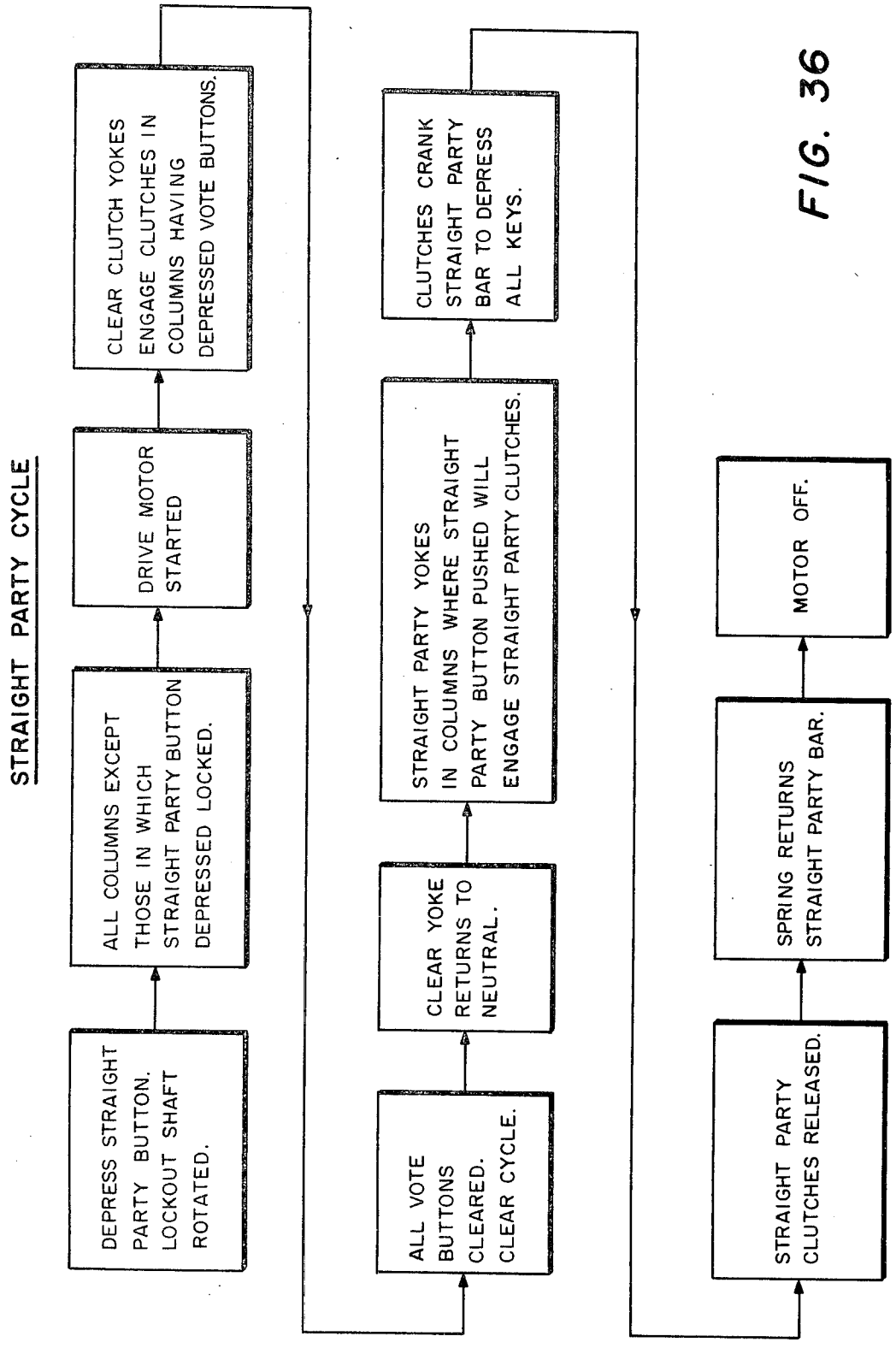

STRAIGHT PARTY CYCLE
DEPRESS STRAIGHT PARTY BUTTON. LOCKOUT SHAFT ROTATED.
ALL COLUMNS EXCEPT THOSE IN WHICH STRAIGHT PARTY BUTTON DEPRESSED LOCKED.
DRIVE MOTOR STARTED
CLEAR CLUTCH YOKES ENGAGE CLUTCHES IN COLUMNS HAVING DEPRESSED VOTE BUTTONS.
ALL VOTE BUTTONS CLEARED. CLEAR CYCLE.
CLEAR YOKE RETURNS TO NEUTRAL.
STRAIGHT PARTY YOKES IN COLUMNS WHERE STRAIGHT PARTY BUTTON PUSHED WILL ENGAGE STRAIGHT PARTY CLUTCHES.
CLUTCHES CRANK STRAIGHT PARTY BAR TO DEPRESS ALL KEYS.
STRAIGHT PARTY CLUTCHES RELEASED.
SPRING RETURNS STRAIGHT PARTY BAR.
MOTOR OFF.

FIG. 36

VOTING MACHINE

This is a division of application Ser. No. 309,174, filed Nov. 24, 1972.

This invention relates to voting machines and more particularly is directed to improved voting machines of the general construction described in prior U.S. Pat. No. 3,168,240 and 3,524,969.

A large number and variety of mechanical voting machines can be found in the prior art. Machines most commonly found in use today are of the type as shown in the U.S. Pat. No. 3,408,002 and the patents referred to therein.

These machines are generally referred to as "lever-type" voting machines and have found general acceptance and are widely used. In lever machines, multiple horizontal or vertical rows of selector levers are interconnected by cranks or similar mechanisms to counter mechanisms which register the number of votes cast for a particular candidate or issue.

Machines of this general type have a number of disadvantages. One of the foremost disadvantages of the lever-type machines is their extreme size and weight, often in excess of **500** pounds. Because of the weight, a single machine requires the effort of several men to transport the machine from its place of storage to the polls. Further, the large size requires an extreme amount of storage space when it is considered that a city of, for example, one million people may own or lease several thousand voting machines. Transportation and storage of the machines during periods of non-use can constitute a major financial burden on a governmental unit.

Aside from the above-mentioned problems of storage and transportation, the lever-type machines require complex procedures on the part of the custodian to prepare the machine for voting, particularly when the machine is to be used in primary elections. In primary elections it is common that one or more candidates will be selected by the voter from a larger group running for the office and, accordingly, the columns must be broken down into subgroups of the correct number of candidates. The subgroups are established by various interlock arrangements which usually require that grouping pins or compensators be inserted in the columns to serve as barriers to permit only a selected number of voting keys to be depressed within the column. This can be a difficult operation requiring skill and much preparation time on the part of reelection officials in order to insure proper machine functioning.

Another disadvantage of the lever-type voting machine is that the accompanying ballot is often confusing and difficult for the voter to understand because it does not duplicate the format of the traditional paper ballot. This is especially true of machines having horizontal selection rows which require a specialized ballot format to adapt to the machine. It is generally accepted practice for conventional paper ballots to display the candidates in a vertical rather than a horizontal arrangement.

It is the primary object of the present invention to provide a simple to operate, console type voting machine of substantially reduced size and weight to facilitate handling and storage. The present invention employs a very efficient, compact selector mechanism using displaceable steel balls arranged in columns which permit lists of candidates for more than one office to be placed in a single column. Further, the columns can be set so that one or more selections from that list can be made by the voter. Such an arrangement would be typically used in a primary election. The voting machine of the present invention also permits adjacent vertical columns to be mechanically interlocked so that the selection groups on the ballot can be arranged horizontally as is necessary in a general election.

The present invention further has provision for straight party, write-in, and random voting procedures and insures that the voter cannot disenfranchise himself by casting two opposing votes. The voting machine of the present invention also makes chain voting impossible. A unique clutch mechanism performs multiple functions including a clearing and locking function after each voting cycle and when a straight party selection is made.

