United States Patent [19]

Woodie

[11] **3,780,939**

[45] **Dec. 25, 1973**

[54] **SELECTIVE PUNCH**

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[73] Assignee: **American Totalisator Company, Inc.,** Towson, Md.

[22] Filed: **Nov. 6, 1972**

[21] Appl. No.: **304,195**

[52] **U.S. Cl.** **234/115,** 234/116

[51] **Int. Cl.** **G06k 1/02**

[58] **Field of Search** 234/115, 116

[56] **References Cited**

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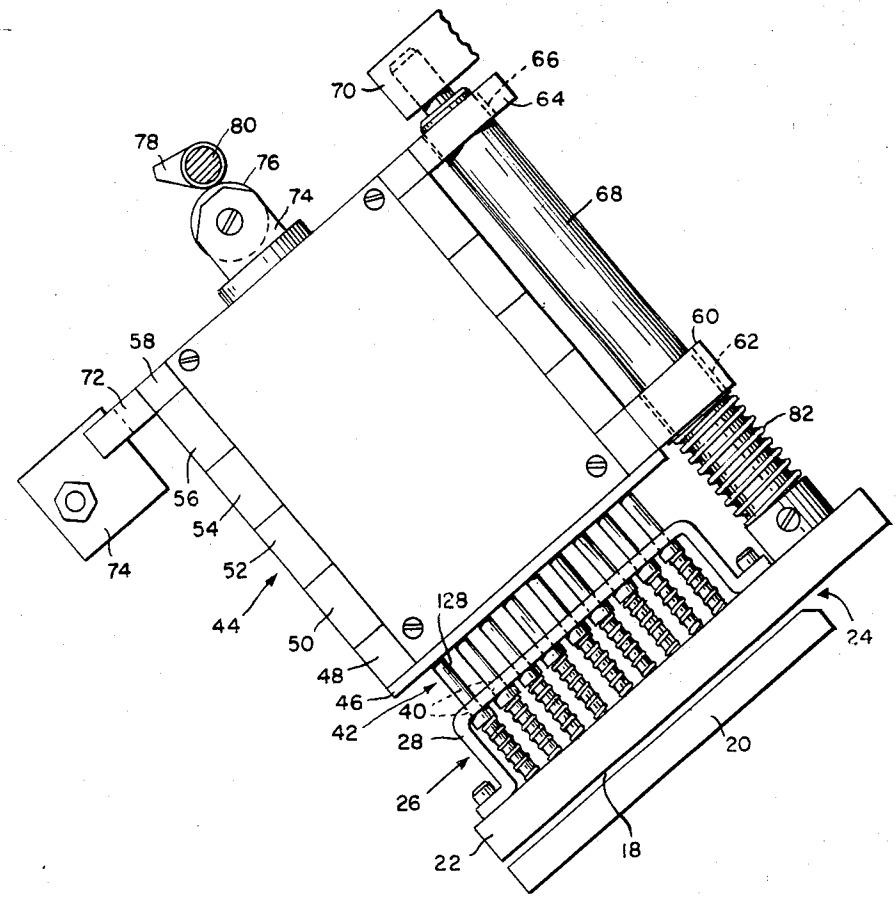
Primary Examiner—J. M. Meister

Attorney—George A. Smith, Jr.

[57] **ABSTRACT**

An apparatus for producing variable, information-bearing patterns of perforations on parking lot tickets comprises an array of punches and an assembly of electrically selectable interposers which is movable as a unit whereby selected interposers operate corresponding punches. The interposers are arranged in layers, each layer of interposers being associated with a different row of punches. The interposers are guided in slots formed in individual blocks of an assembly of blocks, and are operated by solenoids mounted on circuit boards which are slidable into a mounting so that the circuit boards and interposers can be readily replaced. Maloperation of the solenoids produces an electrical signal by means of armature-operated switches utilizing foil elements on the circuit board as contacts.

8 Claims, 17 Drawing Figures



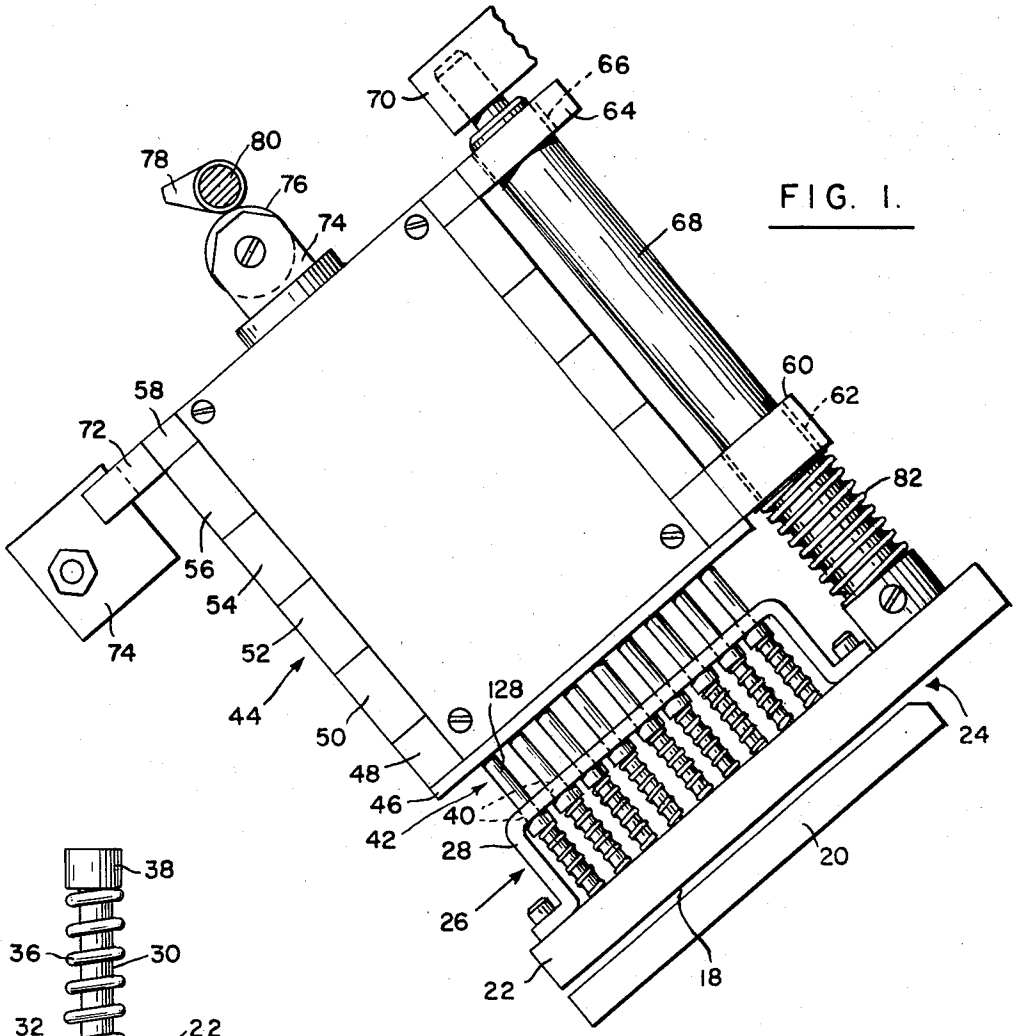


FIG. 1.

