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GB 1514997
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US 3843132 A
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(54) Electronic game board

(57) A chess or draughts board is equipped with a reed switch (15) below each square which is closed by a magnet in the game piece when the piece is placed on the square. Each square also has a light-emitting diode 51. A computer 45 senses the changing positions of the pieces on the board by scanning rows and columns to find intersections 43 at which the switch (15) is closed and a connection is hereby made to earth through a column driver Q9 to Q19. The computer also indicates its own moves in the game by illuminating the appropriate diodes 51 through row drivers Q_1 to Q_8 and column drivers Q9 to Q19.

The game and moves can be timed, the times being displayed and audibly signalled. The matrix may be 8 × 10.

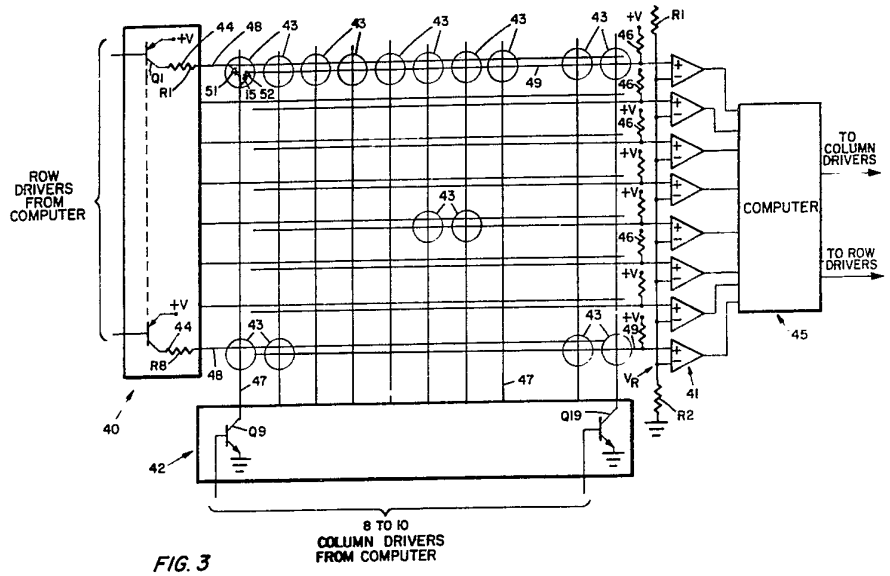

FIG. 3

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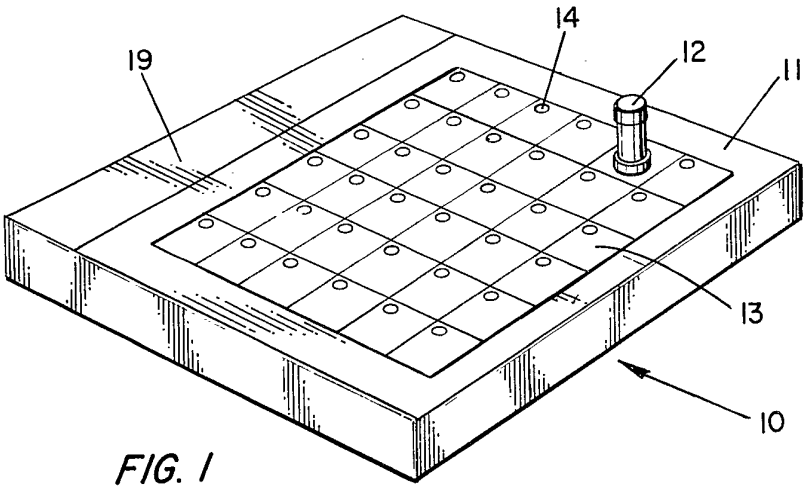

