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(54) MANUAL OPERATING DEVICE, GAME APPARATUS USING THE SAME, GAME METHOD AND COMPUTER READABLE MEDIUM

(76) Inventors: **KOJIRO MINAMI**, KOBE-SHI (JP); **HIDEKI KOTANI**, KOBE-SHI (JP); **TOSHIMITSU OISHI**, AKASHI-SHI (JP)

Correspondence Address:
JORDAN AND HAMBURG
122 EAST 42ND STREET
NEW YORK, NY 10168

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(57) **ABSTRACT**

A manual operating device including a joystick lever tiltably supported by a bearing provided on a support plate, a control unit for controlling and detecting tilt displacement of the control lever, and a stimulation-imparting mechanism provided in the joystick lever for vibrating the joystick lever to impart stimulation. This simple arrangement of the manual operating device enables not only that an action command made by an operator due to the operation of the joystick lever is imparted to characters displayed on a screen but also that a stimulation corresponding to contents of images displayed on the screen is imparted from the control unit to the operator. A game apparatus using the manual operating device, a game method and a computer readable medium are also disclosed.

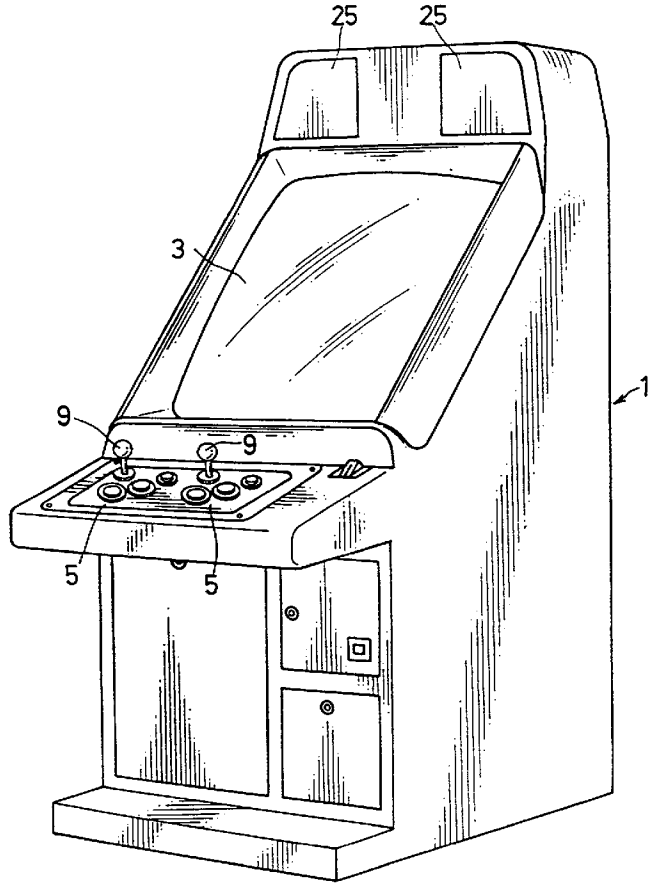


FIG. 1

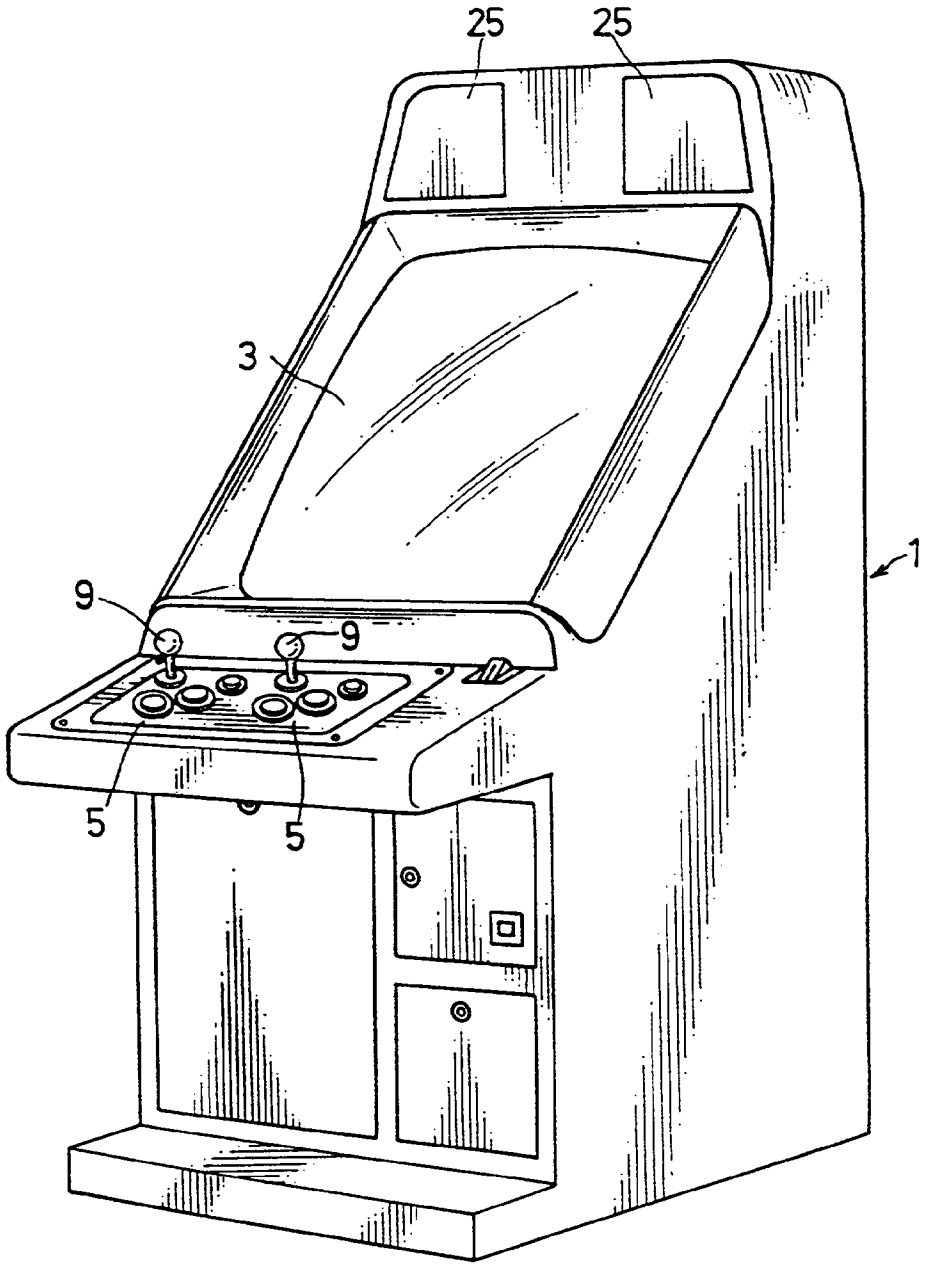


FIG. 2

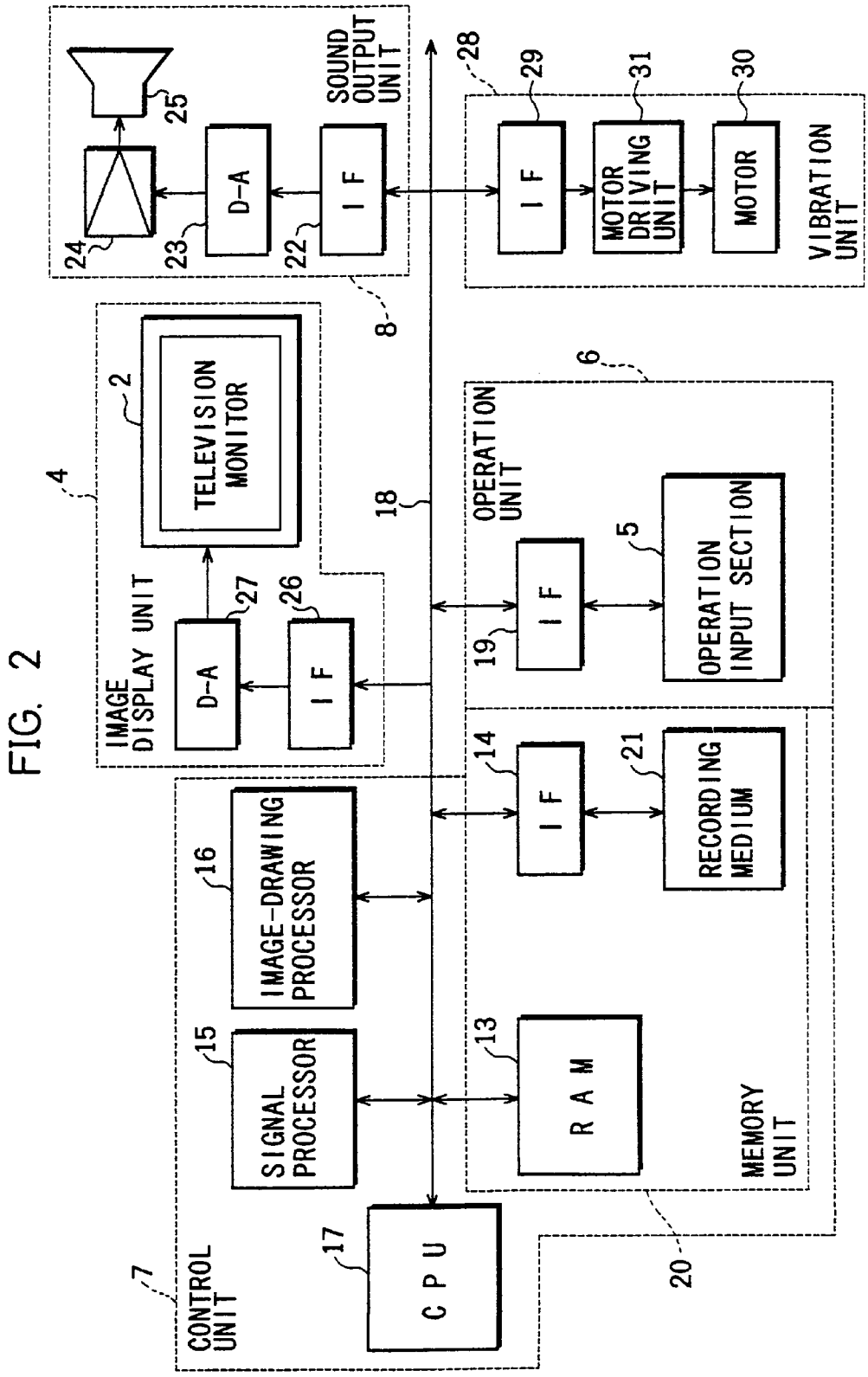

SOUND OUTPUT UNIT
25
24
23
D-A
22
I F
8
28
29
I F
31
MOTOR DRIVING UNIT
30
MOTOR
VIBRATION UNIT
4
2
TELEVISION MONITOR
IMAGE DISPLAY UNIT
27
D-A
26
I F
18
6
OPERATION UNIT
19
I F
5
OPERATION INPUT SECTION
14
I F
21
RECORDING MEDIUM
16
IMAGE-DRAWING PROCESSOR
15
SIGNAL PROCESSOR
13
R A M
MEMORY UNIT
7
CONTROL UNIT
17
C P U
20

