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(71) Applicant: **WILLIAMS ELECTRONICS, INC.**
Chicago Illinois 60618 (US)

(72) Inventor: **Bleich, Charles R.**
Cary, Illinois 60013 (US)

(74) Representative: **Loisel, Bertrand**
Cabinet Plasseraud,
84, rue d'Amsterdam
75440 Paris Cédex 09 (FR)

(54) **Amusement game with improved distribution and location of electronic circuits**

(57) An amusement game (10) includes a cabinet housing (12) for defining a pinball game, including a playfield (14) having one or more illumination devices (50), one or more solenoids (46) for activating devices on the playfield (14) and one or more switches (48). Driver circuits mounted to the playfield (14) are operatively coupled with one or more of the illumination devices (50) and solenoids (46). Interface circuits (62,64,66) for the solenoids, illumination devices and switches may also be mounted to the playfield (14). Drivers for the solenoids may be mounted to the associated solenoids.

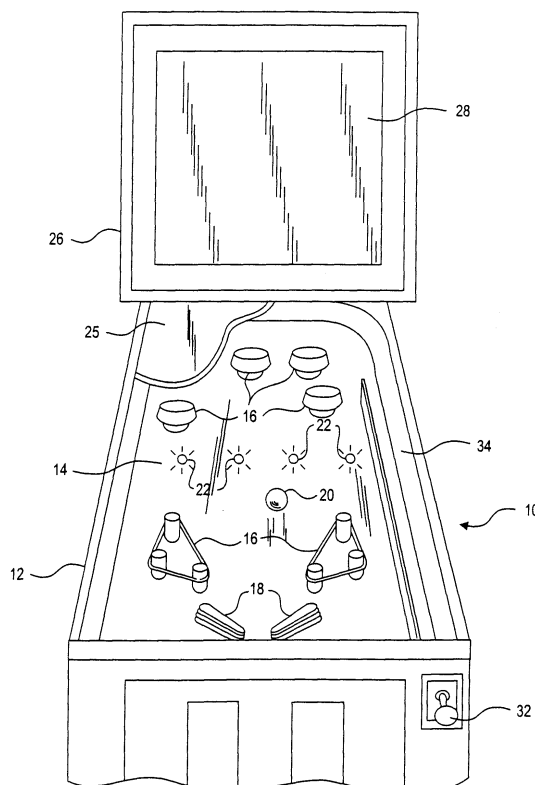


FIG. 1

EP 0 992 264 A1

Description

FIELD OF THE INVENTION

[0001] This invention relates generally to amusement games and more particularly, to an amusement game which incorporates improvements in the distribution and location of electronic circuits.

BACKGROUND OF THE INVENTION

[0002] Amusement games such as pinball games and video games are often found together in arcades and other gaming establishments. The designers of these games strive to constantly provide innovations to continue to attract interest of the public in playing the games, both to attract new players and to retain the interest of present players. In pinball games, new and different playfield designs incorporating various moving or drop-targets, raised portions of the playfield, auxiliary ball propelling devices, and the like have been developed for attracting and retaining players.

[0003] Video games have also been generating considerable interest among players. Generally speaking, these video games utilize a video display on a cathode ray tube (CRT) or equivalent device to provide the "playfield" for the game. This in effect replaces the electromechanical playfield and rolling ball of the pinball game. However, many types of game action can be displayed in video games.

[0004] In pinball games, generally speaking, the playfield is located in a horizontally disposed cabinet, with the playfield generally tilted or inclined at a slight angle from the horizontal to encourage the return of the ball to the end or bottom area of the playfield, where the skilled player may attempt to propel the ball back into the playfield area. Usually, the display portion of the pinball game consists of an alphanumeric score display which shows the score for one or more players, and it is usually mounted in a backbox which is mounted to the top portion of the cabinet and generally at an end thereof opposite the player position. This display is usually either electromechanical or illumination elements such as gas discharge or neon tubes or LEDs. In some cases, so-called dot-matrix display elements or panels have been used to generate alphanumeric displays, and in some cases, other limited visual displays.

[0005] Other graphics or artwork, often referred to as the "back glass" usually forms a front or visible service of the backbox. Additional lighting or other audiovisual effects may also be mounted in or upon the backbox to make the appearance of the pinball game more attractive. Additional artwork related to the play of the game and to further enhance the overall attractiveness of the pinball game is often included on other surfaces of the backbox as well as on the playing surface of the playfield.

[0006] The present invention provides a number of

schemes for more efficiently and effectively distributing electronic components of an amusement game. For example, in present pinball games, most of the electronic components for controlling or operating the game are located in the backbox which is mounted above the cabinet which houses the playfield. The playfield incorporates various play features, including lamps, switches and solenoid-driven play features, such that cable runs containing relatively large numbers of wires or cables must generally be run between each of the elements on the playfield and corresponding inputs and/or outputs of the electronic circuits mounted in the backbox. Such wiring requires large numbers of wires and associated cable runs, as well as large numbers of connectors at each end of each cable, i.e., where it connects to electronic circuit components in the backbox and to individual game elements such as solenoids, lamps, switches and the like, generally under the playfield. Many problems can arise both during initial assembly of such cables, connectors and the like, and while the game is in service in the field, such as loss of electrical contact at one or more pins in a connector, the buildup of contact resistance, and the like. Problems with the continuity and integrity of various wires within such cable runs may also arise during assembly or while in service. Generally speaking, such problems are relatively hard to diagnose and correct where large numbers of wires and connectors are involved.

[0007] Moreover, with the electronic control circuitry in the backbox, it has heretofore been the practice to design a single or universal control circuit which has the capability of controlling many different combinations of solenoids, switches, lamps and other devices which might be selected by designers for the playfield of a given pinball game. While this is highly desirable in terms of the design and production of the control components as one or more standardized units, it can impose certain limits upon game designers. For example, a standardized control board may contain enough drivers to accommodate only a given number of solenoids having given power requirements, thus limiting the number of solenoids which a game designer may employ in a given playfield. On the other hand, a standardized control board may contain more driver circuits than a designer requires for a given playfield design, thus, in effect, "penalizing" the designer by adding the extra expense of unused circuits.