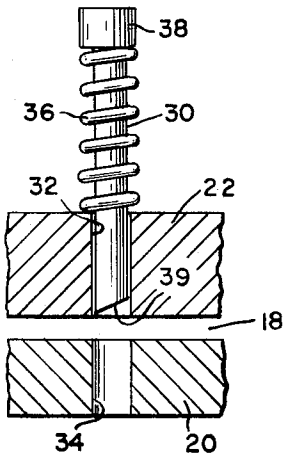


FIG. 2.

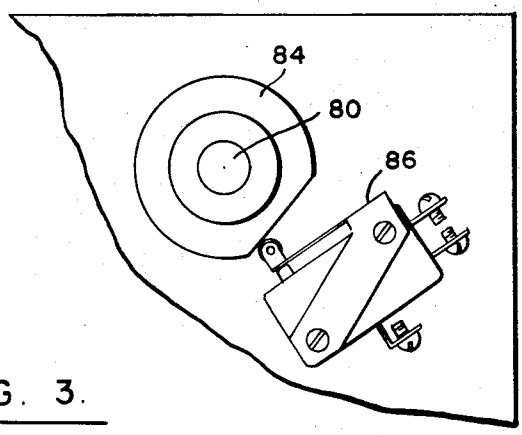


FIG. 3.

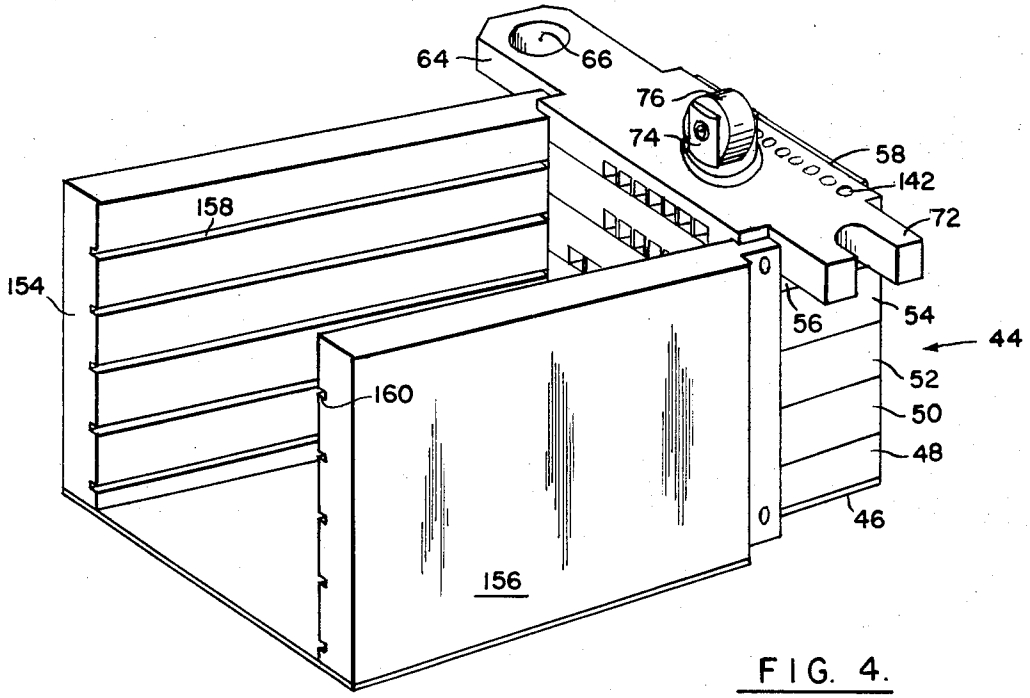

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FIG. 4.

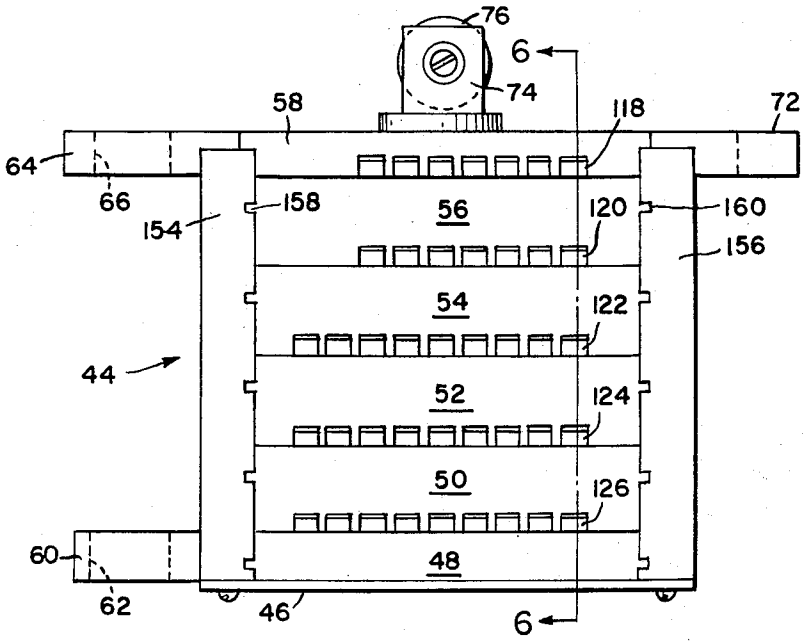

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FIG. 5.