FIG. 3

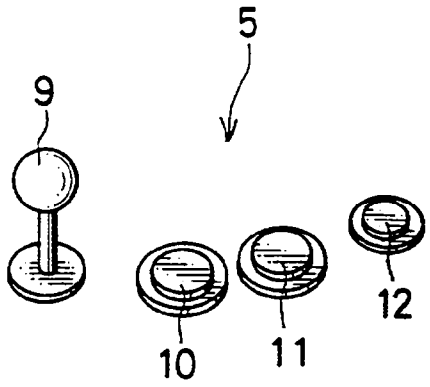


FIG. 4

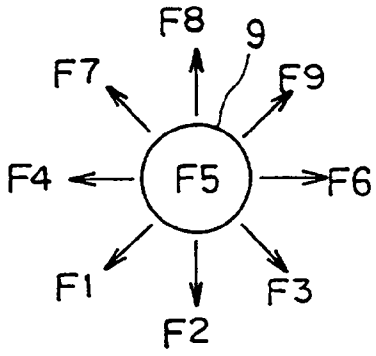


FIG. 5

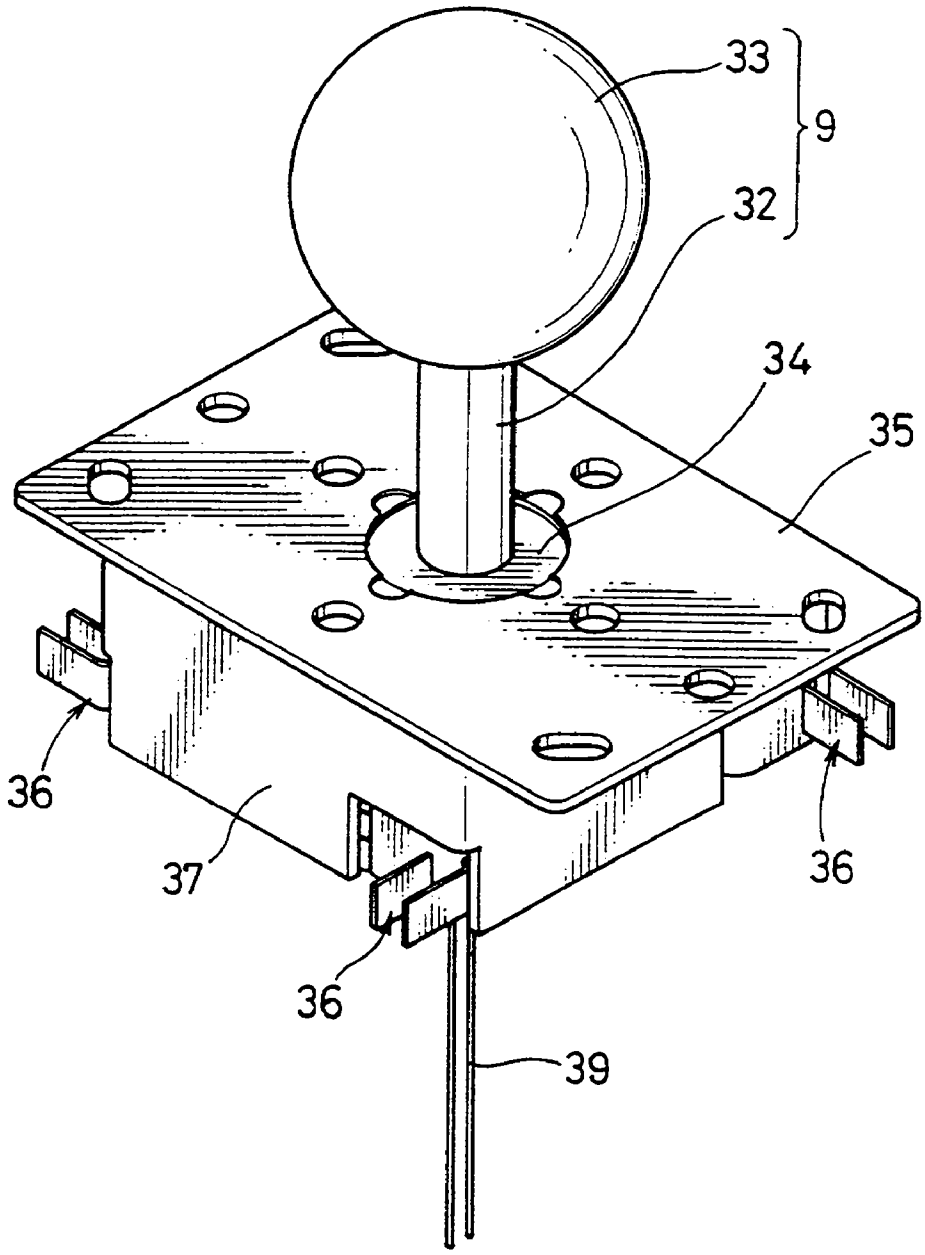


FIG. 6

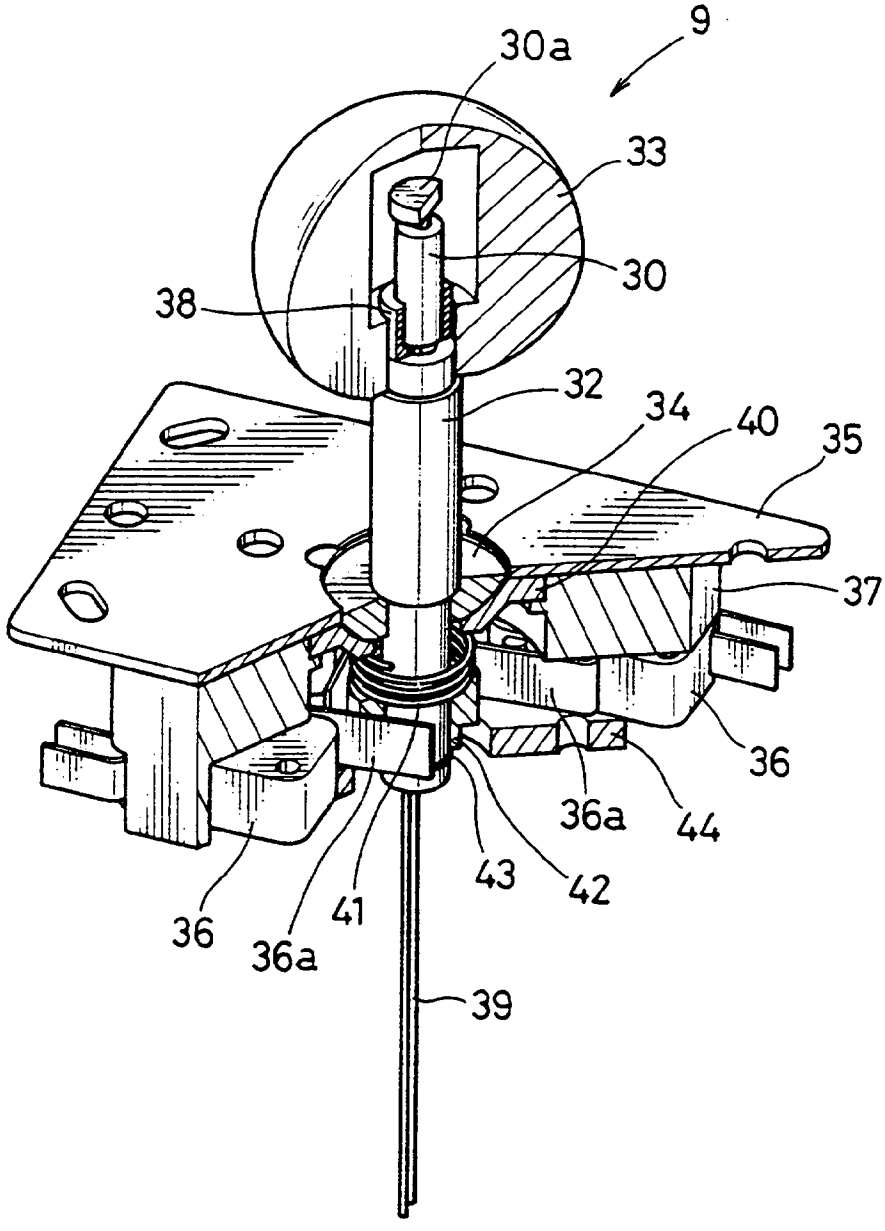


FIG. 7

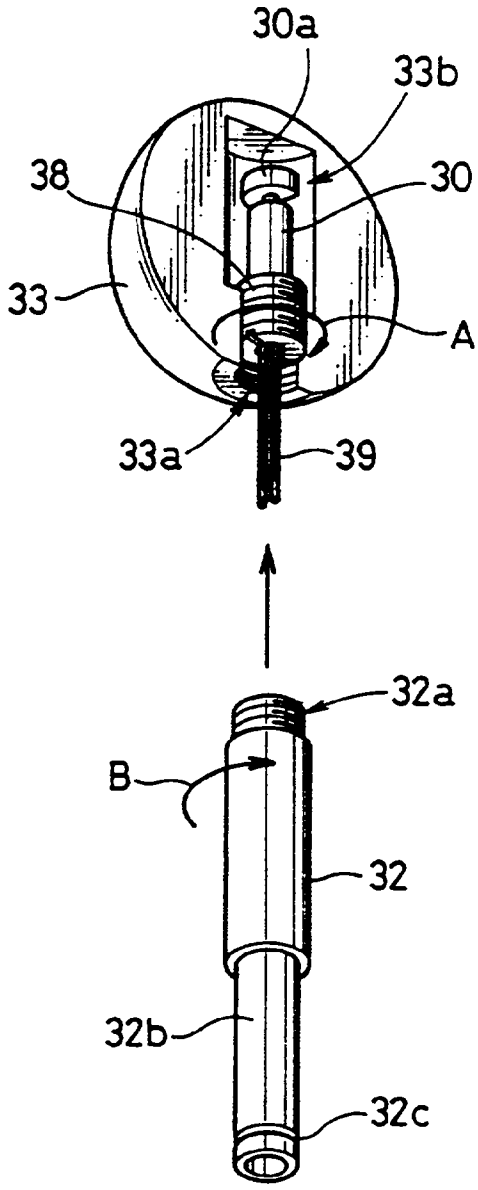


FIG. 8

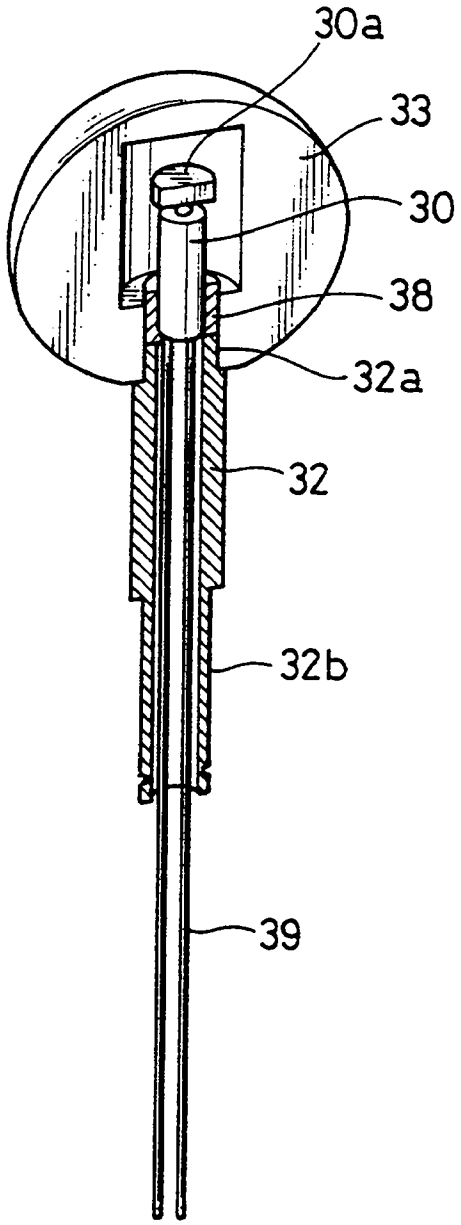


FIG. 9

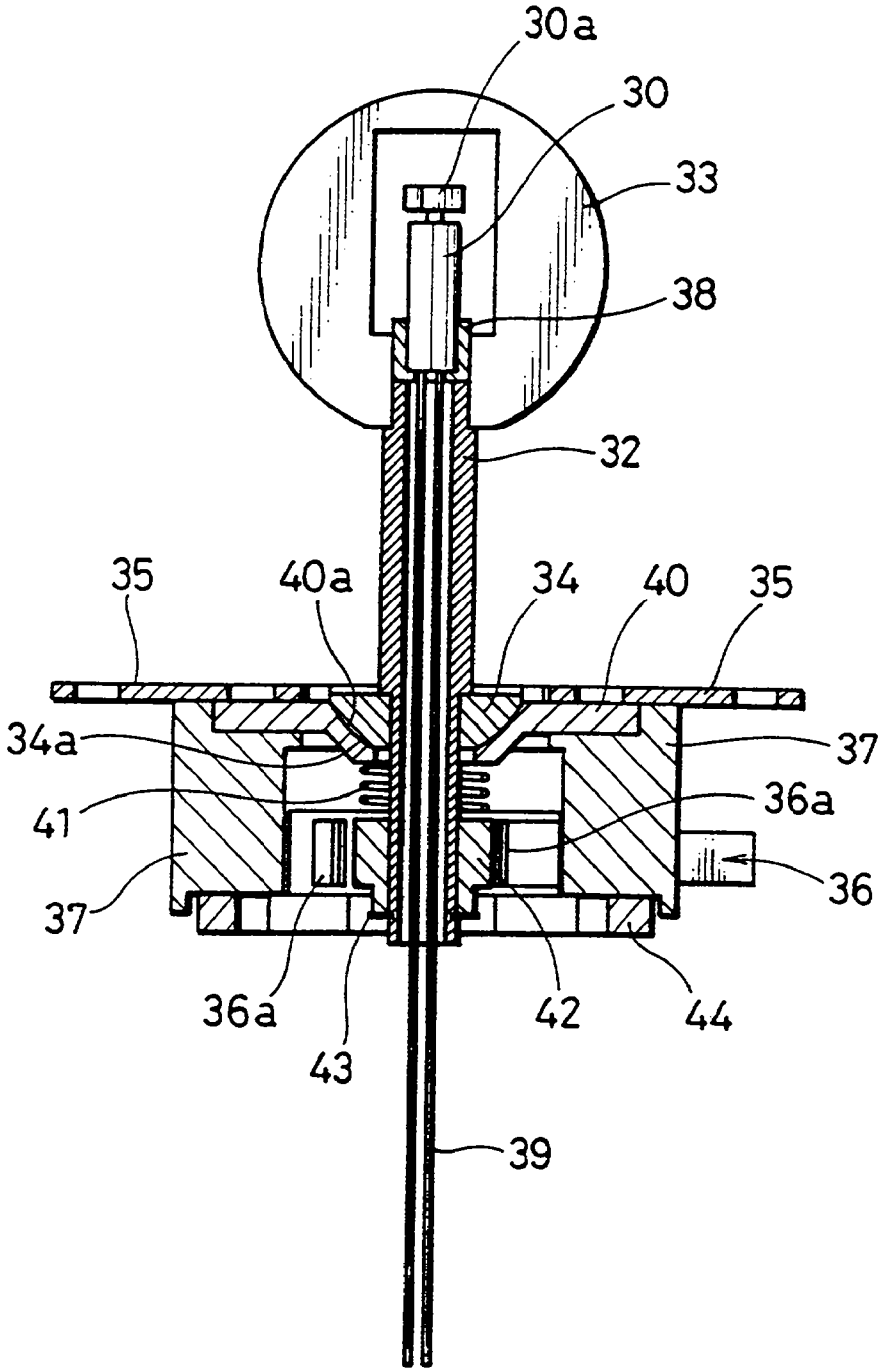
