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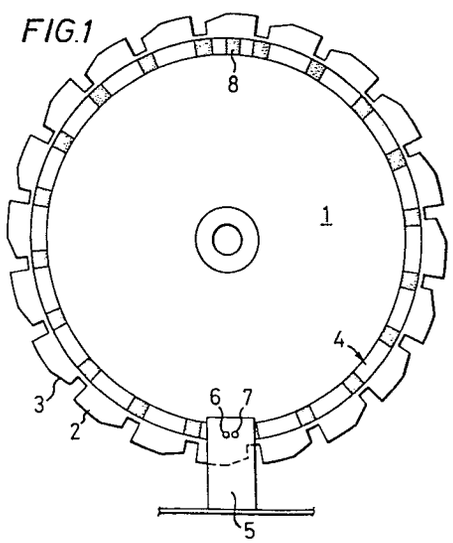
(54) **Improvements in or relating to gaming or amusement machines.**

(57) In a gaming machine, e.g. of the 'fruit machine' type the symbols are inscribed on the peripheral cylindrical surface of drums or reels. A respective co-axial disc (1) is mounted for rotation with each symbol bearing drum and the rotational position of the drum is sensed by sensing the rotational position of the disc (1). A ring (4) of alternate black and white surfaces is painted on the disc. A light source (6) and receiver (7) are mounted to one side of the disc and reflections from the white areas of the ring (4) are reproduced as pulses in the receiver. These are counted to provide an indication of the position of the disc.

FIG.1



EP 0 036 291 A2

DESCRIPTION

This invention relates to gaming or amusement machines.

In a gaming machine of the fruit-machine type one or more parallel rows of symbols are displayed to a player through a viewing window. These symbols are commonly pictures of fruit or playing cards, but may take any form. Each symbol in a row is one of a succession of picture symbols inscribed on the narrow cylindrical surface of a drum. When the disc is caused to rotate, usually by the insertion of a coin and the operation of a push button or lever, the player sees the pictures moving through the viewing window until the disc comes to rest and new stationary pictures are displayed. Thus three rotating discs may be used to show three parallel rows of three symbols through the viewing window.

The player either wins or loses on the machine according to the symbols displayed in the window, that is to say according to the rotational position of the discs. It is required that the machine should automatically sense the rotational positions of the discs and to pay out or to give some other benefit to the player if the combination is one of the winning combinations of positions.

To sense the rotational position of a disc it has been proposed to provide a series of holes in the disc or in a co-rotating disc, which are disposed about the axis of rotation. A light source and sensor are located on opposite sides of the holes so that the rotational position of the disc is known by counting the number of light pulses received through the holes.

In a first aspect, the present invention provides:-

a gaming or amusement machine including at least one rotatable member on which are disposed a series of indicia displayed to a player in succession when the member is rotated,

means for sensing the rotational position of the member and hence which of the indicia is displayed to a player, comprising the combination of a radiation source and a radiation sensor, and

a series of alternate surfaces; one of either the radiation source and sensor combination or said series of surfaces being fixed, and the other being mounted for rotation with the rotatable member,

the series of surfaces being such that, and being disposed such that, radiation from the radiation source is incident on the series of surfaces as the rotatable member rotates and radiation incident on alternate ones of said surfaces is reflected to the raidation sensor,

wherein the rotational position of the rotational member is sensed by counting the alternations in the light intensity received by said radiation sensor.

The series of surfaces is preferably a series of reflecting and non-reflecting surfaces. This series may be disposed in an annular band on a disc which either comprises said rotatable

member or rotates with the rotatable member.

The number of reflecting surfaces is preferably equal to the number of stop positions of the rotatable member, each reflecting surface thus being associated with a corresponding one of the indicia disposed on the rotatable member.

In a second aspect the present invention provides:-

a gaming or amusement machine including at least one rotatable member on which are disposed a series of indicia displayed to a player in succession when the member is rotated,

means for sensing the rotational position of the member and hence which of the indicia is displayed to a player, comprising means for generating a magnetic field and a sensor for sensing changes in the magnetic field, and a series of alternate areas of different magnetic permeability mounted for rotation with the rotatable member,

the series of alternate areas being disposed in said magnetic field such that as the rotatable member rotates, the magnetic field sensed by said sensor alternates in intensity

wherein the rotational position of the rotatable member is sensed by counting the number of instances that said magnetic field alternates.