[0008] In accordance with one embodiment of the present invention, the drive or drive components for one or more of the solenoids or lamps or other devices of a playfield are incorporated as a part of the playfield itself, for example, mounted to the underside of the playfield. In this way, the numbers of drivers and/or drive circuits can be customized to the number of associated components (e.g. lamps or solenoids) selected by the designer for given playfield. This embodiment of the invention further provides for addressing the individual driver circuits from a processor or CPU which can be programmed or

otherwise provided with suitable customized software for operation with the numbers and types of drivers which are provided in connection with a given playfield. Thus, the game designer is not constrained by the control electronics available in a "standard" control unit or control board or boards, but may employ the desired numbers and combinations of solenoids, lamps and other devices in the playfield design.

[0009] In accordance with another embodiment of the invention, interface components for receiving or delivering the communications protocol or signals from/to a controller, processor or CPU and for routing and delivering appropriate corresponding control signals to drivers for the solenoids, lamps or other devices, or for receiving signals from switches on the playfield, may also be mounted to the underside of the playfield. In this way, the wiring or cabling between a processor or control unit which may be located either in the game cabinet or in the backbox can be limited to the wiring for carrying the communications protocol or data to the interface circuitry. This comprises essentially low power, low voltage signals, whereby higher power signals for driving solenoids, lamps, etc. or from switches, can be confined to the playfield. This consideration can simplify wiring runs and cabling requirements.

[0010] Moreover, employing the foregoing considerations makes it possible to more easily replace or upgrade amusement games in the field. Heretofore, an amusement game operator was generally required to buy an entire new pinball machine in order to install a new pinball game. However, with the above-noted embodiment of the invention, it is possible to provide a replacement playfield as a separate unit. Thus, installation of a new game requires only a new playfield and the reprogramming or other provision of new software for the processor or control unit. This latter function can usually be accomplished by replacing one or more memory boards or other memory components of the processor. Thus, an essentially new and different game can be provided within an existing cabinet, with the existing display, requiring only replacement of the playfield and some of the software elements (and/or related processor or memory components) of the amusement game.

[0011] In some individual prior art pinball games, occasionally one or more drivers for specific play features have been mounted in the cabinet or mounted to the playfield itself for specific reasons. In such cases, this has usually been done because the drivers provided in the control circuitry did not include either enough drivers or enough of the right types of drivers for the desired functions. Sometimes one or more drivers were mounted separately from the main control circuitry because of unusual or relatively high power requirements which could not be accommodated by the drivers provided in the control circuitry, or which were required for additional functions above and beyond those provided by the drivers having like power capacity in the control circuitry. In some cases, these relatively high power drivers may

have been intentionally mounted apart from the other control circuitry in order to isolate the higher power switching devices, such as transistors, from the control circuitry, so as to protect the control circuitry in the event of failure of these relatively higher power devices. However, heretofore it has not been the practice to mount the majority of drive or driver components for the playfield devices to the playfield itself, or to mount the drivers in close proximity to the devices operated thereby.

[0012] In accordance with another embodiment of the invention, the driver circuitry for each solenoid is mounted directly to the associated solenoid. In this way, each solenoid and its driver can be provided as a separate unit. This is advantageous, in that upon solenoid failure, generally one or more components of its associated driver circuit, and usually the output transistor, also fails. Since in most present pinball games, the drivers are part of a circuit board mounted within the backboard of the pinball game, solenoid failure often necessitates removal and replacement of not only the solenoid but of the entire circuit board upon which the driver of the failed solenoid is located. Usually, these circuit boards are relatively large, incorporating a large number of other components, and are relatively expensive.

[0013] While the replacement of the board and solenoid as such may not be particularly complicated, the necessity of replacing an entire, relatively expensive board requires that the amusement game operator or repair service stock a number of such expensive boards in order to have the capability of providing quick on-site repair services. Generally speaking, tracking down the individual failed driver circuits or components and making repairs or replacements of the individual components on the boards while on site is too time-consuming to be cost effective. Moreover, the level of skill required to repair or refurbish the individual components of a relatively large and complex circuit board may be beyond the level of skill of the average repairman in the field. That is, it is sometimes more cost effective to employ less highly skilled field service technicians while employing a smaller number of a relatively more highly skilled technicians at a central facility for effecting more complicated testing and repairs of the circuit boards.

45 OBJECTS OF THE INVENTION

[0014] Accordingly, it is an object of the invention to provide an amusement game which distributes electronic circuits associated with the game and its display in an efficient and cost-effective fashion.

[0015] A related object is to provide an amusement game in accordance with the foregoing object in which driver circuits associated with various lamps, switches, solenoids and other devices on the playfield are mounted to the playfield.

[0016] A further object is to provide an amusement game in accordance with the foregoing objects in which interface circuits for the drivers and/or for switches are

also mounted to the playfield.

[0017] Yet another object is to provide an amusement game in accordance with one or more of the foregoing objects wherein driver circuits associated with individual solenoids are mounted directly to the associated solenoids.

SUMMARY OF THE INVENTION

[0018] Briefly, and in accordance with the foregoing discussion, an amusement game in accordance with one aspect of the invention comprises a cabinet, apparatus in said cabinet defining pinball play, including a playfield, one or more playfield devices, and driver circuits mounted to the playfield, said driver circuits comprising a majority of the driver circuits used for the operation of said playfield devices.

[0019] In accordance with another aspect of the invention an amusement game comprises a cabinet, apparatus in said cabinet defining pinball play, including a playfield, one or more playfield devices and at least one driver circuit mounted to the playfield in close proximity to one of said playfield devices to be driven thereby.