FIG. 1

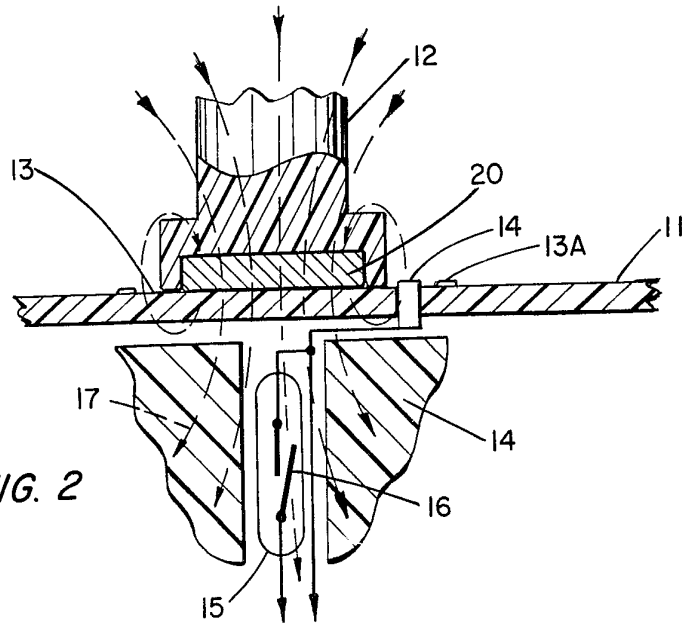

FIG. 2

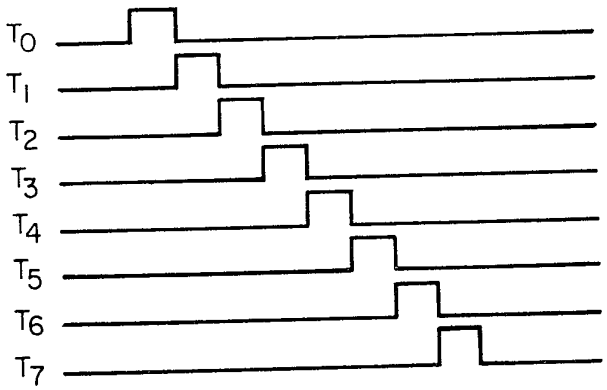

FIG. 5

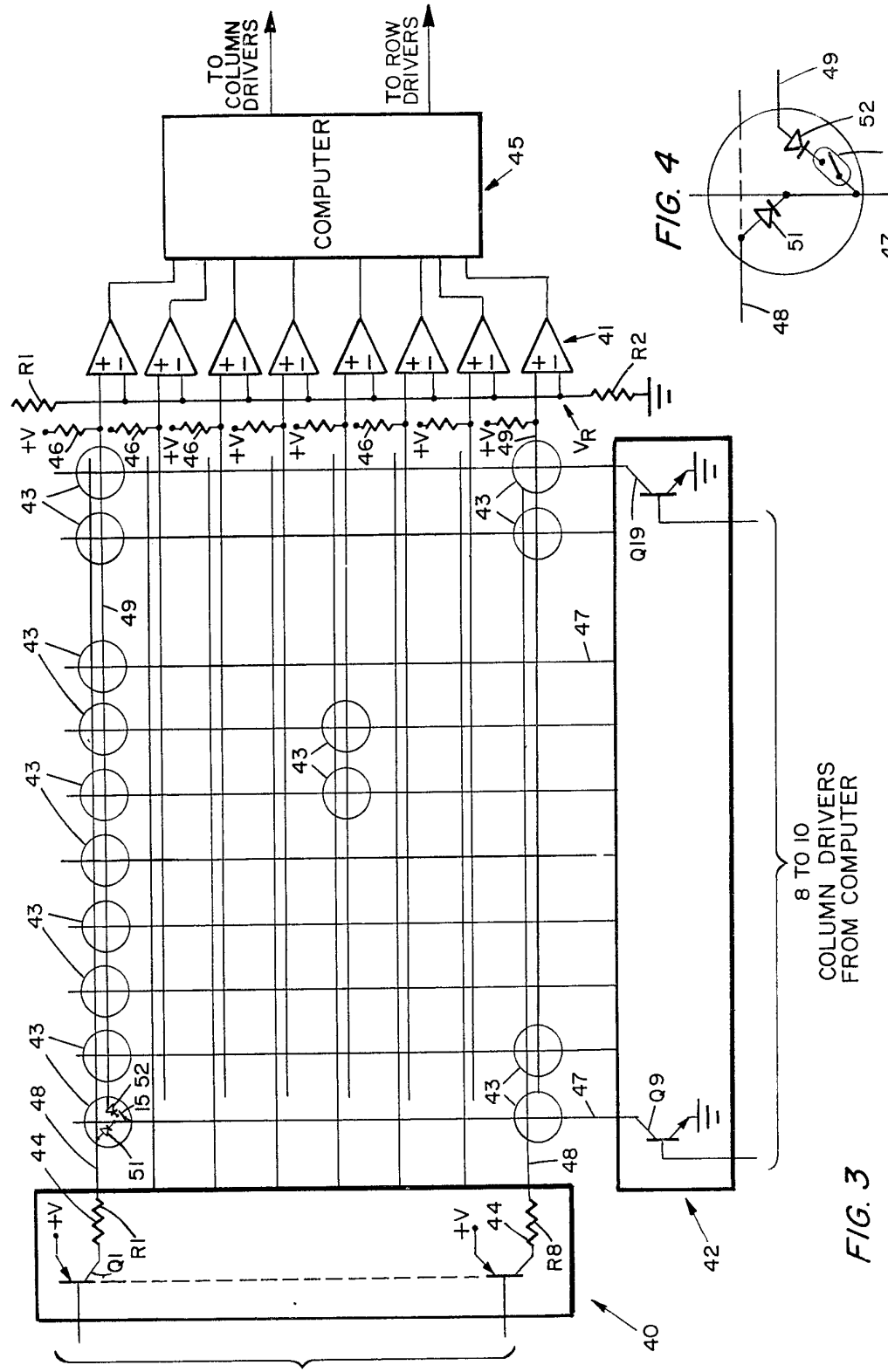

FIG. 3

FIG. 4

SPECIFICATION

Electronic board game

1. Field of the invention.
This invention is directed to game boards, in general, and to an electronic game board, in particular, which detects game play and responds thereto.

2. Prior art.
There are available in the market place many electronic game devices. However, most of these game devices present specific applications of hand held calculator devices with light emitting diode (LED) displays which simulate the movement of devices such as cars in a road race game, players in a football game and the like. In particular, these games permit little or no game play by the operator inasmuch as the game is played against a random function in the game control chip. Other games of electronic skill have been developed also. These games are of the chess or checker type game, for example. The currently available games of this type generally use a keyboard which is separate from the game board and an independent display device to interface with the game playing computer. In this instance, the board and display resemble the small hand held calculator as noted above. Thus, a game board of usual configuration is provided and the pieces are moved on the game board by the player. For each move, the play puts the appropriate entry into the computer via the keyboard. The computer operates upon the entry and determines the appropriate counter move. The player then makes the move of the pieces of the opponent as indicated by the display in response to the computer operation.

In more expensive models, a larger, for example typewriter style, keyboard is used to provide the input to the computer. A TV or CRT-type monitor provides the output display. Again, the move made by the player on a separate "standard" game board is entered into the computer by the keyboard. The computer's move is then provided on the display for readout device whereupon the player translates this instruction into an appropriate board move or position.

The problem with present games is the lack of the "hands on" feel of the game. Each move must be mentally translated to an address location then entered into the computer via a keyboard. The player loses concentration by continually transferring his thoughts between the game and the separate computer.

Other game arrangements includes game boards which are responsive to the pieces or men thereon to produce a "hard-copy" tabulation of the game progress. That is, a specialized board is provided which senses or detects movement of the pieces and prints out a running tabulation of the moves of the players. In this instance, the game board does not control game play.