The present invention also permits insertion of a computer compatible card into the machine on which card is recorded the voter's selections. This card may then be processed by computer to expedite computation of the election results and minimize decoding and transcription. The machine adapts to the requirements of almost any election and the ballot can be arranged in a format familiar to most voters. The buttons are depressed and the voted buttons are easily identifiable to the voter by and X appearing at the voted button. In summary, the present invention provides a voting machine having improved interlock systems to render the machine simple, efficient, lightweight, and yet at the same time highly versatile and applicable to a variety of voting procedures and adaptable to the various voting laws and requirements in effect in the various jurisdictions throughout the country. These and other objects of the present invention will become apparant from the following drawings and descriptions in which:

FIG. **1** is a perspective view of the voting machine of the present invention with a representative ballot in place:

FIG. **2** is a front view of the voting machine with the ballot removed;

FIGS. **3, 4** and **5** are elevational views of a voting key;

FIGS. **6** and **7** are enlarged detail views of the end of the voting key;

FIG. **8** is an enlarged detail view of the voting key and associated button;

FIG. **8A** is a perspective view of the button shown in FIG. **8**;

FIGS. **9** and **10** are opposite side elevational views of the individual voting machine columns, FIG. **10** being inverted; FIG. **11** is an enlarged partial sectional view taken along lines **11—11** of FIG. **9**;

FIG. **12** is a partial sectional view showing the end of the lockout bar mechanism;

FIG. **13** is a partial detail view showing a cam arrangement;

FIG. **14** is a top perspective view of a ball housing block and cam;

FIG. **15** is a bottom perspective view of the ball housing block of FIG. **14**;

FIG. **16** is a partial detail view showing the relatonship of a key overlying a ball housing block;

FIG. **17** is a sectional view taken along lines **17—17** of FIG. **16**;

FIG. **18** is a sectional view taken along lines **18—18** of FIG. **16**;

FIG. 19 is view of the drive assembly as seen from the top end of FIG. 2;

FIGS. 20 to 22 are detail views of drive assembly clutches;

FIG. 23 is a sectional view taken along lines 23—23 of FIG. 19 with the mechanism shown in a locked position;

FIG. 24 is a view similar to FIG. 23 but with the mechanism shown in a voted position;

FIG. 25 is a sectional view taken along lines 25—25 of FIG. 19 with the straight party mechanism in a non-voted position;

FIG. 26 is a view similar to FIG. 25 but with the straight party mechanism in a voted position;

FIG. 27 is a detail view of a part of the straight party mechanism;

FIG. 28 is a sectional view of a portion of the column assembly as seen along lines 28—28 of FIG. 19;

FIG. 29 is a partial sectional view taken along lines 29—29 of FIG. 19;

FIG. 30 is a view similar to FIG. 29 but with the main voting button mechanism shown in an alternate position;

FIG. 31 is a partial sectional view generally taken along lines 25—25 of FIG. 19 with structure removed to more clearly illustrate the motor control switch;

FIG. 32 is a view similar to FIG. 31 showing the motor control switch in an actuated position;

FIG. 33 is a partial sectional view generally taken along lines 25—25 of FIG. 19 with structure removed to more clearly illustrate the actuation of the motor control switch in the straight party cycle;

FIG. 34 is a view similar to FIG. 33 showing the switch in an actuated position;

FIG. 35 is a flow chart representation of the clear cycle operation; and

FIG. 36 is a flow chart representation of the straight party cycle.

The voting machine is shown in FIG. 1 and is generally designated by the numeral 10. The machine would generally be incorporated in an appropriate voting machine cabinet, not shown, when placed in use. The cabinet would provide for either a vertical or horizontal mounting of the mechanism for voter access depending on preference and voting requirements. The machine 10 generally has a basic frame structure comprising opposite side members 12 and 13 and opposite end members 14 and 15. A top panel 16 is carried by the frame structure and has provision for mounting of the ballot 20. The ballot is divided into a series of eight vertical selection columns identified 18*a* through 18*i*. It should be noted, as used throughout this description, the term "horizontal" means a plane parallel to ends 14 and 15 of the machine. The term "vertical" refers to a plane parallel to sides 12 and 13.

Ballot 20 is not a typical ballot one would find when voting but rather is a representative ballot to illustrate the operation of the machine. Left hand columns 18*a*, 18*b*, 18*c* and 18*d* are set up in a format corresponding to that used in most general and some city elections in which several political parties offer candidates for the same offices as are listed in column 18A. As shown, the voter would make a choice for the office of president from either columns 18*b*, 18*c*, or 18*d* and, once having voted one of the selections, is not permitted by the interlock system of the present invention to make another selection for that office. Column 18*h* illustrates a typical primary election ballot wherein one selection is chosen from several candidates to be the particular party's candidate in the general election. It will be appreciated that any other number of rows could as well be provided. At the top of each of columns 18*b* to 18*d* is a straight party button 21 which, as will be more fully explained hereafter, when depressed will cause all the voting keys in the associated vertical column to be depressed, clearing all other buttons on the machine. A slot 25 in the upper right hand of the machine is provided to accept a data processing card which is punched in response to the voting operation. A resetting lock 26 is used to lock or release the mechanism after each vote is recorded preparing the machine for the next voter. Lock 28 operates the column lockouts to lock out of operation certain selected columns or partial columns. The keys for lock 26 and 28 are retained by the election judge or official on duty at the election location. When the voter has completed making selections, main vote button 44 initiates the machine through its operative cycle. A tray 30 accessible through front 15 contains the tally counters and a public counter. On tally counter is provided to correspond to each of the voting buttons on the machine. For a more complete description and understanding of the operation of the candidate counters and the card insert and card punching mechanism, please refer to commonly assigned co-pending application entitled "Punch Assembly and Method of Making Same", U.S. Ser. No. 309 192, and commonly assigned U.S. Pat. No. 3,821,522, granted June 28, 1974, entitled "Counter", both filed concurrently herewith.

FIG. 2 illustrates a machine of the present invention with the balot 20 and cover plate 16 removed to expose the basic components of the machine. The rectangularly arranged frame members 12, 13, 14, and 15 support eight vertical column members 31 through 38. Each of the columns 31 to 38 are similar in construction and each is generally elongate and provided with a vertical row of slots 39 therein which slidably receive the end key slides 40. Slot 146 provides access to a cam device for setting up vertical selection subcolumns. The details of the key slides are shown in FIGS. 3 through 6 and are discussed in the following paragraphs. The purpose of the present brief description is to outline the interaction of the main components so that the operation of the voting machine will be more easily understood. To make a selection, key slides 40 are manually depressable through a voting button 23 extending through the panel 16 and ballot 20. Tray 30 containing the tally counters is horizontally positioned subjacent columns 31 to 38 and depression of a key slide 40 will engage a corresponding counter in the tray 30 through plunger 54 at the terminal end of slide 40. The counters may be of the well known star wheel type or similar to those disclosed in the co-pending application referenced above.

Also operatively engaging each of the key slides is a rod 48 which extends transversely of the columns and is received in punch bank selector 42. Rods 48 are horizontally displaced to the right by actuation of the corresponding key slide by cam surfaces 55 on the slides 40. Rightward movement of a transverse bar 48 into the punch bank selector 42 will block a corresponding punch selector bar 49 so that upon actuation of the voting cycle by main voting button 44, the card inserted in slot 25 of card punching mechanism 43 will be perfo-

rated in a pattern corresponding to the voter's choice. Clearing of the machine and actuation of the straight party cycle is by virtue of the multiple clutch drive mechanism **50** shown at the upper portion of the machine. An electric motor **45** powers the mechanism through the clearing and straight party cycles as will be explained. Provision can be included for manually driving the machine by a crank in case of a power failure.

