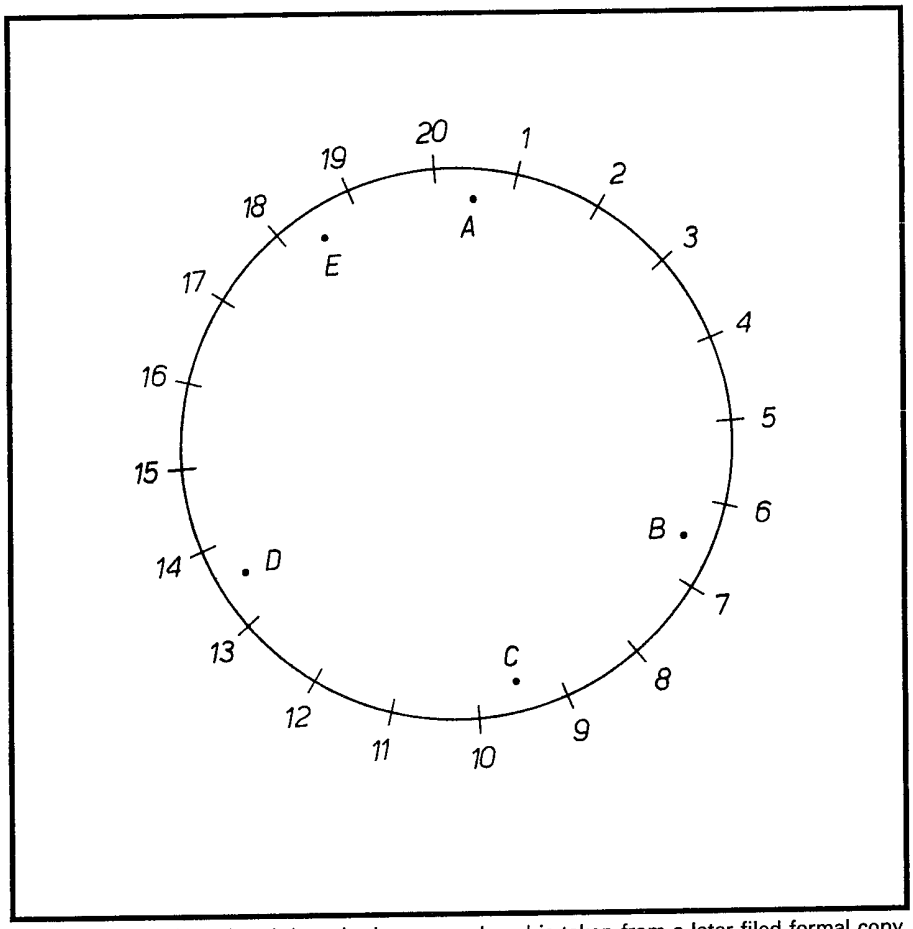
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(54) A drive mechanism for use in apparatus for playing a game of chance