Embodiments of the invention will now be described by way of example only, with reference to the accompanying drawings. In the drawings:-

Figure 1 is a side elevation view of a rotating disc employed in a machine embodying the present invention;

Figure 2 is a plan view of the disc shown edge-on together with sensing apparatus; and

Figure 3 is a diagrammatic plan view of a rotating disc in a second embodiment of the invention.

Referring to the Figures, in a gaming machine of the fruit-machine type the indicia are carried on the peripheral cylindrical surfaces of rotating drums or reels. A respective further disc 1 is co-axially mounted with each of the indicia-bearing members for rotation therewith. Each further disc 1 is used to provide stopping means to arrest rotation of the associated rotating drum or reel and to provide means for sensing the angular position of the drum or reel.

The disc 1 has a number of circumferentially spaced teeth 2. These teeth are pro-

vided with slopes 3 on their trailing edges. Each tooth corresponds to a particular picture symbol on the associated rotating disc or drum. The disc 1 is stopped when a latch is dropped into one of the slots between the teeth and the trailing edge slope ensures that the latch slips easily into the slot.

A ring 4 of alternate black and white surfaces is printed on the face of the disc coaxial with the disc. Each white surface is located beneath a corresponding tooth 2 and is longer than each black surface.

A rectangular support plate 5 is mounted adjacent the disc 1 and separated from it by a narrow gap. The support plate 5 is positioned so that it overlaps the ring 4 of black and white surfaces. The plate 5 supports a light source 6 and a photoelectric receiver 7, between the plate and the disc 1. The source 6 and receiver 7 are so angled that light from the source is incident on the ring 4, and if reflected, returns to the receiver 7. When the disc 1 rotates, light from the source 6 is successively incident on the black

and white surfaces of the ring 4. The reflected radiation from a white surface passing the sensor is sufficient for the receiver 7 to produce an electric pulse whilst the light reflected from a black surface is not. Thus as the disc rotates the receiver 7 produces a series of electrical pulses. These pulses are counted by an electronic counter connected to the receiver 7 and the rotational position of the disc can hence be computed.

Referring to Figure 3, in a second embodiment of the invention two source/sensor units 10, 11 are provided for each rotating disc 1. The source/sensor units are closely spaced on the support plate 5 their spacing being less than one quarter of the extent of a white surface in the ring 4. The two sensor units 10 and 11 function independently and either may provide the count pulses. However, the pulse transitions in the output signals from these sensors are displaced in time. When the disc 1 rotates in a forward direction a transition from a white to a black space on the ring 4 opposite the sensors is detected first by sensor 10 then by sensor 11. This is reversed when the disc rotates in the opposite direction. This difference is detected by the computing circuitry so that pulses occurring when the disc moves in reverse are not added to the count total but subtracted, thereby ensuring that

the count total corresponds to the disc position in whichever direction it rotates.

It is necessary to have some form of reset for the counter so that it is reset once per revolution. In the present embodiment this is achieved by including an additional black surface 8 in the ring 4. This gives rise to two close light pulses in place of the one which would occur in the absence of the additional black surface 8. These two close pulses are detected by the computing circuitry to reset the counter.

As an alternative to the extra black surface 8 a further light source and receiver may be provided which are located radially further inwards than the source and receiver 6 and 7, and a small reflecting area on the disc surface is also included which passes the further source and receiver onee per revolution to produce a corresponding electrical pulse from the receiver. This pulse is used by the computing circuitry to reset the counter.

When the additional black surface method is used to reset the counter or if one black surface is given an extent greater than the others detecting this different length can be a problem at low rotational speeds. The angular velocity may be continually monitored by measuring the length of the black/white and white/black conditions and the timing limits adjusted accordingly. However, for added security at very low rotations the next

position of the disc is deduced without reference to the black pulse length. Thus if there are 22 display positions after counting 22, the next count is treated as 0 automatically.