[0020] In accordance with another aspect of the invention an amusement game comprises a cabinet, apparatus in said cabinet defining pinball play, including a playfield, one or more playfield devices, and one or more switches operatively associated with said playfield, driver circuits mounted to said playfield for operation of said playfield devices, and further including interface circuits mounted on said playfield and operatively coupled with at least some of said driver circuits and of said switches.

[0021] In accordance with another aspect of the invention an amusement game comprises a cabinet, apparatus in said cabinet defining pinball play, including a playfield, one or more solenoids for activating devices on the playfield, and a solenoid driver circuit for each of said solenoids, wherein at least one of said solenoid driver circuits is mounted to an associated solenoid.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] In the drawings:

FIG. 1 is a perspective view of an amusement game in accordance with one embodiment of the invention;

FIG. 2 is a section in side elevation of the amusement game of FIG. 1 in accordance with one embodiment of the invention;

FIG. 3 is a section in side elevation of the amusement game of FIG. 1 in accordance with another embodiment of the invention;

FIG. 4 is a functional block diagram of one embodiment of the invention;

FIG. 5 is a partial functional block diagram of another embodiment of the invention;

FIG. 6 is a simplified elevation of a solenoid incor-

porating a driver board in accordance with one embodiment of the invention; and

FIG. 7 is an end view of FIG. 6.

DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[0023] While the invention is susceptible to various modifications and alternative forms, specific embodiments have been shown by way of example in the drawings and will be described in detail herein. However, it should be understood that the invention is not intended to be limited to the particular details disclosed. Rather, the invention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

[0024] Referring now to the drawings, and initially to FIG. 1, an amusement game in accordance with one embodiment of the invention is designated generally by the reference numeral 10. The game 10 includes a cabinet 12 which houses various apparatus for defining pinball play. Generally speaking, this apparatus includes a playfield 14 which incorporates a number of playfield accessories or devices 16. In this regard, a pair of flippers 18 is usually provided for propelling a ball 20 relative to the playfield. As best viewed in FIG. 2, the playfield is usually inclined from the horizontal such that the ball 20 tends to eventually roll back down the playfield in the direction of the flippers 18. The playfield accessories or devices 16 may also include elements such as bumpers or targets as well as various lights or illumination devices which may comprise lamps 22 or other devices. The playfield 14 may be covered by a transparent or glass sheet 25 to permit viewing of the playfield.

[0025] The amusement game 10 may include additional or different play features without departing from the invention, the foregoing being by way of example only. In addition to the foregoing, the playfield usually includes a plunger element 32 which shoots the ball 20 up an alley 34 onto the playfield 14. Other player-activated elements, usually in the form of push-buttons (not shown) on the sides of the cabinet 12 are usually provided for controlling operation of the flippers 18.

[0026] In accordance with conventional practice, the amusement game 10 also includes a backbox 26 which is mounted to overlay a top rear portion of the cabinet 12 and which contains a game display 28. In one embodiment, the display 28 includes a video display unit such as a cathode ray tube (CRT) 30 (also see FIG. 2) or equivalent device.

[0027] As shown in FIG. 2, in accordance with one embodiment of the invention, a majority of, and in the illustrated embodiment, substantially all of the electronic circuits for controlling both the operation of the playfield and the operation of the CRT or other video display device 30 are located in the cabinet 12. These electronic circuits are indicated generally by the reference numeral 40 in FIG. 2, it being understood that they may be housed in a suitable housing 42, for example, in the form

of one or more circuit boards (not shown) which may be mounted to a suitable support element or a frame (not shown). In the embodiment illustrated in FIG. 2, the electronic circuits 40 are mounted generally in a bottom, rear portion of the cabinet 12 spaced apart from an undersurface 44 of the playfield 14.

[0028] Also visible in FIG. 2 on the undersurface 44 of the playfield 14 are a number of playfield devices or elements including one or more solenoids 46, one or more switches 48 and one or more lamps or other illumination elements 50. In the illustrated embodiment, all of the drivers or drive circuits for all of the playfield devices incorporating or requiring drivers are mounted on the underside of the playfield. Thus, elements 46 and 50 may also include their associated drivers in FIG. 2, such that in one embodiment, drivers are mounted in close proximity to the associated solenoids, lamps or other playfield devices. However, it is within the scope of the invention to so mount fewer than all of the driver elements, so long as either a majority of such driver elements are so mounted or the drivers so mounted are located in close proximity to the associated devices which they drive. Generally speaking, by drivers or drive circuits is meant such elements as transistors and associated circuitry which receive a control signal through a suitable interface circuit from a processor, CPU or other controller and convert the control signal to a suitable signal level for operating the associated device, such as a solenoid or illumination device. Usually, such drivers take the form of a transistorized switching circuit, but may take other equivalent forms without departing from the invention.

[0029] Suitable connection elements, such as wires and connectors (not shown) are provided for coupling the electronic circuits 40 to these various elements 46, 48 and 50 of the playfield 14 as well as to the CRT or other display 30, and are illustrated in FIG. 2 in the form of respective cables 52 and 54. These cables 52 and 54 may comprise wiring harnesses carrying a number of individual wires or conductors, as necessary to carry suitable signals from the electronic circuits 40 to the CRT or other display device 30 on the one hand and to the elements 46, 48, 50 of the playfield 14 on the other hand.

[0030] While the drawings illustrate a CRT as the display portion of the game, and a CRT has been described as the display in one embodiment of the invention, other embodiments of the invention may employ other types of displays. Accordingly, these other embodiments of the invention are not limited to use with a CRT, but may use other types of displays, such as alphanumeric displays, electromechanical display elements, electroluminescent elements, gas discharge or neon tubes, LED's, LCD's, dot matrix displays or combinations of two or more of these various types of display elements (including a CRT).