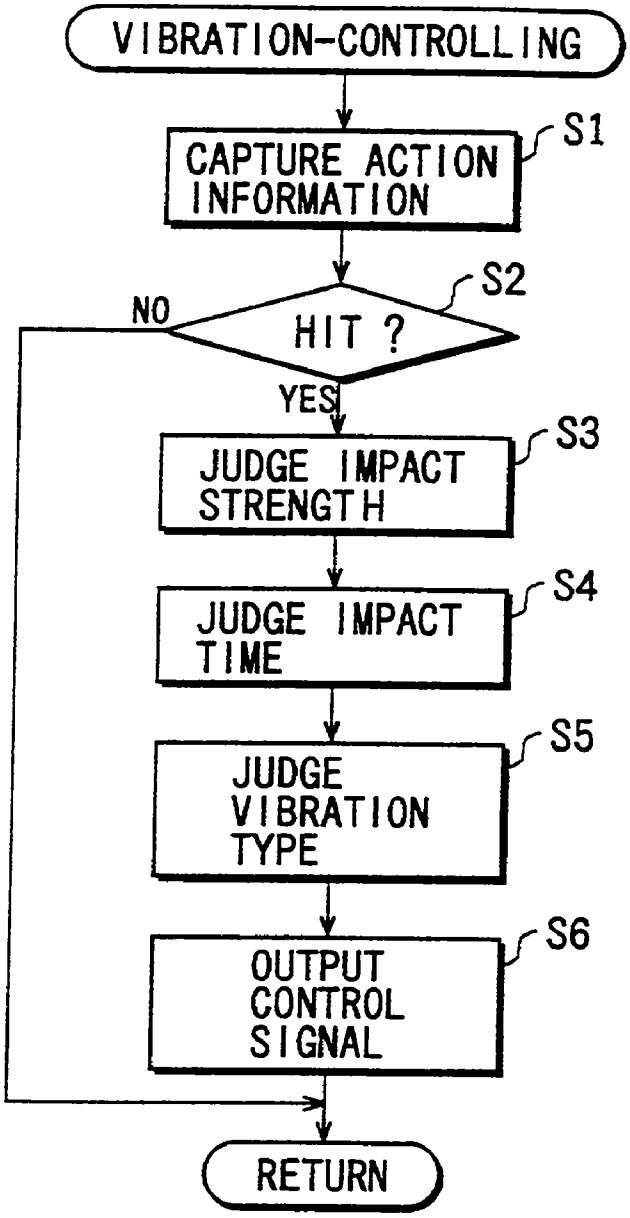
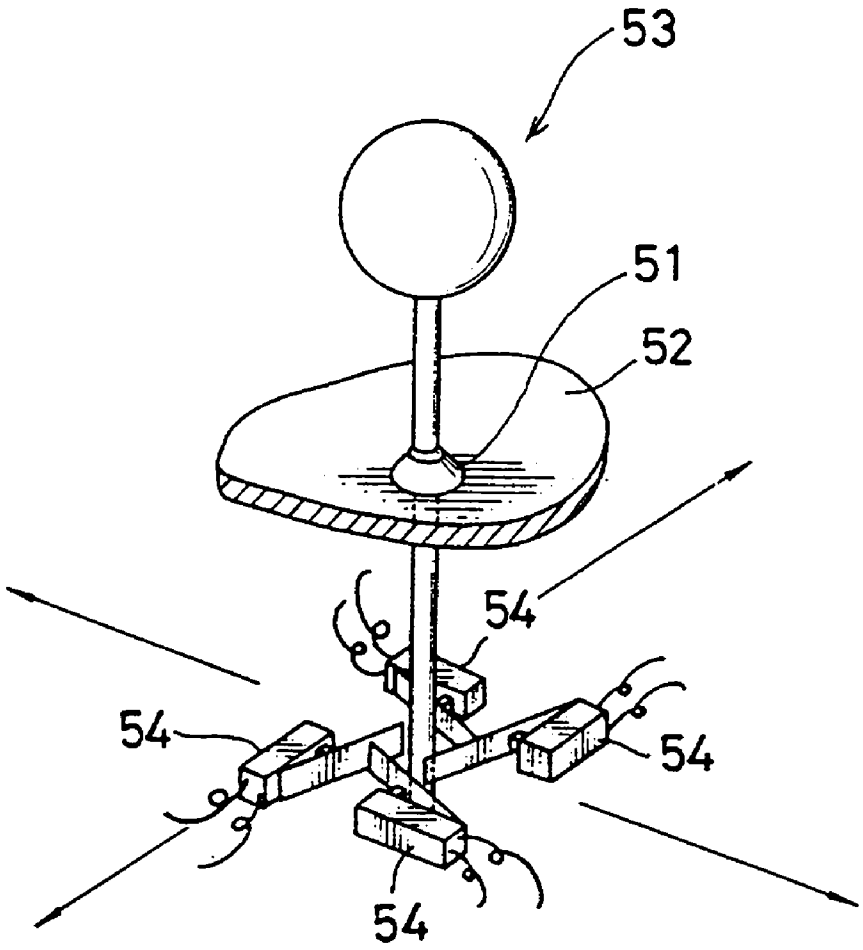


FIG. 10


VIBRATION-CONTROLLING
CAPTURE ACTION INFORMATION
S1
HIT ?
S2
NO
YES
JUDGE IMPACT STRENGTH
S3
JUDGE IMPACT TIME
S4
JUDGE VIBRATION TYPE
S5
OUTPUT CONTROL SIGNAL
S6
RETURN

PRIOR ART

FIG. 11



MANUAL OPERATING DEVICE, GAME APPARATUS USING THE SAME, GAME METHOD AND COMPUTER READABLE MEDIUM

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a manual operating device for use in operating and controlling player characters and objects in a playing machine, such as a TV game machine, and to a game apparatus using the same. The invention is also concerned with a game method, and a computer readable medium.