Although the use of an annular band to provide the alternate reflecting and non-reflecting surfaces has been described, other arrangements are possible. For example, the flat surfaces of the teeth 2 may be used as the reflecting surfaces and the gaps between them as the non-reflecting surfaces, it is preferable in this case to paint the surfaces of the teeth white to improve reflection.

In another version the teeth on the disc may be painted black to provide the non-reflecting surfaces, while the reflecting surface is provided by a white or mirrored surface behind the disc on which light is incident through the teeth.

In an alternate embodiment of the invention a magnetic sensing arrangement is used instead of the optical arrangement described above. The annular band may comprise successive areas of different magnetic permeability located in a magnetic field. The changes in the intensity of the field when respective ones of the areas of the disc pass by produce corresponding electrical pulses in a sensor which may comprise a coil or possibly a Hall-effect device. The operation

of the counter being analogous to the corresponding part of the embodiment described in detail above.

CLAIMS

1. A gaming or amusement machine including at least one rotatable member on which are disposed a series of indicia displayed to a player in succession when the member is rotated,

means for sensing the rotational position of the member and hence which of the indicia is displayed to a player, comprising the combination of a radiation source and a radiation sensor,

and a series of alternate surfaces; one of either the radiation source and sensor combination or said series of surfaces being fixed and the other being mounted for rotation with the rotatable member, the series of surfaces being such that, and being disposed such that, radiation from the radiation source is incident on the series of surfaces as the rotatable member rotates and radiation incident on alternate ones of said surfaces is reflected to the radiation sensor,

wherein the rotational position of the rotational member is sensed by counting the alternations in the light intensity received by said radiation sensor.

2. A gaming or amusement machine as claimed in claim 1 wherein the alternate surfaces comprise reflecting and opaque surfaces respectively.

3. A gaming or amusement machine as claimed in claim 2 wherein the series of alternate surfaces are disposed on an annular band located either on said rotatable member or on a co-rotating member.

4. A gaming or amusement machine as claimed in any one of the preceding claims wherein the number of reflecting surfaces in said series of alternate surfaces is equal to the number of stop positions of the rotatable member, each reflecting surface being associated with a corresponding one of the indicia disposed on the rotatable member.

5. A gaming or amusement machine as claimed in claim 1 wherein the series of alternate surfaces comprise peripheral teeth and the spaces therebetween, the teeth either forming part of said rotatable member or being on a co-rotating disc.

6. A gaming or amusement machine as claimed in any one of the preceding claims wherein one of the members of said series of alternate surfaces is different in length to the direction of rotation that the other ones of that type, and the detection of which is utilised by associated circuitry to reset the count once per revolution of the rotatable member.

7. A gaming or amusement machine as claimed in any one of the preceding claims including means for sensing the direction of rotation of the rotatable member comprising a source and a sensor of radiation spaced from said combination of radiation source and sensor and being disposed in relation to the series of alternate surfaces such that boundaries between the alternate surfaces are not simultaneously detected by the two sets of source and sensors.

8. A gaming or amusement machine including at least one rotatable member on which are disposed a series of indicia displayed to a player in succession when the member is rotated,

means for sensing the rotational position of the member and hence which of the indicia is displayed to a player, comprising means for generating a magnetic field and a sensor for sensing changes in the magnetic field, and a series of alternate areas of different magnetic permeability mounted for rotation with the rotatable member,

the series of alternate areas being disposed in said magnetic field such that as the rotatable member rotates, the magnetic field sensed by said sensor alternates in intensity,

wherein the rotational position of the rotational

member is snesed by counting the alternations in the magnetic field intensity received by the sensor.

9. A gaming or amusement machine substantially as hereinbefore described with reference to, and as illustrated in, the accompanying drawings.