PRIOR ART

A preliminary search has uncovered the following patents which are recorded herewith.

Ferguson (U.S. patent 3,843,132). This patent shows a game apparatus including pieces having magnets in the base thereof, a board with Hall-effect devices under each square for detecting the magnet in each game piece, a logic system for detecting moves and a printer for producing hard-copy reports of the game progress.

Tinman (U.S. patent 3,856,306). This patent shows a game apparatus with pieces having magnets in the base thereof and a board with horizontally located read relays and a distributor mechanism associated therewith.

Gardner (U.S. patent 3,893,671). This patent shows a game board, into which devices can be plugged including fiber optics for illuminating various board squares as a function of the piece involved.

Geraci (U.S. patent 4,065,130). This patent shows a game board with switches therebeneath for controlling a timing function.

Haith et al (U.S. patent 3,789,136). This patent shows a game display device using a CRT.

Gloess (U.S. patent 3,443,175). This patent shows a game display device using a CRT.

Melton (U.S. patent 3,739,117). This patent shows a game board with a magnet disposed therebeneath for selectively closing a circuit in response to a piece located at an associated location.

Khlebutin (U.S. patents 3,683,363 and 3,670,409). These patents each show chess games with pieces having tuned oscillating circuits therein and an inductance coil thereunder with circuitry adapted for detecting the piece and reporting on game progress.

SUMMARY OF THE INVENTION

There is shown an electronic game board apparatus which provides a direct electrical interface between a game board and a game-controlling computer. The game board has the appearance of a standard game board. The game board includes a plurality of reed-relay-type switches disposed beneath and normal thereto. The game pieces incorporate magnets which produce magnetic flux fields which interact with the reed-relay switches to selectively cause the switches to be closed. The switches are, preferably, connected in a matrix array and are selectively sensed by scanning the matrix to detect switch closures.

The computer detects closures of switches in the row array strobing while the column array is connected to the computer to provide

an input thereto. Thus, the computer can monitor the display field condition and produce an appropriate output. The preferred output includes a display arranged in the game board to include a light emitting diode (LED).

Other features can be applied to the device. For example, isolation diodes can be installed in the array to prevent sneak path problems. In addition, status lights and function keys can be added external to the game board, per se, to provide considerable functions and status arrangements for the game operator or player. In addition, timers, audio displays and the like can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic, perspective view of one embodiment of the game board of the instant invention.

Figure 2 is a cross-sectional view of a portion of the board and an interacting game piece of the instant invention.

Figure 3 is a schematic circuit diagram of the instant invention.

Figure 4 is an enlarged view of the interconnect arrangement of the circuit shown in Fig. 4.

Figure 5 is a partial timing diagram indicating the row address strobing arrangement.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to Fig. 1, there is shown a schematic representation and perspective view of the game board of the instant invention. In this rendition, game board 10 is shown as a rectilinear shaped unit having an upper surface 11. The upper surface comprises the game board surface, per se. The game board surface, in this embodiment, includes a plurality of spaces or squares 13 which are related to the game board apparatus. In the embodiment shown, the game board array of squares 13 is a 6×6 array. In a typical chess or checker board array, the number of spaces or squares 13 is generally 8×8. Of course, an array having any suitable number of squares can be provided. Playing pieces 12 of any appropriate size and shape relative to the appropriate game is provided. Only one such piece is depicted in Fig. 1. The playing piece includes a base portion in which a magnet is included as described hereinafter.

In the embodiment shown in Fig. 1, each of the squares or spaces 13 includes a display unit 14 which can comprise any type of illuminatable device such as a light emitting diode (LED). The LEDs 14 are used to indicate various positioning techniques in the game progress and/or operation and are under the control of the game computer, as described hereinafter.

A portion 19 of the game board can be optionally provided to mount the electronic chip or computer which controls the game, to mount an auxilliary display, to support an audio unit or any other optional equipment useful with the game board. Alternatively, the computer chip which controls the game can be mounted under the game board in any suitable fashion, especially in view of the small size of such chips. In the event that battery operation is desirable, batteries can be stored in portion 19 as well.

Referring now to Fig. 2, there is shown a cross-sectional view of a portion of the board apparatus shown in Fig. 1. In particular, the surface 11 is depicted. Elements 13A are included as representational showings of the lines which define spaces or squares 13. Typically, elements 13A are printed on, or even in, the surface 11, and have virtually no actual thickness, per se. A suitable playing piece 12 is shown as well. Located within the base of playing piece 12 is magnet 20 which produces magnetic field 17, shown in dashed lines. It is seen that the magnetic field 17 is substantially vertical when the piece 12 is within the confines of space or square 13. With this arrangement, a suitable reed-relay 15 of known configuration is disposed beneath the appropriate square. In fact, a similar reed-relay is disposed beneath each of squares 13. In a preferred arrangement, reed-relay 15 is disposed vertically with respect to surface 11 and substantially centrally located relative to space 13. A suitable support structure 14 is provided to support reed-relay 15. Support structure 14 can be fabricated of polyurethane or the like with apertures therethrough to support the relay switch. In addition, reed-relay 15 is connected to the display device 14 which is schematically represented as passing through game board 11. Of course, device 14 can be mounted under the board with an aperture, lens or the like passing through the board. Display device 14 is connected to one terminal of relay switch 15 and to row driver 48 as described hereinafter. Reed-relays are preferred because they are sealed and inhibit corrosion or other related problems.

It should be noted with the configuration shown and described in Fig. 2, the relationship of reed-relay 15 relative to magnetic field 17 permits more selective arrangement and interaction between the magnetic field 17 and the reed-relay switch 15. Thus, a condition wherein contacts 16 are closed, is effected while the play piece 12 is in the square 13 associated with the relay 15. However, when play piece 12 is moved so as to straddle play field line 13A, the magnetic field is ineffective to close contacts 16, wherein an ambiguous detection condition is not produced.

Referring now to Fig. 3, there is shown a schematic diagram of the circuit arrangement utilized in the instant game board. In particular, row drivers 40 comprise a plurality of transistors Q_1 through Q_7. In the embodiment

shown, the transistors are utilized to provide the +V driver for the eight rows in an 8 × 8 (or 8 × 10) matrix. In this embodiment, transistors Q_1 through Q_7 are PNP-type transistors with the base electrode connected to receive signals from the computer circuit 45. The emitter electrodes of the transistors are all connected to a suitable source +V while the collector electrodes are all connected through respective current limiting resistors R1–R8 to respective row lines 48. A plurality of individual row lines 48 are devices to establish the rows of the LED matrix array.

Similarly, a plurality of LED column drivers 42 are provided. In this embodiment, eight to ten NPN transistors Q_9 through Q_{19} are provided. The emitter electrodes are connected to ground while the base electrodes are connected to receive signals from computer 45 as described hereinafter. The collector electrodes are connected to the column conductors 47 which form the columns of the matrix array. It is noted, column drivers 42 can comprise eight to ten (or more) transistors to drive the eight columns in the array described herein as well as to drive any other optional equipment or devices as described hereinafter.

In addition, a plurality of row return comparator amplifiers 41 are provided. These row return amplifiers are designated Z_1 through Z_8 and are used to detect the voltage threshold between an open or a closed switch contact in the matrix. Each amplifier has two input terminals respectively designated "+" or "−". The negative (−) input terminal of each amplifier is connected to a common reference voltage V_R. The reference voltage is derived from a resistor divider circuit comprising resistors R_1 and R_2. The reference voltage is approximately one half the value of the +V supply voltage.

Each positive (+) input terminal of each comparator is connected to one of the row return lines 49 and also to a pull-up resistor 46. The pull-up resistor is connected to voltage source +V and assures the positive quiescent voltage level for any open circuit (i.e. no energized contact). The input voltage level at the (+) terminal is pulled to ground level only if a contact (reed-relay switch 15) is closed and the corresponding column driver is in the conducting state thereby producing a low impedance path to ground. That is, without the combination of a closed switch and a conductive transistor a circuit from ground is not established.

A plurality of intersections 43 are provided in the array. That is, there is an intersection at each row and column crossing of the array. Only some of the intersections 43 are shown in the interest of clarity. It should be noted that the column driver transistors are common to both LED drive and the reed switched, while separate row drivers and row receivers are provided.

Referring concurrently to Figs. 3 and 4, the intersection 43 is shown in detail in Fig. 5. Thus, light emitting diode 51 is connected between row conductor 48 and column conductor 47. In the particular embodiment, the anode of LED 51 is connected to conductor 48 while the cathode thereof is connected to column conductor 47. In addition, reed-relay switch 15 (see Fig. 1) is connected in series with isolation diode 52. The series connected network of switch 15 and diode 52 is connected between row return conductor 49 and column conductor 47, Again, the anode of diode 52 is connected to line 49 while the anode of diode 52 is connected, via switch 15, to row conductor 47.

In operation, play piece 12 (including magnet 20) is moved from space to space on play surface in accordance with the rules of the game. When play piece 12 is placed on a particular space 13, the associated reed-relay 15 is energized wherein the contacts 16 thereof are closed. Thus, the electronic game board automatically detects the piece move and transfers the information directly to the computer 45. That is, the computer detects the closure of contacts 16 of the reed-relay beneath the magnet and, as well, the opening of the contacts of the reed-relay associated with the space from which the play piece has been moved. The information is stored in the computer for operation. In addition, the lights in the play surface are also lit or extinguished as the case may be.

The computer evaluates the game board condition by interrogating the individual switch closures relative to the play field. In particular, the column transistors Q_9 through Q_{19} are sequentially turned on, one at a time at appropriate time intervals. As shown in Fig. 5, pulses are supplied to transistors Q_9 through Q_{19} at time periods t_0 through t_7. The pulse which is applied to the particular transistor is operative to turn on this transistor. At the time a row transistor is energized, the computer 45 also examines the row return lines at amplifiers Z_1–Z_8 of the play field matrix. In the event that a switch 15 has been closed in the row which is energized by the column driver, a ground potential signal is applied to the corresponding row return amplifier 41 through the interconnection provided by closed switch 15 and isolation diode 52. This ground level signal is supplied to the (+) input of the appropriate column return amplifier 41 (i.e. amplifier Z through Z_8) whereby the appropriate amplifier is turned on and the signal is supplied to computer 45. Thus, by sequentially turning on each row transistor and, simultaneously monitoring each of the column return lines, the play field conditions will be determined by the computer.

Isolation diode 52 is provided in series with reed-relay 15 to prevent the sneak current

path return in the event multiple switches are closed. This condition can occur in the event that one or more pieces are positioned in any particular row which situation is highly likely in view of the large number of pieces involved in many games.

Light emitting diodes 51 are connected between lines 48 and 47. Consequently, when one or more of the LED column drivers 42 is energized or turned on by the computer 45, the LEDs associated therewith are also turned on when the appropriate row driver 40 is energized. Series resistor 44 is provided in the collector circuit of each row driver transistor 40 in order to limit the current in the LED to a safe design level. With an appropriate multiplexing scan rate of approximately 60 Hz, the row and column drivers can be operated rapidly enough to provide a flicker-free display.

Computer 45, as shown in Fig. 3, can be any suitable computer such as, but not limited to, a microprocessor chip which can be installed readily within the confines of the game board, per se. Of course, a much larger device can be utilized if so desired but the advantage of a small, hand-held, portable game will be diminished. With such a microprocessor chip, other options can be provided in the circuit as shown. For example, microprocessor chip 45 can be used as a timer clock. A microprocessor chip can do the timing procedure with little or no difficulty. The timer can then be used to operate a numeric display (not shown) which can be mounted at portion 19 of the game board (see Fig. 1). This timer arrangement can be used to provide any number of factors such as elapsed time per game, elapsed time per player, number of plays per game, and/or a time limit for each move of a respective player.

Moreover, an audio device, such as a speaker or the like, can be included on the game board to improve communication between the computer and the player. Thus, the computer can produce an audible beep or sound-tone when a certain time has elapsed, for example.

In addition, by expanding the matrix from the 8×8 matrix typically encountered in a chess or checker game, to an 8×10 matrix, there will be provided 16 additional functions. These functions can be in the form of key caps for manually inserting information or any other suitable arrangement.

Thus, there has been shown and described an electronic game board which provides a direct interface between the game board and a controlling computer. Typically the game plans, rules and procedures are inserted into the computer in accordance with a programming routine of appropriate nature which are known in the art. The invention described herein is not directed to the play of the game nor to the program or algorithm which controls the game operation. The electronic game board has all the appearance of a standard game board and uses individual playing pieces in a standard fashion. During the operation or playing of the game, the player simply moves the pieces in accordance with game play. The game board automatically detects the piece moved and the location from and to which the piece has been moved. This information is transferred directly to the control computer. The computer further indicates the move which it intends to follow by illuminating one or more of the lights located on each square of the play field. The game board of this invention permits the player to concentrate on the game in progress as it is occuring on the play field. There is no need to continuously perform a translation of information from the play field to the keyboard or the display as is so typical in the game boards currently known in the art. In addition, the game board of the instant invention is readily adaptable to modification and expansion to perform other game related functions.

In addition, the structure as shown and described relative to the orientation of the reed-relay and magnetic field is selected to permit the switch closure to be more uniform and to prevent a "null" or possible non-closing contact which can be present with a horizontally mounted switch.

The invention shown and described herein includes a specific recitation of components and interconnections. Modifications to these specific components and interconnections can be made by those skilled in the art. However, any such modifications which fall within the purview of this description are intended to be included herein as well. The scope of this invention is not to be limited by the description but is limited only by the scope of the claims appended hereto.

Having thus described a preferred embodiment of the instant invention, what is claimed is:

CLAIMS

1. A game board apparatus comprising:

a game board having a plurality of defined spaces on a surface thereof;

switch means associated with each space on said game board;

said switch means adapted to be selectively operated by game pieces on said game board;

control means;

column driver means connected to said control means, and

row return means connected to said control means;

said switch means connected between said column driver means and said row return means whereby said computer means can detect the presence of a game piece in a particular space as a function of the operation of said switch means.

2. The apparatus recited in Claim 1 including:

row driver means connected to said control means, and;

radiation emitting means connected between said row driver means and said column driver means to selectively emit radiation as a function of signals supplied by said control means.

3. The apparatus recited in Claim 2, wherein:

said control means comprises a microprocessor circuit.

4. The apparatus recited in Claim 1, wherein:

said switch means comprise a plurality of reed-relay switches arranged with one reed-relay switch per space.

5. The apparatus recited in Claim 2, wherein:

said radiation emitting means comprise light emitting diodes (LED).

6. The apparatus recited in Claim 1, wherein:

said row return means include comparator amplifier means having a first input connected to row return lines and a second input connected to a reference signal.

7. The apparatus recited in Claim 6, wherein:

said reference signal is provided by voltage divider means.

8. The apparatus recited in Claim 1, wherein:

said control means strokes said row return means and sequentially drives said column driver means.

9. The apparatus recited in Claim 2, wherein:

said column driver means comprises a plurality of first transistors; and

said row driver means comprise a plurality of second transistors.

10. The apparatus recited in Claim 1, including:

isolation means connected in series with said switch means.

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