[0003] 2. Description of the Related Art

[0004] Hitherto, a so-called joystick tiltably operated in multiple directions (eight directions, for example) has been employed as a manual operating device for operating and controlling player characters and objects on a display screen of a playing machine, such as a TV game machine, to perform various types of actions on the screen. The joystick includes, as shown in **FIG. 11, a** control lever **53** tiltably supported by a body frame **52** through a bearing **51**, and four detection switches **54** provided near the lower end of the control lever **53**. Any one of the detection switches **54** is set to the ON state, or two adjacent detection switches are set to the ON state, whereby an input operating signal corresponding to the direction of operation of the control lever **53** can be obtained.

[0005] That is, when one detection switch **54** is set to the ON state by the tilting operation of the control lever **53**, the control lever **53** is tilted to the opposite side of the detection switch **54** set to the ON state, and the control lever **53** is tilted to the opposite side of the detection switches **54** set to the ON state when two adjacent detection switches are set to the ON state, thereby obtaining the input operating signal corresponding to the direction of operation of the control lever **53**.

[0006] The conventional joystick, however, has only the function of giving an action command resulting from the input operating signal to the playing machine side by the tilting operation thereof so as to move player characters and so forth displayed on the screen. Therefore, the concern of the game is focused on an image displayed on the screen, causing the game to lack realistic feeling and to be dull.

[0007] For this reason; in a driving game machine having a driver's seat and a screen for displaying a driving course, the entire driver's seat is vibrated by a driving device together with a player in response to a running state of a car, such as at the time of collision, thereby imparting stimulation corresponding to the display screen from the driving game machine side to the player's side.

[0008] However, the control such that the entire driver's seat is vibrated together with the player requires a large-scale vibrating apparatus, resulting in a high cost of manufacturing the game machine.

SUMMARY OF THE INVENTION

[0009] Accordingly, it is an object of the present invention to provide a manual operating device capable of imparting stimulation corresponding to a display screen from the manual operating device side to the operator's side to enhance the realistic feeling and of effectively increasing the game quality, and to provide a game machine using the same.

[0010] It is another object of the present invention to provide a game method and a computer readable medium.

[0011] According to a first aspect of the present invention, there is provided a manual operating device including a control lever tiltably supported by a bearing provided on a support plate; and a detection mechanism for detecting tilt displacement of said control lever, wherein a stimulation-imparting mechanism for vibrating the control lever to impart stimulation is provided in the control lever.

[0012] With the described arrangement, not only an action command made by an operator as a result of the operation of the control lever is imparted to the characters on the display screen, but also stimulation corresponding to the display screen is imparted from the device to the operator gripping and operating the control lever with a simple construction of the provision of the stimulation-imparting mechanism provided in the control lever. Therefore, dullness of the game is relieved, and the realistic feeling can be enhanced and the game quality can be effectively increased, so that the operator can further enjoy the game.

[0013] In the manual operating device of the present invention, the stimulation-imparting mechanism may preferably be a motor with an eccentric weight.

[0014] With this arrangement, if the motor with the eccentric weight is employed as the stimulation-imparting mechanism, vibration is generated only by rotating and swinging the eccentric weight with the motor, the structure for vibrating the control lever is simplified, and the mechanism can be easily contained in the control lever, so that the vibration control can be easily realized.

[0015] According to a second aspect of the prevent invention, there is provided a game apparatus in which a game is played on the basis of an operation command corresponding to tilt displacement of a tiltably supported control lever, the game apparatus including a manual operating device having a control lever tiltably supported by a bearing provided on a support plate, and a detection mechanism for detecting tilt displacement of the control lever, wherein a stimulation-imparting mechanism for vibrating the control lever to impart stimulation is provided in the control lever; and control means for controlling the stimulation-imparting mechanism so as to be vibratingly driven in response to a game situation.

[0016] With the described arrangement, the stimulation-imparting mechanism provided in the control lever is vibratingly driven in response to the game situation, so that not only an action command made by an operator as a result of the operation of the control lever is imparted to the characters on the display screen, but also stimulation corresponding to the display screen is imparted from the device to the operator. Therefore, dullness of the game is relieved, and the realistic feeling can be enhanced and the game quality can be effectively increased, so that the operator can further enjoy the game.

[0017] In the game apparatus of the present invention, the control means may preferably drive and control the stimu-

lation-imparting mechanism at least in one of an amount of vibration and a type of vibration, in response to the game situation.

[0018] With the described arrangement, the amount and type of vibration can be driven and controlled in response to the game situation, so that stimulation corresponding to the display screen is imparted in detail. Therefore, dullness of the game is relieved, and the realistic feeling can be enhanced and the game quality can be effectively increased, so that the operator can further enjoy the game.

[0019] According to a third aspect of the present invention, there is provided a method of playing a game on the basis of an operation command corresponding to tilt displacement of a tiltably supported control lever, wherein a stimulation-imparting mechanism provided in the control lever is vibratingly driven in response to a game situation.

[0020] According to a fourth aspect of the present invention, there is provided a computer readable medium storing a control program which, when playing a game on the basis of tilt displacement of a control lever, executes a step for controlling a stimulation-imparting mechanism so as to be vibratingly driven in response to a game situation.

[0021] With the described arrangements, the amount and type of vibration can be driven and controlled in response to the game situation, so that stimulation corresponding to the display screen is imparted in detail. Therefore, dullness of the game is relieved, and the realistic feeling can be enhanced and the game quality can be effectively increased, so that the operator can further enjoy the game.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] **FIG. 1** is a perspective view showing a construction of a game apparatus according to an embodiment of the present invention;

[0023] **FIG. 2** is a block diagram showing a control structure of the game apparatus of **FIG. 1**;

[0024] **FIG. 3** is an external view in perspective of an operation input section of **FIG. 1**;

[0025] **FIG. 4** is a top view showing directions of operation of a joystick lever of **FIG. 3**;

[0026] **FIG. 5** is a perspective view schematically illustrating the entire structure of a manual operating device of **FIG. 1**;

[0027] **FIG. 6** is a partially cutaway view in perspective of the manual operating device of **FIG. 1**;

[0028] **FIG. 7** is a partially exploded sectional view in perspective of a joystick lever of **FIG. 5**;

[0029] **FIG. 8** is a longitudinal sectional view in perspective of the joystick lever of **FIG. 5**;

[0030] **FIG. 9** is a longitudinal sectional view of the manual operating device of **FIG. 5**;

[0031] **FIG. 10** is a flowchart showing a vibration-controlling subroutine of the operation of the game apparatus of **FIG. 1**; and

[0032] **FIG. 11** is a perspective view schematically illustrating a construction of a conventional manual operating device.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0033] A preferred embodiment of a game apparatus according to the present invention will now be described with reference to the accompanying drawings.

[0034] **FIG. 1** is an external view in perspective of a game apparatus according to an embodiment of the present invention, and **FIG. 2** is a block diagram showing a control structure of the game apparatus.

[0035] Referring to **FIGS. 1 and 2**, a game apparatus **1** includes an image display unit **4** provided at an easy-to-see location of the upper portion of the game apparatus **1** and having a projection screen **3** projected from a television monitor **2** for outputting an image of a game, an operation unit **6** having an operation input sections **5** which are operated by an operator so as to control fighting actions of player characters, a control unit **7** for executing an action command corresponding to an operating signal from the operation unit **6** and controlling joystick levers **9** serving as control levers gripped by an operator, so as to be vibrated in response to a game situation, and a sound output unit **8** for outputting a sound corresponding to a situation of the image on the projection screen **3**.