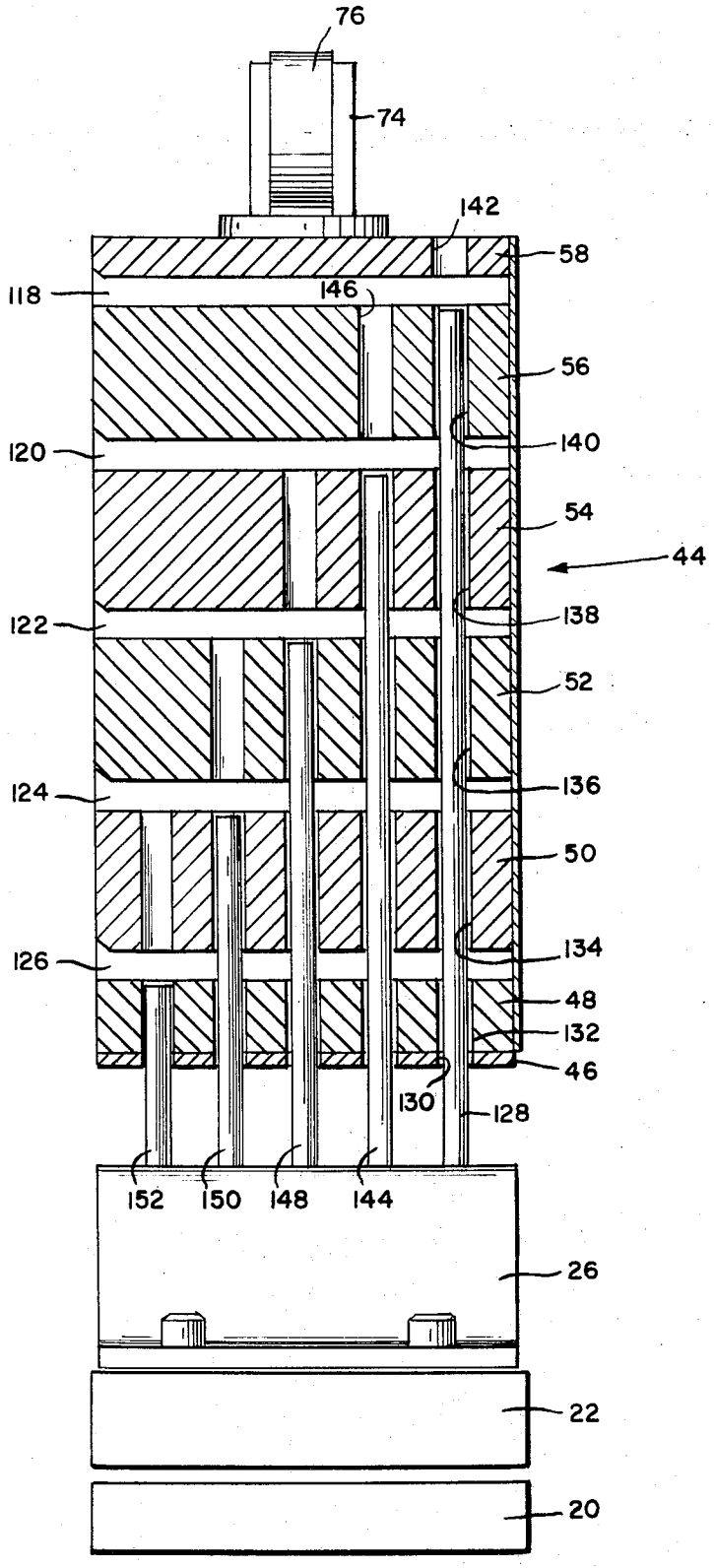

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FIG. 6.

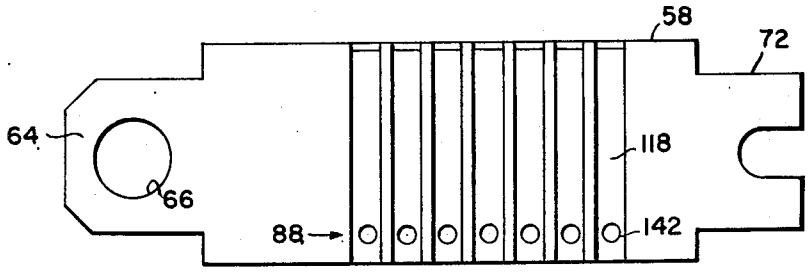


FIG. 7.

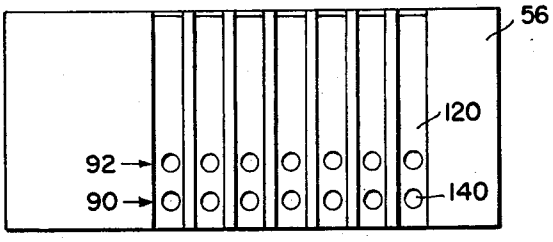


FIG. 8.

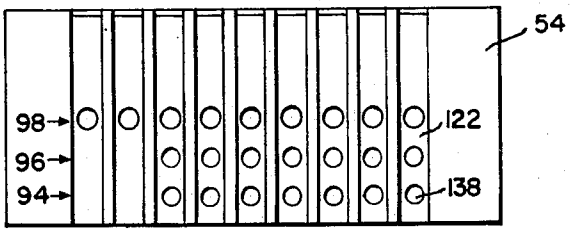


FIG. 9.

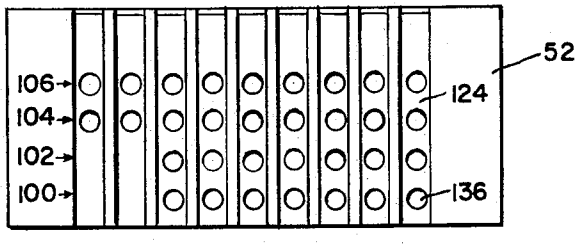


FIG. 10.

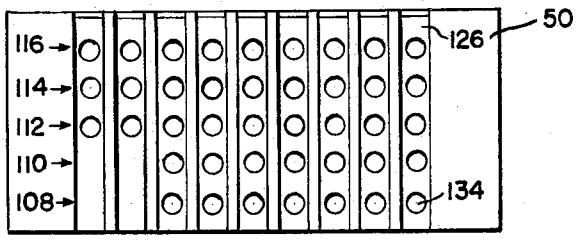


FIG. 11.