The foregoing is just a brief description of the various main components to the machine so that their relative location and interrelationship may be appreciated. The operation and mechanism of the counter assembly and the punch mechanism form no part of the present invention but rather are the subject of the separate aforementioned patent applications. The present invention concerns itself with the voter selection mechanism and more particularly with the interlock arrangement for setting up and limiting voting selections and the clutch-drive mechanism for clearing the machine and for voting a straight party ticket.

Referring now to FIGS. **3** through **6**, the voting key slide **40** is shown in detail. The key slide **40** comprises an essential part of the machine which is operative to register the voter's selections. Key **40** extends laterally in slots **39** in each of the columns and each is manually depressable through button **23** by the voter. Each key **40** includes an upper generally rectangular shank portion **52** and a lower extension **51** having opposite sides **77** and **78.** Opposite transverse slots **65** and **66** extend across the intermediate portion of the key **40.** Angular cam surfaces **55** are provided on one edge of the key. The cam surface **55** on each slide is associated with the end of transverse punch actuator bars **48.** The longitudinal position of cam surfaces **55** along extension **51** varies with the column in which the key slide **40** is located. For example, cam surfaces **55** on the key slides located in column **38** are immediately adjacent the shank **52** and the loction of the corresponding cam surfaces **55** is displaced downwardly for the slides in each leftwardly successive row. In this way, all rods **48** that are associated with the keys in a horizontal row of key slides are in vertical alignment beneath the columns. The rods **48** are configured to avoid interference with the adjacent key slides.

Inward of the lower end of the key **40** a shoulder **59** projects laterally. Shoulder **59** is adapted to be engaged by a clear bar of the drive mechanism **50** to return the key to a non-actuated position. Extending from the opposite side of the key is projection **58** which is adapted to be engaged by a bar in drive **50** to pull the associated key **40** downwardly when a straight party button **21** is actuated on the machine. The clear and straight party mechanism is actuated by drive mechanism **50,** as will later be explained.

An important feature of this invention is the vertical interlock arrangement which limits the number of voting buttons a voter can depress within a column by blocking the remaining slides when the predetermined number of selections has been made. The vertical interlock is achieved by camming accurate steel balls in a tool line extending through the columns along a cam surface on the keys **40.** Each key is provided with cam means **56** including adjacent circular bores **67** and **68** extending through the shank of the key slide. A semi-circular camming surface **69** extends approximately at a 30° angle from the edge of hole **67** at surface **77** toward the edge of bone **68** at surface **78.** Axial slot **70** extends between bores **68** and **69** through the intermediate cam surface **69.**

The vertical interlock mechanism permits the election official to set up the machine in vertical selection column as, for example, would be necessary in a primary election. Other elections may require that the machine be programmed horizontally as in a general election. Accordingly, an important feature of the present invention includes means to selectively interlock adjacent horizontal keys to define a selection group and so that only one key can be voted within the group. As best seen in FIGS. **6** and **7,** a cam **79** is provided on the upper end of the slide **40** in opposite sides which cooperate with horizontal locking pins to prevent actuation of more than one key within a group. The cam means include bore **71** that extends transversely through the shank portion **52** of the slide **40.** Cam **79** includes generally V-shaped surfaces **72** and **73** which intersect bore **71** at the longitudinal centerline of the shank portion. As best seen in FIG. **7,** surfaces **72** and **73** diverge outwardly to oppositely arranged lands **74** and **75,** respectively, which are all commonly defined within recess **76** in the opposite edges of the key **40.**

FIGS. **9** to **11** and **16** to **18** best show the relationship of the slides **40** in the columns. Keys **40** are all received in adjacent vertical columns **31** to **38** aligned vertically and horizontally. Each column contains a selected number of keys. The following description is with reference to column **33** which is typical. Column **33** is a generally elongated rectangular section and has an aligned series of slots **82** which receive the main body portion of keys **40.** Enlarged slots **39** aligned with slots **82** extend to the surface of the column. A shoulder **84** at the bottom end of each slot **39** serves as a stop to engage outwardly extending flange portion **60** of the associated key. Thus, looking at FIG. **11,** which is a sectional view through a portion of adjacent columns, key **40** is shown in a normal unactuated position; when actuated it will be moved inwardly until flange **60** contacts shoulder **84** at the bottom of slot **39.** An over center toggle pin, not shown, may be associated with each key slide **40** to give the key a positive action. Cross bore **85,** approximately corresponding in diameter to the cross bore **71** in the shank portion of key slide **40,** intersects column slot **82** and terminates in rectangular slot **86** which extends longitudinally in column **33.** Horizontal interlock bar **90** is slidable in slot **86.** Another longitudinal channel **91** extends the length of column **33** perpendicular to the axis of key slide **40** and intercepts slot **82** and houses vertical interlock ball housing blocks **110** which, as will be described later, are interposed between and cooperate with vertically adjacent keys **40** in the vertical interlock mechanism.

As seen in FIG. **11,** a pair of plungers **92** and **93** in the form of pins having rounded ends are positioned in cross bore **85.** The pins are dimensioned so that pin **92** extends from the center line of the slide key at the apex of the cam surfaces **72** and **73** to the edge **89** of the column **33** next adjacent column **34.** Similarly, plunger **93** extends leftwardly from the center line of slide **40.** Column **32** next abuts column **33** at edge **88** having bore **85***a* in direct alignment with slot **86** of column **33.** Similarly, at side **89,** adjacent column **34** has its interlock bar **90**b in direct alignment with bore **85** of column **33.** The subcripts *a*, *b*, b, etc. , here and throughout the specification, designate identical or similar elements.

Interlock bar **90** extends the vertical length of column **33** in slot **86.** A number of cross bores **95** are provided in bar **90** and are spaced so that the distance between bores **95** is half the distance between adjacent vertical cross bores **85** in the columns. Every other bore **95** houses a compression spring **96** forming a socket **97.** A slidable plunger **94** extends in bores **95** not housing a spring.

Referring to FIGS. **11** and **12,** the interlock bar **90** is vertically shiftable relative to the associated column to move either a plunger **94** or a spring socket **97** in axial alignment with column cross bores **85.** An actuating handle **100** is connected to the lower end of bar **90** and projects into recess **101** in the column. Manually moving actuator handle **100** will displace bar **90** to position the bar in accordance with the election requirements.

It will thus be understood, referring to FIG. **11,** that as key **40** is depressed in response to a voter operation, the cam surface **79** will be urged between adjacent plungers **92** and **93** parting them in opposite directions. If it is desired to horizontally interlock adjacent vertical columns, as for example when the machine is set up as shown in ballot columns **18***b*, **18***c* and **18***d* of figures, actuator **100** in column **33** is moved to position interlock bar **90** to align plungers **94** in the bar with bores **85** of the column. The interlock bars in columns **32** and **34** are similarly positioned. For example, when a key **40** in column **33** is depressed, associated plunger **93** will move leftwardly urging adjacent plunger **94** in bar **90** leftwardly into engagement with pin **92***a* located in the adjacent column. Pin **92**a in adjacent column **32** will be moved into blocking engagement beneath the apex of associated cam **79***a* of the key slide in that column.

Column **34** located immediately adjacent side **89** of column **33** has been preset having its interlock bar **90***b* positioned with spring sockets **97***b* in axial alignment with cross bores **84** of column **33.** Upon depression of a key slide **40** in column **33,** pin **92** will simply move into engagement in socket **97***b* causing spring **96**b to be depressed. The axial motion of plunger **92** will not be transferred across interlock bar **90***b* to prevent the actuation of the key slides in column **34.** Therefore, looking at an arrangement of FIG. **1,** it will be seen that by selectively positioning interlock bar **90,** horizontal listings of condidates may be made and the selection limited to one candidate from the preselected row or group across the columns. The interlock bar between adjacent columns can be positioned to either interlocking or isolate the columns, as the case may be. An entire or partial horizontal row of key slides **40** may be locked out by virtue of cams **102** as seen in FIG. **13.** Cams **102** are rotatively mounted on cam shaft **103** immediately adjacent column **38.** Each cam aligns with cross bore **85** *i* in that column. To lock out a horizontal row of keys, associated cam **102** is rotated into engagement with pin **92***i* to move the horizontal interlock pins **92** in each column into blocking engagement with the keys **40.** A partial horizontal row can be locked out by interrupting the movement of pins **92** by moving interlock bar **90** to align spring sockets **97** with the pins **92.** The horizontal lock is particularly useful in accommodating more unusual election requirements. The operation of cam shaft **103** is controlled by the election judge.