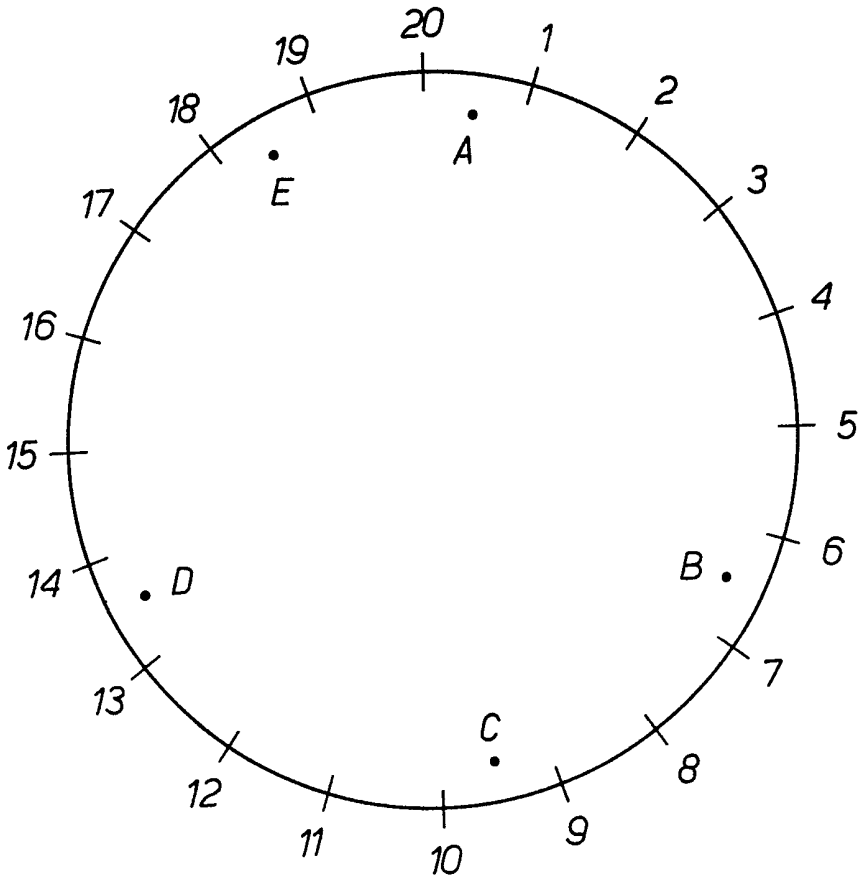
(57) A fruit machine reel signals a number of datum positions A–E for each revolution, and the symbol at which the reel is to stop is pre-selected and identified by its distance from one of the datum positions. The pre-selection is used to govern a stepping motor drive. The datum positions are coded, the favoured arrangement being elements unequally circumferentially spaced around the reel and each in turn producing a pulse at a single sensor. The pulse spacing, in terms of steps of the motor from one datum to the next, identifies each datum. Apart from one datum providing an origin from which the stopping position is reckoned, usually the first datum identified, the other datums are used to keep a check on the reel rotation.



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The drawing originally filed was informal and the print here reproduced is taken from a later filed formal copy.

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SPECIFICATION

A drive mechanism for use in apparatus for playing a game of chance

This invention relates to a drive mechanism for use in apparatus for playing a game of chance. It is primarily concerned with the drive to the drums or reels of a fruit machine. In such machines the reels are spun in an apparently random manner and ultimately stop with a row of symbols, very often fruit, showing in a window. Certain combinations of such symbols generate a prize.

There has to be some correlation between the stopped position of the reels and the prize-awarding mechanism. In the past, it has been common for the reels to have associated code plates and sensors and for each symbol there was generated a unique signal. When this was done by electro-mechanical means there were problems with wear and imperfect contacts. However, these have gradually been superseded.

One new approach is to use a stepping motor which is indexed around by pulses from a control unit. This should make it possible not to refer to the reels at all. The number of pulses applied to the stepping motor can be used to determine where the reel stops, provided of course that the initial starting position is known. In theory, once the machine has been set up and measures taken not to erase any memory of the current reel positions, even when the machine is switched off, there would be no need to refer to the reels at all. However, in practice this is unsafe and generally a check, and re-synchronisation if necessary, will be made from a datum point on the reels, once for each revolution. Even so, this is slightly hazardous since there are a large number of symbols on the reels of most machines and it is possible to lose synchronism between the datum points and the intended stopping position. Also, there is still the need to provide a memory of the last stopping position, and hence the next starting position, particularly in case the reels do not complete a full revolution and pass a datum point. A further problem is interference with the reel between games.

It is the aim of the invention to adopt some of the benefits of the stepping motor drive but reduce some of the drawbacks outlined above.

According to the present invention there is provided a fruit machine reel drive system comprising a reel having a plurality of circumferentially spaced datum points dividing the reel into a corresponding plurality of sectors, and control means governing the stepping motor drive to stop the reel at a selected position in one of said sectors by reference to one of the datum points as the reel rotates but without reference to the reel when stopped, the datum points being coded to be identifiable to sensor means.

The control means, such as a digital computer, may be programmed before the game to stop the reel at a given symbol position within a particular segment, or it could generate a signal corresponding to a stopping position during the game itself. Although this may in fact be a pre-ordained position it will not be known to the player and to all outward appearances the stopping is at random.