[0031] Referring to FIG. 4, generally speaking, the electronic circuits 40 usually are arranged on three

boards, namely, the processor circuits or processor circuit board 56, the power/driver or power supply circuits or board 58 and the audiovisual or AV processor/generator circuits or board 60. Heretofore, the power/driver circuits, located on the board 58, included respective interface and/or driver circuits, including solenoid interface and/or driver circuits, lamp interface and/or driver circuits and switch interface circuits associated with the respective solenoids, lamps and switches of the playfield 14.

[0032] Referring to FIGS. 3 and 4, and in accordance with one embodiment of the invention, at least one of the interface components is moved from the board 58 and assembled with or mounted on the undersurface or back 44 of the playfield 14. FIGS. 3 and 4 illustrate three of such interface circuits indicated respectively by reference numerals 62, 64 and 66. Switches are indicated by reference numeral 48. Solenoid drivers 46 are operatively coupled with a solenoid interface circuit 66, switches 48 are operatively coupled with a switching interface circuit 62 and lamp drivers 50 are operatively coupled with a lamp interface circuit 64. It is also within the scope of the invention to locate both the drivers for the solenoids 46 and lamps 50 together with the associated interface circuits on respective boards 66 and 64. Alternatively, the drivers and interface circuits for the solenoids, lamps, switches and any other playfield devices may be located on more or fewer boards (e.g. all on a single board) without departing from the invention, so long as at least one of the drivers and one of the interface circuits are located on the playfield 14.

[0033] In the above-described manner, the driver and interface components associated with the respective switches, lamps and solenoids selected by the game designer for use with a particular playfield 14 will be located on the playfield itself, thus making the playfield a self-contained unit, as discussed hereinabove. Thus, the pinball game 12 can be modified, changed or upgraded by replacing the playfield 14, together with replacing related software of the processor or CPU board 56, which may involve no more than changing individual memory components, such as a ROM card, flash card, RAM components, or other types of memory devices.

[0034] Generally speaking, the term "interface" as used herein refers to circuitry which is functionally located between the control, processor or CPU components and the drivers for the individual solenoids, lamps, switches, and the like. Generally speaking, these interface circuits or components perform the functions of receiving control signals from the processor and correctly routing these control signals in a suitable form to the individual driver circuits or components. These interface circuits may communicate with the processor or CPU using suitable data communications protocol within the scope of the invention. Such interfaces may also receive switch signals from switch elements 48 associated with the playfield and route these signals back to the control or CPU board, while retaining the identity or location of

the switch from which such signals originated.

[0035] The interface components 62, 64, 66 require only suitable control signal connections from the processor board 56 and power inputs from the power supply board 58. The required power can generally be provided to the interface circuits 62, 64 and 66 from the power supply board 58, by relatively few and simple wires and leads in relatively simple cable(s) or power transmission line(s) 70, 72.

[0036] The signals from the processor 56 to the respective interface circuits 62, 64 and 66 may be handled by a data communications network or system, such as RS432, RS485, I²C, or USB (universal serial bus) or some combination of these protocols, or any other data communications protocol. Respective data communications interfaces 57 in the processor, and 63, 65, 67 in the interface circuits 62, 64, 66 may be provided for this purpose. Such data communications can be implemented with a cable 72 having a relatively small number of individual conductors, such that the processor 56 can address the various interface circuits for the solenoids, lamps and switches. The fact that this can be accomplished with a relatively small number of conductors greatly simplifies the wiring, cabling and connector requirements.

[0037] Referring now to FIGS. 5, 6 and 7, in accordance with yet another embodiment of the invention, individual driver circuits, such as a circuit card 80, for individual ones of the solenoids, such as a solenoid 82, are mounted directly to their associated solenoids, for example by straps or bands 83, as best viewed in FIGS. 6 and 7, to form a solenoid/driver assembly 84. Other methods may be used to mount the drivers to the solenoids without departing from the invention. For example the solenoids may be provided with bobbins or housings with flat surfaces configured for directly mounting small circuit boards by adhesive means, sonic welding or the like, or the drivers may be provided as small prepackaged components which can readily be both mechanically and electrically connected to a solenoid.

[0038] FIG. 5 illustrates a circuit schematic by which all of the solenoid drivers are operatively coupled, as indicated at 88, to a solenoid interface circuit 86. The solenoid interface circuit 86 may comprise the solenoid interface 66 of FIGS. 3 and 4, mounted on the back 44 of the playfield 14. Alternatively, the solenoid interface circuit 86 may be a portion of the electronic circuits 40 in the housing or enclosure 42 shown in FIG. 2. Suitable wires 90 provide the power requirements of the interface circuit 86 and solenoid/drivers 84 from the power supply 58. This also simplifies the wiring, wire harness and connector requirements for the game 10.

[0039] What has been illustrated and described here is a novel and improved amusement game. In one embodiment, the invention provides for mounting of electronic circuits for operation of the playfield and of a display (which may or may not employ a CRT) in a cabinet with the playfield, with the display being mounted in a

backbox above the cabinet. In accordance with one aspect of the invention, the driver circuits associated with playfield elements may be mounted to or otherwise incorporated as part of the playfield itself. In accordance with another aspect of the invention, interface circuits for operating the driver circuits are also mounted to the playfield. In accordance with a further aspect of the invention, the driver circuits associated with individual solenoids are mounted directly to their associated solenoids.