The present invention also has provision for selectively interlocking the voter selections in a vertical column and for establishing subcolumns or groups. As seen in FIG. **9,** a series of ball housing blocks **110** are received in channel **91** and form part of a vertical interlock system that limits the selections that can be made in a column. Blocks **110** are alterantely interposed between adjacent key slides **40.** The construction of the individual ball housing **110** is best seen in FIGS. **14** and **15.**

Each block **110** consists of a main body portion **111** which is generally rectangular having flanged portions **112** and **113** extending at right angles from top surface **114** and bottom surface **116,** respectively. Flanges **112** and **113** are each of a depth approximately one-half of the width of the keys **40.** A slot **115** extends along one side of the block to receive a corresponding transverse flange in column channel **91** to serve as a guide for lateral adjustment of blocks **110.** Projecting from the back of block **110** are legs **118, 119, 120** and **121.** A U-shaped opening **122** is defined between upper legs **118** and **120** and a similar opening **123** is defined between legs **119** and **121.** Transverse slots **124** and **125** extend in the opposite sides of the block between the upper and lower legs.

Biasing spring **128** extends from the center of the front face **129** of the block. A bore **130** vertically extends between top side **114** and bottom **116** of the block. Spaced from bore **130** is a socket or blind bore **131.** Bore **130** and blind bore **131** are of the same diameter. Socket **131** houses a biasing spring **134** which is compressible to accept a single interlock ball. Parallel guide members **132** and **133** at one edge of surface **114** are respectively aligned with the center of bores **130** and **131.** At the other edge adjacent the bores **130** and **131,** keeper members **135** and **136** are biased outwardly by virtue of a spring, not seen, acting within a receiving bore in the block. Keepers **135** and **136** serve to maintain alignment in the row of interlock balls as will be more fully appreciated.

Slots **124** and **125** at the end of cam housing block **110** receive cam member **140** which carries cam **142.** Eccentric actuator shaft **144** adapts the cam for manual actuation. As seen in FIG. **11,** cam **140** is positioned with shaft **144** supported in slot **124** and **125** so that cam member **142** abuts block end **147.** Shaft **144** extends parallel to the keys **40** in holes **146** in each of the columns. Cam **140** is adjustable by insertion of a tool into hole **146** to rotate the cam through shaft **144.**

Ball housing blocks **110** are sequentially arranged and oriented in the columns so that face **114** of a block **110** abuts surface **77** of a key slide **40** and opposite surface **78** engages the surface **116** of the next adjacent block **110** with the longitudinal axis of slide **40** transverse to block **110.** Spring **128** extending from the ball housing blocks engages side wall **89** of the next column to bias the blocks into channel **105.** Thus, it will be observed that block **110** can laterally be displaced by rotation of shaft **144,** causing cam **142** to bear against surface **147** moving the block against the force of biasing spring **128.**

In the normal position, blocks **110** are oriented with hole **67** of key slide **40** in line with bore **130** of the cam blocks **110.** Projection **133** on the side **114** of the adjacent ball housing block **110** aligns with slot **70** on the surface **77** of the key slide **40.** Thus, in the assembled position, there is a pattern as disclosed in FIGS. **16** to **18** with a continuous column or tool line **150** assembled with identical steel balls **151** extending vertically

through the column. The outer hole **68** in each key slide **40** also contains a steel ball **152** identical to balls **151** contained within the tool line **150.**

By laterally displacing a ball housing block **110** relative to the associated key **40,** a column can be divided into several subcolumns. As is the case in many primary elections, a single candidate is to be selected from a number of primary candidates. One voting key slide **40** would be associated with each of the candidates for the particular office. A subcolumn would be indexed by moving the cam block **110** adjacent the keys defining the group in the subcolumn to a blocking position relative to the associated key slide **40.** For example, looking at FIGS. **17** and **18,** upper and lower blocks **110** and **110***c* have been moved to separate a subcolumn of candidates for a particular office. To accomplish this, cam shaft **144** was rotated 180° by an appropriate tool causing cam member **142** to bear against surface **147** of the cam block and urge the block against the bias of spring **128** to the position relative to the respective keys shown in FIG. **18.** In this blocking position, socket **130** of ball housing block **110** and **110**c now align with tool line **150.** This establishes a three candidate subgroup with a voter being able to select one of the three keys **40, 40***a* and **40***b*.

To understand what occurs when a key in a subcolumn is voted, assume that the voter has made a selection on the voting machine causing key slide **40***b* to be depressed. As the key slide **40***b* is moved inwardly, ball **151***b* in hole **67***b* of key slide **40***b* will be forced or cammed upwardly by cam **56***b* into bore **130***a* of the next upper adjacent ball housing block **110***a*. When the key **40***b* is fully depressed ball **152***b* will have been introduced into the tool line **150** causing the tool line to advance upwardly by one ball diameter against the action of spring **134** in socket **131** in the upper terminal ball housing block **110.** Spring **134** in the terminal ball housing block will not allow the tool line to advance more than one diameter into the socket **131,** so that it is impossible for more than one additional ball to be introduced into the tool line. Ball **152***b* in bore **68***b* of the key slide will now occupy a position in the tool line. Should the voter attempt to actuate another key slide, such actuation will be resisted as there is not room in the tool line for any additional balls, hence only one key can be moved in each series or subcolumn.

If it is desired to vote for more than one candidate out of a series, as for example in an election for city council, the upper end of the columns are used to index a subcolumn. Referring to FIG. **9,** a receiver assembly **160** is provided to permit multiple selections to be made. A number of adjacent ball housing blocks corresponding to the number of candidates are positioned having their bores **67** in alignment so that a continuous column of balls extends in the tool line. Receiver passageway **161** aligns with bores **67.** A guide passagway **162** extends in the column parallel to the receiver passageway. A slider **164** has a tubular stop **165** in passage **161** and tubular guide member **166** in passage **162.** Web **166** interconnects the tubular members. The inner end of stop **165** engages the uppermost ball in tool line **150.** Slider **164** is spring biased by spring **170.** Adjusting pin **168** abuts the upper end of slide **164.** Pin **168** is inseted into vertically spaced grouping holes **169.** By vertically adjusting the position of pin **168,** the effective length of the tool line can be changed so that a predetermined number of balls can be introduced into the tool line. For example, if it is desired that three candidates be selected from the series, pin **168** is moved upwardly a corresponding number of grouping holes **169** to permit slider **164** to be displaced upwardly to admit three additional balls **151** into tool line **150.** As explained above, each time the voter depresses the voting key, the action of the associated cam surface **56** will cause an additional ball to be moved into the tool line. When three candidates have been voted, a continuous column of balls will be formed in the tool line extending between the lower terminal ball housing block and slider **164** of the receiver **160.** No additional selector keys can be depressed as they will be opposed by a solid chain of balls. It will be noted that the arrangement of the present invention has several advantages in that if a voter changes his mind he may simply pull the voting key out of its original position which will effectively remove one ball from the tool line thus permitting another selection to be made. Similarly, since the actuation of any one key in the series does not block the tool line at that position, the selections do not have to be made in any order. That is, the voter does not or is not required to vote for a number of candidates in ascending or descending order as was necessary with certain prior art types of verical interlocks.