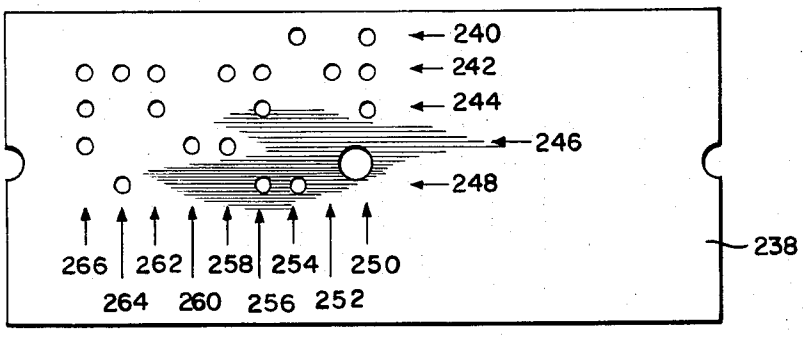


FIG. 17.

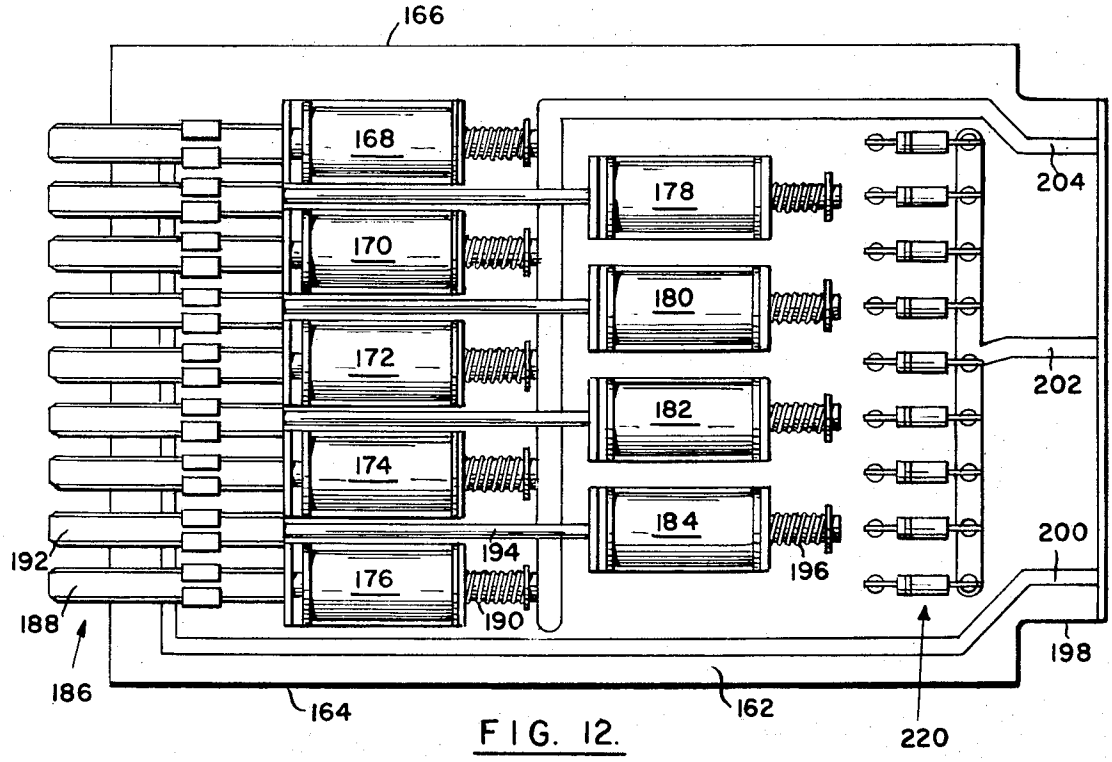


FIG. 12.

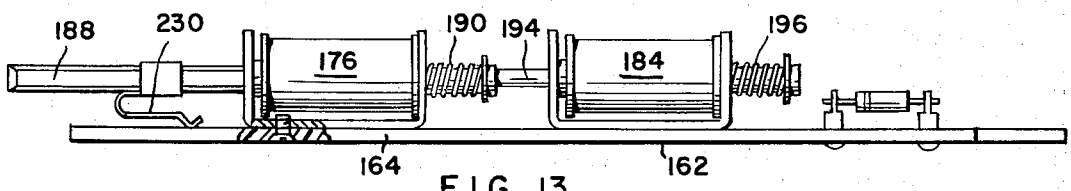


FIG. 13.

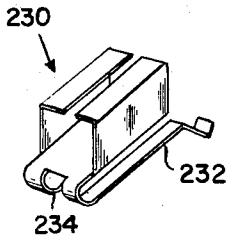


FIG. 14.

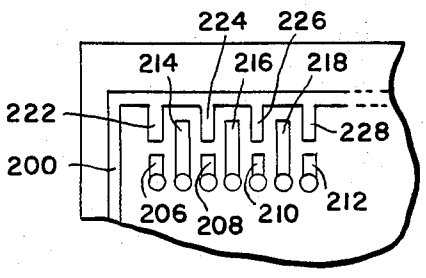


FIG. 15.