Claims

1. An amusement game comprising:
 - a cabinet;
 - apparatus in said cabinet defining pinball play, including a playfield having one or more switches, and one or more playfield devices operated by driver circuits; and
 - a plurality of driver circuits mounted to the playfield, said driver circuits comprising a majority of a set of driver circuits used for the operation of said playfield devices.
2. The amusement game of claim 1 wherein said driver circuits are mounted to an undersurface of said playfield.
3. The amusement game of claim 1 and further including control circuits and connecting elements for connecting said driver circuitry to said control circuits.
4. The amusement game of claim 1 and further including at least one interface circuit mounted to said playfield and operatively coupled with at least some of said driver circuits and said one or more switches.
5. The amusement game of claim 4 and further including a processor.
6. The amusement game of claim 5 and further including a data communications network operatively interconnecting said processor with said at least one of said interface circuits which is mounted to said playfield.
7. The amusement game of claim 1 and further including a CRT display.
8. The amusement game of claim 1 and further including solenoid interface circuits, lamp interface circuits and switch interface circuits mounted to said playfield.
9. The amusement game of claim 8 and further includ-

ing a processor.

10. The amusement game of claim 9 and further including a data communications network for operatively interconnecting said processor with said solenoid interface circuits, said lamp interface circuits and said switch interface circuits mounted to said playfield. 5
11. The amusement game of claim 8 wherein said playfield devices include solenoids and illumination devices, and further including connecting elements for operatively interconnecting said solenoid interface circuits with respective ones of said solenoids, said lamp interface circuits with respective ones of said illumination devices and said switch interface circuits with respective ones of said switches. 10
12. The amusement game of claim 1 wherein said playfield devices include solenoids and wherein said driver circuits include a solenoid driver circuit for each of said solenoids, and wherein each of said solenoid driver circuits is mounted to an associated solenoid. 20
13. The amusement game of claim 4 wherein said playfield devices include solenoids and wherein said driver circuits include a solenoid driver circuit for each of said solenoids, and wherein each of said solenoid driver circuits is mounted to an associated solenoid. 25
14. The amusement game of claim 8 wherein said playfield devices include solenoids and wherein said driver circuits include a solenoid driver circuit for each of said solenoids, and wherein each of said solenoid driver circuits is mounted to an associated solenoid. 30
15. An amusement game comprising: 35
a cabinet;
apparatus in said cabinet defining pinball play, including a playfield having one or more switches, and one or more playfield devices operated by driver circuits; 40
driver circuits mounted to the playfield for operation of said playfield devices; and
interface circuits mounted on said playfield and operatively coupled with at least some of said driver circuits and said one or more switches. 45
16. The amusement game of claim 15 and further including a processor and a data communications network operatively interconnecting said processor with said interface circuits which are mounted to said playfield. 50
17. The amusement game of claim 15 wherein said playfield devices include solenoids and wherein each of said solenoid driver circuits is mounted to an associated one of said solenoids. 55
18. The amusement game of claim 15 wherein said playfield devices include one or more illumination devices and one or more solenoids, and wherein said interface circuits include solenoid interface circuits, lamp interface circuits and switch interface circuits mounted on said playfield and operatively coupled with selected ones of said driver circuits and said one or more switches.
19. The amusement game of claim 18 and further including a processor and a data communications network operatively interconnecting said processor with said solenoid interface circuits, said lamp interface circuits and said switch interface circuits which are mounted to said playfield.
20. The amusement game of claim 1 wherein said driver circuits are mounted to an undersurface of said playfield in close proximity to the playfield devices respectively operated thereby.
21. The amusement game of claim 15 wherein said driver circuits comprise a majority of the driver circuits used for operation of said playfield devices.
22. The amusement game of claim 15 wherein at least one of said driver circuits is mounted in close proximity to an associated one of said playfield devices.
23. An amusement game comprising:
a cabinet;
apparatus in said cabinet defining pinball play, including a playfield having one or more solenoids for activating devices on the playfield; a solenoid driver circuit for each of said solenoids; and
wherein at least one of said solenoid driver circuits is mounted to an associated one of said solenoids.
24. The amusement game of claim 23 wherein each of said solenoid driver circuits is mounted to an associated one of said solenoids.
25. The amusement game of claim 23 wherein a majority of said solenoid driver circuits are mounted to respective solenoids to be driven thereby.
26. The amusement game of claim 15 wherein a majority of said solenoid driver circuits are mounted to respective associated solenoids.