[0036] An operation input section **5** comprises, as shown in **FIG. 3, a** joystick lever **9** operable in eight directions, a G button **10** for instructing a guard action to the player characters projected on the projection screen **3**, a P button **11** provided on the right of the G button **10** for instructing a punching action to the player characters, and a K button **12** provided on the right of the P button **11** for instructing a kick action to the player characters, and two sets of the operation input section **5** are provided on the left and right positions of the operation unit **6**. With the described arrangement, two operators can allow the player characters to fight with each other on the projection screen **3** by operating the operation input sections **5**, respectively, and one operator can allow the player character and a CPU character (a character controlled by a CPU to be described later so as to execute a fighting action corresponding to a fighting situation with the player character on the projection screen **3**) to fight with each other on the projection screen **3** by operating the operation input sections **5** and further, the CPU characters can be allowed to fight with each other on the projection screen **3** as a demonstration when the operators are not operating the operation input sections **5**.

[0037] The joystick lever **9** controls the direction of movement and the direction of action of the player characters projected on the projection screen **3**. For example, when the joystick lever **9** is left to stand upright (placed in a neutral position) as shown by the direction F**5** of **FIG. 4**, the control unit **7** is instructed so that the player characters stop at the positions when instructed, and this is displayed on the projection screen **3** by the control unit **7** through the television monitor **2**. In addition, when the joystick lever **9** is tilted in the direction F**8** of **FIG. 4**, for example, the control unit **7** is instructed so that the player characters jump upward of the screen **3**, and this is displayed on the projection screen **3** by the control unit **7** through the television monitor **2**. Further, when the P button **11** is pressed while tilting the joystick lever **9** in the direction F**8**, the control unit **7** is instructed so that the player characters punch while jumping, and this is displayed on the projection screen **3** by the control

unit **7** through the television monitor **2**. Still further, a simultaneous operation of respective buttons can allow the control unit **7** to instruct the player characters to execute various types of combined actions, for example, to instruct the player characters to perform a throwing technique by pressing the G button **10** and P button **11** simultaneously.

[**0038**] In addition, a RAM **13** capable of reading and writing of various data, an interface circuit **14**, a signal processor **15**, an image-drawing processor **16** and a CPU **17** are connected by a bus **18** including an address bus, a data bus and a controller bus. The operation input section **5** is connected to the bus **18** through the interface circuit **19** so as to allow the CPU **17** to execute an operation command corresponding to the operating signal from the operation input section **5**.

[**0039**] A memory unit **20** serving as storage means is provided with at least a readable recording medium **21** connected to the interface circuit **14**, in addition to the above RAM **13**. Game data including image data, sound data, program data, and so forth are recorded in the recording medium **21**. In particular, the image data include a fighting action corresponding to the fighting situation of the CPU character and the action of the player character corresponding to the operating command made by tilt displacement of the joystick lever **9**. In addition, in the recording medium **21**, there is recorded a control program for executing a step for controlling an stimulation-imparting mechanism, which will be described later, in the joystick lever **9** to be vibratingly driven corresponding to the game situation. Further, the recording medium **21** is composed of a so-called ROM cassette such that a ROM stores therein the game data and program data of an operating system is accommodated in a plastic case, an optical disk, or a flexible disk.

[**0040**] In addition, the signal processor **15** mainly conducts calculation of two-dimensional positions of the fighting characters, generation of the sound data and processing thereof, and the image-drawing processor **16** conducts writing of the image data to be drawn to the RAM **13** on the basis of the calculation results of the fighting characters conducted by the signal processor **15**. Therefore, the control unit **7** controls the CPU **17** so as to conduct various types of signal processing of the game data recorded in the recording medium **21** by the signal processor **15**, and to conduct writing of the image data and the sound data to the RAM **13** by the image-drawing processor **16** on the basis of the results of the various types of signal processing.

[**0041**] The sound output unit **8** includes an interface circuit **22** connected to the bus **18**, a D/A converter **23** for digital-analog converting a signal from the interface circuit **22**, a preamplifier **24** for amplifying the sound signal converted by the D/A converter **23**, and a speaker **25** for outputting the sound on the basis of the sound signal amplified by the preamplifier **24**. The sound data written in the RAM **13** by the image-drawing processor **16** are input to the speaker **25** through the interface circuit **22**, the D/A converter **23** and the preamplifier **24**, whereby the sound corresponding to the game situation is output.

[**0042**] The image display unit **4** includes an interface circuit **26**, a D/A converter **27** for digital-analog converting the image signal from the interface circuit **26**, and the television monitor **2** for outputting the image on the basis of the image signal converted by the D/A converter **27**. The image data written in the RAM **13** by the image-drawing processor **16** are input to the television monitor **2** through the interface circuit **26** and the D/A converter **27**, whereby the player characters fighting with each other and the CPU characters fighting with each other are displayed on the television monitor **2** together with peripheral images thereof, and the image displayed on the television monitor **2** is enlarged and projected onto the projection screen **3** so as to be easily seen.

[**0043**] A vibration unit **28** for vibrating the joystick lever **9** includes an interface circuit **29**, a motor **30** with an eccentric weight serving as a stimulation-imparting mechanism for vibrating the joystick lever **9** gripped by an operator to impart stimulation to the operator's hand, and a motor driving unit **31** for rotationally driving the motor **30** on the basis of the control signal input from the CPU **17** through the interface circuit **29**. The CPU **7** inputs the control signal corresponding to the game situation (whether or not predetermined requirements are satisfied) into the motor driving unit **31** through the interface circuit **29**, whereby the motor driving unit **31** rotationally drives the motor **30**, changes the rotation speed and the rotation time of the motor **30** to vary the amount of vibration, and further to vary a type of vibration due to the continuous rotation and the intermittent rotation of the motor **30**.

[**0044**] According to the foregoing description, the control unit **7** includes player character control means for controlling the player character so as to fight with the CPU character on the projection screen **3** in response to the operating signal as the operating command from the operation input section **5**, CPU character control means for controlling the CPU character so as to execute the fighting action corresponding to the fighting situation with the play character read from the recording medium **21** on the projection screen **3**, and vibration control means for outputting a control signal for rotationally driving the motor **30** so as to vibrate the joystick lever **9** in response to the game situation. The vibration control means controls the rotation speed and the rotation time of the motor **30** so as to control the amount of vibration in response to the game situation, and outputs the control signal for controlling the types of the rotation of the motor **30**, such as continuous rotation and intermittent rotation.

[**0045**] In controlling the fight of the fighting characters (the player character and the CPU character), the CPU **17** allows the signal processor **15** to conduct calculation of the positions of the fighting characters, and allows the image-drawing processor **16** to conduct writing of the image data and the sound data to the RAM **13**, and the image data written in the RAM **13** are displayed on the projection screen **3** through the television monitor **2**. In addition, in controlling the vibration of the joystick lever **9**, the CPU **17** outputs the control signal to the vibration unit **29** so that the motor driving unit **31** varies the rotation speed, the rotation time and the type of rotation, such as continuous rotation and intermittent rotation, of the motor **30**, in order to change the amount of vibration and the type of vibration of the joystick lever **9** in response to the game situation whether or not predetermined vibration requirements are satisfied on the basis of the game data including the image data, sound data and program data recorded in the recording medium **21**.

[0046] A description will now be given in detail of a structure of the manual operating device including the joystick lever **9** with reference to FIGS. **5** to **9**.

[0047] Referring to **FIGS. 5 and 6**, the manual operating device includes the joystick lever **9** having a grip ball **33** fixed as a knob to the upper end of a stick shaft **32**, a ball joint **34** serving as a bearing portion for tiltably supporting the stick shaft **32**, a chassis **35** serving as a support plate for tiltably supporting the joystick lever **9** through the ball joint **34**, four microswitches **36** provided near the lower end of the stick shaft **32** and serving as detection switches for constituting a detection mechanism for detecting tilt displacement of the stick shaft **32**, and a cabinet **37** constructed so as to surround the four microswitches **36** by the side surfaces thereof.

[0048] In the grip ball **33**, there is provided the motor **30** with the eccentric weight serving as the stimulation-imparting mechanism for vibrating the joystick lever **9** to impart stimulation to the operator's hand. The arrangement of the motor **30** is such that an eccentric weight **30***a* in the form of an eccentric cam is mounted to the head of the motor shaft in a decentered manner, and the eccentric weight **30***a* is swung around the motor shaft by the rotation of the motor shaft thereby to form a source of vibration.