Preferably a single sensor is employed. The datum points may then be arranged to generate signals with different characteristics, in which case they can be evenly spaced around the reel. However, in another system, the sectors are all unequal and the coding of the datum points lies in their circumferential spacing. Each datum point is then identified by reference to the number of motor steps or symbol positions occurring since the previous datum point passed the sensor. In this case, the control means may provide a random number when the reel starts to spin, this number determining the number of motor steps or symbol positions to occur after the first positive identification of a datum point. In order to remove any possible bias, as explained further below, the control means may provide a further random number when the first positive identification is made, this further number lying in a range dependent on the datum point identified, and being added to the first random number to adjust the eventual stopping position of the reel.

The system is compatible with a feature known as "nudging", where the player is offered the chance to index the reels to achieve a winning combination. Generally, this feature is offered after a reel spin, and each operation of a button or the like will generate the necessary number of pulses to be passed to the stepping motor to move the reel associated with that button one symbol position. The feature is part of a single game and the reel positions will still be known and updated as indexing proceeds. The final stopping position can thus be a conscious selection by the player (within limits imposed by the amount of indexing allowed) rather than a random selection by a computer.

If this feature is sometimes available without a previous reel spin, or if a 'hold' feature is present, allowing selected reels to be held while others are spun, then provision must be made for memorising where the reels stopped in the previous game.

A convenient system for relating the reel position to the symbol showing on the combination line in the display windows is to assign a number to each different symbol position, so that each symbol that shows on the combination line is uniquely identified by a particular number. The numbers and their relationship to one or more of the datum points are stored in a memory. Thus when the control

means randomly selects a number *n*, meaning for example that an orange should appear on the combination line when the reel stops, as the reel spins one of the datum points is detected and informs the control means of the reel position. If the orange in question will be displayed when the reel moves on *n* positions from that datum pint, the control means will govern the stepping motor accordingly. If it is another datum point that is detected first, an addition or subtraction can be made to or from the pulses that the control means will apply to the stepping motor, in accordance with the spacing of that other datum point from the first one from which the *n*th position is reckoned. As each datum position is passed, a check on the control means, and updating if necessary, is made.

It is customary for the reels to stop in sequence with fairly regular intervals, generally from left to right. It can be arranged that while the left hand reel is spinning, the random position selection, the sensing of datum points, or any other step in the arresting of the remaining reels is delayed. Once the left hand reel has stopped, the arresting process of the next reel is enabled and so on. It can be arranged for the left hand reel itself to have a generous spin time, rather than being stopped almost immediately after the first datum point, as could happen if certain selections were made. Of course, all the reels will be arranged to spin through one sector so that at least one datum point is identified.

The stopping position of a reel is of course the starting position of that reel for the next game, unless the machine is tampered with. But for normal spinning of the reels, this position does not have to be memorised. In any game, the reels will soon pass one of the individually coded datum points, or a pair of individually spaced points, and the control means will be instantaneously informed of the position of the reel and the sector which is then about to pass the display window. Generally there will only be a few symbol positions in each sector and there is virtually no opportunity to lose synchronism; modern stepping motors are sufficiently reliable to allow this brief open-loop arrangement.

Individually coded datum points may be provided by being marked on or attached to the reel itself and co-operating with a single sensor. Alternatively a single element on the reel could co-operate with a plurality of sensors spaced around the reel axis. Conveniently, there will be two or four datum points for each reel having twenty symbol positions, with ten or five symbol positions respectively in each sector, but other divisions and reels with a different number of symbol positions are quite feasible.

The sensing of each datum point can be by any suitable means, such as optical, capacitive or even mechanical, and there are various ways in which the respective datum points can be distinguished. For example, with the plurality of points on the reel itself they may generate different numbers of pulses in a single sensor, or there could be different signal intensities. If four datum points are identified by one, two, three and four pulses respectively, the multiple pulses will be so closely grouped in relation to the interval between datum points, whatever the speed of the reel, that they can be distinguished by a single sensor. If every symbol position were to be coded, a single sensor could probably not cope. If there is a plurality of sensors spaced around the reel axis which respond sequentially to a single element on the reel, then the coding can exist simply by virtue of the different lines or channels into which the separate sensors can feed. An alternative is to have a group of fixed sensors along one radial line and to provide the reel with different combinations of tabs or sensor activating elements along the various radii corresponding to datum positions.