Clutch drive system **50** of the voting machine controls the registering operation of the machine and clears or depresses predetermined voting keys in accordance with the operational mode. Functionally, the drive system cooperates with the keys in the individual voting columns to perform the following functional operations:

1. Prevents actuation of the main voting button until at least one key in any of the columns has been depressed;
2. Automatically depresses all the keys under a party heading if the voter selects a straight party ticket;
3. Clears all previously depressed selector keys when a straight party button is actuated;
4. Automatically locks all voting keys and all remaining straight party buttons during a straight party voting cycle;
5. Clears all voting keys on the machine and restores them to an up position at the completion of the voting cycle;
6. Automatically locks out all voting keys in the machine after the completion of each voting cycle;
7. Provides a key controlled lock to be operated by the election judge to release all buttons to prepare the machine for the next voter; and
8. Permits selected columns or partial columns to be completely locked out by the election judge in accordance with the requirements of the particular ballot.

The mechanism of the main drive system **50** will best be understood by understanding operational sequence of events that occur in the voting cycle. When inactive, before the beginning of an operational voting cycle, the voting machine is in a locked condition which does not permit operation by a voter until the machine is placed in a ready condition by an appropriate election official or judge outside the voting booth.

All the voting keys are locked in an up position by means of the clear mechanism, a bar which extends the full length of each vertical column and engages each of the voting keys. The clear bar, as will be explained in more detail hereafter, is actuated by a clutch mecha-

nism in drive **50.** The bar and clutch assemblies are locked at the end of each voting cycle and are held in the up position by a common stop which can be released only by an election official using an appropriate key in lock **26** at the side of the machine.

In addition, each individual bar and clutch assembly can be locked by a selective lockout device also actuable by an election judge using an appropriate key. These individual controls can be set to the requirements of the individual election before the election official moves the master control from a locked to voting position.

The return or clear bars remain in the up locked position until the voter presses at least one button on the panel making a voting selection. This operation depresses the clear bar in the column in which the selection is made. The main voting mechanism is locked mechanically until one of the clear bars is depressed by the voter making one selection. The main vote button **44** can then be depressed to register the voter's selections on the counters and punch card in the machine. Thus it will be seen that the clear bar performs multiple functional operations to insure the integrity and security of the voting operation performed on the voting machine.

The sequence of events outlined above are illustrated in FIG. **36** which is a system operation flow chart of the clear cycle. It will be seen from this flow chart that the drive mechanism **50** operates to lock the machine at the beginning and at the completion of the voting cycle. Further, the main vote button is not cleared until at least one voter selection is made on the voting panel. After the voter's selections have been properly registered on the counters and punch card in the machine, the clear bar will return all voting keys to their normal up position.

The drive and clear bar mechanism is best seen in FIGS. **19, 24** and **28.** The mechanism is essentially the same for each of the columns and therefore description as applied to one column will apply equally to all. The drive mechanism **50** is located at the upper end of the columns **31** to **38.** A series of vertical frame elements **193** separates the mechanisms of the individual columns. Electric drive motor **45** is secured to frame element **193** associated with right hand column **38.** The output of the electric motor is connected by suitable gearing **191** to main clutch shaft **192** which extends through frame elements **193** horizontally across the width of the column assembly. Carried on the main clutch shaft **192** at each column is a clear clutch **205** which has driver gear member **206** splined to shaft. Spaced apart from clutch driver **206** is driven member **208.** Clutch members **206** and **208** have teeth adapted for engagement. Member **208** is biased away from member **206** by a spring, not shown, intermediate the clutch members **206** and **208.** Driven clutch member **208** is not keyed to main drive shaft **192** so that shaft **192** is free to turn within member **208** when clutch **205** is disengaged. A peripheral flange **210** extends from clutch driven member **208.**

Parallel to the main drive shaft **192** and extending laterally to the columns through frame elements **193** is clear clutch yoke shaft **215.** One end of the yoke shaft **215** engages cam surface **216** on main cam **194.** Yoke member **217** is secured to shaft **215** at each of the columns to engage flange **210** of clear clutch member **208.** As seen in FIGS. **19** to **21,** yoke **217** has a collar **226** with **234** and **235** oppositely extending in a general C shape. The ends of arms **234** and **235** are notched at **236** to accept the flange **210** on the driver clutch member **208.** Arm **235** is provided with an internal stepped bore which carries pin **237** which is normally biased to the extended position shown in FIG. **20** by a spring. The outer end of pin **237** extends beyond the terminal end of arms **235** and when force is applied to the end, the pin will be caused to move into engagement with shaft **215.** Thus shaft **215** is free to move laterally within collar **226** until locking engagement occurs by virtue of inward displacement of locking pin **237.**

Lateral leftward movement of yoke **217** with shaft **215** will bring clutch members **206** and **208** into engagement to clear the keys in that column when a voting button has been depressed. Yoke shaft **215** is biased toward cam **194** by springs, not shown, and will follow cam **194** and will laterally shift in accordance with the rotative position of cam surface **216.**

The clear bar **202** is part of a four bar parallel linkage generally indicated **201** that extends the length of each column adjacent shoulder **59** on the lower end of keys **40.** The lower end of the clear bar is privotally connected to link **203** which in turn pivots about shaft **211** which extends laterally across the columns and is secured to the frame elements **193.** The opposite end of the clear bar adjacent the drive mechanism is pivotally connected to link **204** at pivot **213.** A crank **212** extends from pivot point **213** on the four bar linkage to a stub shaft **214** extending from the face of driven clutch member **208** opposite the gear teeth. Abutment **220** is carried on crank **212** and is adapted to be rotatively moved into engagement with yoke pin **237** upon depression of a key **40** as seen in FIG. **24.** This operation locks yoke **217** to shaft **215** and is shown in FIG. **25.** The operational sequence of the clearing operation will be described in more detail hereafter.

Referring also to FIGS. **29** and **30,** main vote button **44** which serves to energize the drive motor **45** upon completion of voting selection has a member **301** that extends into the drive **50** in column **38.** When member **301** is blocked the main voting button cannot be depressed and the voting cycle cannot be initiated. An abutment member **306** physically engages section **305** of the member **301** to prevent actuation except when a voter selection has been made in one of the columns on the machine. Abutment **306** is connected to pivotal square shaft **222.** Shaft **222** extends laterally across the columns pivotally engaging crank arms **204,** as seen in FIG. **24** at shoulder **225** formed at the upper end of crank **204.** After the machine has been cleared and prior to any voting operation, all of the clear bars **202** will be in the up position as will all the voting keys as seen in FIG. **29.** Upon the making of a selection at any column, the associated clear bar **202** in that column will be forced downwardly by shoulder **59** on key slide **40** causing crank **204** in that column to accordingly pivot to the position seen in FIG. **30.** The pivoting action of the crank will impart a slight rotation to square shaft **222** through shoulder **225** to cause shaft **222** and member **306** to be swung out of its interfering position with member **301** of the voting key, leaving the voting key free to be depressed. If the voter should try to actuate the main voting button prior to making a selection, it will be obvious that the machine cannot be activated and nothing will happen. This insures that the voter cannot disenfranchise himself by operating the ma-

chine through a voting cycle without having actually made one or more voting selections.

Referring again to FIGS. 19 and 23 and 24, all of the voting columns are locked in a nonoperational condition at the completion of the voting cycle by means of lockout shaft 228 which extends transversely across the columns through frame elements 193 in a location below the main drive shaft 192. A lockout pawl 230 having a pawl arm 231 and flange 232 is provided in each of the columns. The pawl arm 231 pivots with shaft 228 from an unlocked position below crank 212, as seen in FIG. 24, to a locked position, as seen in FIG. 23, with the end of pawl arm 231 bearing against the underside of crank 204. It will be obvious that in this latter position, pawl arm 231 will prevent movement of clear bar 202 by the depression of a voting key. Therefore, pawl 230 serves through clear bar 202 to lock the voting keys in a nonactuated position. Pawl shaft 228 is connected through appropriate gearing and cable 319 to lock 26 on the side of the machine. After the completion of the voting cycle, the lockout shaft is rotated in a locked position by the election official by means of lock 26, thereby preventing depression of any of the column keys. To prepare the machine for the next voter, an election judge or official would simply insert a key into locking mechanism 26 and rotate it to an unlocked position which will rotate lockout shaft 228 and pawl arm 231 to an unlocked position in preparation for the next voter.

