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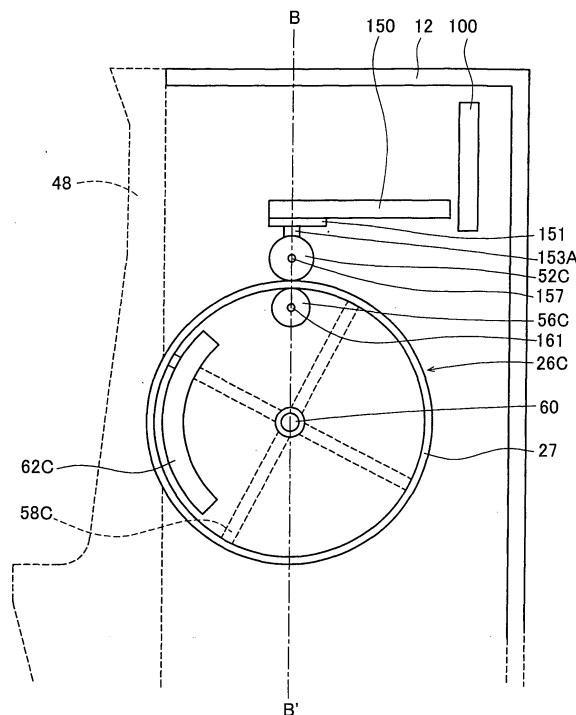
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(54) **Gaming machine**

(57) In the gaming machine 10, it is provided the drive rollers 52L, 52C, 52R each of which is rotatably supported while contacting to the outer periphery of the cylindrical member 27 at the side edge of each reel 26L, 26C, 26R and the following rollers 65L, 56C, 56R each of which is rotatably supported while contacting to the inner surface of the cylindrical member 27 corresponding to the contact portion where each of drive rollers 52L,

52C, 52R is contacted to the outer periphery of the cylindrical member 27, thereby the cylindrical member 27 in each reel 26L, 26C, 26R is held between the drive roller 52L, 52C, 52R and the following roller 56L, 56C, 56R. Each reel 26L, 26C, 26R is rotated together with the drive roller 52L, 52C, 52R and the following roller 56L, 56C, 56R when each drive roller 52L, 52C, 52R is rotated by the stepping motor 54L, 54C, 54R.

FIG.4



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Description

CROSS-REFERENCE TO THE RELATED APPLICATION (S)

[0001] This application is based upon and claims a priority from the prior Japanese Patent Application No. 2003-003769 filed on Jan. 9, 2003, the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to a gaming machine having a plurality of reels rotated by drive motors. In particular, the present invention relates to a gaming machine in which stop position of each reel can be easily and precisely controlled.

2. Description of Related Art

[0003] In a gaming machine such as so-called Japanese pachislot machine, slot machine, a plurality of reels (usually three reels) are rotatably arranged in a cabinet, and the reels starts to rotate at the same time that game is started. Further, when all reels stop, a game result is determined based on a stop state of symbols which are described on an outer periphery of each reel.

[0004] Therefore, bringing game contents in the above gaming machine into focus, it is no exaggeration to say that the moving state of the reels is the most important point for a player.

[0005] In the above previous gaming machine, it is general that a rotational axis portion of the reel and a drive shaft of a drive motor to rotate the reel are directly connected with each other. When the reel is rotated, the rotational axis portion of the reel is rotated by the drive motor, thereby the reel is rotated.

[0006] Here, in the reels of the previous gaming machine, though a peripheral portion of the reel is formed in a strip construction to display various symbols thereon, there exists only spokes in an inner side of the reel, the spokes having function to connect and fix the rotational axis portion and the peripheral portion. Thus, most of total mass of the reel is concentrated near the peripheral portion due to its structure. Therefore, in the reel having the above structure, it may occur a problem that a very large torque is necessary when the reel is driven, in order to stably rotate the reel by rotation of the rotating shaft thereof.

[0007] Taking the above situation into consideration, it is disclosed, for example, in Japanese Unexamined publication Nos. 10-33749 and 2001-231915 gaming machines which have construction that the reels are driven to rotate at the peripheral portion thereof.

[0008] In the gaming machines shown in the above mentioned Publications, since rotational force of the reel

is obtained at the peripheral portion thereof through a drive roller or a drive pinion when starting rotation of the reel, the reel can start rotation thereof by less torque in comparison with the gaming machine in which the rotational axis portion of the reel and the drive shaft of the drive motor are directly connected.

[0009] However, even in the gaming machines shown in the above mentioned Publications, there may still occur a problem as follow.

[0010] That is, in the gaming machines shown in Japanese Unexamined publication Nos. 10-33749 and 2001-231915, though the reel can start rotation thereof by less torque in comparison with the gaming machine in which the rotational axis portion of the reel and the drive shaft of the drive motor are directly connected at start of reel rotation, the reel in rotation has large moment of inertia, thus it is required very large braking force to stop the reel in rotation. Here, in the above mentioned gaming machines, it is not described or suggested braking construction for controlling stop of the reel in rotation. Therefore, it is very difficult to precisely control stop position of the reel in rotation in the above mentioned gaming machines.

[0011] And, in the above mentioned gaming machines, a main control circuit unit for entirely controlling the gaming machine is usually arranged at a rear upper position in the gaming machine and a rotation control circuit unit for controlling rotation of the reel is almost arranged at a side position of the reel.

[0012] Here, the motors for rotating the reels are arranged at outside of the reels, but are arranged at underside of the reels. Thus, it is required long electric wires to electrically connect the main control circuit unit, the rotation control circuit unit and the drive motors, and wiring of the electric wires becomes very complexed.

[0013] Further, since construction of the reels, the drive motors and the other parts arranged around the reels is very complexed, it is required many processes for mutually assembling them and there is lack in consideration for recycle of the gaming machine, the recycle of products becoming social problem in recent years.

[0014] As mentioned, the gaming machines disclosed in the related art have no purpose to accomplish the above problems. Therefore, in the above gaming machines, it is very difficult to precisely stop the reels at the desired positions and it is required long electric wires to electrically connect the main control circuit unit, the rotation control circuit unit and the drive motors, and wiring of the electric wires becomes very complexed.

[0015] Further, in the gaming machine disclosed in Japanese Unexamined Publication No. 2001-231915, in order to stop the reel by stopping the drive roller, it is necessary that enough frictional force effectively acts between the drive roller and the reel. To realize this function, the drive roller has to be arranged so as to give enough force toward a normal line direction in the contact surface where the drive roller and the reel contacts with each other. At the same time, it is necessary that

the reel can resist the force given from the drive roller without distortion.

[0016] In the above case, if there are arranged any parts for stopping the reel while reducing the force given from the drive roller to the reel, the reel can stop without distortion even if it is used the reel generally utilized. However, since such parts are not arranged in the gaming machine, the reel in the gaming machine must have a strong construction so as not to distort by the force acted on the peripheral portion of the reel. Due to this, cost of reels increases, as a result, there may occur a problem that total cost of the gaming machine increases.

SUMMARY OF THE INVENTION

[0017] The present invention has done to accomplish the above problems, and provides a gaming machine in which stop position of each reel can be easily and precisely controlled.

[0018] To accomplish the above object, according to one aspect of the present invention, it is provided a gaming machine as follows.

[0019] That is, it is provided a gaming machine comprising:

- a cabinet;
- a plurality of reels rotatably supported in the cabinet, each of the reels having a cylindrical member with an outer periphery, on which symbols are formed;
- a drive motor for rotating each of the reels;
- a rotation control circuit unit for controlling rotation of the drive motor;
- a drive member rotatably supported while contacting to the outer periphery of the cylindrical member at a side edge of the reel; and
- a follower rotatably supported while contacting to an inner surface of the cylindrical member corresponding to a contact portion where the drive member is contacted to the outer periphery of the cylindrical member;

wherein the drive member is connected to the drive motor, and

wherein the cylindrical member is disposed between the drive member and the follower, and each of the reels is rotated together with the drive member and the follower when the drive member is rotated by the drive motor.

