



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 1 489 566 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
22.12.2004 Bulletin 2004/52

(51) Int Cl.7: **G07F 17/32**

(21) Application number: **04013859.6**

(22) Date of filing: **14.06.2004**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PL PT RO SE SI SK TR**
Designated Extension States:
AL HR LT LV MK

(72) Inventor: **Omomo, Shingo**
Tokyo 135-0063 (JP)

(74) Representative: **HOFFMANN - EITLE**
Patent- und Rechtsanwälte
Arabellastrasse 4
81925 München (DE)

(30) Priority: **18.06.2003 JP 2003173732**

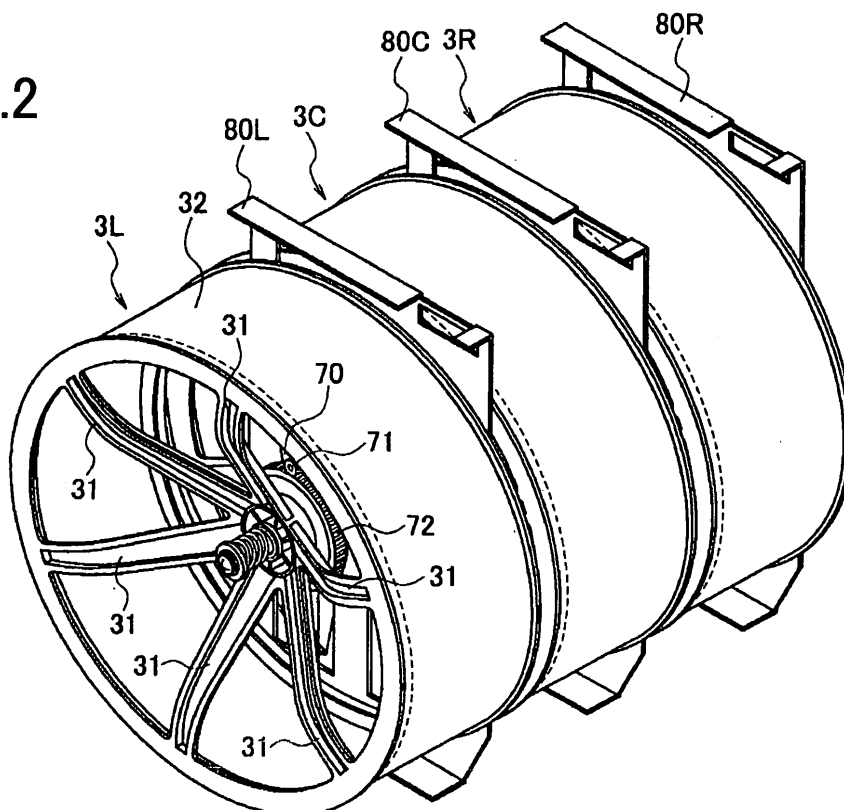
(71) Applicant: **Aruze Corp.**
Tokyo 135-0063 (JP)

(54) Reel drive device for a gaming machine

(57) The reel drive device is provided with the reel 3 having the cylindrical member 32 formed from transparent material, on an outer periphery of which a plurality of symbols are described, and an input gear installed in the cylindrical member 32; the shaft support part 720 for rotatably supporting the reel 3; the stepping motor

70 for rotating the reel 3 through the input gear 72; the detection member 11 arranged in the input gear 72, the detection member 11 being formed from opaque material; and the position detection sensor 10 for detecting the detection member 11 as the rotation reference position of the reel 3.

FIG.2



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a reel-type gaming machine having a plurality of reels on each of which a plurality of symbols are formed and motors each of which rotates each reel, the gaming machine detecting rotation reference positions of the reels.

2. Description of Related Art

[0002] Conventionally, as described in Japanese Unexamined Publication No. 10-71240, a reel drive device for a reel-type gaming machine (for example, Japanese Pachislot machine) generally outputs a signal pulse representing a reel rotation reference position as a reset pulse, the reel drive device installed in a stepping motor (for example, the stepping motor is a direct-drive type motor that a rotation shaft thereof can be directly put in a central hole of the reel). And as the other type of reel drive device, there is a reel drive device which is installed out of the stepping motor and outputs the above reset pulse by detecting a detection member to specify the reel rotation reference position.

[0003] However, since the above reel drive device is not installed beforehand in a general stepping motor, a designer of the gaming machine has to design so that the reel drive device can be installed in a peripheral construction of the reel. On the other hand, there exists a reel drive device which is constructed so as to output the reset pulse by detecting a detection member formed in the reel. In a case that such reel drive device has a circuitry construction of a so-called light transmitting type, the reel drive device can detect the detection member by detecting whether sensor light emitted from the reel drive device is transmitted through the detection member or not.

[0004] By the way, in order to conduct variegated effects in connection with a game done in the gaming machine, if a liquid crystal display device, through which symbols formed on the reels can be seen from outside, is arranged in front of the reels, the reels have to be formed from transparent material so that troubles in effect do not occur by preventing shadow of the reels from being projected on the liquid crystal display device. Due to this, if the detection member is formed from transparent material into one body with the transparent reel, the reel drive device cannot properly detect the detection member since the sensor light emitted therefrom is transmitted through the detection member. Taking the above situation into consideration, it is desired to develop the reel construction in which the detection member is able to be made opaque when the detection member is formed in the reel made from transparent material.

SUMMARY OF THE INVENTION

[0005] The present invention has been done to resolve the above problems and it is an object to provide a reel drive device in which the detection member can be surely detected by arranging the detection member in the gear member formed from opaque material, the gear member being arranged in the reel and rotating the reel by receiving rotation force from the motor.

[0006] In order to accomplish the above object, according to one aspect of the present invention, it is provided a reel drive device comprising:

- a reel having a cylindrical member formed from transparent material, on an outer periphery of which a plurality of symbols are described, and a gear member installed in the cylindrical member;
- a shaft support part for rotatably supporting the reel;
- a motor for rotating the reel through the gear member;
- a detection member arranged in the gear member, the detection member being formed from opaque material; and
- a position detector for detecting the detection member as a rotation reference position of the reel.

[0007] Here, in the reel drive device, it is desirable that the gear member is formed from opaque material and the detection member is formed into one body with the gear member.

[0008] And it is desirable that the position detector has a light emitting part and a light receiving part and detects the rotation reference position of the reel based on that sensor light emitted from the light emitting part is interrupted by the detection member when the detection member positions between the light emitting part and the light receiving part.

[0009] Further, it is desirable that the light emitting part and the light receiving part are integrally formed in the position detector and the detection member is constructed so as to reflect the sensor light emitted from the light emitting part. In this case, the position detector detects the rotation reference position of the reel based on that the light receiving part receives the sensor light reflected through the detection member.

[0010] According to the reel drive device of the present invention, since the detection member is not arranged on the cylindrical member of the reel formed from transparent material but is arranged on the gear member formed from opaque material, the reel drive device can surely detect the detection member through the position detector. That is to say, in the reel drive device, when the reel is positioned at the predetermined position, the sensor light emitted from the light emitting part in the position detector is surely interrupted by the detection member formed from opaque material, thereby the position detector can surely detect the detection member.

[0011] As mentioned, according to the present invention, the detection member can be surely detected by forming the detection member in the gear member formed from opaque material.

[0012] 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

[0013] The accompanying drawings, which are incorporated in 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.

[0014] In the drawings,

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

Fig. 2 is a perspective view showing a construction of reels when obliquely seeing the reels in the embodiment,

Fig. 3 is a side view of the reel in the embodiment,

Fig. 4 is an enlarged explanatory view showing a construction near a shaft support portion of the reel in the embodiment,

Fig. 5 is an explanatory view showing a shaft support portion of the reel in the embodiment,

Fig. 6 is a sectional view showing a construction in which the shaft support portion is arranged on a support plate, in the embodiment,

Fig. 7 is an enlarged explanatory view schematically showing a construction of a position detection sensor in the embodiment, and

Fig. 8 is a block diagram schematically showing a control system in the gaming machine in the embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

(basic construction of motor drive device)

[0015] The motor drive device of the embodiment will be described with reference to the drawings. Fig. 1 is a perspective view of a gaming machine 1 according to the embodiment.

[0016] As shown in Fig. 1, in front of a cabinet forming a whole construction of the drum-type gaming machine 1, three panel display windows 5L, 5C, 5R are formed. Reels 3L, 3C, 3R constructing a reel unit are seen and recognized through the panel display windows 5L, 5C, 5R, respectively. And on the panel display windows 5L, 5C, 5R, three pay lines 6 are described along three hor-

izontal directions and two pay lines 6 are described along two oblique directions. These pay lines 6 are made effective according to the number of coins inserted through an insertion slot 7 and the number of pay lines 6 are determined.

[0017] Each of the reels 3L, 3C, 3R starts to rotate when a player inserts coins in the insertion slot 7 and operates a start lever 9. And when the player presses stop buttons 4L, 4C, 4R arranged corresponding to the reels 3L, 3C, 3R respectively, rotation of the reels 3L, 3C, 3R is stopped. Further, based on symbol combination of each of reels 3L, 3C, 3R which are seen and recognized through each of the panel display windows 5L, 5C, 5R when rotation of the reels 3L, 3C, 3R is stopped, winning mode is determined. And when winning is obtained, coins the number of which corresponds to the winning mode are paid out to a coin tray 8.

[0018] Fig. 2 is a perspective view showing the construction of the reel unit arranged within the panel display windows 5L, 5C, 5R. As shown in Fig. 2, the reel unit has three support plates 80L, 80C, 80R, three reels 3L, 3C, 3R arranged inside of each support plate 80L, 80C, 80R, respectively, and three stepping motors 70L, 70C, 70R rotating the reels 3L, 3C, 3R, respectively. The stepping motor 70L, 70C, 70R rotates the reel 3 since an output gear 71 fixed on a drive shaft 70A thereof (see Fig. 3) is meshed with an input gear 72.

[0019] Hereinafter, for convenience sake of explanation, although description will be done to limit to the left reel 3L (reel 3), the left support plate 80L (support plate 80), the left stepping motor 70L (stepping motor 70), among three reels 3L, 3C, 3R, three support plates 80L, 80C, 80R, three stepping motors 70L, 70C, 70R, the other reels 3C, 3R, the other support plates 80C, 80R, the other stepping motors 70C, 70R have the same construction as those of the reel 3L, the support plate 80L, the stepping motor 70L, so long as explanation is not especially referred.

[0020] Fig. 3 is a left side view of the reel 3. As shown in Fig. 3, the reel 3 is made from transparent material and the center portion of the reel 3 is rotatably supported on a reel post 76 which is extended in a direction perpendicular to the plane of the support plate. Further, as shown in Fig. 3, the reel 3 is constructed from six arms 31 extending spokewise from the center of the reel 3 and a cylindrical member 32 integrally formed so that top ends of the arms 31 are connected thereto.

[0021] On an outer periphery of the cylindrical member 32, symbol marks 33 are printed with a predetermined pitch, total number of the symbol mark 33 being 21 in the embodiment. And a symbol sheet (not shown) is adhered on the outer periphery of the cylindrical member 32. This symbol sheet is set to the outer periphery of the cylindrical member 32 by a method such as adhesion so that center of the symbol printed on the symbol sheet is positioned at the symbol mark 33. Here, a position detection sensor 10 and a detection member 11 shown in Fig. 3 will be described hereinafter.

[0022] A speed reduction transmission mechanism 700 is arranged between a drive shaft 70A of the stepping motor 70 and a rotation shaft of the reel 3, as shown in Fig. 3. This speed reduction transmission mechanism 700 transmits rotation of the stepping motor 70 to the rotation shaft of the reel 3 with a predetermined reduction ratio.

[0023] As shown in Fig. 3, the speed reduction transmission mechanism 700 has two gears, one of which is an output gear 71 put on the drive shaft 70A of the stepping motor 70 and the other is an input gear 72 meshing with the output gear 71 and being arranged in the reel 3 so that the rotation center of the input gear becomes the same shaft center as the rotation shaft of the reel 3. The input gear 72, as mentioned later, is installed in the cylindrical member 32. And the output gear 71 transmits rotation of the stepping motor 70 to the reel 3 by meshing with the input gear 72.

[0024] As the output gear 71 and the input gear 72, spur gears are, for example, utilized. The tooth number of the input gear 72 in the embodiment is set to the tooth number obtained by multiplying the tooth number of the output gear 71 by 7. Therefore, the speed reduction transmission mechanism 700 is constructed so as to transmit rotation of the stepping motor 70 to the reel 3 while reducing rotation number of the stepping motor 70 to 1/7 thereof.

[0025] It is desirable that the reduction ratio of the above output gear 71 and the input gear 72 is obtained based on the ratio of the step number necessary for one rotation of the stepping motor 70 and the least common multiple calculated from the symbol number described on the reel 3 and the step number for one rotation of the stepping motor 70.

[0026] Fig. 4 is a perspective view indicating a periphery part of the rotation shaft of the reel 3. Fig. 5A is an explanatory view indicating a construction of the shaft support part 720 for rotatably supporting the reel 3. Fig. 5B is an explanatory view indicating a construction for supporting the reel 3 by the shaft support part 720 arranged on the support plate 80. And Fig. 6 is a sectional view indicating a whole construction for supporting the reel 3 by the shaft support part 720.

[0027] As shown in Figs. 5A and 5B, the shaft support part 720 has a stopper screw 73, colors 74a, 74b, a vibration restraining member 75 and a reel post 76. The reel post 76 is provided with a rotation support portion 76a to which the input gear 72 is inserted and rotatably supported, a position fixing portion 76b to which a member for fixing the position of the reel 3 is inserted, a projection portion 76c which projected toward the support plate 80 from the bottom plane of the reel post 76 and is utilized for inserting the reel post 76 in a hole 81 formed in the support plate 80, screw holes 76d for fixing the reel post 76 to the support plate 80 by screws and a screw hole 76e in which the stopper screw 73 is fastened while the input gear 72 is inserted to the rotation support portion 76a and the colors 74a, 74b are inserted

to the position fixing portion 76b while existing the vibration restraining member 75 therebetween, thereby the input gear 72 is prevented from coming off from the reel post 76.

[0028] The vibration restraining member 75 has function to brake rotation of the reel 3 when the reel 3 is rotating, based on stop control by the CPU 40, and to decline vibration of the reel 3 occurring when rotation of the reel 3 is stopped. As the vibration restraining member 75, springs can be utilized. In the embodiment, description will be done according that the spring 75 shown in Fig. 5A is used as the vibration restraining member. As shown in Fig. 5B, the input gear 72 is inserted to the rotation support portion 76a, the spring 75 is inserted to the position fixing portion 76b while being sandwiched between the colors 74a and 74b.

[0029] The above mentioned stopper screw 73 is, as shown in Fig. 5B, inserted and fastened to the screw hole 76e, thereby the colors 64a, 74b and the spring 75 inserted to the position fixing portion 76b are prevented from coming off therefrom. The spring 75, which is prevented from coming off by the stopper screw 73, presses the input gear 72 toward the support plate 80 through the color 74b by its resilient force. At that time, frictional force occurs between the input gear 72 and the support plate 80, thereby the spring 75 can decline vibration of the reel 3 occurring when the reel 3 is stopped.

[0030] As shown in Figs. 5 and 6, in the input gear 72, two cylindrical projection portions 72a and 72b are integrally formed from both sides of the plate portion. Both the cylindrical projection portions 72a, 72b are perpendicularly projected from both sides of the plate portion, thereby the rotation support portion 76a can be inserted through the cylindrical projection portions 72a, 72b along an axis passing through the center of the cylindrical projection portions 72a, 72b. The input gear 72 is inserted to the rotation support portion 76a so that one cylindrical projection portion 72b faces to the support plate 80. The other cylindrical projection portion 72a is pressed into the hole 34 formed at the center position of the reel 3. Therefore, when the output gear 71 is rotated, the input gear 72 and the reel 3 are rotated all together around the rotation support portion 76a.

[0031] The detection member 11 is arranged on the opaque input gear 72, the detection member being formed from opaque material. The detection member 11 in the embodiment is formed from material which can be colored in any desirable color and is formed on the input gear 72 into one body by mold formation. This detection member 11 is formed so as to interrupt the sensor light emitted from the position detection sensor 10. Concretely, as shown in Fig. 6, the detection member 11 is arranged at a position where the position detection sensor 10 can detect the detection member 11, and arranged near the outer periphery of the disc plate constructing the input gear 72.

[0032] Here, as for opaque colors, such color is not limited to the color which completely interrupt the sensor

light emitted from the position detection sensor 10 and may be the color which can decline the sensor light to an extent that the position detection sensor 10 cannot detect the sensor light emitted therefrom.

[0033] As shown in Figs. 5 and 6, the position detection sensor 10 is attached to the support plate 80 through a support portion 10C, the position detection sensor 10 being a position detector which detects the detection member 11 as the rotation reference position of the reel 3. Fig. 7 is an explanatory view showing a construction of the position detection sensor 10. As shown in Fig. 7, a light emitting part 10A and a light receiving part 10B are formed in the position detection sensor 10. The light emitting part 10A and the light receiving part 10B are arranged at positions that both parts 10A and 10B face with each other. The light emitting part 10A emits the sensor light toward the light receiving part 10B. And the light receiving part 10B receives the sensor light emitted from the light emitting part 10A.

[0034] As shown in Fig. 7, when the detection member 11 is positioned between the light emitting part 10A and the light receiving part 10B by rotation of the reel 3, the sensor light emitted from the light emitting part 10A is surely interrupted by the detection member 11. And the light receiving part 10B detects that the sensor light is interrupted by the detection member 11 and outputs the detected result as detected signal to the main CPU 40. This detected signal becomes a signal which indicates the rotation reference position of the reel 3.

[0035] Here, in a case that the light emitting part 10A and the light receiving part 10B are integrally formed in the position detection sensor 10, the detection member 11 may be constructed so as to reflect the sensor light emitted from the light emitting part 10A and the light receiving part 10B may detect the detection member 11 as the rotation reference position of the reel 3 by receiving the light reflected by the detection member 11 and output the detected rotation reference position as the detected signal to the main CPU 40.

[0036] Fig. 8 is a block diagram indicating an electrical construction of the gaming machine 1, including the reel drive device (for example, the reel 3, the motor drive circuit 20, the position detection sensor 10, the detection member 11 and the main CPU 40). The reel drive device is provided with the stepping motor 70 which acts as a drive source of the reel 3 having a plurality of symbols thereon and detects the rotation reference position of the reel 3.

[0037] As shown in Fig. 8, in a microcomputer, there are provided a main CPU 40 functioning as a main controller for mainly controlling and calculating, a program ROM 40b for storing programs and various data, a control RAM 40a utilized for data reading and writing, and a random number generator (not shown) for generating predetermined random number values.

[0038] Input parts such as a start switch 3 for detecting operation of the start lever 9, a reel stop signal circuit 12 for detecting operation of the stop buttons 4L, 4C,

4R, an input part 2 including BET switches 2a ~ 2c for betting credited coins by pressing thereof and output parts such as a motor drive circuit 20, coin payout part (not shown) and gaming effect control execution part 50, are connected to the main CPU 40.

[0039] The main CPU 40 reads and writes data in the control RAM 40a according to the program stored in the program ROM 40b, thereby serially controls operation of each input and output part and conducts lottery treatment by utilizing the random number value generated by the random number generator after detecting operation of the start lever 9. The gaming effect control execution part 50 executes effects corresponding to the lottery treatment, based on commands from the main CPU 40.

[0040] When the reel 3 is rotated, the main CPU 40 calculates the number of drive pulses provided to the stepping motor 70 and writes the calculated value in the predetermined area of the control RAM 40a. This main CPU 40 clears the value of drive pulses written in the control RAM 40a to "0", based on the detected signal input from the position detection sensor 10. Thereby, in the control RAM 40a, the calculated value (rotation pitch) corresponding to the rotation position within one rotation is stored every each reel 3L, 3C, 3R.

[0041] Further, when stop operations by the stop buttons 4L, 4C, 4R are conducted, the main CPU 40 specifies the rotation position of the reel 3 with reference to the control RAM 40a at the time of the stop operations by the stop buttons 4L, 4C, 4R. And when the symbol combination corresponding to the specified rotation position coincides with the specific winning combination which is internally won, the main CPU 40 executes stop control so as to draw the symbols of the above combination into the pay line.

[0042] On the other hand, when the specific winning combination is not internally won, the main CPU 40 conducts slide treatment of the symbols (this treatment is done by sliding the predetermined number of symbols), thereafter the main CPU 40 conducts stop control of the reels 3.

(action and effect by motor drive device)

[0043] According to the embodiment, since the detection member 11 is not arranged on the cylindrical member 32 of the reel 3 formed from transparent material but is arranged on the input gear 72 formed from opaque material, the position detection sensor 10 can surely detect the detection member 11. That is to say, when the reel 3 is positioned at the predetermined position, the sensor light emitted from the position detection sensor 10 is surely interrupted by the detection member 11 formed from opaque material, thereby the position detection sensor 10 can surely detect the detection member 11.

[0044] Here, it is not limited to the detection member 11 which is formed into one body with the input gear 72

by mold formation. And if the detection member 11 is constructed so as to reflect the sensor light emitted from the light emitting part 10A, the detection member 11 may be formed by metal with the input gear 72 and paint plating may be done to the detection member 11 after

formed from transparent material with the input gear 72. **[0045]** As mentioned above, since the detection member 11 is formed into one body with the input gear 72 formed from opaque material, the detection member can be surely detected.

constructed so as to reflect the sensor light emitted from the light emitting part (10A).

5. The reel drive device according to claim 4, wherein the position detector (10) detects the rotation reference position of the reel (3) based on that the light receiving part (10B) receives the sensor light reflected through the detection member (11).

Claims

1. A reel drive device comprising:

a reel (3) having a cylindrical member (32) formed from transparent material, on an outer periphery of which a plurality of symbols are described, and a gear member (72) installed in the cylindrical member (32);

a shaft support part (720) for rotatably supporting the reel (3);

a motor (70) for rotating the reel (3) through the gear member (72);

a detection member (11) arranged in the gear member (72), the detection member (11) being formed from opaque material; and

a position detector (10) for detecting the detection member (11) as a rotation reference position of the reel (3).

2. The reel drive device according to claim 1, wherein the gear member (72) is formed from opaque material, and

wherein the detection member (11) is formed into one body with the gear member (72).

3. The reel drive device according to claim 1 or claim 2, wherein the position detector (10) has a light emitting part (10A) and a light receiving part (10B) facing to the light emitting part (10A), and

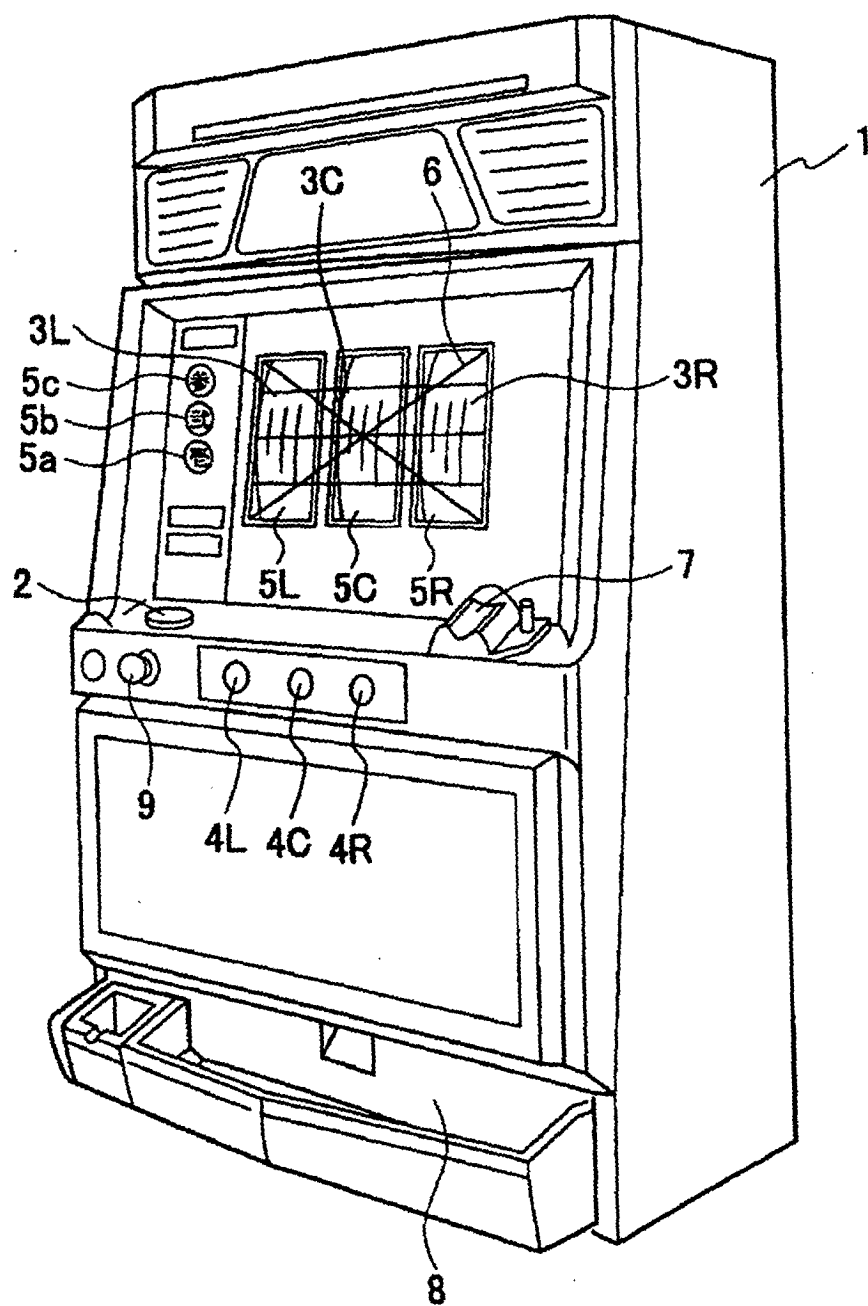
wherein the position detector (10) detects the rotation reference position of the reel (3) based on that the sensor light emitted from the light emitting part (10A) is interrupted by the detection member (11) when the detection member (11) positions between the light emitting part (10A) and the light receiving part (10B).

4. The reel drive device according to any one of the preceding claims, wherein the position detector (10) has a light emitting part (10A) and a light receiving part (10B) facing to the light emitting part (10A),

wherein the light emitting part (10A) and the light receiving part (10B) are integrally formed in the position detector (10), and

wherein the detection member (11) is con-

FIG.1



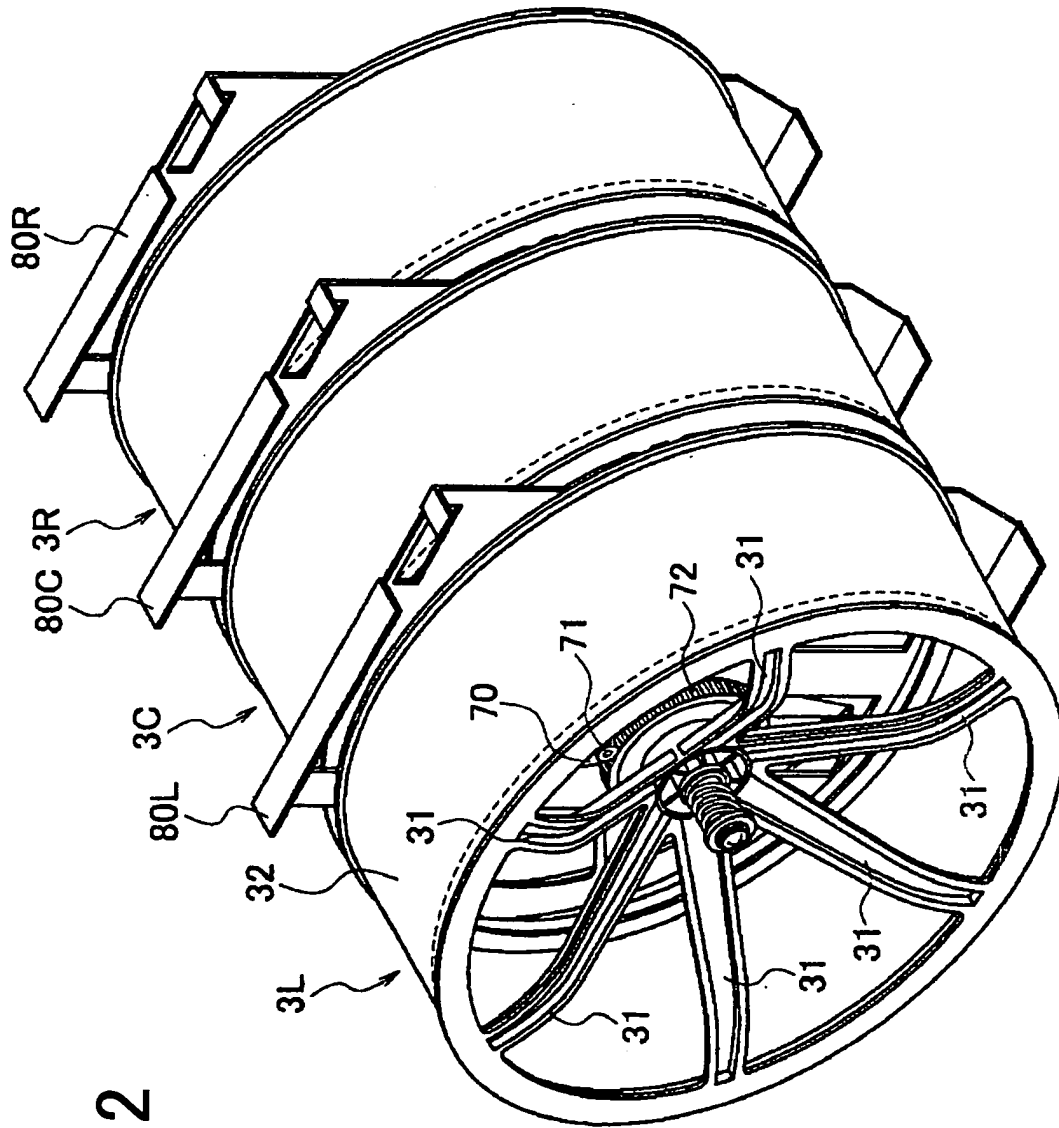


FIG. 2

FIG.3

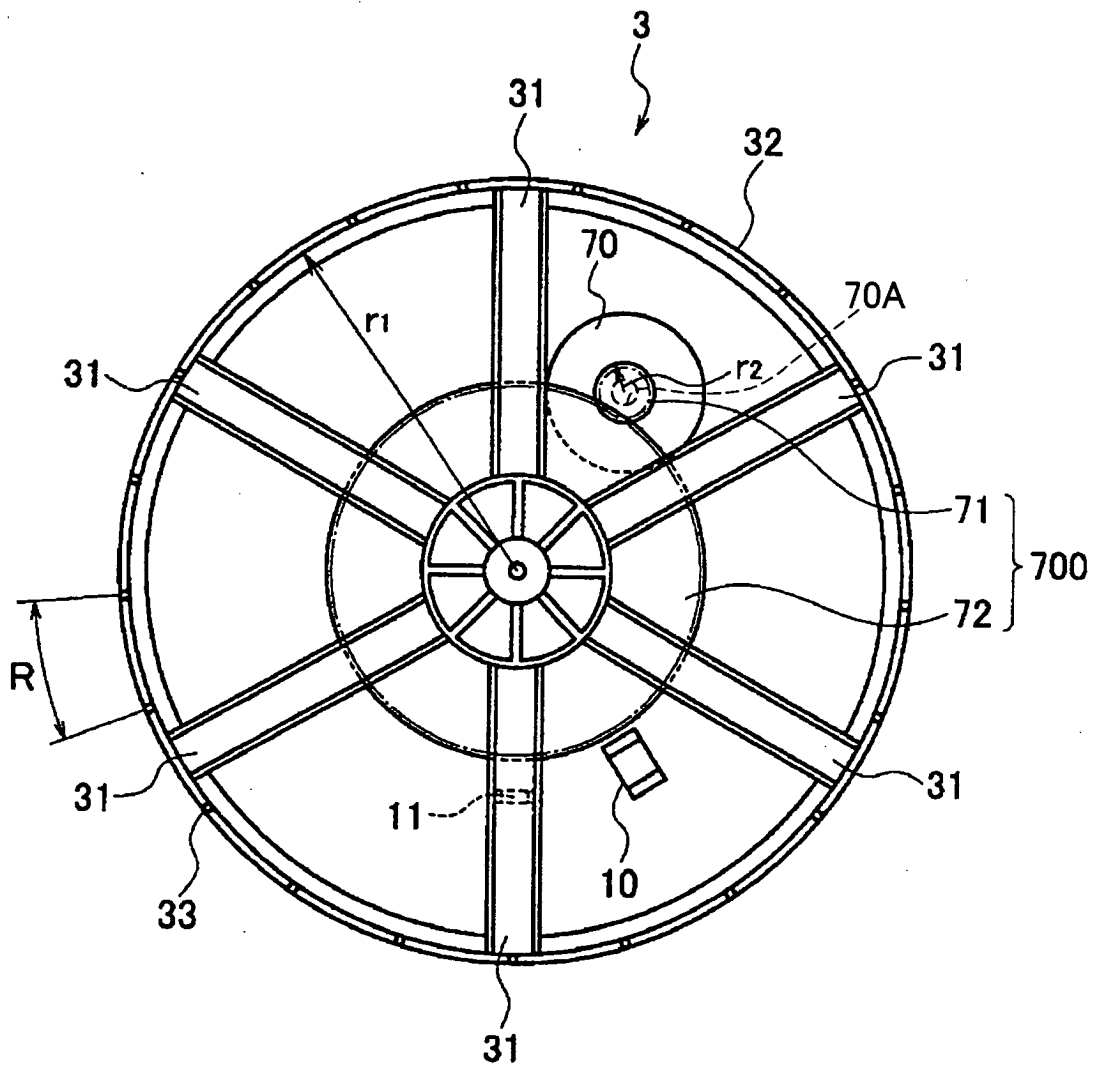


FIG.4

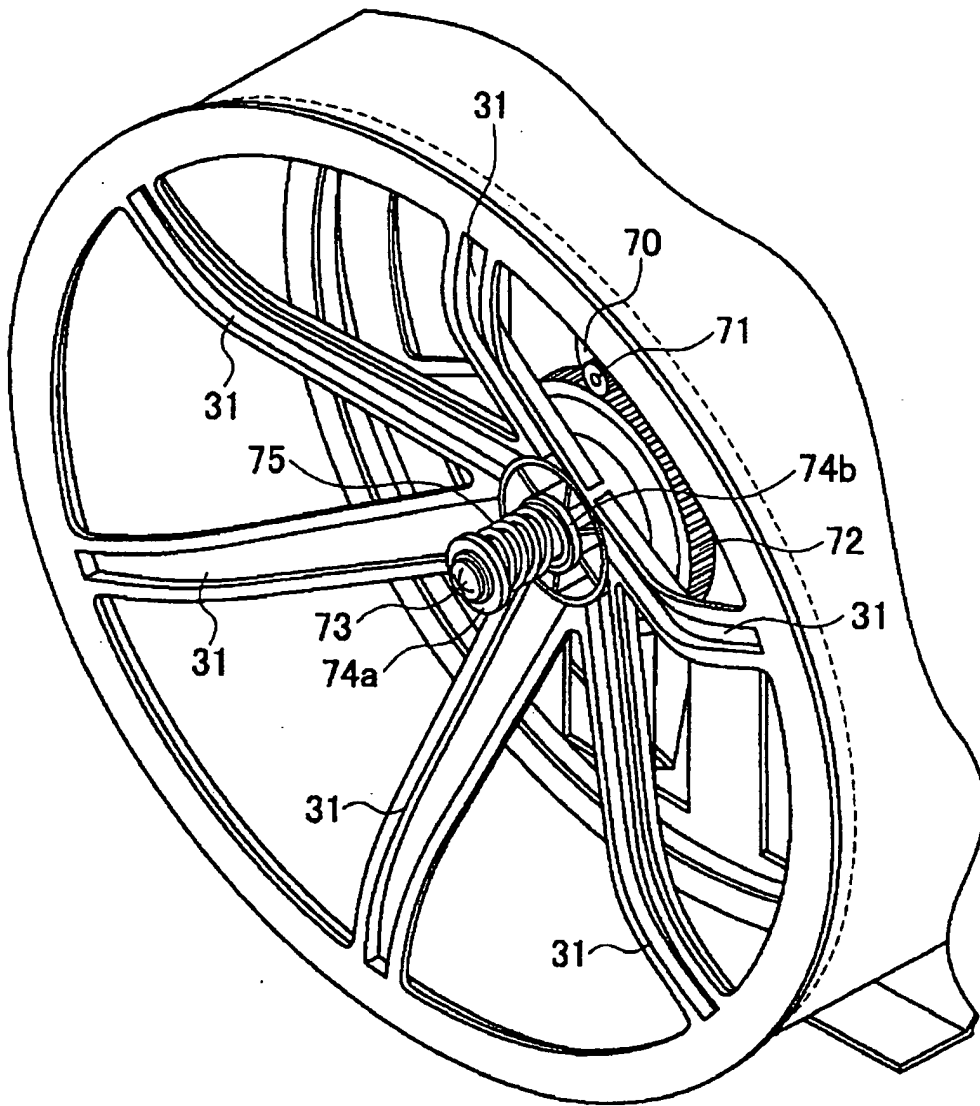


FIG.5A

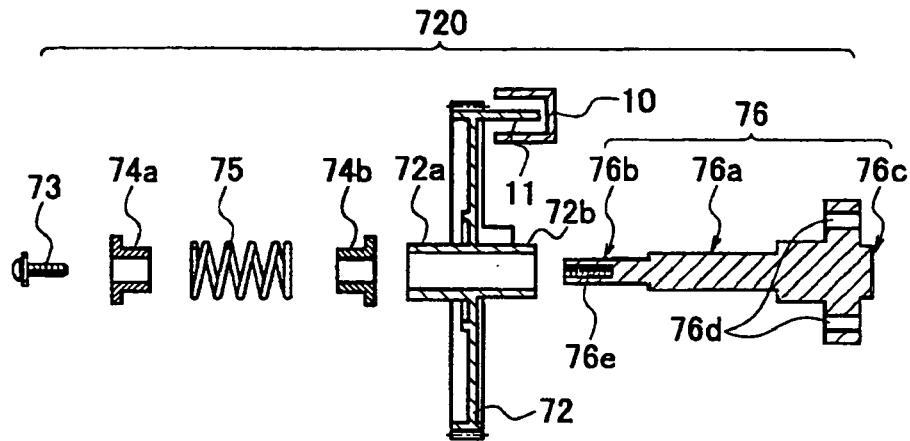


FIG.5B