Looking at the system operation flow chart shown in FIG. 35 as well as FIGS. 19 to 24 and 29 and 30 which show in detail the clear mechanisms described above, the operation of the voting machine through the clearing cycle would be as follows: Several operations must be performed prior to placing the machine in an operational condition. The voting official or attendant will insert a key in lock 26 and rotate the key to move from a locked to vote condition. This will cause lockout shaft 228 to rotate lockout pawl arms 231 out of engagement with the underside of cranks 212 on the columns. The voter must now insert a data processing ballot card in the slot 25 in the upper right hand of the machine. Proper positioning of the card releases an interfering solenoid armature that prevents depression of the main voting key. The machine is in the ready condition for the voter to make his selections. The voter proceeds with voting operations, making the desired selections by pushing down selected buttons which will cause the corresponding key slides 40 to be depressed. Once the first selection is made by the voter, the corresponding key 40 by virtue of shoulder 59 will displace clear bar 202 in the column in which the selection is made downwardly causing square lockout bar 222 to rotate abutment 306 out of an interfering position with abutment 305 of main voting button member 301. Thus, at any time after a single selection has been made, the voting cycle can be initiated by the voter pushing the main button 44. The voter continues to make the selections of his choice with the column interlock system described above preventing a voter from overvoting. After the voter has completed his selections and is satisfied with his choices, he presses the vote button 44 and the machine punches the data card and registers the votes on the tally counters simultaneously. In those columns in which voter choices were made, the yoke 217 is engaged with shaft 215 by virtue of pin 237 abutting shoulder 220 of crank 212. Drive motor 45 rotates main shaft 192 and associated main cam 194 to a position where clear clutch yoke shaft 215 is cammed to cause clear clutch member 208 to contact member 206 to cause the clear clutch 205 to engage. Rotation of main drive shaft 192 will be imparted through driven member 208 and crank 212 to the clear bar 202 of the four bar linkage to return the keys 40 to an up position by engagement at shoulder 59. At the completion of the clear cycle and rotation of the clutch members, the cam surface on main cam 194 will drive the yoke shaft to its nonactuated position opening clear clutch 205. At this point the vote cycle is completed, all the voting buttons having returned to their up position with the tally counters and data card properly registered. Rotation of clutch member 206 will bring cam lobe 229 into contact with cam surface 302 on main voting member 301 to return the main vote button 44 to an up position.

FIGS. 31 and 32 are views similar to FIGS. 29 and 30 and additionally show the components of actuation of the motor by switch 310 which is in the motor control circuit, not shown, when vote button 44 is depressed. Switch 310 is a normally closed micro-switch actuable to an open position by lever 311 acting to depress plunger 312. Switch 310 is mounted on the end of switch arm 313 which is pivotal about shaft 314. Member 330 carries abutment 331 which is adapted to engage lever 311 when arm 313 is in the horizontal position. Locking pin 345 projects from switch arm 313. Arm 313 is connected to arm 340 of member 306 by tension spring 335. Pawl 315 has arms 316 and 317 and is rotatable about shaft 326. Locking member 320 includes arm 322 having a notch 324 near its terminal end and pawl 321 rotative about shaft 228. Pawl 321 is provided with flange 336. Pawl arm 321 and arm 322 are joined to common pivot 346. The arms are urged to the relative positions shown in FIG. 31 by torsion spring 323 located at pivot 346. Actuating arm 302 of vote button body member 301 is configured to project adjacent switch 310 having foot 304 engaging lever 313 and foot member 303 engaging arm 316 in a nonactuated position.

FIG. 31 shows the motor switch 310 in a nonactuated position. Member 306 has been pivoted downwardly by square shaft 222 by virtue of one or more voting selections having been made. At the completion of the voting cycle, button 44 is depressed which through member 304 pivots arm 313 downwardly about shaft 314. Locking arm 322 is disengaged from pin 345 by pawl arm 317 which is rotated into position engaging the underside of arm 322 by foot member 303. The movement of arm 313 disengages switch lever 311 from abutment 331 permitting plunger 312 to release to close the switch 310 energizing motor 45 to actuate the drive mechanism 50 through the clear cycle as described above.

Upon completion of the clear cycle, member 301 and button 44 are returned to the up position by cam 229 which engages roller 341. Clearing of the machine will move link 204 to cause member 306 to be returned to its vertical position as seen in FIG. 32 tensioning spring 335. Spring 335, in a tensioned condition, will exert sufficient form to return arm 313 into a non-actuated position with lever 311 engaged at abutment 331 with pin 345 in notch 303. Should any column not be cleared, as for example due to the non-engagement of a clear clutch 205, member 306 will not be returned to the vertical position; spring 335 is not tensioned in this

position of member **306** and switch arm **313** will remain in the down, switch-on position until all columns are cleared and member **306** returns to the vertical position.

It will be understood that drive motor **45** can be used to power the punch operation prior to the initiation of the clearing cycle. In such case the clearing operation is not commenced until these tallying operations are completed. This may be accomplished by appropriately configuring cam surface **216.**

At the completion of the clearing cycle lockout shaft **228** will rotate to bring pawl arms **231** into engagement with cranks **212.** The voting cycle is completed and the machine is in a locked condition with clear bar **202** engaging the shoulders **59** on key slides **40** thereby interfering with the downward actuation of any of the voting keys until the machine is released by an official.

The present voting machine also has provision for straight party voting. Referring back to FIG. **1,** it will be seen that a button designated by numeral **21** is provided at the top of each column. This button initiates the straight party cycle. If the voter in a general election wishes to vote for all of the candidates of a single party, he depresses the straight party button in the appropriate column. For example, depression of key **21** at the top of column **18***c* as seen in FIG. **1** would initiate the automatic cycle of operations shown in FIG. **36** which depresses all the vote buttons in a selected column causing a vote to be cast for each of the Republican candidates. The energization of the motor circuit will be described later.

Referring to FIGS. **19, 25, 26** and **28,** straight party yoke shaft **243** extends laterally across the columns the drive unit adjacent clear clutch shaft **215.** Straight party clutch assembly **240** is mounted on main clutch shaft **192** adjacent the clear clutches **205.** Straight party clutch assembly **240** includes driver member **241** having teeth on one face. Driven clutch member **242** is adjacent member **241** and has teeth oppositely arranged to cooperate with the teeth on clutch member **241.** Driven member **242** is engaged by yoke **218** mounted on yoke shaft **243.** Yoke **218** is similar to yoke **217** and has a pair of oppositely extending arms **244** which are notched to receive annular flange **245** of member **242.** Moveable pin **238** extends in pin block **247** having an outer end adapted to depress the pin inwardly. The inner end of pin **237** is adapted to contact shaft **243** when the outer end is depressed to engage yoke **218** and yoke shaft **243.** Pin **238** is depressed by the action of the straight party button **21.** The straight party clutch components are identical in structure to the clear clutch components shown in FIGS. **20–22,** to which reference may be made.

Straight party button **21** includes assembly **249** having elongated shaft portion **254** extending into the drive **50** connected to a body member **255** adjacent the straight party yoke **218.** Roller cam **251** is carried on body **257** and aligned to engage pin **238** when depressed. Foot member **256** extends from member **257** in alignment with flange **232** of pawl **230.** A keeper **248** is spring biased to a position engaging shaft **258** as seen in FIG. **25.** A compression spring **255** exerts a downward force on assembly **244** resisted by the engagement of keeper **248** at shaft **258.** Depression of straight party button **21** will, by virtue of a linkage not shown for clarity, pivot keeper **248** out of engagement with shaft **258.** Spring **255** will drive assembly **249** downwardly so that cam **251** contacts pin **238** and foot **256** engages pawl flange **232.**

The straight party cycle is effectuated by means of another four bar mechanical linkage generally designated **259.** A straight party linkage bar **260** is disposed on the side of the voting keys opposite the clear bar immediately below projection **58** at the terminal end of the blade. Links **261** and **262** are pivotally connected to opposite ends of bar **260** at pivot points **213** and **269.** A crank **263** is pivotally connected between pin connection **213** on bar **260** and clutch element **242** at stub shaft **266.** It will be obvious that when straight party clutch **240** is engaged, pin connection **266** will be rotated causing straight party bar **260** to move into engagement with shoulder **58** thereby depressing all the voting keys in that column.