[0020] In the above gaming machine, it is provided the drive member rotatably supported while contacting to the outer periphery of the cylindrical member at the side edge of the reel and the follower rotatably supported while contacting to the inner surface of the cylindrical member corresponding to the contact portion where the drive member is contacted to the outer periphery of the cylindrical member. Thereby the cylindrical member of the reel is disposed between the drive member and the

follower and the reel is rotated together with the drive member and the follower when the drive member is rotated by the drive motor. As a result, direct stop control of the reel can be easily conducted and rotation stop position of the reel can be easily and precisely controlled.

[0021] Here, in many of the previous gaming machines with plural rotatable reels such as Japanese pachislot machines, each reel is rotated by the motor the drive shaft of which is directly connected to the rotational axis portion of the reel, therefore moment of inertia of the reel becomes large while rotating. Thus, it is difficult to brake and stop rotation of the reel at the predetermined position. And in the gaming machine in which the reel is directly driven to rotate at the outer periphery of the reel, since driving force is transmitted to the reel by contacting the drive roller to the reel along one direction, rotational energy of the reel has to be caught at one portion when the reel stops. Therefore, it is difficult to brake and stop the reel at the predetermined position.

[0022] Taking the above situation into consideration, in the gaming machine according to the invention, since it is constructed so as to hold the side edge portion of the reel between the drive member and the follower, stop control of the reel can be easily done by the drive member and the follower. Thereby, direct stop control of the reel can be easily and precisely conducted

[0023] Further, since the side edge of the reel is held by the drive member and the follower, pressure exerted from the drive member to the reel is canceled by pressure exerted from the follower to the reel, there is no need that the reel is strongly constructed. Thereby, cost of the reel can be reduced, as a result, total cost of the gaming machine can be also reduced.

[0024] Further, according to another aspect of the present invention, it is provided a gaming machine comprising:

- a cabinet;
- a plurality of reels rotatably supported in the cabinet, each of the reels having a cylindrical member with an outer periphery, on which symbols are formed;
- a drive roller rotatably supported while contacting to the outer periphery of the cylindrical member at a side edge of the reel;
- a following roller rotatably supported while contacting to an inner surface of the cylindrical member corresponding to a contact portion where the drive roller is contacted to the outer periphery of the cylindrical member;
- a drive motor for rotating each of the drive rollers;
- a rotation control circuit unit for controlling rotation of the drive motor; and
- a main control circuit unit for controlling an entire game conducted by the reels;

wherein the cylindrical member is disposed between the drive roller and the following roller, and each of the reels is rotated together with the drive roller and the following roller when the drive roller is rotated by the drive motor; and

wherein the drive motor, the rotation control circuit unit and the main control circuit unit are arranged out of the reel in a state that the drive motor, the rotation control circuit unit and the main control circuit unit are closely arranged with each other.

[0025] In the above gaming machine, it is provided the drive roller rotatably supported while contacting to the outer periphery of the cylindrical member at the side edge of the reel and the following roller rotatably supported while contacting to the inner surface of the cylindrical member corresponding to the contact portion where the drive roller is contacted to the outer periphery of the cylindrical member. Thereby the cylindrical member of the reel is disposed between the drive roller and the following roller and the reel is rotated together with the drive roller and the following roller when the drive roller is rotated by the drive motor. As a result, direct stop control of the reel can be easily conducted and rotation stop position of the reel can be easily and precisely controlled.

[0026] Further, since the side edge of the reel is held by the drive roller and the following roller, pressure exerted from the drive roller to the reel is canceled by pressure exerted from the following roller to the reel, there is no need that the reel is strongly constructed. Thereby, cost of the reel can be reduced, as a result, total cost of the gaming machine can be also reduced.

[0027] In addition, since the drive motor, the rotation control circuit unit and the main control circuit unit are arranged out of the reel in a state that the drive motor, the rotation control circuit unit and the main control circuit unit are closely arranged with each other, there is no need for complex wiring when the drive motor, the rotation control circuit unit and the main control circuit unit are electrically connected. Therefore, the drive motor, the rotation control circuit unit and the main control circuit unit can be easily connected and the reel can be easily removed. Thereby, disassembling processes of the gaming machine can be reduced when recycling thereof.

[0028] And wiring among the drive motor, the rotation control circuit unit and the main control circuit unit can be easily conducted and designing and assembling of the gaming machine can be simply and easily done.

[0029] Further, the drive motor and the rotation control circuit unit or the rotation control circuit unit and the main control circuit unit can be integrally exchanged, thus the gaming machine can be easily changed to another gaming machine in which different games are conducted by recycling.

[0030] The above and further objects and novel features of the invention will more fully appear from the following detailed description when the same is read in

connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for purpose of illustration only and not intended as a definition of the limits of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] The accompanying drawings, which are incorporated herein and constitute a part of this specification illustrate embodiments of the invention and, together with the description, serve to explain the objects, advantages and principles of the invention.

[0032] In the drawings,

Fig. 1 is a schematic perspective view of a gaming machine according to the embodiment of the present invention,

Fig. 2 is an enlarged front view of display windows and reels of the gaming machine, in which the display windows and the reels are partially enlarged and shown,

Fig. 3 is an explanation view showing a state that a front door of the gaming machine is opened leftward,

Fig. 4 is a A-A' sectional view in Fig. 3,

Fig. 5 is a B-B' sectional view in Fig. 4,

Fig. 6 is a block diagram showing a circuit construction including a main control circuit unit for controlling the gaming machine and peripheral devices electrically connected to the main control circuit unit, and

Fig. 7 is a block diagram showing a sub-control unit for controlling a display device and various lamps in the gaming machine and peripheral devices electrically connected to the sub-control unit.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0033] Hereinafter, a gaming machine according to the present invention will be described based on the embodiment embodying the present invention, with reference to the drawings. Here, in the embodiment, though the gaming machine of the present invention is realized in a so-called Japanese pachislot machine and description thereof will be done, the present invention can be applied to any types of gaming machines such as slot machines which have mechanically reels. And though any types of game media such as coins, medals, tokens can be utilized in the gaming machine, it will be described the gaming machine in which coins are used as the game medium.

[CONSTRUCTION OF THE GAMING MACHINE]

[0034] The basic construction of the gaming machine 10 is shown in Fig. 1.

[0035] In front of a cabinet 12 forming an outline of

the gaming machine 10, there are arranged three display windows 14 (14L, 14C, 14R) each of which is formed into a longitudinally lengthy rectangular shape substantially positioned vertically. And on the display windows 14L, 14C, 14R, there are arranged five pay lines which comprise horizontal three pay lines (center pay line L1, upper pay line L2A, bottom pay line L2B) and oblique two pay lines (pay line L3A the right end of which is directed downward, pay line L3B the right end of which is directed upward). At the both ends (right end and left end) of each pay line L1, L2A, L2B, L3A, L3B, there are arranged bet number display parts 16 which display pay lines (suitably abbreviated as effective lines) which become effective according to the number of inserted coins in the gaming machine 10 and the coin number betted. Concretely, the bet number display parts 16 is arranged such as "3," "2," "1," "2," "3," in order from the uppermost part.

[0036] When a player presses a 1-BET switch 20 (mentioned later), one pay line among five pay lines, for example, the pay line L1 is made effective. When the player presses a 2-BET switch 22 (mentioned later), three pay lines among five pay lines, for example, the pay lines L1, L2A and L2B are made effective. And when the player presses a MAX-BET switch 24 (mentioned later), all pay lines of five pay lines, that is, the pay lines L1, L2A, L2B, L3A and L3B are made effective. The effective pay line is brightly indicated by lightening an effective line display lamp 18 (see Fig. 6, mentioned later) which is arranged behind the bet number display part 16.

[0037] In the cabinet 12, three reels 26 (26L, 26C, 26R) are rotatably arranged. On each outer periphery of the reels 26, a plurality of symbols are described. Each reel 26L, 26C, 26R can be seen through the display windows 14L, 14C, 14R, respectively. As mentioned later, the reel 26L, 26C, 26R is driven to rotate so that the symbols described on the outer periphery of the reel 26L, 26C, 26R are moved from upper side toward lower side in the display window 14L, 14C, 14R.

[0038] Further, at lower position of the display windows 14L, 14C, 14R, a frontward projection portion 28 is horizontally formed. In the center of the frontward projection portion 28, a display device 30 constructed from a liquid crystal display panel is arranged. On the display device 30 game histories are displayed and image direction in bonus games is conducted.

