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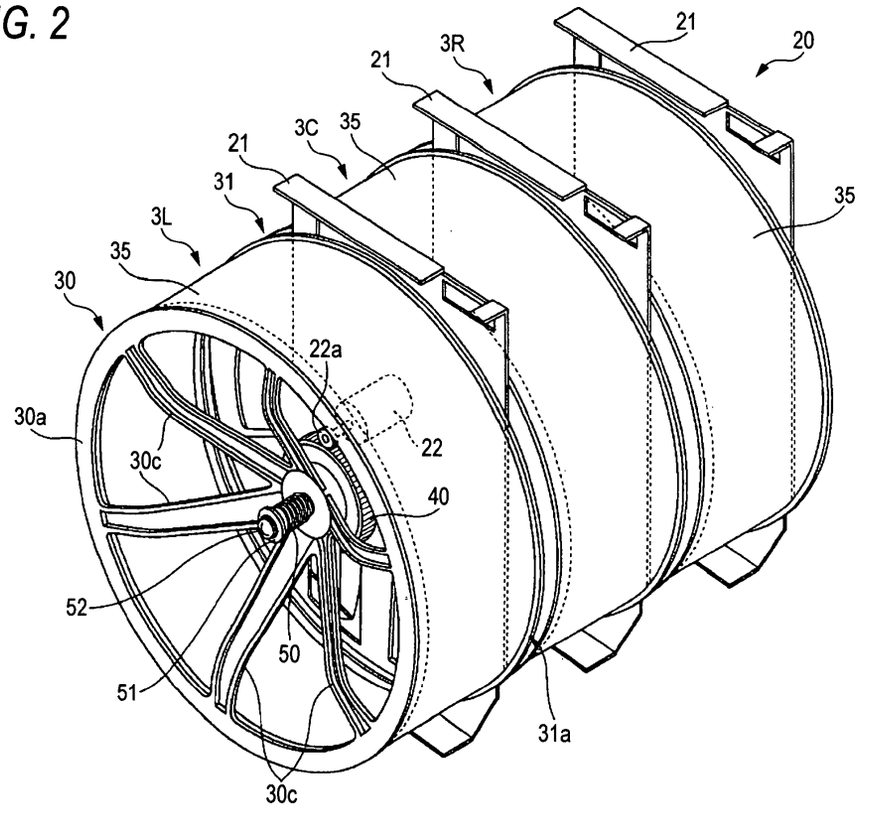
(54) Reel unit for a gaming machine

(57) A reel unit according to this invention includes a reel equipped with a frame body 3 0, on the outer periphery of which a plurality of kinds of symbols are formed; a drivingmotor 30 for driving the reel; and a speed reduction gear 40 for reducing an output from the driving motor, arranged at the center of the frame body so that it can be rotated integrally to the frame body. The reel unit is characterized in that an engaging portion 30 is formed radially outside its center of the frame body and an engaged portion 40 to be engaged with the engaging portion is formed at the corresponding position of the speed reduction gear 40.

FIG. 2



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] This invention relates to a reel unit built in a gaming machine such as a slot machine and having a reel on the outer periphery of which a plurality of kinds of symbols are successively formed.

Description of the Related Art

[0002] The gaming machine such as a slot machine incorporates a reel unit as a game device which rotatably supports a reel with a plurality of kinds of symbols successively formed thereon. Generally, the reel unit of the slot machine, as disclosed in JP-A-10-71240, supports three reels on the same axis. When a player operates a start lever, all the reels are driven. when the player operates a stopping button, each reel is stop-controlled individually. When the exposed symbols of the stopped reels become prescribed symbols (when a prize symbol holds), a game media (medal, coin, etc.) is given for the player.

[0003] As disclosed in JP-A-10-71240, the above reel unit generally includes stepping motors corresponding to the respective reels. With the output axis of each stepping motor being directly fit in a central axis hole of the reel, driving and stop-control of each reel are executed.

[0004] However, an inertial force acted on the reel to a certain degree in a rotating direction occasionally presents precisely stopping the symbols on the reel. This gives an inconvenience of giving a sense of visual disorder to the player such as the symbols when stopped slightly deviating from the positions to stop properly when seen from the player, the backlash state of the reel being visually recognized during stopping, etc.

SUMMARY OF THE INVENTION

[0005] This invention has been accomplished in order to overcome the above problem and intends to provide a reel unit through which the reel can be precisely stopped without losing smoothness in motor braking.

[0006] In order to solve the above problem, according to a first aspect of the invention, there is provided a reel unit including: a reel equipped with a frame body, on the outer periphery of which a plurality of kinds of symbols are formed; a driving motor for driving the reel; and a speed reduction gear for reducing an output from the driving motor, arranged at the center of the frame body so that it can be rotated integrally to the frame body, wherein an engaging portion is formed radially outside the center of the frame body and an engaged portion to be engaged with the engaging portion is formed at the corresponding position of the speed reduction gear.

[0007] In accordance with the first aspect of the invention, since the reel and the speed reduction gear are integrally rotatably fixed radially outside their centers by the engaging portion and the engaged portion, backlash which is likely to occur during the rotation of the reel can be effectively suppressed. specifically, since the engaging portion and engaged portion are formed to constitute a baffle between the reel and the speed reduction gear at the area on which great inertial force of the reel acts (area radially outside from the center), baffling of both reel and speed reduction gear can be effectively carried out, thereby effectively preventing the backlash at the time of starting and stopping of the rotation. When the reel is stopped or started, this prevents a player from being given a sense of visual disorder such as the symbols formed on the surface of the reel deviating from the proper positions, or the backlash state of the reel being recognized.

[0008] In accordance with the reel unit according to this invention, since the reel and the speed reduction gear are integrally rotatably fixed radially outside their centers by the engaging portion and the engaged portion, backlash of the reel which is likely to occur owing to the inertial force at the time of starting or stopping of the reel can be effectively suppressed. This prevents a player from being given a sense of visual disorder such as the symbols formed on the surface of the reel deviating from the proper positions, or the backlash state of the reel being visually recognized.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] These and other objects and advantages of the present invention will be more fully apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view showing an exemplary configuration of the slot machine incorporating a reel unit according to this invention;

Fig. 2 is a perspective view of the schematic configuration of the reel unit;

Fig. 3 is a perspective view of a part of the frame body constituting a reel which is rotatably supported by the reel unit;

Fig. 4 is a perspective view of a mounting relationship between the frame body shown in Fig. 3 and a speed reduction gear;

Fig. 5 is a view showing a modification of this invention which is a perspective view of a part of the frame body constituting the reel; and

Fig. 6 is a perspective view of a mounting relationship between the frame body shown in Fig. 5 and a speed reduction gear.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] Now referring to the attached drawings, a detailed explanation will be given of an embodiment of the reel unit according to this invention.

Fig. 1 is a perspective view of an embodiment of the slot machine according to this invention. Fig. 2 is a view showing the schematic structure of a reel unit built in the slot machine.

[0011] As seen from Fig. 1, a slot machine 1 has a cabinet 3 provided with a door (front door) which is openable/closable on the front face. The door 2 has a game region 2a above a nearly central position on the front face. On the game region 2, square display windows 4L, 4C and 4R are provided from which the respective reels 3L, 3C and 3R of the reel unit described later are exposed. On the outer periphery of each reel, a symbol column composed of a plurality of kinds of symbols is drawn. The symbols drawn on each reel can be visually recognized through the display window 4L, 4C, 4R. Each reel is designed to be rotatable at a constant speed (e.g. 80 revolutions/minute).

[0012] Beneath the game region 2a, a control panel 5 which is a nearly horizontal face is formed. On the left side of the control panel 5, a BET button 6 is provided for betting a credited medal by a button operation. On the right side of the control panel 5, a medal insertion slot 7 in which a medal or a game medium is inserted is provided. At the left end of the front face, a C/P button 8 is provided for switching the credit/paying of the medal (s) acquired in the game by the player by a pushing button operation. By switching the C/P button 8, the medal (s) is paid from a medal paying mouth at the lower part of the front face and accumulated in a medal receiving portion 10.

[0013] On the right side of the C/P button 8, a starting lever 12 is provided for rotating the reels 3L, 3C and 3R by the operation of the player. The starting lever 12 is attached to be movable within a predetermined angular range. Further, at the central portion on the front face of the control panel 5 and on the right side of the starting lever 12, three stopping buttons 13L, 13C and 13R are provided for stopping the rotation of the above three reels 3L, 3C and 3R, respectively.

Besides, the configuration can be modified, as the stopping buttons do not exist.

[0014] On the game region 2a are provided a bonus game information display segment 16, BET lamps 17a - 17c, a paying display segment 18, a credit display segment 19, etc. These elements are displayed (lit) according the status of the game.

[0015] When the player inserts the medal(s) in the medal insertion slot and operates the starting lever 12, the respective reels 3L, 3C and 3R start to rotate. When the player presses the stopping button 13L, 13C or 13C, the corresponding reel 3L, 3C or 3R stops rotation. When the reels stop rotating, the manner of win is determined by a combination of the symbols of the respective reels which is visually recognized through the display windows 4L, 4C and 4R. The medal (s) the number of which corresponds to the manner of win is paid out in the medal receiving portion 10.

[0016] Fig. 2 is a view showing the schematic structure of the reel unit mounted within the cabinet 3 of the slot machine shown in Fig. 1.

In this embodiment, for the purpose of downsizing the stepping motor arranged to correspond to each reel, the stepping motor is arranged at the position shifted from the central axis of the reel, and a speed reduction transmission mechanism (speed reduction gear) is arranged between the output of the stepping motor and the central axis of the reel. In such a configuration, with the central axis hole of the frame body constituting each reel being formed in a sectional non-circular shape, a protrusion formed in a sectional non-circular shape at the center of the speed reduction gear is fit in this central axis hole so that both can be rotated integrally.

The reel unit 20 is provided with a base plate. On the base plate, three attaching plates 21 for rotatably supporting the reels 3L, 3C and 3R, respectively are provided in parallel and adjacently to each other. On each attaching plate 21, a driving motor (illustrated for only the reel 3L) is provided at a position shifted from the central position of the reel. The rotation and stopping of the reel is controlled in such a manner that the driving and stopping of the driving motor 22 is controlled.

[0017] Now, an explanation will be given of the configuration of the reel and that of the driving force transmission mechanism arranged between the output axis of the driving motor and the reel. Incidentally, since each reel 3L, 3C, 3R is supported on each attaching plate by the same supporting structure and same driving force transmission mechanism, the following explanation will be representatively given of only the portion relative to the reel 3L.

[0018] The reel 3L includes a pair of ring-shaped frame bodies 30 and 31 and a symbol sheet 35 with a continuous symbol column drawn thereon which is provided on the outer periphery of each frame body 30, 31. The ring-shaped frame body 30, as seen from Fig. 3, includes an outer ring 30a, a central support 30b and a plurality of spokes 30c coupled therebetween. These elements are integrally formed of synthetic resin. The frame body 31 opposite to the frame body 30 includes no spoke so that it does not interfere with the driving motor 22 and driving force transmission mechanism attached to the attaching plate 21, and is construed of an outer ring 31a. Like the frame body 30, the frame body 31 is integrally formed of synthetic resin. incidentally, the outer rings 30a and 31a of both frame bodies 30 and 31 may be coupled with each other by a coupling member as the need arises. Both frame bodies may be integrally formed.

[0019] A speed reduction gear 40 is firmly fit, at its center, in the central support 30b of the frame body 30;

the speed reduction gear 40 is engaged with an output gear 22a fixed to the output axis of the driving motor 22 to constitute the driving force transmission mechanism. More specifically, the central support 30b of the frame body 30 includes a fitting slot 30d formed in a non-circular shape (D-cut), a plurality of ribs 30e formed at nearly regular intervals so that they extend radially outward from the circumferential wall defining the fitting slot 30d with their one ends being connected to the circumferential wall, the ribs being formed in order to reinforce the fitting hole 30d, and a circular wall 30f to which the other end of each rib 30e is connected. A fitting protrusion of the speed reduction gear 40 is fit in the fitting slot 30d.

[0020] The speed reduction gear 40, as seen from Fig. 4, includes a fitting protrusion 40a protruded from its center and cut in a sectional non-circular shape (D-cut); the fitting protrusion 40a to be firmly fit in the above fitting slot 30d. Incidentally, the fitting protrusion 40a has a circular slot 40b which axially passes therethrough and is adapted to be rotatably supported by a supporting shaft (not shown) fixed to the attaching plate 21.

[0021] The frame body 30 and the speed reduction gear 40 are adapted to be integrally rotatable because the fitting protrusion 40a is fit in the above fitting slot 30d and the fitting shape is non-circular. Further, between the frame body 30 and speed reduction gear 40, an engaging portion and an engaged portion are formed radially outside their fitting areas (centers), respectively so that they can be more integrally rotated during rotation.

[0022] In this embodiment, the engaging portion formed in the frame body 30 is composed of a plurality of ribs 30e formed to extend radially outward from the circumferential wall defining the fitting slot 30d. The engaged portion formed in the speed reduction gear 40 is composed of recesses 40d formed at nearly regular intervals in a circular wall 40c formed protrusively around the fitting protrusion 40a. In this case, the recess 40d has a width enough for the rib 30e to be fit tightly therein to produce no backlash therebetween (i.e. the width approximately equal to that of the rib 30e). The recesses 40c are at three positions formed at intervals of about 120 degrees so that they are engaged alternately of the ribs 30e formed at the intervals of about 60 degrees.

[0023] The reel 3L and speed reduction gear 40 designed as described above are mounted on the attaching plate 21 of the reel unit 20 in the following procedure.

The fitting protrusion 40a of the speed reduction gear 40 is fit in the fitting slot 30d formed at the central portion of the frame body 30 constituting the reel. The recesses 40d (engaged portion) of the speed reduction gear 40 are engaged with the ribs (engaging portion) 30e of the frame body 30. Thus, the reel 3L and the speed reduction gear 40 are integrated. With the supporting shaft (not shown) being fixed to the attaching plate, the circular slot 40b of the speed reduction gear 40 integrated with the frame body 30 is passed over the supporting shaft so that the speed reduction gear 40 is rotatably supported by the attaching plate. In this state, the speed reduction gear 40 is engaged with the output gear 22a of the driving motor 22.

[0024] By mounting a vibration damping (backlash preventing) screw 50, a collar 51, a tightening screw 52, etc. for the supporting shaft from the protruding side, the reel 3L is rotatably supported on the attaching plate 21. It should be noted that the reels 3C and 3R are also rotatably supported by the corresponding attaching plates 21 by means of the same structure.

[0025] In accordance with the reel unit having the configuration described above, the reel 3L (3C, 3R) and the speed reduction gear 40 are adapted to be integrally rotatable by the engaging slot 30d and engaging protrusion 40a at their centers and baffle-fixed radially outside there by the ribs 30e and recesses 40d. This increases a baffle effect between the reel and the speed reduction gear and hence surely prevents backlash from occurring at the time of starting or stopping of the reel. More specifically, when the reel is stopped or rotated, this prevents the player from being given a sense of visual disorder such as the symbols formed on the surface of the reel deviating from the positions to stop properly, or the backlash state of the reel being recognized. Namely, at the time of stopping when high load acts on the reel, the inertial force of the reel is concentrated on the central fitting area, and also at the time of starting when the high load acts on the speed reduction gear, great force urging the reel to rotate occurs. Therefore, possible manufacturing error and/or secular change existing between the reel and the speed reduction gear gives rise to the backlash. However, in accordance with this embodiment, the reel and speed reduction gear are baffle-fixed radially outside their fitting areas so that the effect of baffling is enhanced, thereby permitting the backlash to be effectively prevented.

[0026] Further, in accordance with this embodiment, the engaging portion (ribs 30e) of the frame body 30 and the engaged portion (recesses 40d) of the speed reduction gear 40 which baffle-fix the reel and the speed reduction gear are formed radially outside their fitting areas and at nearly regular intervals in their circumferential direction. For this reason, the inertial force in the circumferential direction can be uniformly acted on the respective ribs 30e so that the backlash between the reel 3L and the speed reduction gear 40 can be effectively suppressed. In the configuration described above, since the frame body 30 generally constituting the reel 3L employs the ribs 30e for reinforcement formed on the circumferential wall defining the central fitting slot 30d as they are, the recesses 40d in which the ribs fit, respectively have only to be formed around the fitting protrusion of the speed reduction gear 40. This reduces the manufacturing cost.

[0027] Further, in accordance with this embodiment, since the inertial force which circumferentially acts uniformly acts on the engaging portion and engaged por-

tion uniformly, the backlash between the frame body of the reel and the speed reduction gear can be suppressed more effectively.

[0028] Further, in accordance with this embodiment, since the reel and the speed reduction gear are firmly fit to each other at their centers, at the time of starting or stopping of the reel, the backlash therebetween can be suppressed more surely. Further, in the frame body generally constituting the reel, the ribs for reinforcement formed on the circumferential wall defining the central fitting slot are employed as they are, the recesses in which the ribs fit, respectively have only to be formed around the fitting protrusion of the speed reduction gear. This reduces the labor of machining.

[0029] Although the embodiment of this invention has been explained hitherto, this invention can be carried out in various modifications other than the embodiment explained above. For example, the method of engaging the engaging portion and engaged portion with each other can be modified in various manners as long as they are formed radially outside their respective centers of the frame body 30 and the speed reduction gear 40 to constitute the baffle therebetween. For example, as seen from Figs. 5 and 6, with recess 30g serving as an engaging portion being formed in the circular wall 30f on the side of the frame body 30, protrusion 40e to fit in the recesses 30g, respectively may be formed around the fitting protrusion 40a of the speed reduction gear 40. If a plurality of recesses 30g and protrusions 40e exists, it is needless to say that in such a configuration, the recesses 30g and protrusions 40e are preferably formed at nearly regular intervals in the circumferential direction.

[0030] As the occasion demands, proper modifications can be made for the structure of the frame body 30 constituting the reel, arrangement of the driving force transmission mechanism, manner of supporting the reel by the reel unit. Further, as long as the frame body 30 and the speed reduction gear 40 are integrally rotatably adapted, contrary to the above embodiment, the fitting protrusion may be provided in the frame body whereas the fitting slot may be provided in the speed reduction gear. Otherwise, without providing the fitting slot and the fitting protrusion at the central portions of the frame body 30 and speed reduction gear 40, the baffle therebetween may be constituted by only the engaging portion and engaged portion.

[0031] This invention can be applied to various gaming machines incorporating a reel unit equipped with a reel as well as the slot machine explained with reference to the embodiment.

Claims

1. A reel unit comprising:

a reel equipped with a frame body, on the outer periphery of which a plurality of symbols are formed;

a driving motor for driving the reel; and

a speed reduction gear for reducing an output from the driving motor, arranged at center of the frame body so that the reel is rotated integrally to the frame body, wherein

an engaging portion is formed radially outside the center of the frame body and an engaged portion to be engaged with the engaging portion is formed at a corresponding position of the speed reduction gear.

2. The reel unit according to claim 1, wherein

the engaging portion and the engaged portion are formed at nearly uniform positions in a circumferential direction.

3. The reel unit according to claim 1 or 2, wherein

the frame body and the speed reduction gear are baffle-fixed by a fitting slot formed at the center of the frame body and a fitting protrusion formed at the center of the speed reduction gear and to be fit in the fitting slot; and

the engaging portion including a plurality of ribs formed to radially outward from a circumferential wall defining the fitting slot, and the engaged portion including a plurality of recesses to be fit over the plurality of ribs, respectively formed around the fitting protrusion of the speed reduction gear.

4. The reel unit according to claim 1 or 2, wherein

the frame body and the speed reduction gear are baffle-fixed by a fitting slot formed at the center of the frame body and a fitting protrusion formed at the center of the speed reduction gear and to be fit in the fitting slot; and

the engaging portion includes a recess formed to radially outward from a circumferential wall defining the fitting slot; and

the engaged portion includes a rib to be fit over the recess formed around the fitting protrusion of the speed reduction gear.

5. The reel unit according to claim 1, further comprising

a circumferential wall defining a fitting slot formed at the center of the frame body, wherein

the engaging portion is defined in an outer peripheral surface of the circumferential wall.

6. A gaming machine comprising

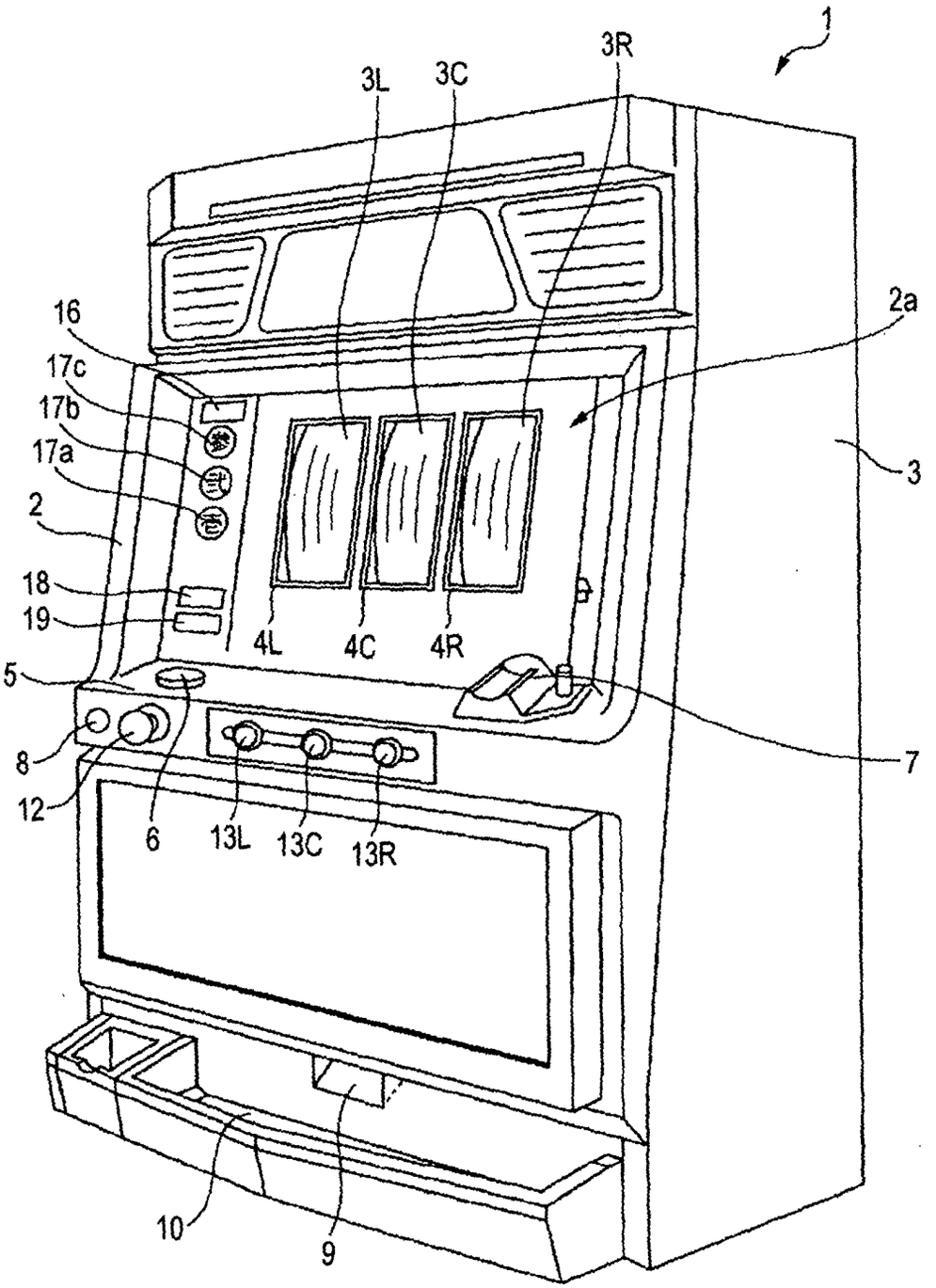
a reel unit, wherein

the reel unit comprises:

a reel equipped with a frame body, on the outer periphery of which a plurality of symbols are formed;

a driving motor for driving the reel; and
a speed reduction gear for reducing an output from the driving motor, arranged at center of the frame body so that the reel is rotated integrally to the frame body, wherein
an engaging portion is formed radially outside the center of the frame body and an engaged portion to be engaged with the engaging portion is formed at a corresponding position of the speed reduction gear.

FIG. 1


1
3R
3L
3C
2a
16
17c
17b
17a
2
3
18
19
4L
4C
4R
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13C
13R
7
10
9

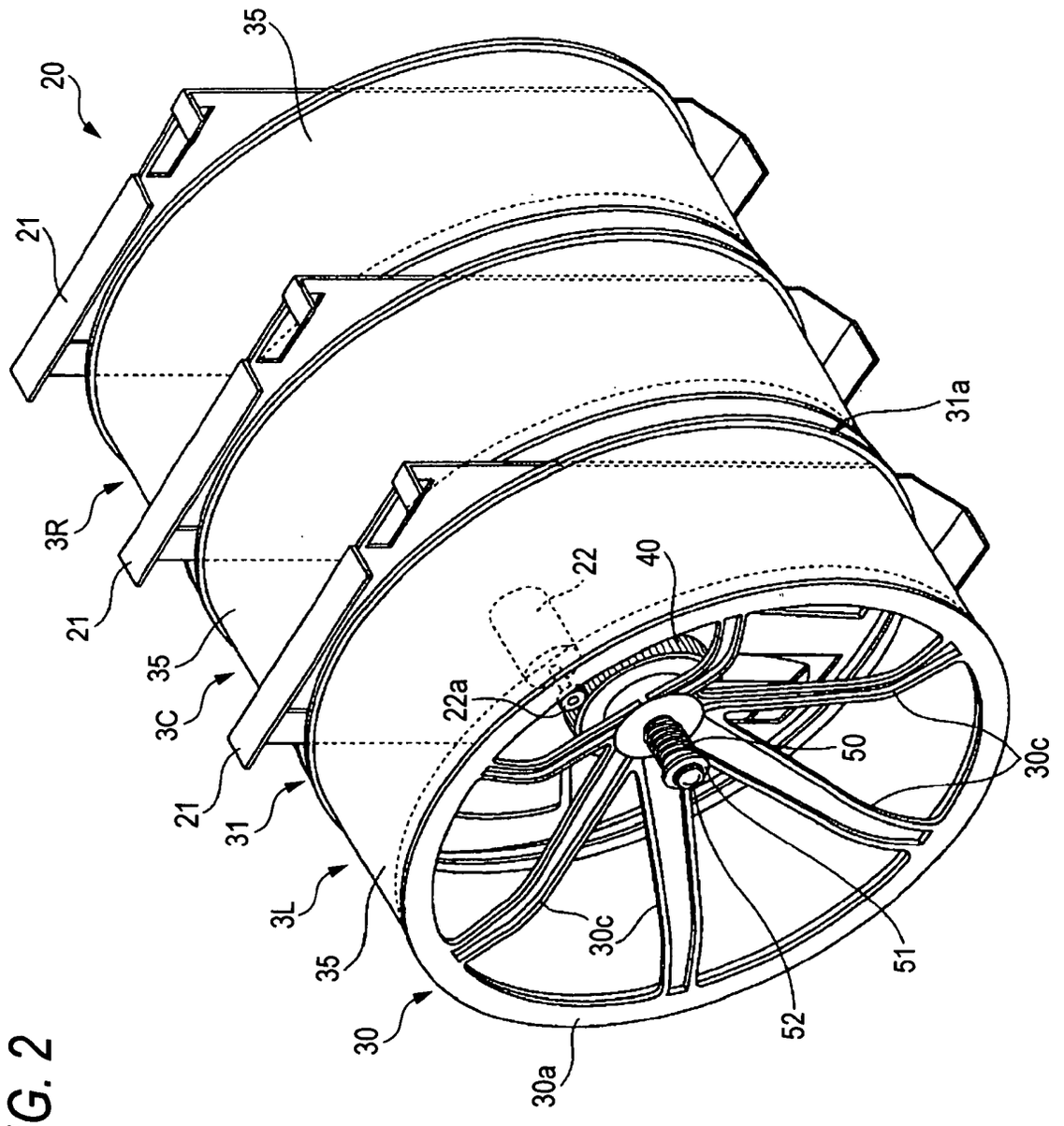

FIG. 2

FIG. 3

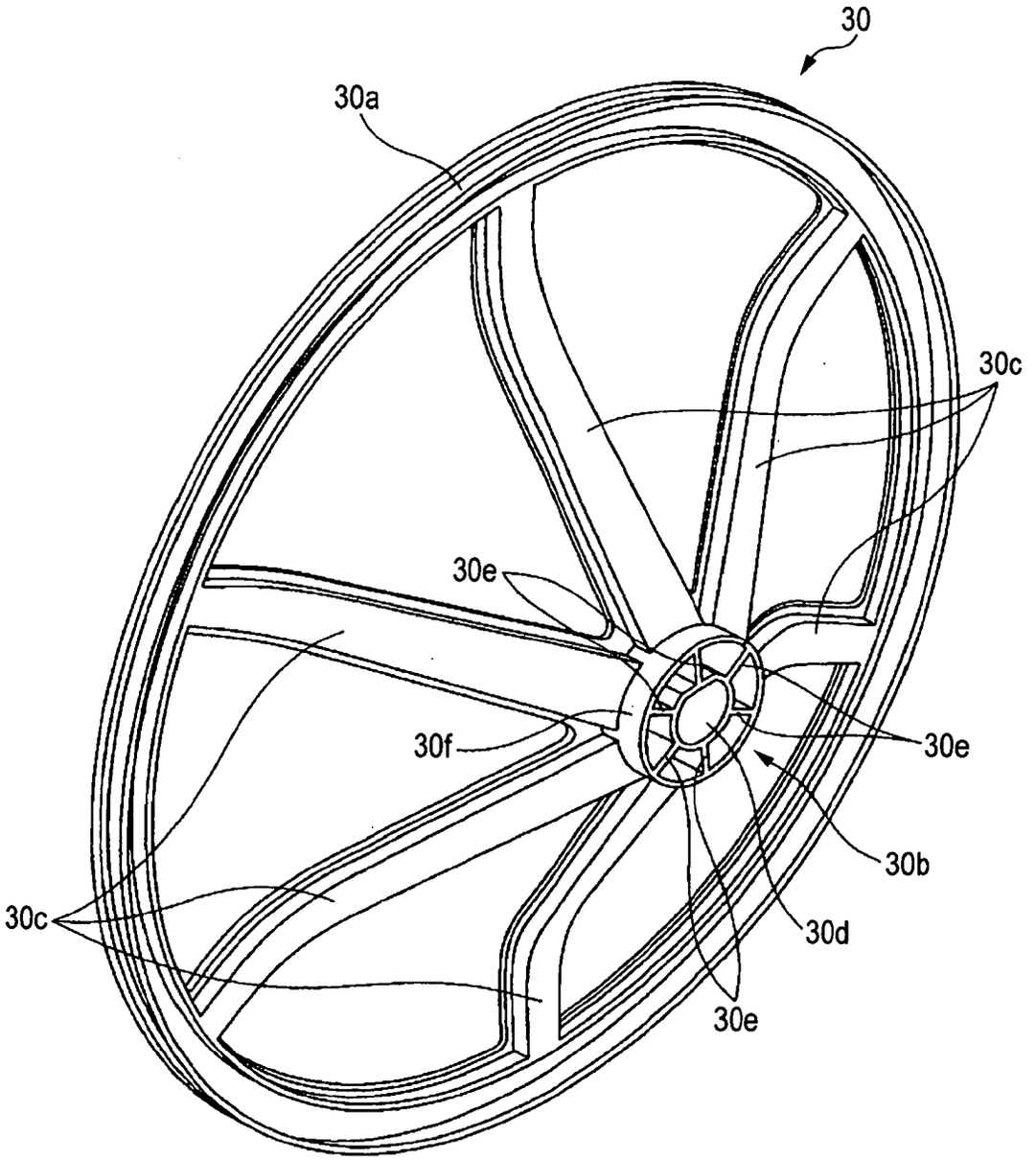

FIG. 4

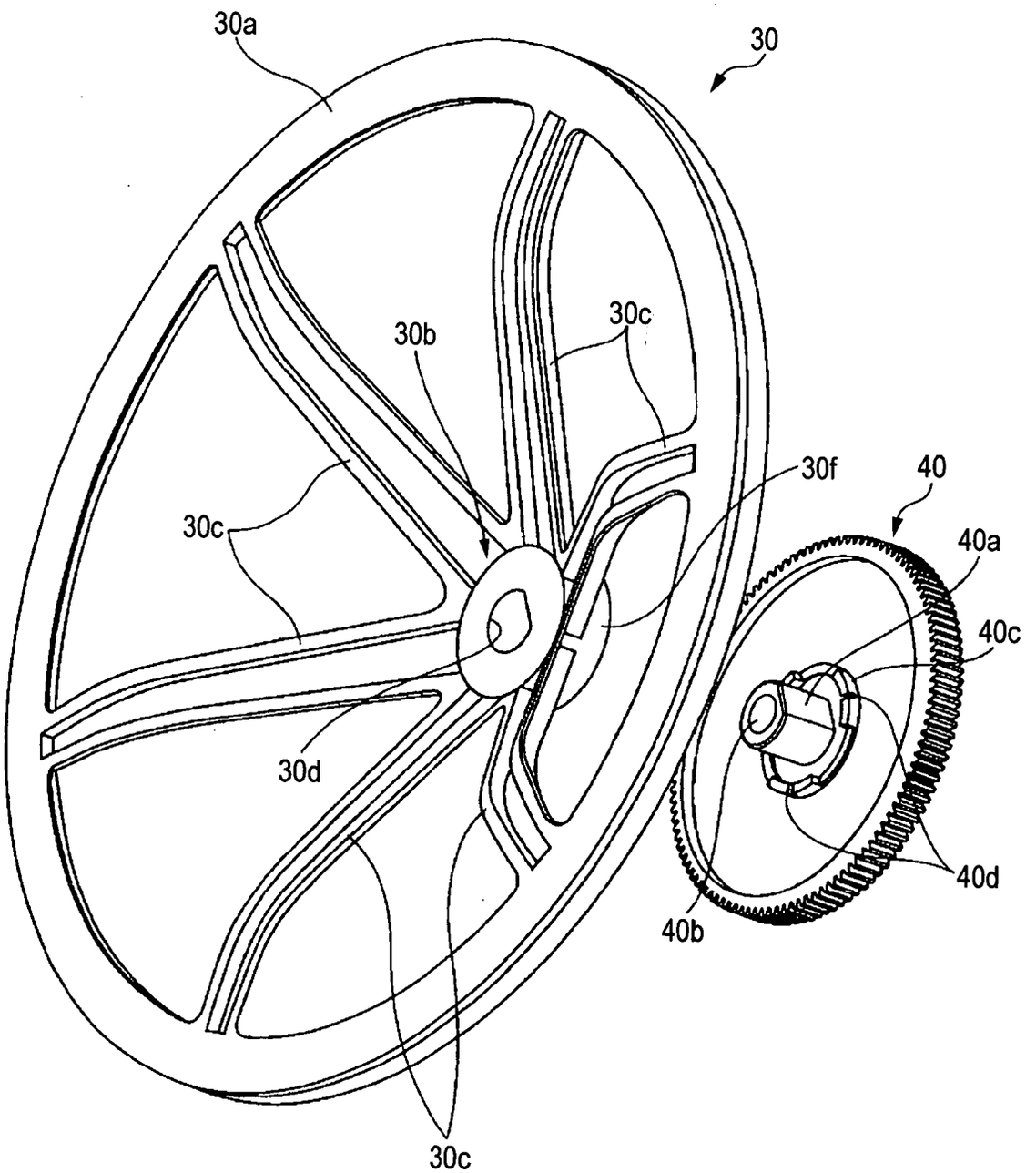

FIG. 5

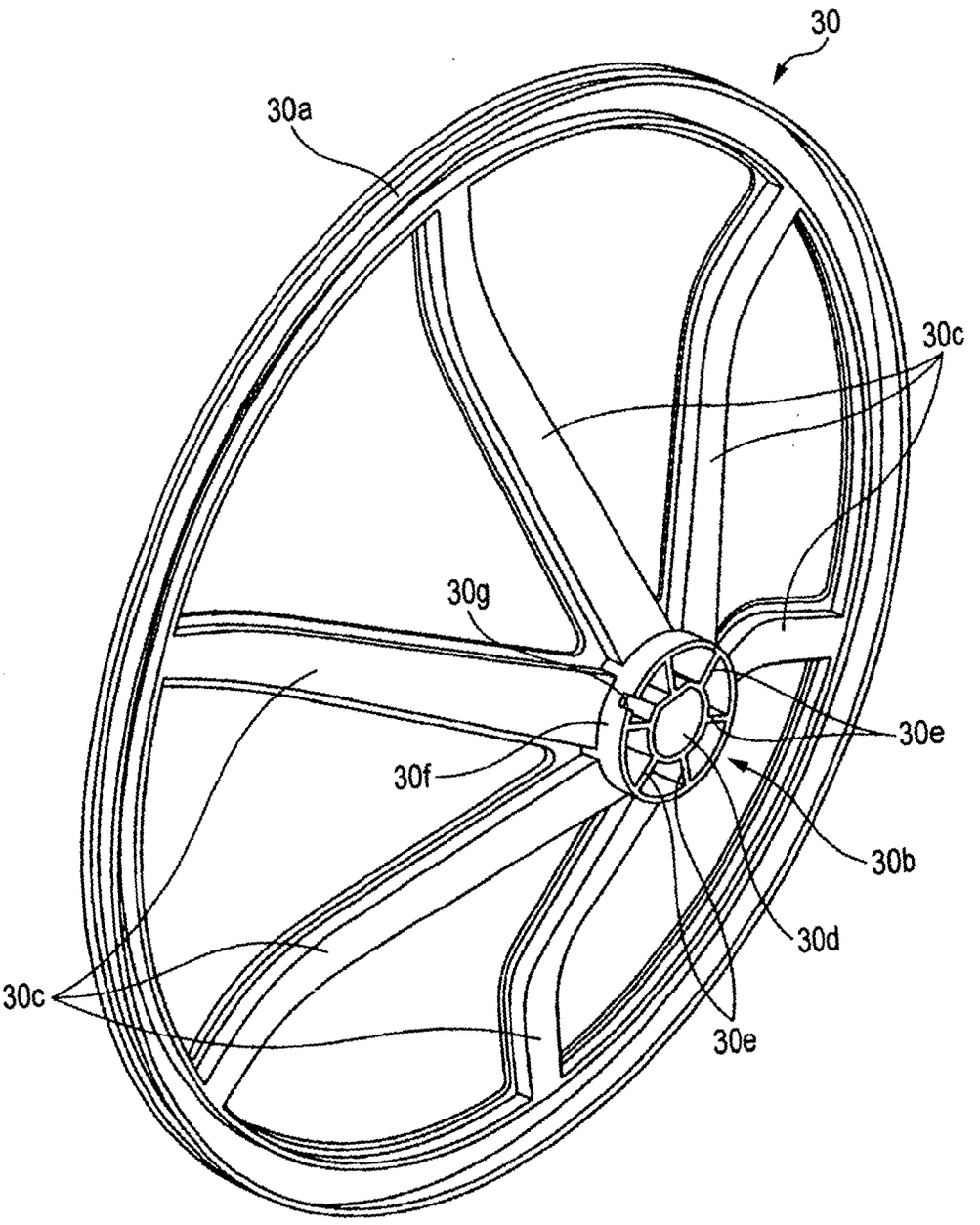

FIG. 6