[0049] In addition, as shown in **FIG. 7**, the stick shaft **32** is formed into a tubular shape, and is stepped at its upper end to form a small diameter portion **32***a*, and a male screw to be threadedly engaged with a female screw hole **33***a* of the grip ball **33** is formed on the small diameter portion **32**. A step portion is formed at a lower part of the center of the stick shaft **32**, and a small diameter portion **32***b* is formed at a lower part of the step portion. A groove **32***c* for fitting thereto a shaft fallout-preventing ring is formed in the outer periphery of the tip of the small diameter portion **32***b*.

[0050] A hollow section **33***b* is formed at the back of the female screw hole **33***a*. The hollow section **33***b* is formed wider than the inner diameter of the female screw hole **33***a* to the extent such that it can accommodate the motor **30** and is not struck by the eccentric weight **30***a* when the motor **30** is rotated. Various methods of forming the hollow section **33***b* may be considered. For example, the grip ball **33** is divided into two pieces, and recesses are formed in the respective divided dome-shaped members and then, the dome-shaped members are bonded by an adhesive or the like with the recesses opposed to each other, thereby obtaining the grip ball **33** and the hollow section **33***a*.

[0051] A motor-fixing housing **38** for fixing the lower part of the motor **30** is formed into a cylindrical shape with a bottom, and a male screw to be threadedly engaged with the female screw hole **33***a* of the grip ball **33** is formed on the outer periphery thereof. The lower part of the motor **30** is inserted and fixed to the inner diameter of the motor-fixing housing **38**. Various methods of fixing the lower part of the motor **30** to the housing **38** may be considered. For example, a male screw may be formed on the outer periphery of the lower part of the motor **30** and a female screw may be formed on the inner diameter side of the housing **38** so as to be threadedly connected to each other, and the lower part of the motor **30** may be merely fitted and fixed to the housing **38** and further, the lower part of the motor **30** may be fixed by an adhesive. At the time of the fixture, lead wires **39** provided on the lower part of the motor **30** are taken out of a center hole formed in the bottom of the housing **38**.

[0052] The male screw formed on the outer periphery of the housing **38** is threadedly engaged with the female screw hole **33***a* of the grip ball **33** and rotated in the direction of the arrow A together with the motor **30** to be screwed toward the predetermined back position and further, the upper small diameter portion (male screw) **32***a* of the stick shaft **32** is rotated in the direction of the arrow B to be screwed into the position it strikes the housing **38**, whereby the housing **38** and the stick shaft **32** are more securely fixed to the grip ball **33** by a double-nut effect. At this time, the stepped portion of the small diameter portion **32***a* is in abutment with the outer peripheral surface of the grip ball **33** so that the stick shaft **32** is fixed more strongly to the grip ball **33**. Further, the lead wires **39** of the motor **30** are taken out of the center hole of the stick shaft **32**.

[0053] As shown in **FIGS. 6 and 9**, a through hole for passing therethrough the stick shaft **32** is formed in the center of the ball joint **34**, and the backside thereof is formed into a spherical projection **34***a*. A ball joint housing **40** is fixed by the chassis **35** as the upper wall and the cabinet **37** as the side wall, and a spherical recess **40***a* is formed in the center thereof. The spherical recess **40***a* is opened upward and has a through hole formed in the center thereof for passing therethrough the stick shaft **32**. The spherical projection **34***a* and the spherical recess **40***a* are formed so as to be fitted to each other and relatively moved with the spherical surfaces in abutment with each other so that they serve as a bearing for tiltably supporting the stick shaft **32** whose lower portion is fixed by being passed through the through holes formed in the ball joint **34** and the ball joint housing **40** until the step portion of the stick shaft **32** strikes the upper surface of the ball joint **34**.

[0054] A return spring **41** and a bush **42** are vertically provided on the lower portion of the stick shaft **32** in a state of being prevented from downward fallout by the shaft fallout-preventing ring **43**. In addition, a four-way/eight-way switching plate **44** is provided on the lower surface of the cabinet **37**, and guide holes for guiding the lower end of the stick shaft to directions of operation are formed radially from the center hole of the switching plate **44**. Further, four microswitches **36** are provided on the upper surface of the switching plate **44** with an actuator **36***a* center-directed and opposed to the outer peripheral surface of the bush **42**. When the stick shaft **32** is tilted, the actuator **36***a* of the microswitch **36** on the opposite side of the tilted stick shaft **32** is pressed by the bush **42** thereby to detect the direction of operation.

[0055] A description will now be given of an operation of the game apparatus. In this embodiment, a description will be given of a fighting game in which the player character fights with the CPU character.

[0056] **FIG. 10** is a flowchart showing a vibration-controlling subroutine of the operation of the game apparatus.

[0057] As shown in **FIG. 10**, action information (fighting situation such as an attack action, a guard action, the distance and position from the opponent, and so forth) is first captured in step **S1**. That is, the control unit **7** is controlled by the game data recorded in the recording medium **21** and captures the action information of the player character as I/O data showing which one is operated of the joystick **9** and buttons **10** to **12**, and also captures the action information of the CPU character as the I/O data. In this case, in addition

to the attack action and the guard action, fighting situations such as the distance between the player character and the CPU character, an attitude of each of the characters (crouching and the like) are captured as the action information.

[0058] Regarding the action information of the fighting characters captured in step S1, it is judged in step S2 whether or not there is a hit on the CPU character and whether or not there is a hit by the CPU character as the result of the fight. That is, in step S2, the control unit 7 is controlled by the game data recorded in the recording medium 21, and when there is the above hit, the procedure advances to step S3 to judge impact strength, and the procedure returns to the original game program from the vibration-controlling subroutine. The word hit means an impact when the player character's attack on the CPU character strikes the CPU character, and an impact when the CPU character's attack on the player character strikes the player character. The impact greatly varies according to the presence of a guard action.

[0059] In step S3, the strength of the hit (impact strength) is judged in response to the fighting situation, and three kinds of vibration strength of the joystick lever 9, "high", "medium" and "low", are set in response to the strength of the hit. In the case of the fighting game, the strength of the hit is a strength of punch, kick and a continuous technique and further, a strength of hit against the ground due to a throw as a combined technique. In this embodiment, a combination of these attacks and the guard actions against them, and the situation of the attitude and distance of the characters are added, and three kinds of vibration strength of the joystick lever 9, "high", "medium" and "low", are set.

[0060] In step S4, impact time of the joystick lever 9 in response to the fighting situation is judged. In this embodiment, three kinds of impact time corresponding to the fighting situation, "long", "ordinary" and "short" are set.

[0061] For example, when the player character's punch and kick hit the CPU character, the impact time is set to "short" as a reaction impact corresponding to the strength of the hit. Conversely, when the CPU character's punch and kick hit the player character, the impact time is set from "short" to "long" as a reaction impact corresponding to the strength of the hit. Further, when a continuous technique of punch, kick, and so forth continuously hits the player character, a reaction impact is generated similar to the foregoing description, resulting in a "long" impact time. Still further, in the case where the player character is knocked down by the punch and kick, a continuous technique thereof and a combined technique with a throwing technique, the impact strength and impact time corresponding to the strength of the hit of the punch and kick are set, and the impact strength and impact time corresponding to the strength when the player character is thrown and knocked down and thereafter, the impact time is set to "long" so as to be continued with the impact strength weaker than that of the point of impact time. An impact amount is constituted by the impact strength and the impact time, and the amount of vibration (vibration strength and vibration time) of the joystick lever 9 is determined in response to the impact amount.

[0062] In step S5, the type of vibration of the joystick lever 9 is judged in response to the fighting situation. In this embodiment, two different types of vibration are set, "continuous" and "discontinuous". In the case of "discontinuous" vibration, the joystick lever 9 is discontinuously vibrated by intermittently rotating the motor 30 provided in the joystick lever 9.

[0063] For example, in the case of a punch, kick and a hit due to the continuous technique thereof and further, a hit against the ground due to a throw as a combined technique, the type of vibration is set to "continuous", and with an image of intermittent vibration such as "convulsive movement of limbs", the type of vibration is set to "discontinuous", so that more realistic feeling is transmitted to the operator's hand.

[0064] In step S6, a control signal corresponding to the fighting situation is output. That is, on the basis of the results of the above judgements made in steps S3, S4 and S5, the control signal is output from the CPU 17 to the motor driving unit 31 through the interface circuit 29. A driving power from the motor driving unit 31 to the motor 30 is changed by the control signal, thereby obtaining the vibration strength and vibration time of the joystick lever 9 corresponding to the strength of the hit. That is, the larger the driving power, the rotation speed of the motor 30 becomes faster, so that strong vibration can be obtained. In addition, a time for supplying the driving power from the motor driving unit 31 to the motor 30 is changed by an output time of the control signal, thereby obtaining the vibration time of the joystick lever 9 corresponding to the fighting situation. Further, it is possible to change the vibration strength so as to be gradually decreased with the passage of the driving time of the motor 30. Still further, a supply of the driving power from the motor driving unit 31 to the motor 30 is changed according to whether the control signal is output continuously or discontinuously, thereby obtaining the type of vibration of the joystick lever 9 corresponding to the fighting situation.

[0065] As described above, according to the present invention, not only the action command made by the operator due to the operation of the joystick lever 9 is imparted to the characters on the screen of the image display 4, but also a stimulation corresponding to the contents of the image is imparted from the control unit 7 to the operator gripping and operating the joystick lever 9 with a simple arrangement of the provision of the motor 30 with the eccentric weight in the joystick lever 9. Therefore, dullness of the game is relieved such that the action command is imparted only in one direction from the operator to the game machine, the realistic feeling can be enhanced, and the game quality can be effectively increased, so that the operator can further enjoy the game.

[0066] In addition, a joystick lever vibrating device applied to a consumer video game machine is often designed for company's own. If the vibrating device is to be mounted to a housing of a normal game machine, the vibrating device should be secured on a control panel with the use of a special jig. Thus, according to the present invention, the joystick lever 9 composed of the grip ball 33 and the stick shaft 32 is vibrated by the motor 30 with the eccentric weight with a simple construction such that several components of the manual operating device including the joystick lever 9 normally used in a game machine are exchanged and added.

[0067] More specifically, examples of the components of a normal manual operating device include the ball joint 34, the chassis 35, the microswitches 36, the cabinet 37, the ball

joint housing **40**, the return spring **41**, the bush **42**, the shaft fallout-preventing ring **43** and the four-way/eight-way switching plate **44** described in the above embodiment. In addition, examples of the components to be exchanged and added in the vibration control of the present invention include the motor **30** with the eccentric weight (a small DC motor and the eccentric weight **30***a*), the interface circuit **29**, the motor driving unit **31**, the stick shaft **32**, the grip ball **33**, the motor-fixing housing **38** and the lead wires **29**.

[**0068**] While the present invention has been described with respect to what is presently considered to be the preferred embodiment, it is to be understood that the invention is not limited to the disclosed embodiment. To the contrary, the invention is intended to cover various modifications and equivalent arrangements included within the sprit and scope of the appended claims.

[**0069**] For example, the present invention is applicable to a shooting game and a driving game. In the case of the shooting game, the motor **30** with the eccentric weight provided in the joystick lever **9** can be driven so that the impact as a reaction of shooting is used as the vibration of the joystick lever **9**. In the case of the driving game, the motor **30** with the eccentric weight provided in the joystick lever **9** can be driven so that the impact as a reaction of collision is used as the vibration of the joystick lever **9**. In addition, in the case of a fighting game played in a ring, the joystick lever **9** can be vibrated when player characters touch the ring ropes through which a current is passed. Further, in the case of a game such that a stick is sequentially passed through a high-voltage-applied space, a short circuit occurs when the stick touches the component of the space. The joystick lever **9** can be vibrated at the time of occurrence of the short circuit. Therefore, vibration control of the joystick lever **9** can be applicable to various types of games.

[**0070**] In addition, a vibrating member such as a small solenoid and a crank mechanism may be used as the stimulation-imparting mechanism. It is essential only that the member to be a source of vibration which can be driven in response to the control signal from the control unit **7**.

[**0071**] Further, various lamps such as red, blue and yellow lamps are flashed and a sound corresponding to a fighting situation is output when controlling vibration of the joystick lever **9**, whereby the effect of the game due to the vibration control of the joystick lever **9** can be further increased.

[**0072**] Still further, the game apparatus of the present invention may take a variety of forms, such as a so-called business game apparatus, a home game machine, and a general personal computer. In the case of the business game apparatus, the operation input section **5** has a joystick lever **9** and various types of shot switches, and the monitor has the television monitor **2** and the projection screen **3** which are the special CRT and the liquid crystal display, respectively, as described above. In the case of the home game machine, the operation input section **5** is normally called a controller and may include a cross key and various types of control buttons. The above control unit **7**, the operation unit **6** and so forth are all included in the home game machine. A television monitor is frequently used as the monitor. In the case of the personal computer, the operation output section **5** is used in place of an input device, such as a keyboard and a mouse, and a graphic display is used as the monitor. The control unit **7**, the operation unit **6** and so forth are all included in the personal computer.

[**0073**] In addition, in the case of the home game machine and the personal computer, a game program stored in a game program storage unit may be recorded in a computer readable medium, such as a floppy disk, a CD-ROM, a magneto-optic disk and a DVD-ROM, and the medium may be brought into a main unit by being read by reading means provided in the game machine and the personal computer.

What is claimed is:

1. A manual operating device comprising a control lever tiltably supported by a bearing provided on a support plate; and a detection mechanism for detecting tilt displacement of said control lever,

wherein a stimulation-imparting mechanism for vibrating said control lever to impart stimulation is provided in said control lever.

2. A manual operating device comprising a control lever provided with a knob on the head thereof; and a detection mechanism for detecting tilt displacement of said control lever,

wherein a stimulation-imparting mechanism for vibrating said control lever to impart stimulation is provided in the knob of said control lever.

3. A manual operating device according to claim 1 or 2, wherein said stimulation-imparting mechanism is a motor with an eccentric weight.

4. A game apparatus in which a game is played on the basis of an operation command corresponding to tilt displacement of a tiltably supported control lever, said game apparatus comprising:

a manual operating device having a control lever tiltably supported by a bearing provided on a support plate, and a detection mechanism for detecting tilt displacement of said control lever, wherein a stimulation-imparting mechanism for vibrating said control lever to impart stimulation is provided in said control lever; and

control means for controlling said stimulation-imparting mechanism so as to be vibratingly driven in response to a game situation.

5. A game apparatus in which a game is played on the basis of an operation command corresponding to tilt displacement of a tiltably supported control lever, said game apparatus comprising:

a manual operating device having a control lever provided with a knob on the head thereof, and a detection mechanism for detecting tilting displacement of said control lever, wherein a stimulation-imparting mechanism for vibrating said control lever to impart a stimulation is provided in the knob of said control lever; and

control means for controlling said stimulation-imparting mechanism so as to be vibratingly driven in response to a game situation.

6. A game apparatus according to claim 4, wherein said stimulation-imparting mechanism is a motor with an eccentric weight.

7. A game apparatus according to claim 4, 5, or **6**, wherein said control means drives and controls said stimulation-imparting mechanism at least in one of an amount of vibration and a type of vibration, in response to the game situation.

8. A method of playing a game on the basis of an operation command corresponding to tilt displacement of a tiltably

supported control lever, wherein a stimulation-imparting mechanism provided in said control lever is vibratingly driven in response to a game situation.

9. A method of playing a game on the basis of an operation command corresponding to tilt displacement of a tiltably supported control lever, wherein said stimulation-imparting mechanism is driven and controlled at least in one of an amount of vibration and a type of vibration, in response to the game situation.

10. A computer readable medium storing a control program which, when playing a game on the basis of tilt displacement of a control lever, executes a step for controlling a stimulation-imparting mechanism so as to be vibratingly driven in response to a game situation.

11. A computer readable medium storing a control program which executes a step for driving and controlling said stimulation-imparting mechanism at least in one of an amount of vibration and a type of vibration, in response to the game situation.

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