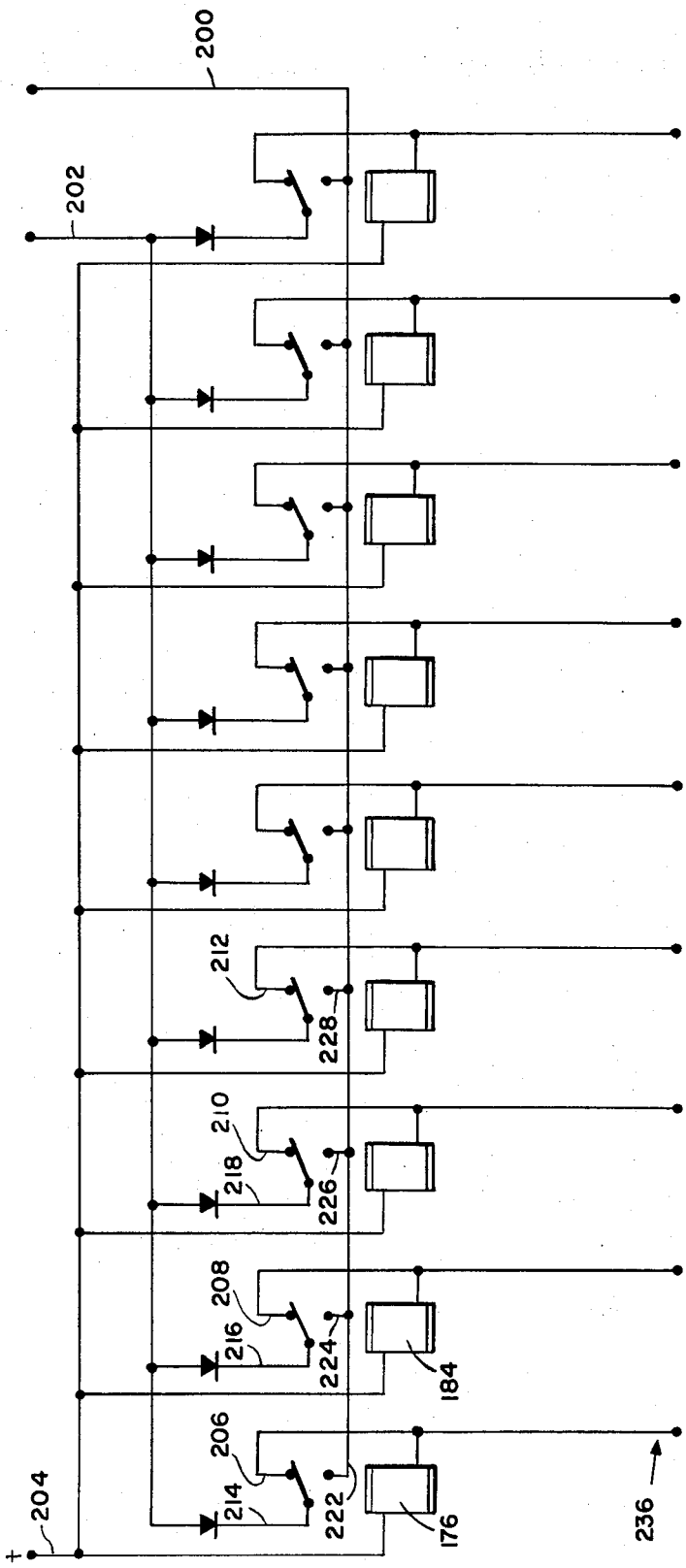

200
202
212
228
210
218
226
208
216
224
184
206
214
222
176
204
+
236

FIG. 16.

SELECTIVE PUNCH

BRIEF SUMMARY OF THE INVENTION

This invention relates to selective punches and particularly to a selective punch adapted to be controlled electrically in order to produce a variable, information-bearing pattern of perforations on a ticket.

The invention is particularly adapted for use in parking lot ticket issuing machines which heretofore normally operated by printing time information on a ticket which accordingly required visual inspection by an attendant and calculation by him of the charge to be made to the customer.

In accordance with this invention, information, including information concerning the time at which a customer enters a parking lot, is punched into a ticket as the car enters the lot so that it may be read out readily by photoelectric, mechanical, or electromechanical means as the automobile is about to leave the parking lot. Automatic calculation of the charge can then be made with the substantial elimination of human error.

In order to punch variable information, such as time information, on a ticket, it is desirable to use an electrical control, and this requires extraordinary precautions in order to achieve satisfactory reliability. The problem of reliability is compounded by the need for a substantial number of independently controlled punching elements and by the fact that the punching elements must be arranged in a sufficiently small space to punch information on a small ticket.

Also, because of the nature of the application of the invention, it is desirable that the ticket punching apparatus be capable of rapid repair should a malfunction occur.

The punching apparatus should be adapted for operation in conjunction with a ticket issuing machine so that tickets can be issued and punched in a single customerinitiated operation.

The punching apparatus should also insure that the holes punched on the ticket are accurately aligned and spaced with respect to each other in order to avoid reading errors which might otherwise occur in the automatic reading means at the parking lot exit.

Finally, the machine should automatically provide an indication of maloperation of the electrical controls, and preferably should be set up to prevent the issuance of a faulty ticket in the event of a malfunction in the electrical controls.

It is the object of this invention to satisfy the above requirements. In brief, this is accomplished by the use of a movable, unitary assembly of solenoid-operated interposers arranged on printed circuit boards in layers, each layer being associated with a different row of punches. The interposers are guided in slots which are formed in the surfaces of blocks which fit together to constitute a movable guide block. A plurality of modules, each consisting of a circuit board, solenoids and interposers, are separately slidable into retaining slots which engage the edges of the circuit board so that the modules can be readily removed and replaced. The entire punch assembly is readily moved for punching operation by means of a cam driven by the operating mechanism of the associated ticket issuing machine. Very exact alignment and spacing of the punched holes with respect to each other is assured by the design of the punching mechanism so that all of the information-bearing holes in a ticket are punched in one punching

movement in which all of the punches move simultaneously. On the circuit board of each module, the armatures of the solenoids are provided with switching elements for connection to indicating and control circuitry so that malfunctions of the solenoids either by reason of their failure to operate or by reason of their failure to return after operation to their normal condition are indicated by the circuitry associated with the switches. The switches utilize foil elements on the circuit board as contacts.

Various other objects of the invention will be apparent from the following description when read in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of the selective punch in accordance with the invention;

FIG. 2 is a fragmentary section showing a punch element and the die associated therewith;

FIG. 3 is an elevation showing a cam and switch operated thereby for producing a control signal for effecting punch selection;

FIG. 4 is a perspective view of the punch assembly;

FIG. 5 is a side elevation of the upper part of the punch assembly as viewed from the side opposite that shown in FIG. 1;

FIG. 6 is a section taken at the plane 6—6 in FIG. 5;

FIG. 7 is a bottom plan view of the uppermost slotted block of the interposer guide block assembly;

FIGS. 8, 9, 10 and 11 are bottom plan views of the successively lower slotted blocks of the interposer guide block assembly;

FIG. 12 is a top plan view of an interposer module showing the circuit board, the solenoids and interposers operated thereby;

FIG. 13 is a side elevation of the module of FIG. 12;

FIG. 14 is a perspective view of a movable switch element adapted to the armature of a solenoid;

FIG. 15 is a partial plan view of a circuit board showing the fixed elements of the switches operated by the solenoid armatures;

FIG. 16 is a schematic diagram of the switching circuitry; and

FIG. 17 is an elevation of a parking lot ticket having an information-bearing pattern of perforations of the kind produced by the punch in accordance with the invention.

DETAILED DESCRIPTION

For the understanding of the arrangement of parts in the selective punch, reference will be made to "rows," "columns," and "layers." These terms are referred to the plane defined by the ticket being punched so that rows and columns extend substantially perpendicular to each other and in directions parallel to the ticket plane. Layers are substantially parallel to the ticket plane, and each layer extends in two dimensions. The "row-wise direction" is parallel to the rows; the "columnwise direction" is parallel to the columns; and the "layerwise direction" is perpendicular to the layers.

In the particular embodiment of the invention described herein, which is built into a ticket issuing machine, ticket stock moves through the punch in the row-wise direction, which direction is in the plane of FIG. 1 and extends from the upper right to the lower left portion of the figure. Ticket stock enters space 18 between die 20 and punch guide 22 at opening 24, the

ticket stock being moved by the conventional feeding mechanism (not shown) of the ticket issuing machine.

The punch elements are arranged in five parallel rows extending parallel to the plane of FIG. **1**, the near row of punch elements being indicated generally at **26** underneath cover **28** which is fastened to the punch guide. Each of the punch elements is slidably mounted in a guide hole and aligned with an opening in the die. FIG. **2** shows a typical punch element **30** located in guide hole **32** and aligned with die opening **34**. Coil spring **36**, which surrounds punch element **30** bears against guide **22** and punch element head **38** to maintain the operative end **39** of the punch element normally in the raised condition and separated from die **20** so that space **18** is clear. All of the remaining punch elements are similar to punch element **30** with the exception that their lengths may be varied so that in a single punching operation, the several selected punch elements do not cut the ticket stock simultaneously. Cover **28** (FIG. **1**) is provided with openings **40** which are aligned with the punch elements, and which are smaller than the punch element heads so that the punch elements are retained against upward movement. Openings **40**, however, are large enough to provide clearance for movement therethrough of punch operating rods, the operating rods in the near row being indicated generally at **42**. Each punch element has an operating rod aligned with it so that each operating rod and its associated punch element provide an individual punch which is operable by an interposer in the several layers of interposers located within interposer guide block assembly **44**.

The guide block assembly **44** is made up of a lower plate **46**, a block **48**, and slotted blocks **50, 52, 54, 56** and **58**. Block **48**, as shown in FIGS. **1** and **5**, has an extension **60** having an internal passage **62**. The uppermost slotted block **58** has a similar extension **64** having an opening **66**. Rod **68** is secured between mounting **70** and punch guide **22**, and extends through openings **62** and **66**. Rod **68** constrains the guide block assembly to movement parallel to the axis of rod **68**. The guide block assembly is constrained against rotation about rod **68** by the cooperation of fork-shaped extension **72** with guide member **74**. The foregoing mountings for the guide block assembly insure against binding.

The guide block assembly is provided at its upper end with a roller mounting **74** which rotatably supports roller **76** which cooperates with cam **78**. Cam **78** is rotated by shaft **80** which is geared to the drive mechanism of the ticket issuing machine with which the punch is associated. Operation of cam **78** produces downward movement of the guide block assembly. The guide block assembly is returned by coil spring **82** located underneath extension **60** of block **48**. Shaft **80** also has mounted on it a cam **84** as shown in FIG. **3**. Cam **84** operates microswitch **86** to close a circuit which transmits an electrical signal to control circuitry for initiating the selection of a particular combination of punches to be operated in the particular downward stroke of the guide block assembly **44** which takes place upon further rotation of shaft **80**. The relationship of cams **78** and **84** is such that microswitch **86** is operated before the guide block assembly begins to move downwardly. Thus, there is sufficient time for the selection mechanism to be operated.

The blocks in guide block assembly **44** are bolted together. The individual blocks are shown in FIGS. **7** through **11** which show slots extending in the columnwise direction and rows of openings which in the final assembly form passageways which extend in the layerwise direction to provide clearance for the operating rods.

Each of blocks **58** and **56**, shown respectively in FIGS. **7** and **8**, has seven columnwise guide slots. The remaining blocks **54, 52** and **50** have nine guide slots each. The guide slots in blocks **58** and **56** are aligned, in the final assembly **44**, with the guide slots on the right-hand sides of blocks **54, 52** and **50**. The purpose of these guide slots is to allow columnwise movement of the interposers while restraining the interposers against movement with respect to each other in the row-wise and layerwise directions. The guide slots are machined on surfaces of the blocks before they are fastened together.

Block **58** has only one row of openings **88**, there being one opening in each of the seven slots. Block **56** has two rows **90** and **92** of openings. Block **54** has three rows **94, 96** and **98**. Block **52** has four rows **100, 102, 104** and **106**. Block **50** has five rows **108, 110, 112, 114** and **116**.

In the final assembly **44**, rows **88, 90, 94, 100** and **108** are aligned with each other to provide seven layerwise passages. Rows **92, 96, 102** and **110** are aligned with each other to provide a second row of seven layerwise passages. Rows **98, 104** and **112** of openings are aligned with each other to provide a third row of nine layerwise passages. Rows **106** and **114** are aligned with each other to provide a fourth row of nine layerwise passages. The openings in row **116** constitute a fifth row of nine layerwise passages.

The lowermost block **48** and plate **46** have openings which, although not illustrated, are similar to and aligned with the openings in block **50**.

FIG. **6** illustrates the relationship between the five rows of operating rods with the slots in assembly **44** when the punch is at rest. Operating rod **128** of row **42** extends upwardly through opening **130** in plate **46** and openings **132, 134, 136, 138** and **140** in the blocks of guide block assembly **44**. All of these openings are large enough to allow free movement of the guide block assembly relative to operating rod **128**. The upper end of operating rod **128** is normally located just below slot **118** as shown in FIG. **6**. An opening **142** is provided in block **58** so that, if operating rod **128** is not selected, the guide block assembly can move downwardly without depressing the operating rod.

Operating rod **144** extends through similar openings in plate **46** and blocks **48, 50, 52** and **54**, terminating just below slot **120**. Again, an opening **146** is provided for operating rod **144** in block **56**. Block **56** is sufficiently thick that rod **144** cannot extend into slot **118** when the guide block assembly moves downwardly.

Operating rod **148** extends upwardly, terminating just below slot **122**. Operating rod **150** extends upwardly, terminating just below slot **124** and operating rod **152** extends upwardly, terminating just below slot **126**. Openings corresponding to **146** are provided in blocks **54, 52** and **50**, and these blocks are made sufficiently thick so that unselected operating rods will not extend through the last-mentioned openings upon downward movement of the assembly.

The arrangement of the other operating rods and openings in the first seven columns is identical to that shown for the first column in FIG. **6**. In the last two col-

umns, operating rods corresponding to **128** and **144** are unnecessary; however, operating rods corresponding to rods **148, 150** and **152** are present and appropriate openings in the block are provided for them. In each column, the operating rods are progressively longer from the first row to the last row so that the punches (which include the operating rods and the punch elements) in each column are progressively longer from the first row to the last row.

Returning to FIGS. **4** and **5,** the support assembly for the circuit boards comprises a pair of slotted support brackets **154** and **156** secured to opposite ends of guide block assembly **44.** These support brackets have five pairs of opposed slots, that is one pair for each layer of interposers or one pair for each row of punches. Slots **158** and **160** are the slots for supporting the uppermost circuit board. Five circuit boards are used, one for each pair of opposed slots in the support brackets. The purpose of the slotted support brackets is to mount all of the interposers in the selective punch against row-wise and layerwise movement with respect to one another and for simultaneous movement in the layerwise direction so that any punch having an interposer in registry with it is moved into its corresponding die opening. The circuit boards are secured against columnwise movement in their slots by a plate (not shown) fastened between the ends of support brackets **154** and **156.**

FIGS. **12** and **13** show typical circuit board **162** of the type used in the lower three layers. Edges **164** and **166** slide into the mounting slots.

On the circuit board there are mounted nine electromechanical solenoids **168, 170, 172, 174, 176, 178, 180, 182** and **184.** These solenoids operate a row **186** of nine interposers, preferably of nylon or similar plastic material adapted to slide readily in a slot. The interposers associated with solenoids **168–176** are identical, interposer **188,** operated by the armature of solenoid **176,** being typical. Electrical energization of solenoid **176** moves interposer **188** in the columnwise direction toward the left as viewed in FIGS. **12** and **13** and compresses coil spring **190** which effects return of the solenoid armature and of the interposer when solenoid **176** is deenergized.

Interposer **192** is connected through rod **194** to solenoid **184** and is operated in a manner similar to that just described for interposer **188.** The return spring is indicated at **196.** Solenoids **178, 180** and **182** are similarly connected to interposers. This arrangement of solenoids in two separate rows permits the interposers to be positioned more closely together in the row-wise direction.

The interposers in row **186** are all in line with each other and are all adapted to enter a row of slots in the guide block assembly when circuit board **162** is inserted into its supporting slots. The interposers have substantially rectangular cross-sections and fit into their corresponding slots in the guide block assembly in such a way that they are unable to rotate about their axes of movement. The interposers, of course, may be of any desirable cross-section but are preferably noncircular in order to avoid rotation.

The interposers shown in FIGS. **12** and **13** are of a length such as to make them suitable for insertion in the lowermost layer of slots in the guide block assembly, namely the slots in block **50.** When extended by the action of their corresponding solenoids, they overlie the openings in row **116** (FIG. **11**) but do not reach the openings in row **114.**

The interposers are progressively longer in successive layers so that an interposer in any slot in any block normally clears all of the openings in its slots but is capable of overlying the first opening in a slot when it is extended. Thus, for each column of punches, there is a plurality of interposers arranged in layers, there being one layer for each punch in the column. Each interposer in each layer is adapted to move in the columnwise direction into and out of registry with a corresponding punch.

The circuit board, as shown in FIG. **12,** has a tongue **198** for connection to a cable connector. Printed conductive elements **200, 202** and **204** are shown on the upper side of the circuit board. On the lower side of the circuit board, at the location of tongue **198,** there are nine conductive elements, one for each solenoid. These nine conductors are connected by means of through connections on the circuit board to conductors on the upper side of the circuit board. On the lower side of the circuit board, at the location of tongue **198,** there are nine conductive elements, one for each solenoid. These nine conductors are connected by means of through connections on the circuit board to conductors on the upper side of the circuit board, four of which are shown in FIGS. **15** at **206, 208, 210** and **212.** Adjacent each of conductors **206–212** is a conductor, three of which are located at **214, 216** and **218** in FIG. **15.** These nine conductors are connected to the cathodes of diodes **220** (FIG. **12**), the anodes of which are connected in common to conductor **202.** Common conductor **200** is provided with projecting conductive elements aligned with elements **206–212** in FIG. **15.** These elements are exemplified by elements **222, 224, 226** and **228.**

On each of the interposers there is mounted a metal spring element similar to element **230** shown in FIGS. **13** and **14.** Spring element **230** has two arms **232** and **234.** Arm **234** is always in contact with a conductive element **214** (FIG. **15**). Arm **232** is normally in contact with a conductive element corresponding to conductive element **206.** However, arm **232** clears conductive element **206** and contacts the conductive element corresponding to element **222** when the interposer to which it is attached is extended. The interposers are preferably of insulating material so that they do not short-circuit the spring elements to the metal of the guide block assembly.

The electrical circuitry corresponding to the circuit board shown in FIGS. **12** and **13** is shown schematically in FIG. **16** wherein a positive DC voltage is applied to each of the solenoids through conductor **204** and wherein the solenoids may be energized by the application of negative voltages to individual terminals of the group indicated at **236** or combinations thereof.

Each of terminals **236** is connected not only to a solenoid but also to output line **202** through normally closed contacts of a switch and through a diode in series with said normally closed contacts. The diodes are disposed with their cathodes connected to terminals **236** through the switch contacts and with their anodes connected in common to output conductor **202.** Output conductor **200** is connected to normally open contacts of each of the switches.

If, when electrical energy is applied to one or more of terminals **236,** and any one of the selected solenoids fail to operate, a negative signal will appear in conduc-

tor **202.** This negative signal may be used to inhibit the ticket issuing machine to prevent the issuance of a ticket carrying erroneous information. The diodes prevent negative voltages from being fed to solenoids other than those selected.

If, as a result of a previous operation, the armature of any solenoid remains held in the selected position by reason of friction, for example, conductor **202** will be connected through one of the switches to conductor **200.** The malfunction can be determined easily by the application, prior to operation of the punch, of a positive pulse to conductor **202** or of a negative pulse to conductor **200,** and detecting the pulse at the opposite conductor.

FIG. **7** shows a punched and cut ticket **238** which has been punched with typical information for a parking lot. Certain punches of the array have been operated in punching ticket **238** and others have not.

In row **240,** columns **250** and **254** have been punches. In row **242,** all of the columns except columns **254** and **260** have been punched. In row **244,** columns **250, 256, 262** and **266** have been punched. In row **246,** columns **258, 260** and **266** have been punched. In row **248,** columns **254, 256** and **264** have been punched.

The punched holes in ticket **238** may carry any desired variable information in any of a great number of binary codes. The ticket shown is a parking lot ticket which carries information in several different categories in binary-coded decimal form.

The combination of punched holes in row **248,** columns **260, 258, 256** and **254** identify the entrance lane in a multiple-lane parking lot. In this case, the lane identified is lane number **10.**

The combination of punched holes in row **248,** columns **262, 264** and **266** represents a "sequential number" which in this case is the number **2.** The sequential numbers count to **7,** the count increasing by one for each ticket which is issued in a given minute. The sequential number, taken together with time information elsewhere on the ticket establish a unique identification number for each automobile which enters the parking lot.

The combination of punched holes in row **246,** columns **254** and **256** constitute a "facility code" which identifies the particular parking lot involved. In this case, the parking lot is parking lot number **0.**

The day of the year is represented by three binary-coded decimal digits, the first digit being found in row **246,** columns **258** and **260,** the second digit being found in row **246,** columns **262, 264** and **266** and in row **244,** column **250,** and the third digit being found in row **244,** columns **252, 254, 256** and **258.** On ticket **238** the punched holes represent the **332** day of the year.

The time of the day is similarly represented by four binary-coded decimal digits in the remaining columns of row **244** and in all of row **242.** The time represented in the case of ticket **238** is 1737 or 5:37 P.M.

The punched holes in row **240** are so called "line up" holes which are used in the ticket reader to make sure that the ticket is in the proper position as it moves through the reader when reading takes place.

Row **240** may also carry check bits if desired to insure against errors.

The invention has the advantage that all of the moving parts of the selective punch move as a unit in the punching direction, thus eliminating the need for complex linkages and greatly simplifying the structure and increasing the reliability of the mechanism. In addition, the circuit board and interposer assemblies are readily replaceable in the event of a malfunction. The selective punch in accordance with the invention is specially adapted for use in a conventional ticket issuing machine, there being required only relatively simple modifications to accomplish the punching motion and to produce an electrical signal for initiating operation of the interposer control circuitry. Finally, the use of circuit board-mounted interposer driving solenoids permits the convenient production of error signals by means of slide switches formed by conductive elements on the interposer which cooperate with conductive elements on the circuit boards.

Numerous modifications can be made in the number and arrangement of interposers and punching elements and in other aspects of the invention without departing from the scope of the invention as defined in the following claims.

I claim:

1. Apparatus for producing a variable, information-bearing pattern of perforations on a ticket comprising

a die having a plurality of punch receiving openings arranged in a pattern of rows and columns,

a plurality of punches arranged in corresponding rows and columns, each having an operative end adapted to be moved into one of said openings to produce perforations in a ticket, in each column the punches being progressively longer from a first row to a last row,

means for maintaining said die and punches in separated relationship to provide a space for the insertion of a ticket between them,

a plurality of interposers for each column of punches, the interposers for each column being arranged in layers, there being one layer for each punch in the column, and each interposer in each layer being adapted to move in the columnwise direction into and out of registry with a corresponding punch,

means for mounting all of said interposers for simultaneous movement in the layerwise direction so that any punch having an interposer in registry with it is moved into its corresponding die opening, and

means for effecting columnwise movement of selected interposers.

2. Apparatus according to claim **1** in which said means for mounting all of said interposers comprises means providing a plurality of guide slots, one for each interposer, said guide slots allowing columnwise movement of said interposers, but restraining said interposers against movement with respect to one another in the row-wise and layerwise directions.

3. Apparatus according to claim **1** in which said means for mounting all of said interposers comprises a block comprising a plurality of component blocks fastened together, each of said component blocks having columnwise slots in one of its surfaces which engages an adjacent block, said slots forming guide passages for interposers, and said blocks having layerwise passages for receiving the punches.

4. Apparatus according to claim **1** in which said means for effecting columnwise movement of selected interposers comprises a plurality of circuit boards, each board corresponding to a row of punches, and each having mounted thereon a plurality of electromechanical solenoids having armatures arranged to move in

the columnwise direction, each armature being arranged to effect columnwise movement of one of said interposers.

5. Apparatus according to claim 1 in which said means for effecting columnwise movement of selected interposers comprises a plurality of circuit boards, each board corresponding to a row of punches, and each having mounted thereon a plurality of electromechanical solenoids having armatures arranged to move in the columnwise direction, each armature being arranged to effect columnwise movement of one of said interposers, and in which said means for mounting all of said interposers comprises means providing a plurality of guide slots, one for each interposer, said guide slots allowing columnwise movement of said interposers, but restraining said interposers against movement with respect to one another in the row-wise and layerwise directions, and means providing a plurality of pairs of opposed mounting slots extending in the columnwise direction, said mounting slots being adapted to support said circuit boards against row-wise and layerwise movement with respect to one another.

6. Apparatus according to claim 1 in which said means for effecting columnwise movement of selected interposers comprises a plurality of circuit boards, each board corresponding to a row of punches, and each having mounted thereon a plurality of electromechanical solenoids having armatures arranged to move in the columnwise direction, each armature being arranged to effect columnwise movement of one of said interposers, and switch means mounted on said circuit board, said switch means comprising a plurality of switches, one for each solenoid and each switch being operable by the armature of its solenoid whereby the condition of each switch provides an electrical signal indicating the condition of the corresponding armature.

7. Apparatus according to claim 1 in which said means for effecting columnwise movement of selected interposers comprises a plurality of circuit boards, each board corresponding to a row of punches, and each having mounted thereon a plurality of electromechanical solenoids having armatures arranged to move in the columnwise direction, each armature being arranged to effect columnwise movement of one of said interposers, a plurality of conductors one connected to each solenoid on at least one of said circuit boards for selectively applying electrical power to the solenoids, normally closed switch means operable by the armature of each solenoid and having one terminal connected to the conductor for applying power to the solenoid, a common output line for conducting an error signal, a plurality of diodes, each connected between said common output line and one of the opposite terminals of one of the switch means, said diodes being connected to conduct current from said conductors to said common line when any solenoid fails to operate upon being energized and to isolate the solenoids from said common output line.

8. Apparatus according to claim 1 in which said means for effecting columnwise movement of selected interposers comprises a plurality of circuit boards, each board corresponding to a row of punches, and each having mounted thereon a plurality of electromechanical solenoids having armatures arranged to move in the columnwise direction, each armature being arranged to effect columnwise movement of one of said interposers, and a switch associated with each armature, each switch comprising at least one conductive element on the circuit board and a spring element fixed to its corresponding armature and bearing against said conductive element, each switch being operable by its corresponding armature whereby the condition of each switch provides an electrical indication of the condition of its corresponding armature.

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