To provide a number of sensors is expensive, and therefore the single one is preferred. But to distinguish by number of pulses is not entirely satisfactory for it is then practical only to have a very limited number of datum points; and there are problems, if relying solely on time spacing, when the reel starts up or slows down. To rely on differences of signal amplitude is also hazardous.

A more elegant solution will now be described, by way of example, with reference to the accompanying drawing in which the single figure is a diagram of a fruit machine reel with twenty symbol positions and five datum points.

The symbol positions are numbered 1–20 and the datum points are indicated by letters A–E, each being intermedite a pair of adjacent symbols. There is a single sensor (not shown) which responds with an electrical signal whenever one of these datum points passes. This can be generated in any of many different ways, the preferred one being optical, for example a tab on the reel interrupting a light beam. The circumferential spacing of the datum points (which are of course all at the same radius) is not uniform and differs between each adjacent pair. In the example shown the spacing, in symbol positions, cyclically around the reel from datum point A is 6, 3, 4, 5, 2.

The sensing of one datum point will not, in itself, define the reel position, but once it is sensed a count can be kept of the stepping motor pulses occurring until the next datum point. Such a count will uniquely identify that datum point, and hence the position of the reel. This is repeated for every point, and so there are five checks per reel revolution. It will be appreciated that this system removes the necessity for a complete reel spin when the

machine is first switched on, as well as keeping a much tighter check on the behaviour of the reels than can be had with a single tab/single sensor arrangement.

The spacing of the datum points of the example avoids the juxtaposition of the 6-space interval with the 5- and 4-space intervals and is chosen to minimise the time taken for position identification starting from any random position.

This system lends itself to the following method of playing a game.

When the start button is pressed a random number is selected for each reel, and the reels are set in motion. Their last stopping positions do not have to be memorised. The reels are accelerated up to full speed by the control system, which identifies the reel positions as the second datum tabs pass the associated sensor. The random number selected for a reel represents the number of symbol positions on from that first identified datum at which the reel is to stop. Thus, the control system will know in advance (but not from the very start) what the first symbol combination will be. With this knowledge, the stepping motors are readily controlled to run at full speed and finally slow and stop the reels at the pre-ordained positions, repeated checks being made as the datum positions pass. Should anything be amiss, for example a rotation of 7 or more symbol positions without a tab being detected, or a tab not being coincident with its expected position, then an alarm can be given, and the machine could be made automatically to shut down.

Because of the uneven spacing of the datum tabs identification at certain points is more likely than at others. For example the reel will stop more frequently in the six symbol sector AB than in the two symbol sector. C is therefore a more common starting point than B. To compensate for this and to remove any bias, a further random number is added to the reel spin random number already selected. If this is in terms of symbol positions, the additional random numbers will be in the ranges indicated by the table

A	B	C	D	E
0–2	2–5	0–4	2–3	1–6

The system is not confined to rotation of the reels in one direction only. The control means can be designed or programmed to account for rotation in either direction.

CLAIMS

1. A fruit machine reel drive system comprising a reel having a plurality of circumferentially spaced datum points dividing the reel into a corresponding plurality of sectors, and control means governing a stepping motor drive to stop the reel at a selected position in one of said sectors by reference to one of the datum points as the reel rotates but without reference to the reel when stopped, the datum points being coded to be identifiable by sensor means.

2. A fruit machine reel drive system as claimed in Claim 1, wherein a single sensor is employed, and the datum points generate signals with different characteristics.

3. A fruit machine reel drive system as claimed in Claim 1, wherein a single sensor is employed, the sectors are all unequal and the coding of the datum points lies in their circumferential spacing, each datum point being identifiable by reference to the number of motor steps or symbol positions occurring since the previous datum point.

4. A fruit machine reel drive system as claimed in Claim 1, 2 or 3, wherein the control means provide a random number when the reel starts to spin, this number determining the number of motor steps or symbol positions to occur after the first positive identification of a datum point.

5. A fruit machine reel drive system as claimed in Claims 3 and 4, wherein the control means provides a further random number when said first positive identification is made, this further number lying in a range dependent on the datum point identified, and being added to the first random number to adjust the eventual stopping position of the reel.

6. A fruit machine reel drive system substantially as hereinbefore described with reference to the accompanying drawing.

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