FIG.1

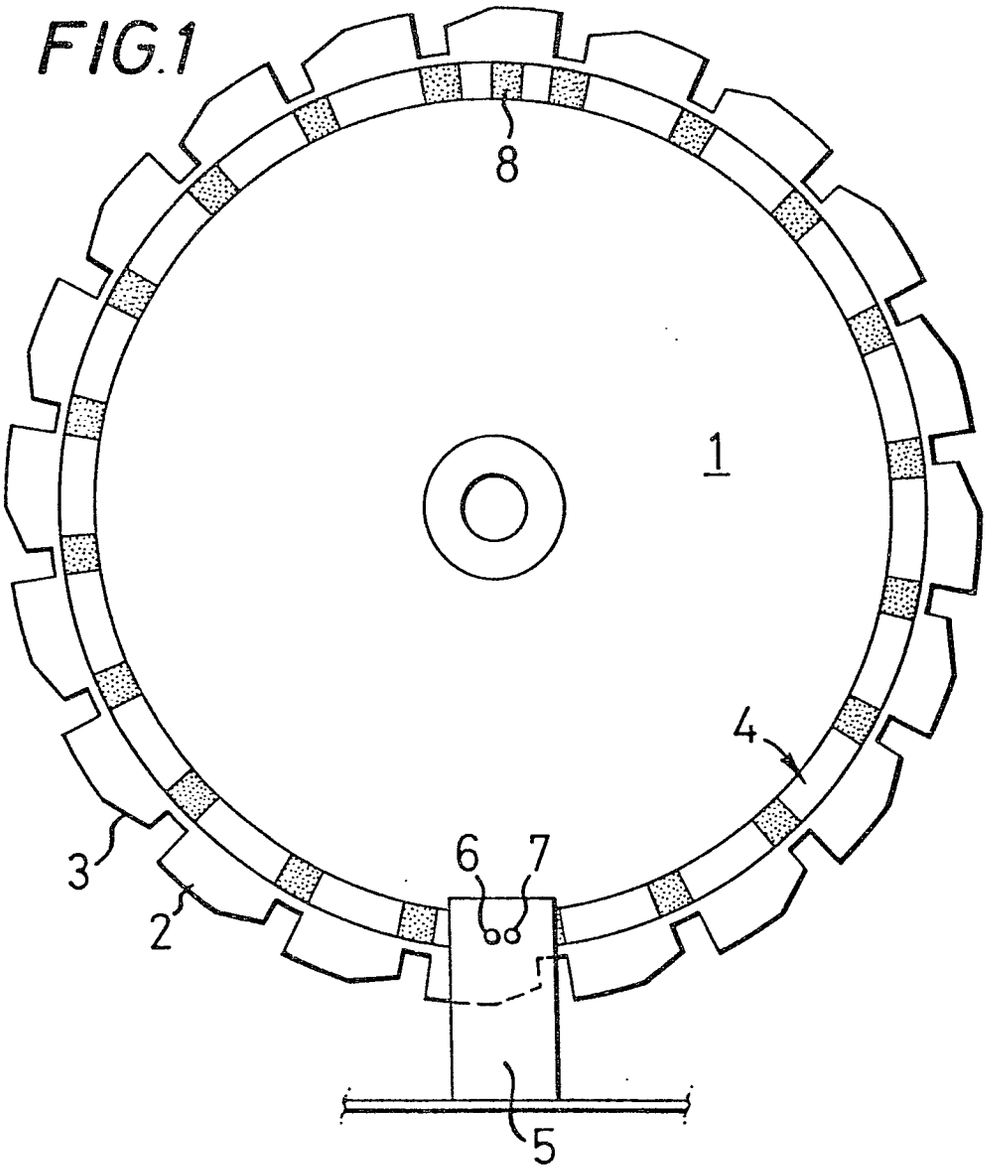


FIG.2

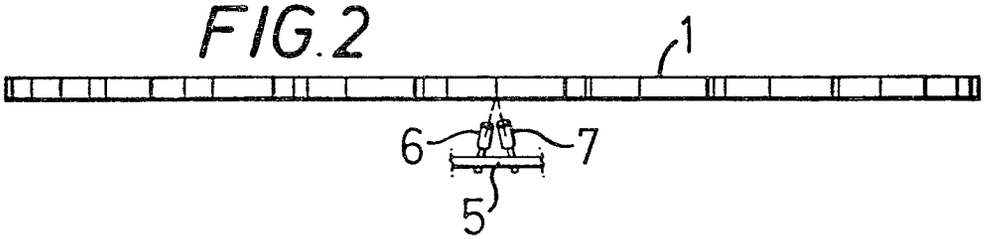


FIG.3