Actuation of the straight party button **21** initiates the following sequence of events which are represented in FIG. **36.** Motor **45** is started by switch **310,** as seen in FIGS. **33** and **34,** which show the motor switch **310** in cooperation with member **249** of straight party button **21.** The switch actuation components have been described above in detail with reference to FIGS. **31** and **32.** Depression of a straight party button **21** moves extension **249** downwardly causing member **256** to engage flange **336.** Locking arm **322** is pivoted, remaining in an engaged position at pin **345** causing switch arm **313** to move downwardly away from abutment **331** to move downwardly away from abutment **331** to close switch **310** and start drive motor **45.** Torsion spring **323** permits member **320** to extend to follow pin **345.** The machine is first cleared. Main cam **194,** which controls the sequence of operation, cams the clear clutch yoke shaft **215** so that the clear clutches **205** in the columns in which any individual selections have been previously made are cleared by means of the clear bar linkage **201.** The clear cycle is necessary to return any other selections to a non-voted position when a straight party ballot is indicated to prevent any cancellation or improper voting procedure. Description of the clear cycle will not be set forth in detail here as it has been discussed above. After rotation of the clear clutches, the clear yokes **217** will disengage the clutches **205** and the straight party cycle begins. Completion of one clear cycle and return of member **306** to its vertical position at the completion of the clear cycle will not, at this time, return switch arm **313** to its non-actuated position since arm **313** is held down by locking member **320.** Keeper **258,** in the column voted, is pivoted away from engagement with shaft **258** permitting spring **255** to drive straight party assembly **259** downwardly. Lockout pawl arm **231** will be held in a disengaged or unlocked position by end **256** of straight party assembly **249.** At the same time, roller cam **251** will engage pin **238** causing yoke **218** to become keyed to shaft **243.** Cam **194** at the end of the clutch shaft **192** cams straight party yoke shaft **243** so that the straight party clutches **240** clutches in the columns in which selections have been made are closed. The clutches are rotated and by means of four bar linkage **259** described above, the straight party bar **260** is displaced depressing all the buttons in that column against shoulder **58** of the keys. At the end of this stroke, cam surface **227** on the driver clutch **241** engages roller **251** and clears the straight party assembly **249** returning it to an up position with keeper **248** in locked engagement at shaft **258.** As the straight party button is cleared the lockout

pawl **230** rotates, releasing all columns and completing the cycle by returning main cam **194** to its index position. Motor **45** continues to operate until the completion of the straight party cycle, when member **249** is returned to an up position by cam **227** engaging roller **251.** This permits spring **335** to return the switch arm to the non-actuated position seen in FIG. **33** and shuts off motor **45.** Upon depression of the main voting botton, the voter's straight party selections will be tabulated on the tally counters and punch card inserted in the machine and the clear cycle described above will be initiated. The machine will be returned to a locked position ready to accept another voter.

The voting machine of the present invention is highly adaptable to various ballot requirements. For example, in many elections, a number of candidates or issues less than the total capability of the machine may be presented to the voter. In this case, it will be necessary to lock out the unused columns so that the voter cannot intentionally or inadvertently actuate the selector buttons in the unused columns.

As seen in FIGS. **19, 23** and **24,** a column lockout shaft **279** extends across the columns and is supported in frame elements **193.** Lockout lever **271** is pivotally connected to shaft **279** in each of the columns. Lever **271** has latching end **277** which is adapted to engage a portion of the clear crank arm **204** at end **225** so that the clear bar is held in engagement with shoulder **59** on the individual keys preventing keys **40** from being depressed. A cam shaft **273** extends parallel to the column lockout shaft **270** and carries a cam **278** in each of the columns. Cam shaft **273** is connected by a flexible cable **318** to lock **28** on the side of the frame. Lock **28** receives a key and has multiple positions which in turn correspondingly position cam shaft **273.** Cams **278** on shaft **273** are configured to engage an actuating arm of lever **271** in selected positions of cam shaft **273.** Therefore by employing different positions in conjunction with multiple position key lock **28,** many combinations of columns can be locked in or out of use.

The column lockout mechanism described above is particularly useful when using the voting machine for primary elections in jurisdictions where the voter must declare his party preference prior to voting. The lockouts can then be actuated to vertical columns established for the parties other than the voter's particular party. In this way, the machine can accommodate multiple primary elections with the election official on duty having only to turn key lock **275** to prevent the voter from voting for candidates in any columns than the column corresponding to the voter's party.

Again referring to FIG. **1,** it will be seen that ballot column **18***i* is provided to permit the voter a write-in choice candidate. For example, if the voter wishes to cast his ballot for a write-in candidate for the office of senator, he would depress the write-in button in Column **18***i* horizontally aligned with that office. Upon completion of the voting operation after the vote button has been depressed and the voter's indication is registered on the punch card, the card would be removed from the slot. The voter can then write the names of the candidates he wishes to vote for on the ballot card itself providing a permanent record thereon in the voter's handwriting. Appropriate blanks for each office could be provided on the data card to facilitate write-in voting. Generally when provision for write-in voting is made in column **38** corresponding to ballot column **18***i*, the straight party mechanism may be omitted from the machine as being unnecessary.

Another unique feature of the present invention allows a voter to easily determine which voting he has previously selected. This is accomplished by a luminescent X becoming visible in the top of the voting button when the voting button is depressed. Referring to FIG. **8,** it will be seen that the outer end of voting key **40** is provided with a circular flange **60** and a projecting conical section **61.** Annular groove **64** extends around the base of conical section **61** adjacent flange **60.** Concentric blind bore **289** extends in the outer end of conical section **61.** Diametral slot **63** extends axially along conical section **61.** The outer end of slide **40** is capped by vote button **23** which is generally cylindrical shaped having its inner open end surrounding flange **60** of slide **40.** A compression coil spring **291** is engaged with in annular slot **61** and extends circumferentially along the interior of vote button **23** and is engaged with interior shoulder **297** of vote button **23.** When vote button **23** is pushed, the force will be transferred to the flange **60** of slide **40** causing slide **40** to correspondingly be depressed. Spring **291** serves to give some resiliency to the voting operation and also serves to protect the voting machine by absorbing any shock that may be imposed on the voting button by unusual voting tactics resulting from voter frustration and anger. A smaller coil spring **292** extends axially within vote button **23** and seats on the bottom of blind bore **262.** Spring **292** terminates short of the end of button **23** and is provided on its outer end with a small cylindrical cap **293.** Cap **293** is provided with an X indicator **294** on its outer surface. Cap **293** is preferably of a bright luminescent color having light gathering characteristics. In this way no special lighted or external illumination is needed for the voting button. This eliminates expensive and complicated electrical circuitry. A retainer **295** extends from the lower end of coil spring **292** in slot **63** along the shank of voting key **40.** With voting key **40** in position in a voting column, retainer wire **295** is secured to shoulder **84** in bore **39** of the column. Similarly, the exterior surface of vote button **23** is snugly fit within bore **39** in the column. Button **23** is transparent and is preferably of a clear plastic material having end surface **298** frosted to diffuse light passing through. Thus it will be seen that when the vote button is in a nonactuated position, cap **293** is positioned away from the inner end **296** of vote button **23.** The X on the end of cap **293** is thus not visible to the voter as the light is diffused at surface **298.** When a voter depresses button **23,** relative movement between button **23** and cap **293** will occur causing end **296** to come into close contact with the end of cap **293.** The light diffusion is reduced on the X on the outer end of cap **293** highly visible to the voter through the end surface **298** of the vote button. The luminescent color of cap **293** further improves the visibility of the X on the voted buttons. Thus, the voter can easily visually determine which button he has selected by simply locating those buttons on which the X is visible. Also, as a further indication to the voter, the physical displacement or depression of the button serves to indicate a voted selection.