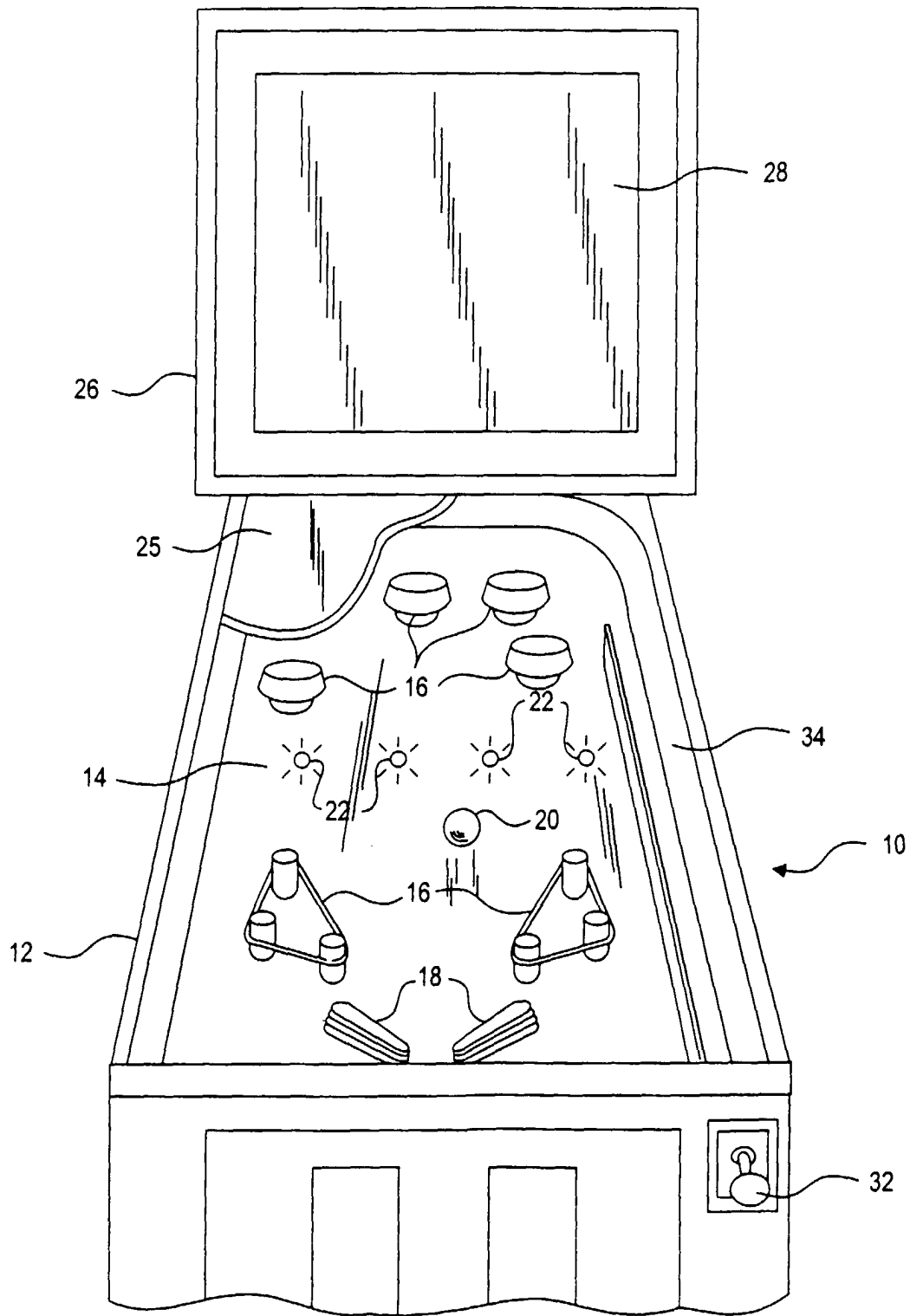


FIG. 1

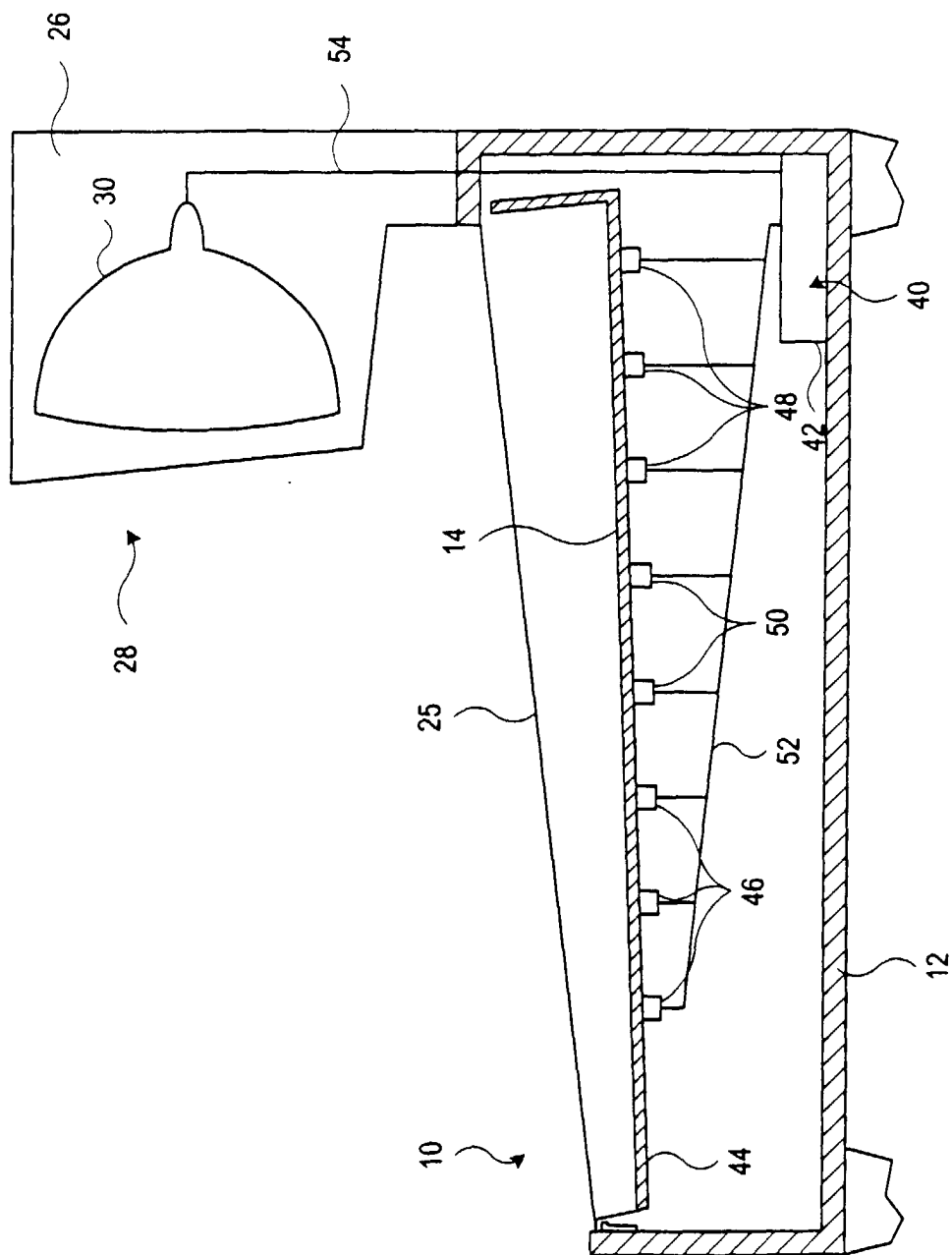


FIG. 2

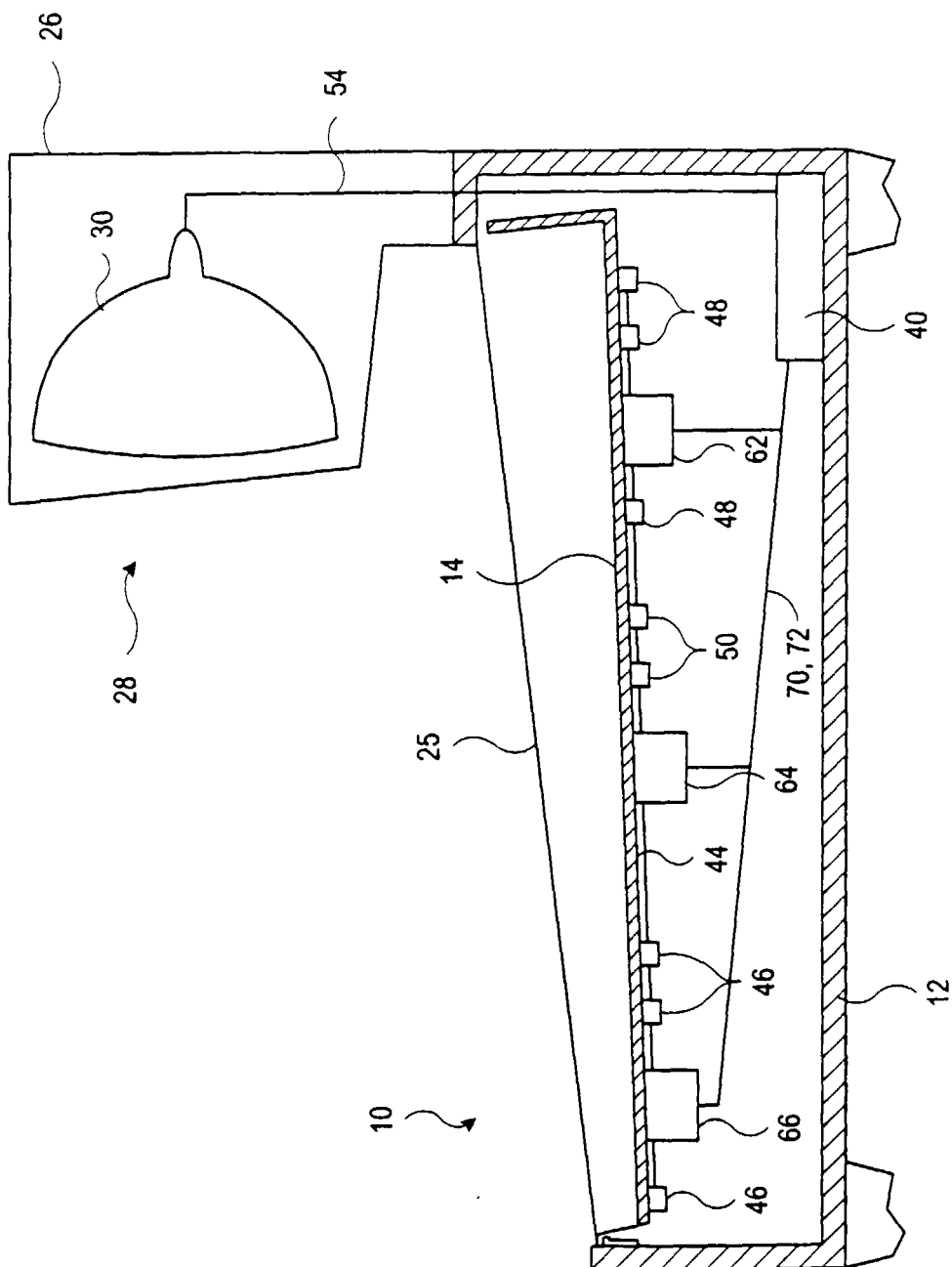


FIG. 3

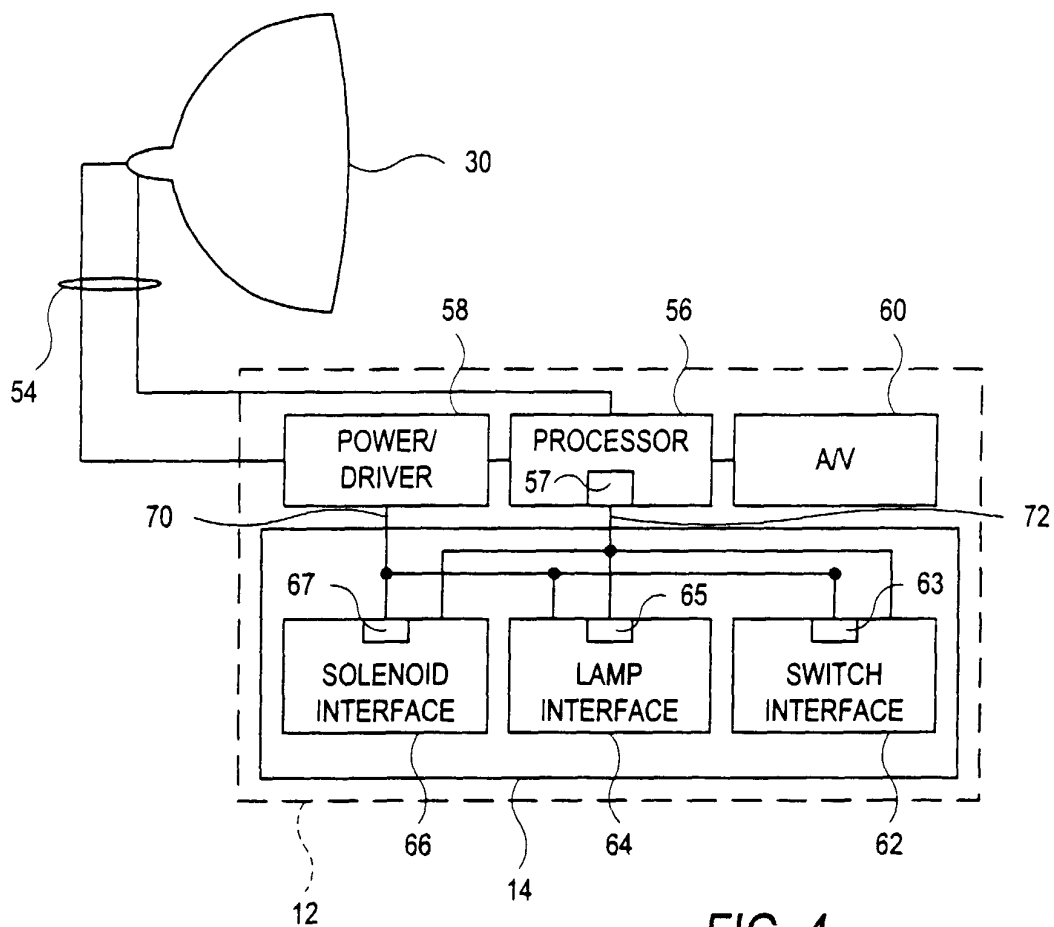


FIG. 4

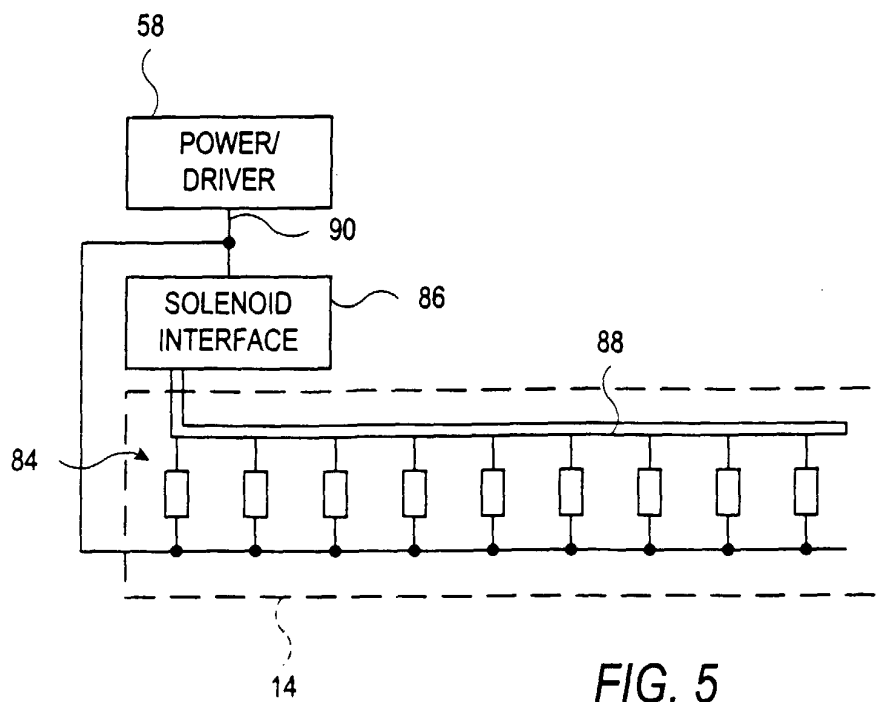


FIG. 5

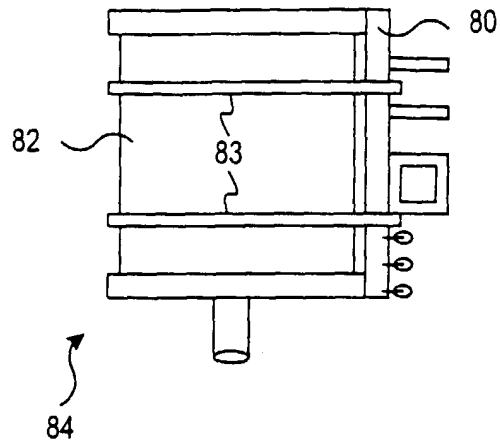


FIG. 6

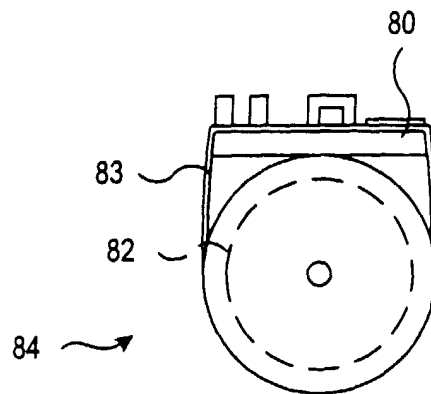


FIG. 7



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 40 2442

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X A	US 5 170 345 A (POOLE DAVID L) 8 December 1992 (1992-12-08) * column 7, line 42 - line 60; figure 8 *	1-3,12, 23-25 5,6, 8-11, 13-15,26	A63F7/02
X A	US 4 239 219 A (HAEFLIGER ROBERT W) 16 December 1980 (1980-12-16) * column 3, line 3 - line 17; figure 3 *	1-3,7, 12,20 4,5,8, 15,23	
A	US 4 367 876 A (KOTOYORI YUKIO) 11 January 1983 (1983-01-11) * column 3, line 9 - line 12; figure 1 *	7	
A	US 4 198 051 A (BRACHA MARION F ET AL) 15 April 1980 (1980-04-15) * column 2, line 47 - line 58; figure 9 *	1,4,15, 23	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			A63F G07F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 12 January 2000	Examiner Mayer, E
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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