[0039] At the right side of the display device 30, a coin insertion slot 32 through which coins are inserted in the gaming machine 10 is formed. In the coin insertion slot 32, a coin detector 64 (see Fig. 6) is arranged and detects coins inserted through the coin insertion slot 32.

[0040] At the left side of the display device 30, the 1-BET switch 20, the 2-BET switch 22 and the MAX-BET switch 24 are provided. Here, the 1-BET switch 20 acts to bet in one game only one coin among coins already inserted in the gaming machine 10 when operated. The 2-BET switch 22 acts to bet in one game two coins

among coins already inserted in the gaming machine 10 when operated. And the MAX-BET switch 24 acts to bet the maximum number of coins capable of betting in one game among coins already inserted in the gaming machine 10. When the BET switch 20, 22 or 24 is pressed, the above mentioned pay lines are made effective according to the depressed BET switch.

[0041] At the left side of the front surface of the frontward projection portion 28, a start lever 34 is provided so as to be able to obliquely move. Based on that the player operates the start lever 34 which is obliquely moved, rotation of three reels 26L, 26C, 26R is started. While three reels 26L, 26C, 26R are rotated, symbols described on each outer periphery of the reels 26L, 26C, 26R are variably displayed within the display windows 14L, 14C, 14R.

[0042] And when rotational velocity of the reels 26L, 26C, 26R reaches to a constant velocity, stop buttons 36 (36L, 36C, 36R, mentioned later) become effective for operation by the player.

[0043] At the center of the front surface of the frontward projection portion 28, three stop buttons 36L, 36C and 36R are provided. Here, the stop button 36L corresponds to the reel 26L, the stop button 36C corresponds to the reel 26C and the stop button 36R corresponds to the reel 26R. When the player presses the stop button 36L the reel 26L stops, and when the player presses the stop button 36C the reel 26C stops. Similarly, when the player presses the stop button 36R the reel 26R stops.

[0044] And when the reels 26L, 26C, 26R stop, symbols described on each outer periphery of the reels 26L, 26C, 26R are controlled to stop at positions corresponding to pay lines L1, L2A, L2B, L3A and L3B

[0045] At the left side of the start lever 34, a payout button 38 is arranged. When the player presses the payout button 38, coins inserted in the gaming machine 10 are paid out from a coin payout opening 40 positioned at the front lower position of the cabinet 12 and the paid out coins are accumulated in a coin tray 42.

[0046] At the upper side of the coin tray 42, a pair of speaker grills 46 are provided so that sounds produced by speakers 44 (see Fig. 3) installed in the cabinet 12 are spread out of the cabinet 12.

[0047] An enlarged front view of the display windows 14L, 14C, 14R of the gaming machine 10 and reels 26 (26L, 26C, 26R) is shown in Fig. 2. In Fig. 2, it is shown a state that the reel 26L stops and both of the reel 26C and 26R are rotating. Here, in fact, since it is difficult to express the rotating state of the reels 26C, 26R, the reels 26C and 26R are expressed as if being rotated.

[0048] As mentioned in the above, the reels 26L, 26C and 26R are respectively arranged behind the display windows 14L, 14C and 14R, and three symbols among symbols described on each outer periphery of the reels 26 can be seen at the same time through each of the display windows 14L, 14C and 14R.

[0049] At the front part of the display windows 14L, 14C and 14R, five pay lines of L1, L2A, L2B, L3A and

L3B are provided, and three symbols among symbols described on each outer periphery of the reels 26L, 26C and 26R stop on the pay lines. Further, a game result is determined based on a combination state of three symbols arranged on each of the pay lines.

[0050] It is shown in Fig. 3 a state that a front door 48 of the gaming machine 10 is opened leftward.

[0051] At the lower position of the rear side in the front door 48, speakers 44 (one speaker 44 is only disclosed in Fig. 3) are arranged so as to position to the rear sides of the speaker grills 46.

[0052] At the rear upper position in the gaming machine 10, a main control circuit unit 100 is arranged, the main control circuit unit 100 entirely controlling the gaming machine 10 and games conducted therein. And a rotation control circuit unit 150 for controlling rotation of the reels 26L, 26C and 26R is arranged at the upper position of the reels 26L, 26C, and 26R.

[0053] At the lower position of the cabinet 12, a hopper 50 is also arranged. The hopper 50 accumulates coins inserted by the player and pays out coins to the player based on the game result.

[0054] In Fig. 4, it is shown the sectional view of the upper part in the gaming machine 10 sectioned along A-A' line in Fig. 3. And it is shown in Fig. 5 the sectional view sectioned along B-B' dotted line in Fig. 4.

[0055] In Figs. 4 and 5, at the rear upper position in the cabinet 12, the main control circuit unit 100 for entirely controlling the gaming machine 10 and games done in the gaming machine 10 is provided.

[0056] And at a position upper than the reel 26 (26C) and near the main control circuit unit 100, the rotation control circuit unit 150 for controlling rotation of the reels 26L, 26C, 26R is provided.

[0057] Further, as shown in Figs. 4 and 5, each reel 26L, 26C, 26R has a cylindrical member 27. At side edge positions of the reel 26L, 26C, 26R, drive rollers 52L, 52C and 52R are arranged respectively so that the drive rollers 52L, 52C and 52R can rotate while contacting with the outer periphery of the cylindrical member 27 in each reel 26L, 26C, 26R. Corresponding to the drive rollers 52L, 52C and 52R, following rollers 56L, 56C and 56R are arranged respectively so that the following rollers 56L, 56C and 56R can rotate while contacting the inner surface of the cylindrical member 27 in each reel 26L, 26C, 26R.

[0058] Here, with reference to Figs. 4 and 5, arranging construction of the drive rollers 52L, 52C, 52R and the following rollers 56L, 56C, 56R will be described hereinafter. On the under surface of the rotation control circuit unit 150, a support member 151 is fixed, and a pair of suspending members 153A and 153B are downwardly provided from the under surface of the support member 151, corresponding to each combination of the drive roller and the following roller.

[0059] As shown in Fig. 5, a stepping motor 54L is fixed to the support member 153A through a fixing member 155, a stepping motor 54C is fixed to the support

member 153A through the fixing member 155 and a stepping motor 54R is fixed to the support member 153A through the fixing member 155. And a drive shaft 157 of the stepping motor 54L is connected to the drive roller 52L so as to be able to rotate the drive roller 52L and is rotatably supported in the support member 153B. Similarly, the drive shaft 157 of the stepping motor 54C is connected to the drive roller 52C so as to be able to rotate the drive roller 52C and is rotatably supported in the support member 153B. And similarly, the drive shaft 157 of the stepping motor 54R is connected to the drive roller 52R so as to be able to rotate the following roller 52R and is rotatably supported in the support member 153B.

[0060] At the lower part of each support member 153B, a U-shaped portion 159 is formed and the following roller 52L, 52C, 52R is rotatably supported in the U-shaped portion 159 through a support shaft 161.

[0061] Based on the above mentioned construction, the drive rollers 52L, 52C, 52R for rotating the reels 26L, 26C, 26R are respectively contacted to the outer periphery of the cylindrical member 27 in each reel 26 between the reels 26L, 26C, 26R and the rotation control circuit unit 150, and each of the drive rollers 52L, 52C, 52R is rotated by the drive shaft 157 in each stepping motor 54L, 54C, 54R driven by the signal transmitted from a motor drive circuit 154 (see Fig. 6) formed on the rotation control circuit unit 150. Further, the reels 26L, 26C, 26R are respectively rotated by rotational force transmitted to the outer periphery of the cylindrical member 27 from each of the drive rollers 56L, 56C, 56R.

[0062] Further, the following roller 56L is contacted to the inner surface of the cylindrical member 27 at the contact portion where the drive roller 52L contacts to the outer periphery of the cylindrical member 27, so as to hold the cylindrical member 27 of the reel 26L between the following roller 56L and the drive roller 52L together with the drive roller 52L. Similarly, the following roller 56C is contacted to the inner surface of the cylindrical member 27 at the contact portion where the drive roller 52C contacts to the outer periphery of the cylindrical member 27, so as to hold the cylindrical member 27 of the reel 26C between the following roller 56C and the drive roller 52C together with the drive roller 52C. And similarly, the following roller 56R is contacted to the inner surface of the cylindrical member 27 at the contact portion where the drive roller 52R contacts to the outer periphery of the cylindrical member 27, so as to hold the cylindrical member 27 of the reel 26R between the following roller 56R and the drive roller 52R together with the drive roller 52R. Therefore, when the reels 26L, 26C, 26R are rotated by the drive rollers 52L, 52C, 52R, the following rollers 56L, 56C, 56R are rotated following to rotation of the reels 26L, 26C, 26R.

[0063] And each of the reels 26L, 26C, 26R is rotatably arranged around a axis portion 60, which acts as the rotational axis of each reel 26L, 26C, 26R and supported within each reel 26L, 26C, 26R by plural spokes 58 (four

spokes 58L in the reel 26L, four spokes 58C in the reel 26C and four spokes 58R in the reel 26R in this embodiment).

[0064] And, for example, as the central reel 26C is shown in Fig. 4, a reel light 62C is provided at the forward position (left position in Fig. 4) within the reel 26C. The reel light 62C irradiates from the backside of the portion which is visible through the display window 14C in the surface of the reel 26C, thereby the reel 26C is brightened. Further, various directions can be done by turning on and off the reel light 62C according to the game condition. Here, though only the reel light 62C in the reel 26C is shown in Fig. 4, such reel light 62 is, of course, arranged in both reels 26L and 26R.

[0065] And the stepping motors 54L, 54C, 54R for rotating the reel 26L, 26C, 26R respectively, are connected to the rotation control circuit unit 150. The stepping motors 54L, 54C, 54R, as mentioned, transmit driving force to the drive rollers 52L, 52C, 52R, respectively, through the drive shaft 157. Thereby, based on that the drive rollers 52L, 52C, 52R are rotated, the reels 26L, 26C, 26R are rotated.

[0066] According to the construction mentioned above, the stepping motors 54L, 54C, 54R, the drive rollers 52L, 52C, 52R and the following rollers 56L, 56C, 56R are suspended from the rotation control circuit unit 150 arranged at upper position of the reels 26L, 26C, 26R.

[0067] As mentioned, in the gaming machine 10 of the embodiment, each reel 26L, 26C, 26R is held at the edge portion thereof by each drive roller 52L, 52C, 52R contacting to each outer periphery of the reels 26L, 26C, 26R and each following roller 56L, 56C, 56R contacting to each inner surface of the reels 26L, 26C, 26R, thereby reels 26L, 26C, 26R become rotatable by driving force of the drive rollers 52L, 52C, 52R. And each drive roller 52L, 52C, 52R is connected to each drive shaft 157 of the stepping motors 54L, 54C, 54R. Accordingly, direct stop control of the reels 26L, 26C, 26R can be easily conducted.

[0068] Further, as shown in Figs. 4 and 5, the drive rollers 52L, 52C, 52R and the stepping motors 54L, 54C, 54R are connected respectively at the upper position outside of the reels 26L, 26C, 26R, thus the stepping motors 26L, 26C, 26R are arranged outside of the reels 26L, 26C, 26R, instead of within the reels 26L, 26C, 26R. Further, it is not required complex wiring to connect the stepping motors 54L, 54C, 54R and the rotation control circuit unit 150. Thereby, the reels 26L, 26C, 26R can be easily removed, as a result, it can be reduced the number of processes for disassembling the gaming machine 10 while recycling thereof.

[0069] As mentioned, the rotation control circuit unit 150 is positioned at the upper position from the reels 26L, 26C, 26R and near the main control circuit unit 100, thus both the stepping motors 54L, 54C, 54R and the rotation control circuit unit 150 are arranged near with each other and both the rotation control circuit unit 150

and the main control circuit unit 100 are arranged near with each other. Thereby, it can be easily done wiring among the stepping motors 54L, 54C, 54R, the rotation control circuit unit 150 and the main control circuit unit 100, therefore the gaming machine 10 can be easily and simply designed and assembled.

[0070] Further, the stepping motors 54L, 54C, 54R and the rotation control circuit unit 150, or the rotation control circuit unit 150 and the main control circuit unit 100 can be integrally exchanged, thereby the gaming machine 10 can be easily changed to another slot machine, in which different games are conducted, when recycling.

[0071] Here, in the above embodiment, though the rotation control circuit unit 150 is positioned at the upper position from the reels 26L, 26C, 26R and near the main control circuit unit 100, it is unnecessary to set the rotation control circuit unit 150 at the above position so long as the same effect can be obtained, thus the rotation control circuit unit 150 may be positioned at any positions in the cabinet 12.

[0072] Further, in the above embodiment, though the reel 26 is held between the drive roller 56 and the following roller 52 and is rotated by rotation of the drive roller 52, it is not limited to the above construction. The reel 26 may be rotated by another members such as a drive pinion and a following pinion.

[CONSTRUCTION OF CONTROL DEVICE FOR GAMING MACHINE]

[0073] It is shown in Fig. 6 the block diagram of circuitry including the control circuit for controlling the gaming machine 10 and the peripheral devices connected to the control circuit.

[0074] The start lever 34 is connected to an interface circuit group 102 of the main control circuit unit 100, and the interface circuit group 102 is connected to an input and output bus 104. Start signal for starting the game produced by the start lever 34 is converted into desired signal in the interface circuit group 102, thereafter the converted signal is provided to the input and output bus 104. The input and output bus 104 is constructed so that data signal or address signal is input to and output from a central processing unit (abbreviated CPU hereinafter) 106.

[0075] And the stop buttons 36L, 36C, 36R, the 1-BET switch 20, the 2-BET switch 22, the MAX-BET switch 24 and the payout button 38 are also connected to the interface circuit group 102. Signals produced by pushing these buttons or switches are also provided to the interface circuit group 102 and converted into desired signals, thereafter the converted signals are provided to the input and output bus 104.

[0076] Further, the coin detector 64 installed in the coin insertion slot 32 is connected to the interface circuit group 102. Signal produced by the coin detector 64 is also input to the interface circuit group 102 and convert-

ed into desired signal, thereafter the converted signal is input to the input and output bus 104.

[0077] To the above input and output bus 104, a ROM (Read Only Memory) 108 and a RAM (Random Access Memory) 110 are also connected. The ROM 108 stores control program for wholly controlling game flow conducted in the gaming machine 10. Further, the ROM 108 stores initial data for executing the control program, character data for displaying messages on the display device 30 and sound data for sounding various sounds from the speakers 44.

[0078] The RAM 110 temporarily stores flag data and variable values utilized in the control program.

[0079] A random number generator 112 for generating random numbers is connected to the input and output bus 104. The random number generator 112 randomly generates numbers within a predetermined range. For example, the random number generator 112 generates random numbers within a range of 0~65535 (corresponding to 2^{16}). Here, in the embodiment, though the random numbers are generated by the random number generator 112 arranged out of the CPU 106, the present invention is not limited to this construction. For example, the random numbers may be generated by processing treatment of the CPU 106 without forming the random number generator.

[0080] A flash memory 114 is also connected to the input and output bus 104 and the flash memory 114 stores a flag number indicating that rights for migrating to BIG BONUS game or REGULAR BONUS game are obtained. Here, in the embodiment, though the above flag number is stored in the flash memory 114, the present invention is not limited to this. It may be used any type of nonvolatile memories such as a hard disc drive capable of rewriting data.

[0081] A communicating interface circuit 116 is also connected to the input and output bus 104. The communicating interface circuit 116 can transmit game state data to and communicate with a server for controlling the gaming machines installed in a game arcade.

[0082] Further, a reel control circuit 152 formed on the rotation control circuit unit 150 is connected to the input and output bus 104. The reel control circuit 152 controls each of the reels 26L, 26C, 26R.

[0083] Further, a motor driving circuit 154 is connected to the reel control circuit 152. And when the reel control circuit 152 receives commands to rotate the reels 26 or stop rotation of the reels 26 from the CPU 106, the reel control circuit 152 transmits command signals for controlling the reels 26 to the motor driving circuit 154, so as to suitably execute contents corresponding to the commands.

[0084] Further, the stepping motors 54L, 54C, 54R, each of which rotates the reel 26L, 26C, 26R, respectively, are connected to the motor driving circuit 154. Each of the stepping motor 54L, 54C, 54R is arranged at the upper position of each of the reel 26L, 26C, 26R, respectively. Here, both the stepping motors 54L, 54C,

54C and the drive rollers 52L, 52C, 52R are positioned so that each drive shaft 157 of the stepping motors 54L, 54C, 54R coincides with each rotational center of the drive rollers 52L, 52C, 52R. And each of the drive rollers 52L, 52C, 52R is positioned so as to contact to each of the outer periphery of the reels 26L, 26C, 26R. Thus, each rotating force of the drive rollers 52L, 52C, 52R is transmitted to each of the reels 26L, 26C, 26R, thereby the reels 26L, 26C, 26R are rotated.

[0085] Drive control command produced in the CPU 106 is converted into drive signal by the motor driving circuit 154 and this drive signal is provided to the stepping motors 54L, 54C, 54R. Here, the drive control command includes rotational velocity command, therefore not only rotational control and stop control of the stepping motors 54L, 54C, 54R but also rotational velocity control thereof are conducted based on the drive control command.

[0086] As mentioned, based on that the CPU 106 controls the stepping motors 54L, 54C, 54R, not only rotational control and stop control of the stepping motors 54L, 54C, 54R but also rotational velocity control thereof can be done.

[0087] To each of the reels 26L, 26C, 26R, rotational angle position sensor 156L, 156C, 156R, each of which senses rotational angle of the reel 26L, 26C, 26R, is attached. And the rotational angle position sensors 156L, 156C, 156R are connected to a reel rotational angle position detecting circuit 158 which is formed on the rotation control circuit unit 150. When signal indicating the rotational angle position of each reel 26L, 26C, 26R is output from the rotational angle position sensor 156L, 156C, 156R, this signal is input to the reel rotational angle position detecting device 158 and converted into predetermined signal, thereafter the converted signal is provided to the input and output bus 104 through the reel control circuit 152.

[0088] The CPU 106 computes symbol code Nos. based on the provided rotational angle position information, thereby it can be specified symbol images which are displayed within the display windows 14L, 14C, 14R.

[0089] Further, to the input and output bus 104, it is connected a sub-control unit 200 for controlling parts to inform the player of various information, such as the display device 30, the speaker 44, the effective line display lamp 18, stop button lamps 72L, 72C, 72R, the reel lights 62L, 62C, 62R. The sub-control unit will be described hereinafter.

[0090] And further, a hopper driving circuit 250 is connected to the input and output bus 104, and when the CPU 106 receives signal indicating that the payout button 38 is pressed or coins have to be paid out based on that the player wins a prize in the game, the CPU 106 sends coin payout signal to the hopper driving circuit 250. Thereby, the hopper driving circuit 250 drives the hopper 50 and coins are paid out corresponding to the prize.

[0091] The block diagram of the sub-control unit 200

is shown in Fig. 7

[0092] In Fig. 7, an interface circuit 202 is connected to an input and output bus 204, and image display command output from the main control circuit unit 100 is provided to the input and output bus 204 through the interface circuit 202. Data signal and address signal are input and output between the input and output bus 204 and a CPU 206.

[0093] To the mentioned input and output bus 204, a ROM 208 and a RAM 201 are also connected. The ROM 208 stores display control program for producing drive signal provided to the display device 30 based on image display command output from the main control circuit unit 100. And the RAM 201 stores flags and variable values, which are used in the display control program.

[0094] Further, a video data processor (abbreviated VDP hereinafter) 212 is connected to the input and output bus 204. The VDP 212 includes, so-called, the sprite circuit, the screen circuit and the pallet circuit, and executes various treatment to display images on the display device 30.

[0095] To the above VDP 212, a video RAM 214 for storing image data corresponding to the image display command output from the main control circuit unit 100, a video data ROM 216 for storing various image data such as image data of symbols, background and characters. Further, a driving circuit 218 for driving the display device 30 is connected to the VDP 212.

[0096] The CPU 206 reads out the display program stored in the ROM 208 and executes the read out program, and makes the video RAM 214 store the image data displayed on the display device 30 according to the image display command output from the main control circuit unit 100. Here, the image display command includes display command such as background display command, symbol display command, character display command.

[0097] The video data ROM 216 stores symbol image data used as the identifying information image in the game, character image data including animals and the like displayed when production is done on the display device 30 and background image data comprising background displayed on the display device 30.

[0098] The symbol image data is utilized when variable displaying and stopping of the symbols are done on the display device 30, and includes image data displayed in various display manners, for example, such as enlarged images, reduced images, modified images. And the character image data includes image data necessary for displaying a series of moving characters.

[0099] To the input and output bus 204, a speaker driving circuit 220 for driving the speaker 44 is connected. The CPU 206 reads out the sound data stored in the ROM 208 and provides the read out data to the speaker driving circuit 220. Thereby, predetermined sound is produced by the speaker 44.

[0100] Further, a lamp driving circuit 222 is also connected to the input and output bus 204. When the CPU

206 receives signal indicating that the 1-BET switch 20, the 2-BET switch 22 or the MAX-BET switch 24 is pressed from the main control circuit unit 100, the CPU 206 send drive command to the lamp driving circuit 222 corresponding to the switch signal output from each switch. Thereby, each of the effective line display lamps 18 is driven to turn on according to the drive command. Sub-control unit 200 may be incorporated in the main control circuit unit.

[0101] And, according to the game condition, the CPU 206 sends drive command to the lamp driving circuit 222, the drive command used for turning on or off each stop button lamp 72L, 72C, 72R and each reel lamp 62L, 62C, 62R. Thereby, each lamp is turned on or off corresponding to the drive command.

[0102] Here, the game condition means, for example, a case that the pressing order of three stop buttons 36L, 36C, 36R is serially informed to the player in a special game such as ASSIST TIME controlled by the sub-control unit 200. In this case, in order to inform the next stop button to be pressed by the player among three stop buttons, the stop button lamp provided with the stop button to be pressed and the reel lamp corresponding to the stop button are turned on and remained lamps are turned off. Although described with a gaming machine with stop buttons, the present invention is applicable to those without stop buttons, video slot machines, and the like.

[0103] The effect described in the specification is merely enumerated as the most suitable effect obtained by the present invention, therefore the effect is, of course, not limited to the effect described in the specification.

Claims

1. A gaming machine (10) comprising:

- a cabinet (12);
- a plurality of reels (26L, 26C, 26R) rotatably supported in the cabinet (12), each of the reels (26L, 26C, 26R) having a cylindrical member (27) with an outer periphery, on which symbols are formed;
- a drive motor (54L, 54C, 54R) for rotating each of the reels (26L, 26C, 26R);
- a rotation control circuit unit (150) for controlling rotation of the drive motor (54L, 54C, 54R);
- a drive member (52L, 52C, 52R) rotatably supported while contacting to the outer periphery of the cylindrical member (27) at a side edge of the reel (26L, 26C, 26R); and
- a follower (56L, 56C, 56R) rotatably supported while contacting to an inner surface of the cylindrical member (27) corresponding to a contact portion where the drive member (52L, 52C, 52R) is contacted to the outer periphery of the

cylindrical member (27);

wherein the drive member (52L, 52C, 52R) is connected to the drive motor (54L, 54C, 54R), and

wherein the cylindrical member (27) is disposed between the drive member (52L, 52C, 52R) and the follower (56L, 56C, 56R), and each of the reels (26L, 26C, 26R) is rotated together with the drive member (52L, 52C, 52R) and the follower (56L, 56C, 56R) when the drive member (52L, 52C, 52R) is rotated by the drive motor (54L, 54C, 54R).

2. The gaming machine (10) according to claim 1, wherein the drive motor (54L, 54C, 54R) is arranged at an upper position of each of the reels (26L, 26C, 26R).

3. The gaming machine (10) according to claim 1 or 2, wherein the rotation control circuit unit (150) is arranged with the drive motor (54L, 54C, 54R) at an upper position of the reel (26L, 26C, 26R).

4. The gaming machine (10) according to one of claims 1 ~ 3, further comprising a main control circuit unit (100) for controlling an entire game conducted by the reels (26L, 26C, 26R),

wherein the drive motor (54L, 54C, 54R), the rotation control circuit unit (150) and the main control circuit unit (100) are closely arranged with each other.

5. The gaming machine (10) according to one of claims 1 ~ 4, wherein the drive member (52L, 52C, 52R), the follower (56L, 56C, 56R) and the drive motor (54L, 54C, 54R) are suspended to the rotation control circuit unit through a suspending member (153A, 153B).

6. The gaming machine (10) according to one of claims 1 ~ 5, wherein the drive member (52L, 52C, 52R) comprises a drive roller connected to a drive shaft (157) of the drive motor (54L, 54C, 54R), and wherein the follower (56L, 56C, 56R) comprises a following roller.

7. The gaming machine (10) according to one of claims 1 ~ 5, wherein the drive member (52L, 52C, 52R) comprises a drive pinion connected to a drive shaft (157) of the drive motor (54L, 54C, 54R), and wherein the follower (56L, 56C, 56R) comprises a following pinion.

8. A gaming machine (10) comprising:

a cabinet (12);
a plurality of reels (26L, 26C, 26R) rotatably supported in the cabinet (12), each of the reels (26L, 26C, 26R) having a cylindrical member

(27) with an outer periphery, on which symbols are formed;

a drive roller (52L, 52C, 52R) rotatably supported while contacting to the outer periphery of the cylindrical member (27) at a side edge of the reel (26L, 26C, 26R);

a following roller (56L, 56C, 56R) rotatably supported while contacting to an inner surface of the cylindrical member (27) corresponding to a contact portion where the drive roller (56L, 56C, 56R) is contacted to the outer periphery of the cylindrical member (27);

a drive motor (54L, 54C, 54R) for rotating each of the drive rollers (52L, 52C, 52R);

a rotation control circuit unit (150) for controlling rotation of the drive motor (54L, 54C, 54R); and a main control circuit unit (100) for controlling an entire game conducted by the reels (26L, 26C, 26R);

wherein the cylindrical member (27) is disposed between the drive roller (52L, 52C, 52R) and the following roller (56L, 56C, 56R), and each of the reels (26L, 26C, 26R) is rotated together with the drive roller (52L, 52C, 52R) and the following roller (56L, 56C, 56R) when the drive roller (52L, 52C, 52R) is rotated by the drive motor (54L, 54C, 54R); and

wherein the drive motor (54L, 54C, 54R), the rotation control circuit unit (150) and the main control circuit unit (100) are arranged out of the reel (26L, 26C, 26R) in a state that the drive motor (54L, 54C, 54R), the rotation control circuit unit (150) and the main control circuit unit (100) are closely arranged with each other.