Thus, the present invention provides a compact mechanically operated voting machine which records each voter's choice simultaneously on mechanical counters and on conventional data cards for computer completion. The voting panel is arranged similar to a

conventional paper ballot providing space for candidates and issues. Vertical and horizontal interlock devices provide almost an infinite number of voting arrangements including straight ticket, split ticket, and selective voting in accordance with the requirements of almost any election or jurisdiction. Lockout devices insure the integrity and security of the voting operation. It will be noted that no one person can alter the election judge since such would require the concerted action of the judge operating the key locks, the person responsible for the tally counting, as well as tampering with the computer checked results. Such concert of action would be easily detected and therefore is not likely, adding to the security of the system. The straight party mechanism permits the voter to choose to vote a straight party ticket with case and accuracy. It will be noted that the machine was described as being powered in the drive system by an electric motor. It will be obvious to those skilled in the art that the main drive system can be operated by means of a hand crank, for example, mechanically connected at gears **191.** With this option, the voting machine of the present invention is totally mechanical permitting voting operations to be effectively carried on during periods when electric power is not available or if electric service is interrupted.

Although preferred embodiments of the invention have been described in detail, it is to be understood that various changes, substitutions, and alterations can be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A voting machine comprising:

a plurality of columnar frame members;

a plurality of selection keys arranged in said frame in alignment in vertical columns and horizontal rows, laterally moveable between a first non-voted and second voted position;

tally means actuable by said keys;

vertical interlock means for limiting the number of selections that may be made within a vertical row of keys, said vertical interlock means comprising first cam means associated with said keys including a through bore in said keys, block means vertically interposed between adjacent keys, said block means having a through bore, said block means shiftable from a first position relative to said vertical keys wherein said block means through bores align with the through bores in said keys to a second blocking position, shiftable interlock ball means in said key through bores and associated with said key cam means and said block means through bores, whereby said keys and block means define a continuous ball column in said respective first positions, means for establishing a vertical subcolumn in which a preselected number of vertically aligned keys may be voted, said means including means for shifting preselected block means to said second position to intercept said ball containing column at a predetermined location to establish one limit of the subcolumn and ball receiving means located at the other limit adapted to accept a predetermined number of balls, whereby movement of selected keys to said voted position will cam a predetermined number of additional balls into said ball column and said ball receiving means thereby preventing actuation of additional voting keys when said predetermined number of balls have been caused to move into said ball receiving means;

horizontal interlock means including second cam means carried on said voting keys, horizontally displaceable plunger means associated with said second cam means and actuable whereby movement of a key will cause said second cam means to cam said associated plunger means toward siad adjacent keys, and transfer means for selectively transferring the displacement of said cammed plunger to the plunger associated with said adjacent key to move said adjacent plunger into blocking engagement with its key thereby preventing actuation of said adjacent key;

a drive system including a clearing mechanism for each of said rows of keys, said clearing mechanism including abutment means on said keys, first linkage means in operative engagement with said abutment means and moveable with said keys and adapted to return said keys to said first non-voted position, power means for said drive system including a drive shaft, clutch means including a driver member connected to said drive shaft and a driven member connected to said first linkage means and adapted to drive same, means for selectively engaging said clutch to actuate said bar to return said keys, registering means actuable by said keys to register voter selections;

said drive system further including a straight party mechanism at selected rows of keys having second abutment means on said keys, second linkage means adapted to engage said second abutment means to move said keys to a voted position, second clutch means including a driver member connected to said drive shaft and a driven member connected to said second linkage means and adapted to drive same; and

means for selectively engaging said second clutch means to actuate said second linkage means.

2. The voting machine of claim **1** further including cam means adapted to sequentially control the operation of said drive system clearing and straight party mechanisms.

3. The voting machine of claim **2** including lockout means engageable with said first linkage means to hold said first linkage in a position corresponding to said key first position thereby preventing actuation of said keys.

4. The voting machine of claim **3** including key actuated lock means operatively controlling said lockout means adapted for operation by an election official.

5. The voting machine of claim **4** wherein said first and second linkages are parallel pivotal linkages and said means for selectively engaging said clutches comprise yoke means adapted to bring said driver and driven members into operative engagement.

6. The voting machine of claim **5** wherein said transfer means comprise a bar interposed between adjacent vertical column of keys slidable relative to said vertical keys, said bar extending longitudinally and having first and second positions relative to said keys, said first bar position placing a pin in alignment with the adjacent key associated plungers and a second position wherein compressible means are aligned with said adjacent key associated plungers to isolate the movement of one key from the next adjacent horizontal key.

7. The voting machine of claim 6 including control means to operatively cycle said machine to register said voter selections on said tally counters.

8. The voting machine of claim 7 including means interlocking said clear mechanism to said control means whereby said main control means remain inoperable until movement of a selected key to said voted position clears said interlock means through said clear linkage.

9. The voting machine of claim 8 wherein said tally means comprise mechanical counters.

10. The voting machine of claim 9 further including selective column lockout means associated with said vertical column of keys, said column lockout including latch means having a first position engageable with said first linkage to prevent displacement of keys in said vertical row of keys and a second non-latching position, and cam means associated with said latch means adapted to selectively position said latch means.

11. The voting machine of claim 1 wherein said power means include an electric motor and a motor control circuit, switch means in said circuit, pivotal arm means carrying said switch, voter operable means adapted to move said switch arm to a position energizing said motor, and spring means adapted for returning said pivot arm to a position de-energizing said switch upon completion of said clearing cycle.

12. The voting machine of claim 11 wherein said straight party mechanism includes voter actuated means adapted to pivot said switch arm to a position energizing said motor to sequentially admit the clearing and straight party mechanism, and locking means securing said switch in said actuated position after completion of said clearing cycle until said straight party cycle is released.

13. The voting machine of claim 12 wherein said spring means are secured to said pivotal arm at one end and at the other end to a member positionable by means engaging and positioned by said clearing mechanism wherein said spring is tensioned to return said arm only when all said rows of keys are cleared.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3,881,092
DATED : April 29, 1975
INVENTOR(S) : Cothburn M. O'Neal, Alfred M. Mayo, George William Childs, deceased

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

Column 5, line 67, delete "bone" and substitute therefor --bore--.

Column 6, line 66, delete the second "b".

Column 8, line 5, delete "alterantely" and substitute therefor --alternately--.

Column 9, line 64, delete "inseted" and substitute therefor --inserted--.

Column 11, line 67, after "with" insert --arms--.

Column 16, line 51, delete "259" and substitute therefor --249--.

Column 18, line 39, after "in" insert --a--.

Column 19, line 16, delete "case" and substitute therefor --ease--.

Column 20, line 9, delete "siad" and substitute therefor --said--.

Signed and Sealed this

eleventh Day of *November 1975*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks

UNITED STATES PATENT OFFICE

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Column 5, line 67, delete "bone" and substitute therefor --bore--.

Column 6, line 66, delete the second "b".

Column 8, line 5, delete "alterantely" and substitute therefor --alternately--.

Column 9, line 64, delete "inseted" and substitute therefor --inserted--.

Column 11, line 67, after "with" insert --arms--.

Column 16, line 51, delete "259" and substitute therefor --249--.

Column 18, line 39, after "in" insert --a--.

Column 19, line 16, delete "case" and substitute therefor --ease--.

Column 20, line 9, delete "siad" and substitute therefor --said--.

Signed and Sealed this

eleventh Day of *November 1975*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks