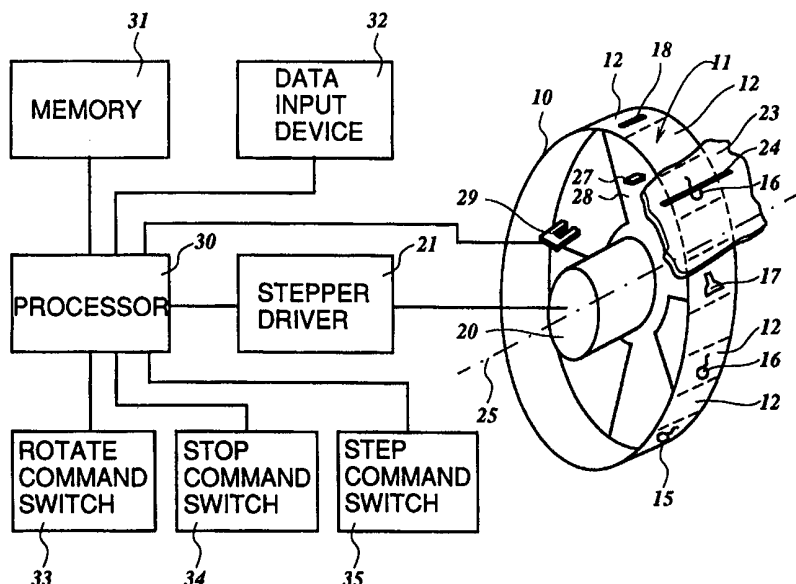




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<b>(21) International Application Number:</b> PCT/NL97/00636 <b>(22) International Filing Date:</b> 20 November 1997 (20.11.97) <b>(71) Applicant (for all designated States except US):</b> ORION CASINO TECHNOLOGY B.V. [NL/NL]; Kastanjelaan 169a, NL-4621 HL Bergen op Zoom (NL). <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only):</b> DE LEIJER, Antonius, Laurentius, Gerardus, Maria [NL/NL]; Deutersestraat 10, NL-5266 AX Vught (NL). <b>(74) Agent:</b> VAN DER AREND, A., G., A.; Van Exter Polak & Charlouis B.V., P.O. Box 3241, NL-2280 GE Rijswijk (NL).		<b>(81) Designated States:</b> AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>In English translation (filed in Dutch).</i>

**(54) Title:** GAMING MACHINE HAVING A REEL ON WHICH, ALONG A CIRCUMFERENCE, SYMBOLS ARE APPLIED

**(57) Abstract**

Gaming machine, comprising a reel, of which a circumferential surface is divided into a number of fields, each suitable for bearing a symbol (which is also understood to include a blank), a microstep drive unit (20, 21), which is suitable for positioning the reel (10) within each field in a number of angle positions and maintaining it therein, a memory with a table whose locations contain enabled stop positions, and random generator means which generate a random number within the address range of the table, for addressing the table therewith, in order to read out the enabled stop position stored in the addressed memory location, and in order to rotate the reel (10) to the read-out enabled stop position.

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Short title: Gaming machine having a reel on which, along a circumference, symbols are applied

The invention relates to a gaming machine according to the preamble of claim 1.

A gaming machine of this type is known from US-A-4448419.

5 In the case of an even earlier, generally known gaming machine the number of numbers from which the random generator means could select a random number was equal to the number of fields into which a circumferential surface of a gaming reel was divided. After the random generator  
10 means had generated the random number, the reel rotating during a game was stopped in a position corresponding to the random number. With the reel at a standstill, the actual angle position was then detected and, together with such read-outs from other reels, used for making a pay-out  
15 or not. The symbols, which in this description are also understood to include blanks, can be applied one or more times to the reel. For a reel with 20 symbols, out of which one symbol is applied only once, a main prize can be attached to the last-mentioned symbol, possibly in combina-  
20 tion with symbols from other reels. However, the chance of a main prize in this example (i.e. per reel) is 1/20, which is too great a chance for allocating to it a large main prize such as is desired these days.

The gaming machine known from US-A-4448419 makes it  
25 possible to achieve a smaller chance for a main prize and for other prizes, without modifying the mechanical part of the older gaming machine described above. To this end, the gaming machine known from US-A-4448419 makes use of an electronic, virtual reel with more virtual fields than the  
30 number of fields of the corresponding physical reel. One or more virtual fields with the same virtual symbol are allocated to a symbol appearing on the physical reel. A random number generated by the random generator means represents a rank number of a virtual field. When a random  
35 number is generated during the rotation of the reel, the reel is stopped in an angle position which corresponds to the symbol allocated to the virtual field with the random

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number as rank number.

Since in the case of the gaming machine according to US-A-4448419 it must be possible to detect the angle position after the reel has been brought to a standstill, the number of fields of the physical reel is fixed. This means that for adjustment of the gaming machine to produce more or fewer fields on the physical reel the number of physically detectable angle positions would have to be adjusted accordingly. This is laborious and expensive. Furthermore, detecting the angle position of the reel on the reel requires separate detection means, which increase the cost. Besides, such detection means can be subject to faults, as a result of which erroneous pay-outs can be made, which can lead to unpleasant situations with players during the running of such a machine. In order to avoid this to a certain extent, the machine has to be inspected/maintained relatively frequently.

The object of the invention is to eliminate the disadvantages of the gaming machine known from US-A-4448419.

To this end, the invention provides a gaming machine of the type described in claim 1.

As a result, the reel can assume a larger number of stable angle positions than previously, so that all possible angle positions can be allocated according to different distributions to different numbers of fields of the reel. If a different number of fields is desired, as regards the physical embodiment, all that is necessary is, for example, to apply, e.g. stick, another tape with symbols over the circumferential surface of the reel. Angle positions can then be allocated to the fields of the new tape in a simple manner, by programming.

Other features and advantages of the invention will emerge from the explanation of an embodiment of the invention which follows with reference to the drawings, in which:

Fig. 1 shows a diagram of a gaming machine according to the invention; and

Fig. 2 shows a chart for explaining the operation

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of the gaming machine of Fig. 1.

The gaming machine shown diagrammatically in Fig. 1 comprises a reel 10 with a circumferential surface 11 which is divided into a number of fields 12. A symbol, such as a pear 15, a cherry 16, a bell 17 and a bar 18, can be placed in each field 12. In this description an empty field 12 (blank) is also regarded as a symbol, namely as something of significance.

The reel 10 is connected to a shaft of a stepping motor 20. The stepping motor 20 is controlled by a drive circuit 21. The drive circuit 21 and the stepping motor 20 are suitable for driving the reel 10 to and maintaining it in more angle positions (microsteps) than the number of poles or double the number of poles of said stepping motor. For this purpose, use can be made of a geared transmission (not shown) between the motor 20 and the reel 10, in such a way that the motor 20 performs several revolutions for one revolution of the reel 10. However, the stepping motor 20 and the drive circuit 21 preferably form a microstep drive, in which, with a suitable electrical control by the drive circuit 21, the rotor of the stepping motor 20 can assume a relatively large number of stable angle positions between adjacent poles. Such a microstep drive mode is described in SGS-Thomson Microelectronics, "data on disc", compact disc CDDATASH197, 1st edition 1997. By using a microstep drive there is no problem with mechanical play, and the maximum achievable speed of revolution of the reel 10 can be higher.

A window panel 23 of an otherwise closed console (not shown) is fitted opposite a part of the circumferential surface 11 of the reel 10. At least one field 12 of the reel 10 is visible through the window panel 23. The window panel 23 has a marking, such as a "pay-out line" 24 parallel to the axis of rotation 25 of the reel 10 and the motor 20.

On the reel 10, for example on a "spoke" 27 thereof, a mark is placed, for example in the form of a projection or flag 28, which can pass through a slot of, for example, an optical bridge detector 29 during the rota-

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tion of the reel 10.

The drive circuit 21 is fed by a processor 30, which is connected to a memory 31, a data input device 32, a rotate command switch 33, a stop command switch 34 and a  
5 step command switch 35.

When the rotate command switch 33 or the stop command switch 34 is actuated by a player of the machine or by other means inside the machine, the processor 30 controls the microstep drive unit 20, 21 for rotating or  
10 stopping the reel 10 respectively.

The processor 30 operates with a program, the instructions and corresponding data of which are stored in the memory 31 or in a separate memory. A subroutine of the program operates, as known per se, so as to generate one or  
15 more random numbers. Of course, instead of such programmatic random generator means, a separate random generator (means), linked to the processor 30, can be connected.

Although only one reel 10 is shown in Fig. 1, a  
20 gaming machine will generally have several such reels, each having its own microstep drive unit 20, 21 and a step command switch 35. Depending on the symbol or the combination of symbols visible beneath the pay-out lines 24 of the reels 10, a pay-out or no pay-out is made to a  
25 player of the machine.

The operation of the gaming machine shown in Fig. 1 will be explained below with reference to Fig. 2.

As an example, it is assumed that the circumferential surface 11 of the reel 10 is divided into 20 fields  
30 and that the microstep drive unit 20, 21 can position and maintain the reel in 10,000 different angle positions. Each angle position or each step of the reel 10 then corresponds to an angle or arc of  $360^\circ/10,000 = 0.036^\circ$ . Further, in this example each field has a range of  $10,000/20 = 500$  angle  
35 positions or steps or possible stop positions of the reel 10.

In the example of Fig. 2, three angle positions out of the available 500 angle positions of the field 1 where the reel 10 may come to a standstill are allocated to the

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first field. These three enabled stop positions could be distributed randomly within the range of 500 positions. However, these positions are preferably selected close together, so that a difference in the distance from, for example, the centre of the corresponding stationary symbol relative to the pay-out line 24 is imperceptible with the naked eye. Although consecutive numbers can be allocated to the enabled stop positions, for the sake of clarity of the drawing, one is skipped between each pair of adjacent enabled stop positions in Fig. 2.

Fig. 2 shows further that six stop positions are enabled for the second field, two stop positions for the third field, one stop position for the nineteenth field, and seven stop positions for the twentieth field.

If for all twenty fields together 200 of the 10,000 possible positions are enabled as stop positions for the reel 10, the memory 31 contains a table with 200 memory locations, each containing one of the enabled stop positions. In this example, the random generator means are then suitable for selecting a random number from 200 possible numbers and delivering that number to the memory 31 as the address for reading a stop position from the corresponding location of the abovementioned table.

As an alternative, the random generator means can have a range which is greater than the number of enabled stop positions (200 in the example), and the random number generated therefrom represents a number of steps by which an address for the table is increased modulo the number of enabled stop positions from the address belonging to the last standstill onwards. As a result, the random generator means do not have to be changed when the number of locations of the table is changed and/or the same random generator means can be used for several reels with identical or different numbers of enabled stop positions, which is in contrast with known machines.

When, during the rotation of the reel 10, the processor 30, using a generated random number, has read an enabled stop position from the table, the processor 30 controls the microstep drive circuit 21 to make the step-

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ping motor 20 stop in this stop position. In order to ensure that no physical angle detection means are necessary, the processor 30 preferably remembers which the last stop position was, calculates the difference between this position and the read-out new position and controls the drive circuit 21 to make the motor 20 take a number of microsteps corresponding to the calculated difference between the stop positions.

The random generator means can be designed to generate a further random number which indicates a number of revolutions of the reel 10 which, after actuation of the stop command switch 34, the reel 10 first has to make before the motor 20 rotates to the stop position read from the table and is brought to a standstill there. The abovementioned number of revolutions can be detected by means of the flag 28 of the reel 10 and the optical bridge detector 29 which is linked to the processor 30.

After the reel 10 has been installed in the gaming machine, a marking point made on the reel, or the centre of a symbol placed in a field 12, can easily be aligned with a fixed mark, for example the pay-out line 24. For this purpose, the stop command switch 35 can be actuated so often that the abovementioned marks appear to coincide to the eye. The number of steps or angle positions which at that moment have been taken since the flag 28 passed through the bridge 29 is subsequently always added as the offset to each read-out angle position, in order to deliver a calibrated read-out angle position. This means that, unlike previously, a laborious mechanical adjustment need not be carried out for the alignment, and additional mechanical means for that purpose can be omitted. Since the offset can be any value of the number of steps or possible angle positions, there is great freedom for applying a new tape with symbols to the reel 10, and the tape can be applied very quickly.

The data input device 32, which is present permanently or otherwise in the gaming machine, can be used for creating and amending the abovementioned table in the memory 31 with enabled stop positions.



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It will be clear from the above that the gaming machine according to the invention can be substantially of universal design physically, and yet can still easily be adapted to specific wishes of customers, for example with a  
5 different chance distribution for prizes, by enabling more or fewer stop positions for the different fields and/or for changing the number of fields by applying another tape with symbols, without this having to be carried out relative to a specific reference point of the reel 10. Furthermore, the  
10 gaming machine according to the invention is simple and maintenance-friendly in particular as far as the mechanical design is concerned.

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Claims

1. Gaming machine comprising:  
a reel (10), of which a circumferential surface (11) is divided into a number of fields (12), each of which can bear a visually perceptible symbol;  
5 means (30-32) for allocating to each of the fields (12) one or more different numbers from a larger number of numbers than the number of fields (12), each number corresponding to an angle position of a field (12);  
random generator means (30) for generating a random  
10 number from the various numbers;  
drive means for rotating the reel (10);  
stop means for stopping the rotation of the reel (10) in an angle position corresponding to the random number;  
15 characterized in that each field (12) has allocated to it one or more numbers which correspond to one or more angle positions situated within the field (12), and the drive means and the stop means together comprise a microstep drive unit (20, 21) which is suitable for positioning the  
20 reel (10) for each field (12) in each of the angle positions corresponding to a number.
2. Gaming machine according to claim 1, characterized in that numbers allocated to a field (12) correspond to angle positions which are difficult to distinguish with the  
25 naked eye.
3. Gaming machine according to claim 2, characterized in that adjacent angle positions corresponding to the numbers of a field differ by less than  $0.1^\circ$  from each other.
- 30 4. Gaming machine according to a preceding claim, characterized in that angle positions allocated to the numbers are stored in a memory (31) and the numbers determine an address for the memory (31).
5. Gaming machine according to one of claims 1 to 3,  
35 characterized in that the random generator means have a range which is greater than the number of enabled angle positions and, after the generation of the random number, a

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following address for reading an angle position out of the memory is determined by the sum of the previous reading address and the random number, modulo the number of allocated angle positions.

5 6. Gaming machine according to claim 4 or 5, characterized in that the memory (31) is rewritable.

7. Gaming machine according to a preceding claim, characterized in that computing means (30) are installed, which computing means calculate the difference between a  
10 last assumed angle position when the reel (10) was at a standstill and an angle position corresponding to the random number, the computing means convert the difference into a number of steps, and the computing means control the drive unit (20, 21) so that the drive unit rotates the reel  
15 (10) through the number of steps.

8. Gaming machine according to a preceding claim, characterized in that the random generator means generate a further random number/numeral which represents a whole number of revolutions of the reel (10) through which the  
20 drive unit (20, 21), after receipt of a stop command, first rotates the reel (10) before stopping the rotation of the reel (10) in the angle position corresponding to the random number.

9. Gaming machine according to a preceding claim,  
25 characterized in that command means (35) are installed for controlling the drive unit (20, 21) in such a way that the reel (10) is moved stepwise to an angle position in which a marking point provided on the reel (10) is aligned with a fixed marking point (24), and an angle position distance  
30 between an angle position of a reference point (28) of the reel (10) and an angle position when the marking points are aligned is added as the offset to the angle position belonging to the generated random number, in order to determine a calibrated angle position where the stop means  
35 stop the rotation of the reel (10).

1/1

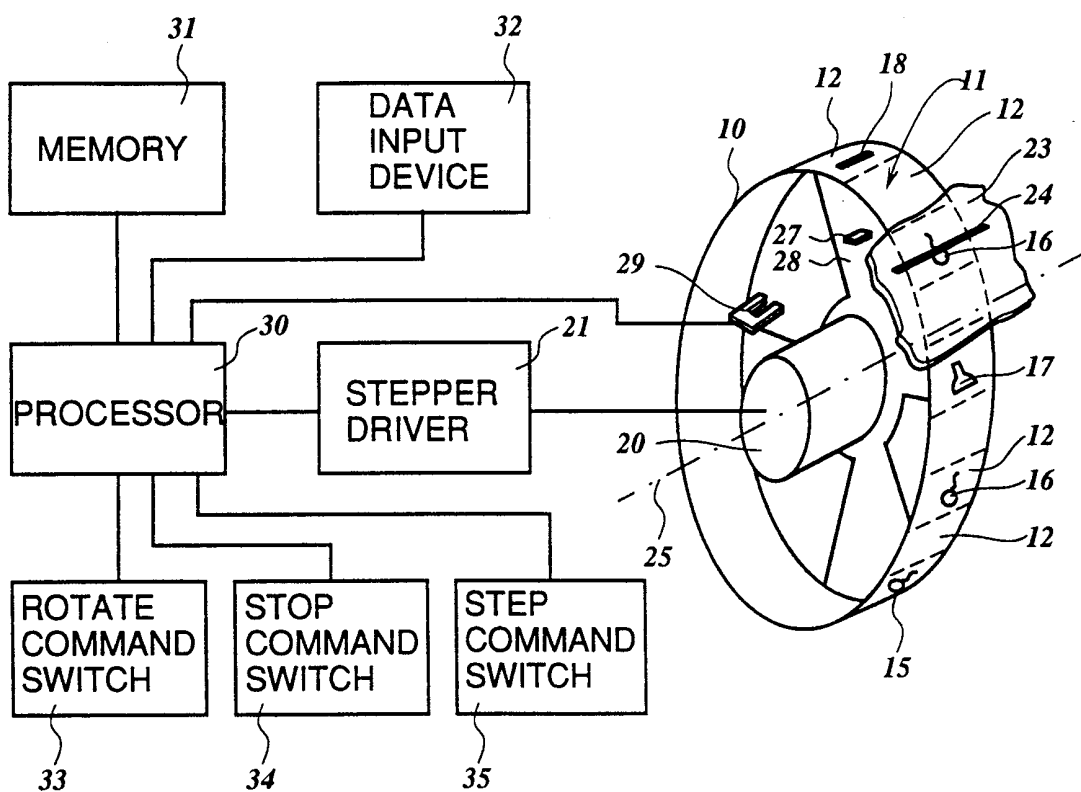


Fig. 1

# **ENABLED STOP POSITIONS**

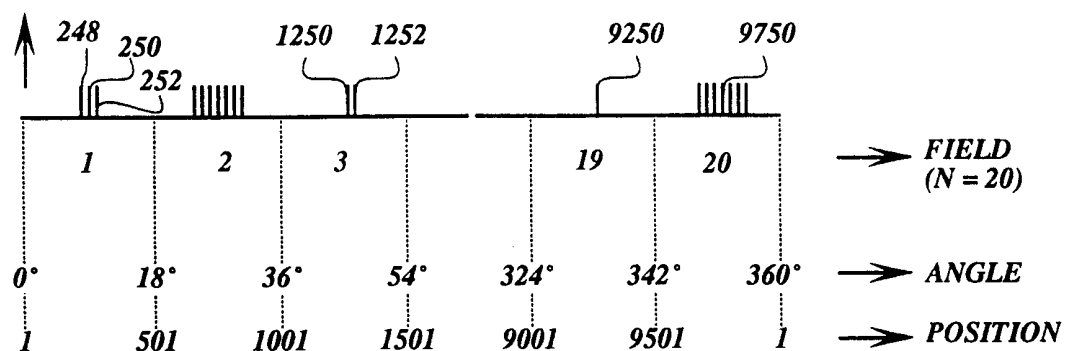


Fig. 2

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/NL 97/00636

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 G07F17/32

According to International Patent Classification(IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G07F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 711 451 A (PAJAK ET AL.) 8 December 1987	1-4,6,7,9
Y	see column 3, line 40 - column 6, line 57; figures 3-6	5
Y	EP 0 338 743 A (BALLY MANUFACTURING) 25 October 1989 see page 4, line 48 - page 5, line 11; figures 6,7	5
X	GB 2 193 025 A (AINSWORTH NOMINEES) 27 January 1988	1,4,7-9
A	see page 3, line 31 - page 4, line 18; figures 5-10	2,3,5,6
A	US 5 219 167 A (HAMANO) 15 June 1993 see column 5, line 14 - column 6, line 45; figures 5-9	1,4,6
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the international search

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 154 421 A (HAMANO) 13 October 1992 see column 4, line 5 - line 25; figure 8 -----	1,4,6

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/NL 97/00636

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