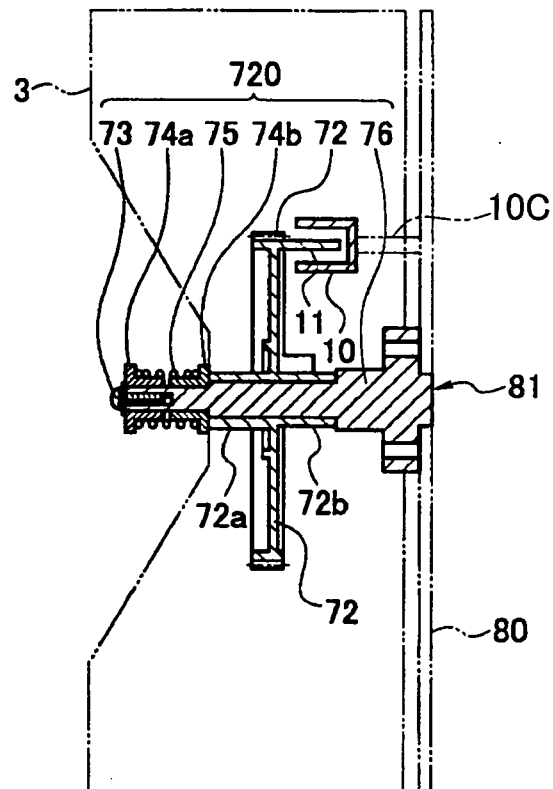


FIG.6

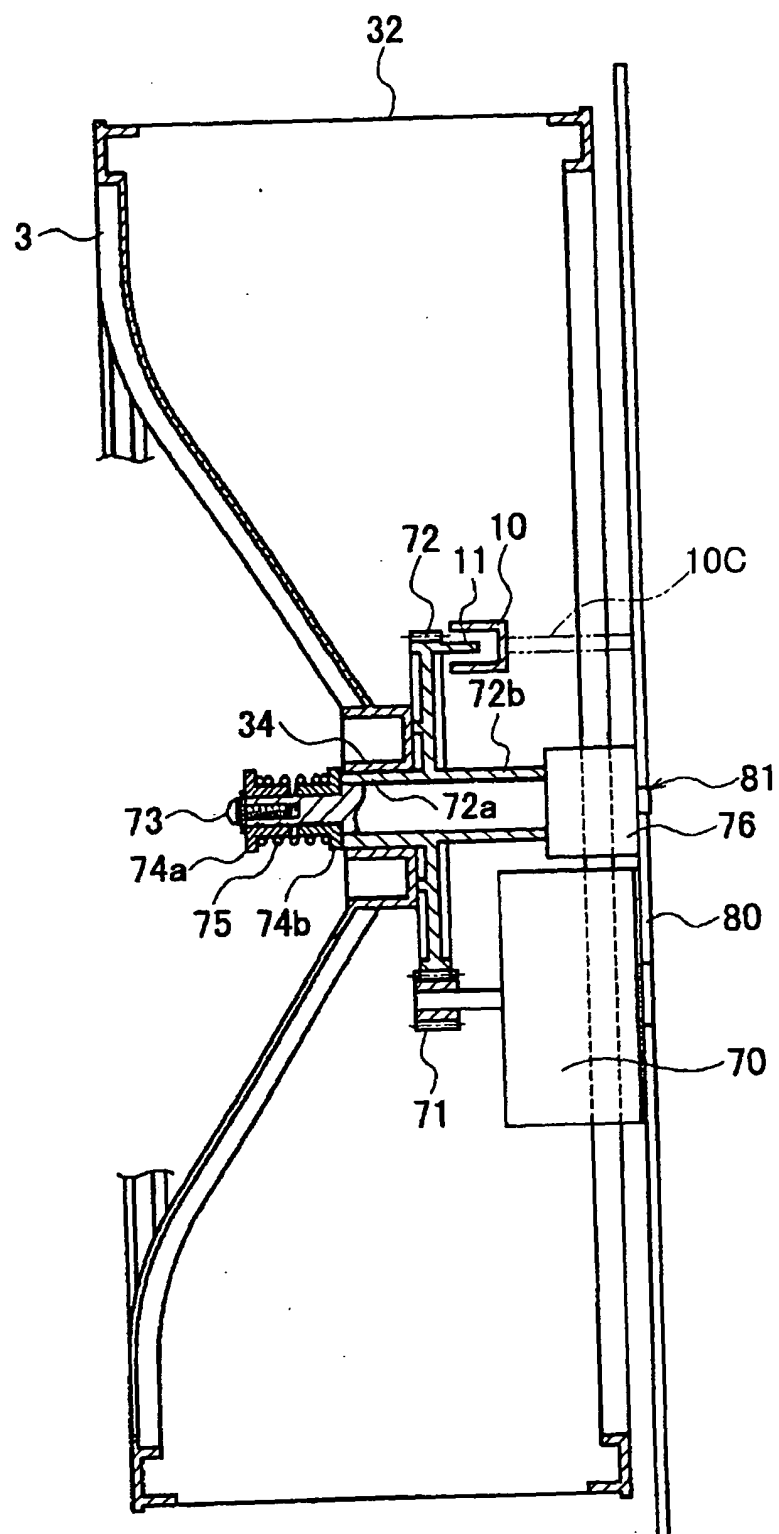


FIG.7

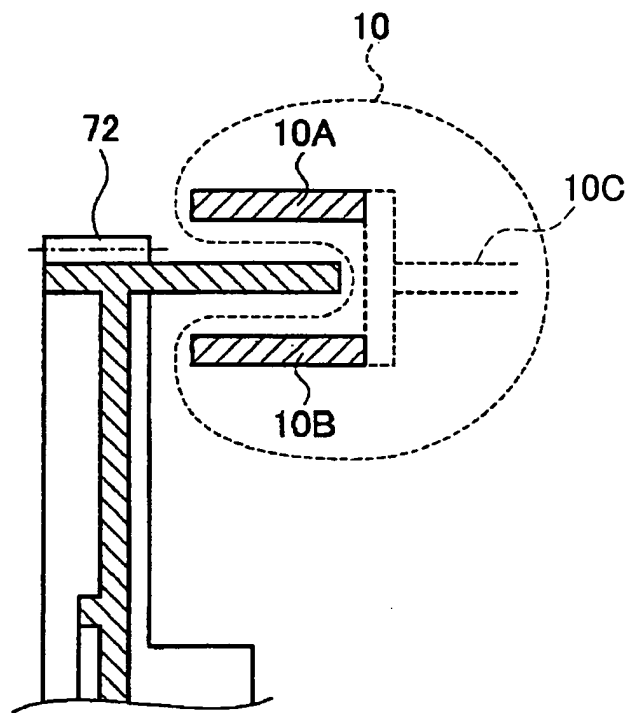


FIG.8