FIG.1

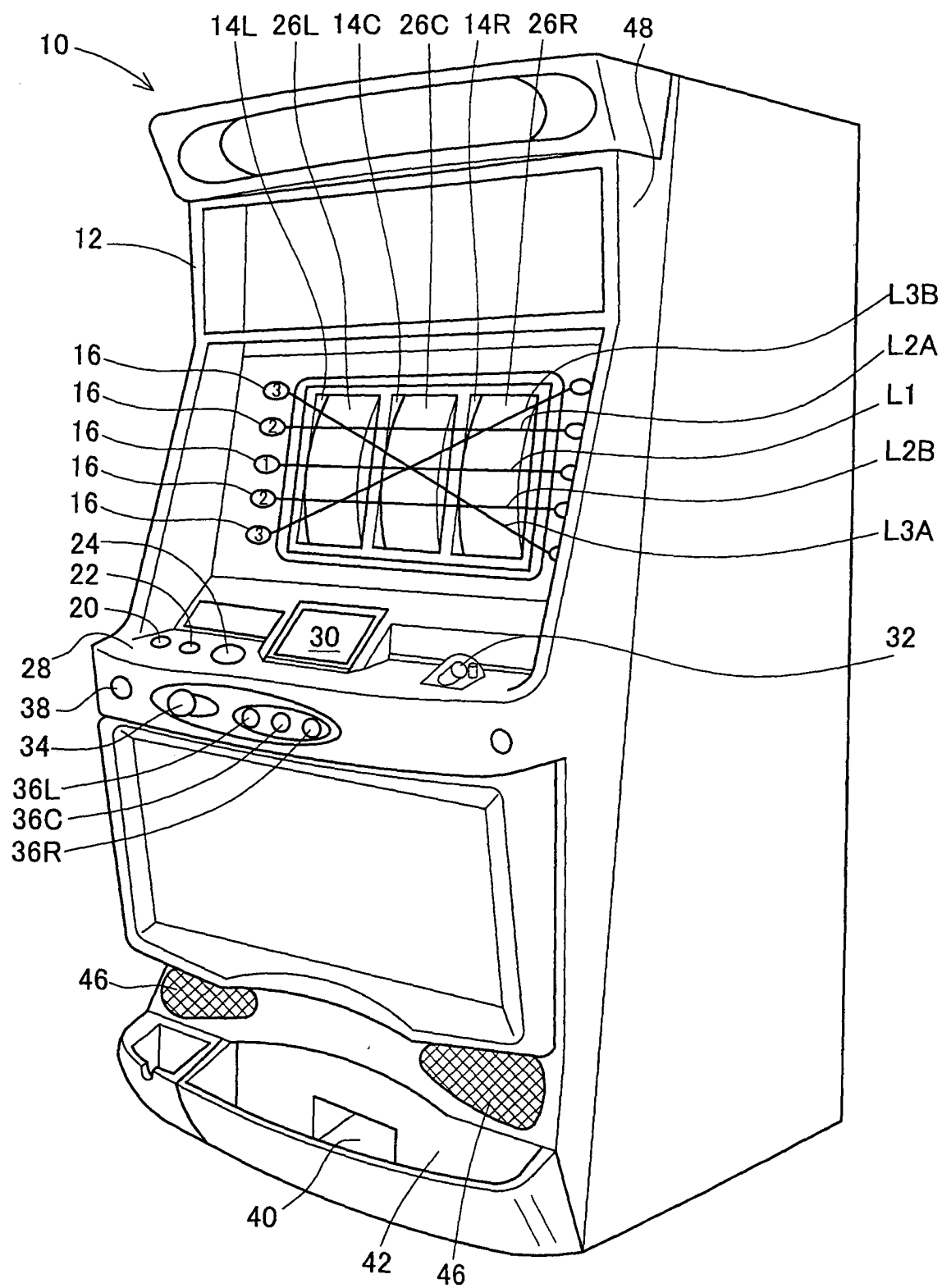


FIG.2

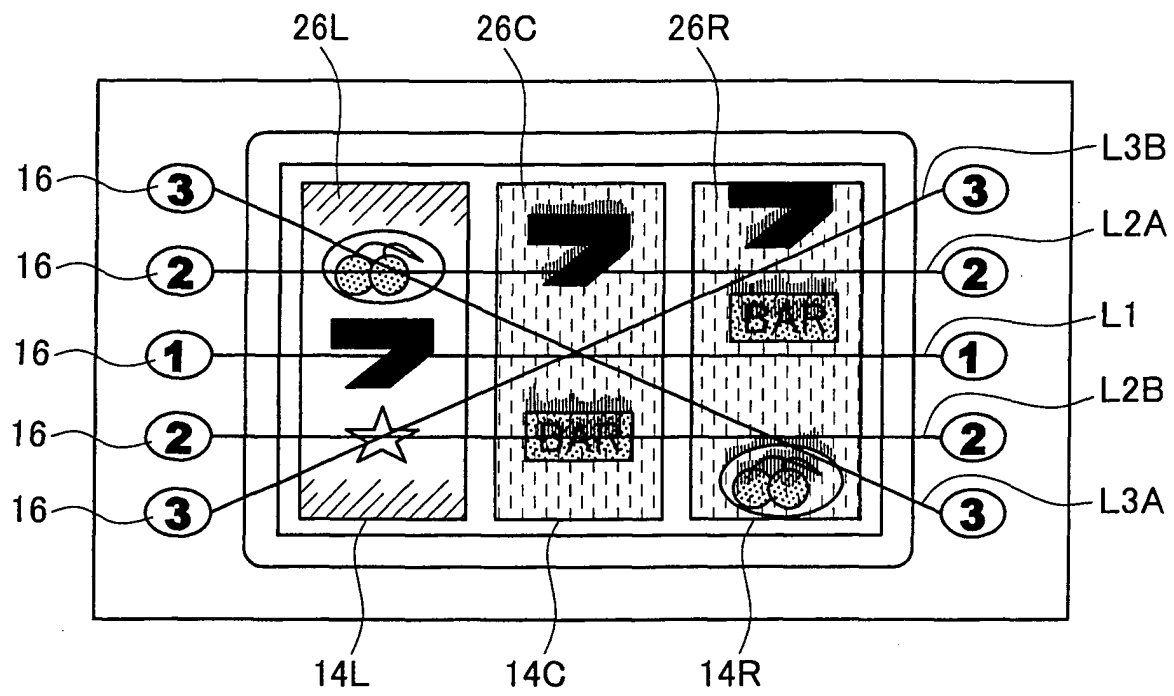


FIG.3

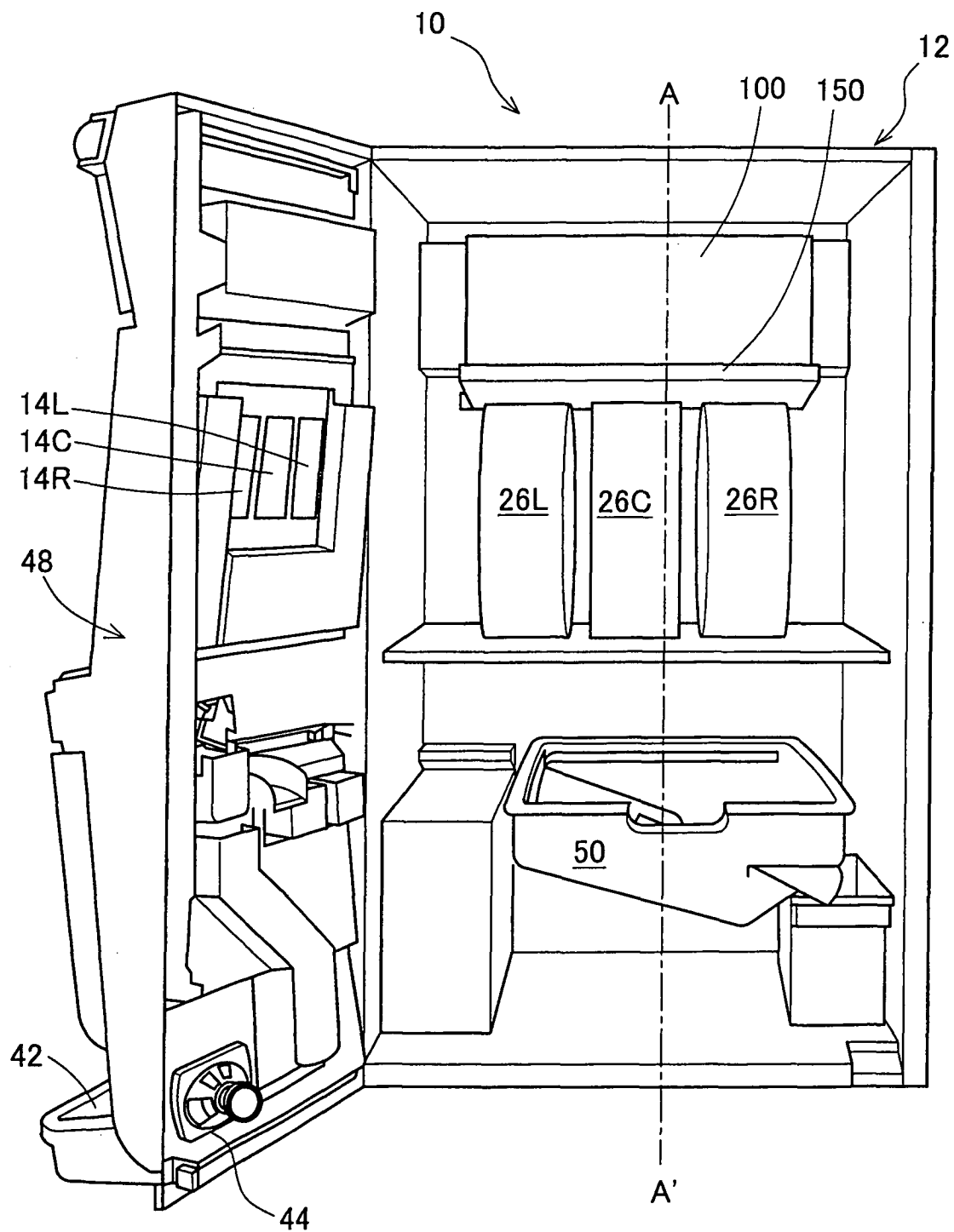


FIG.4

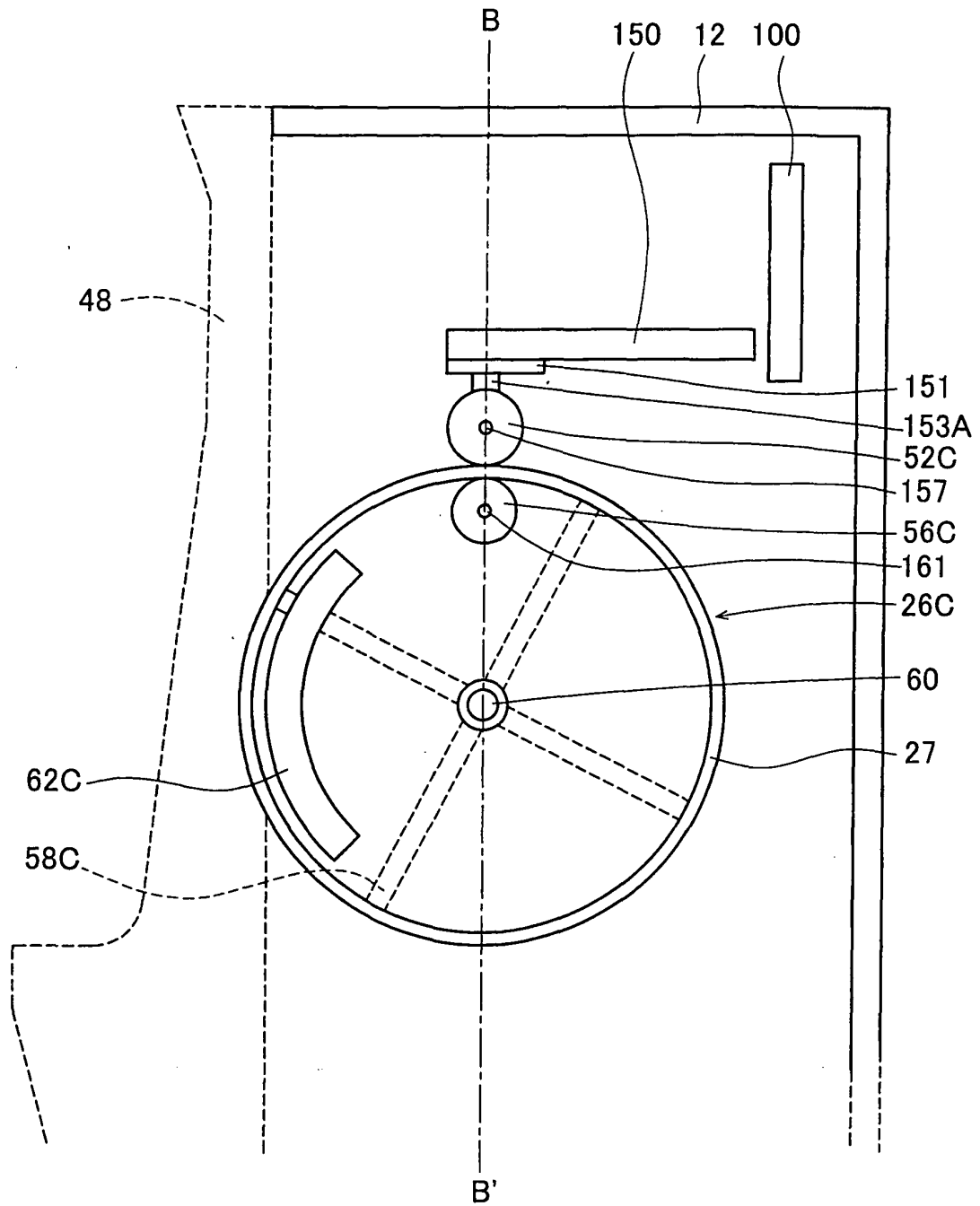


FIG.5

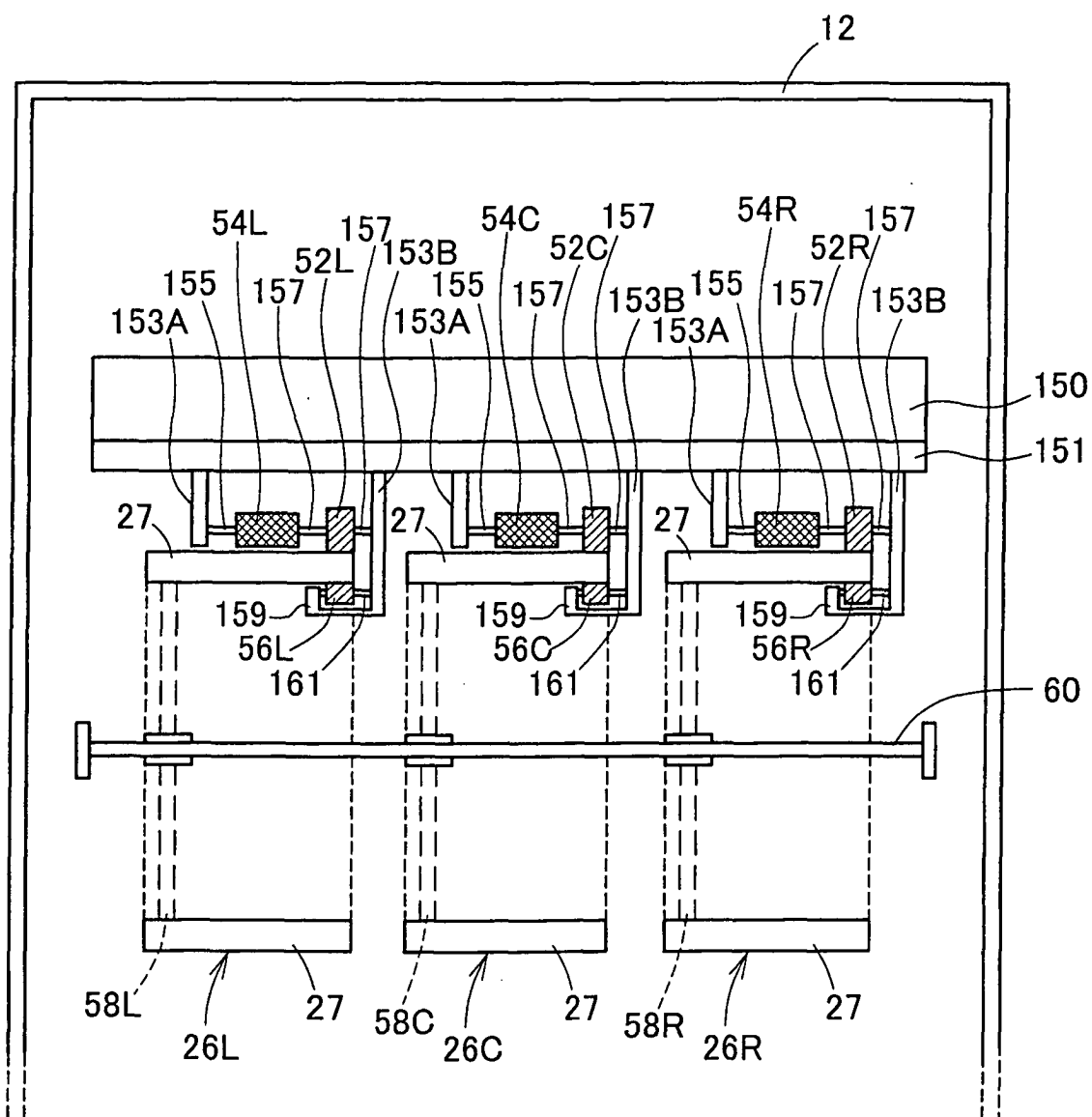


FIG. 6

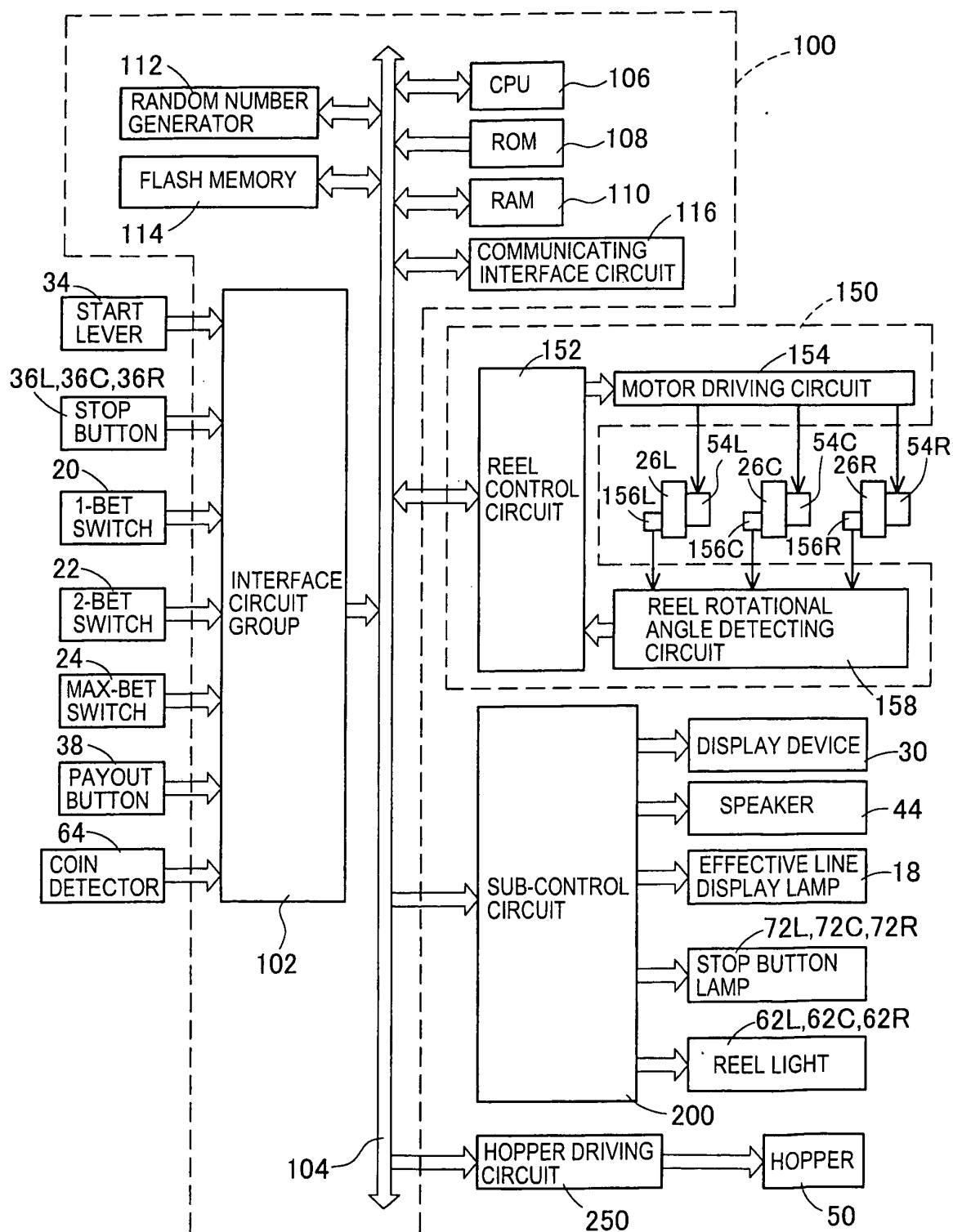


FIG. 7

