Jan. 10, 1967 J. C. GIBSON, JR 3,297,323

RACING GAME

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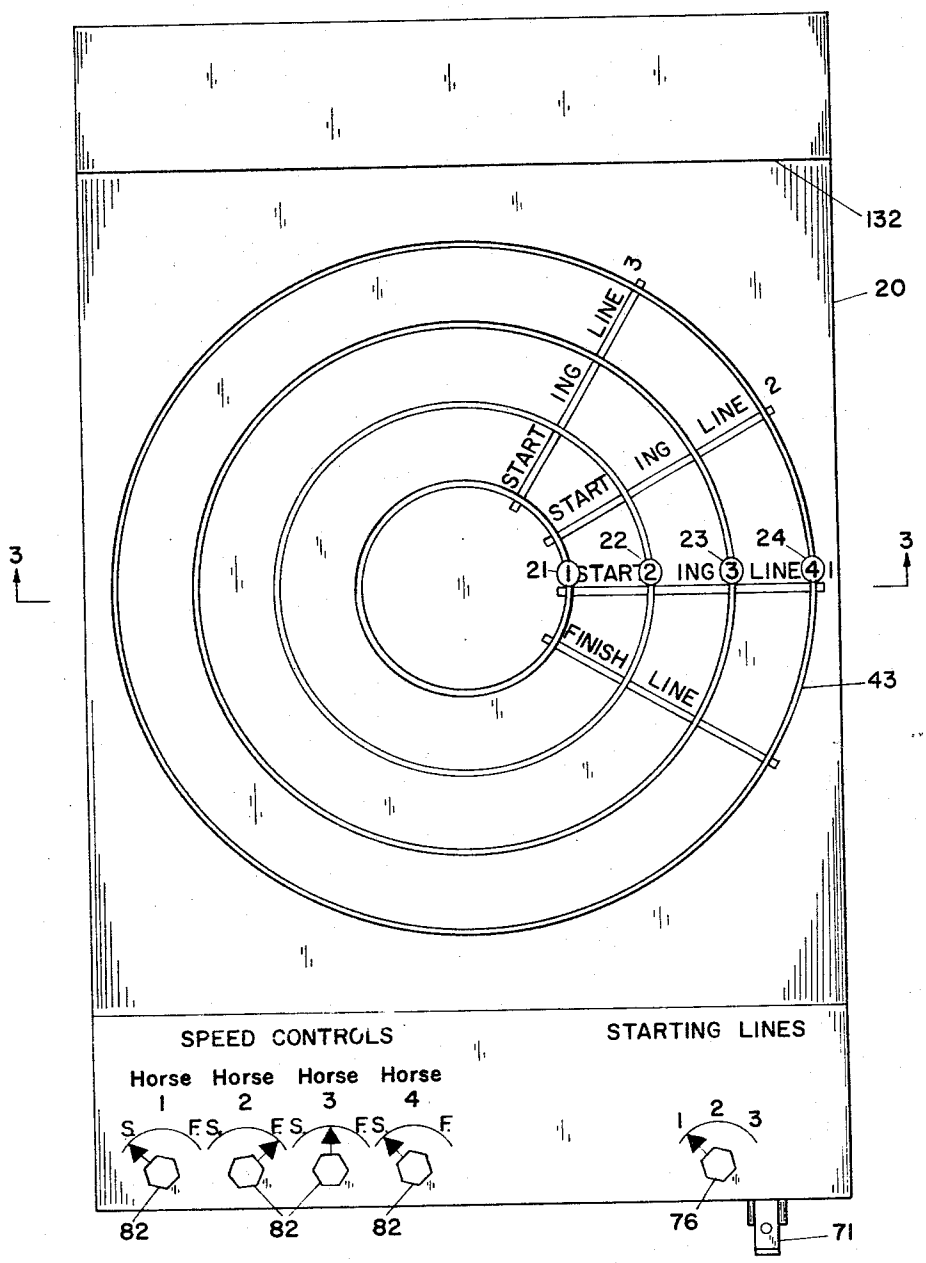



Fig. 1

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RACING GAME

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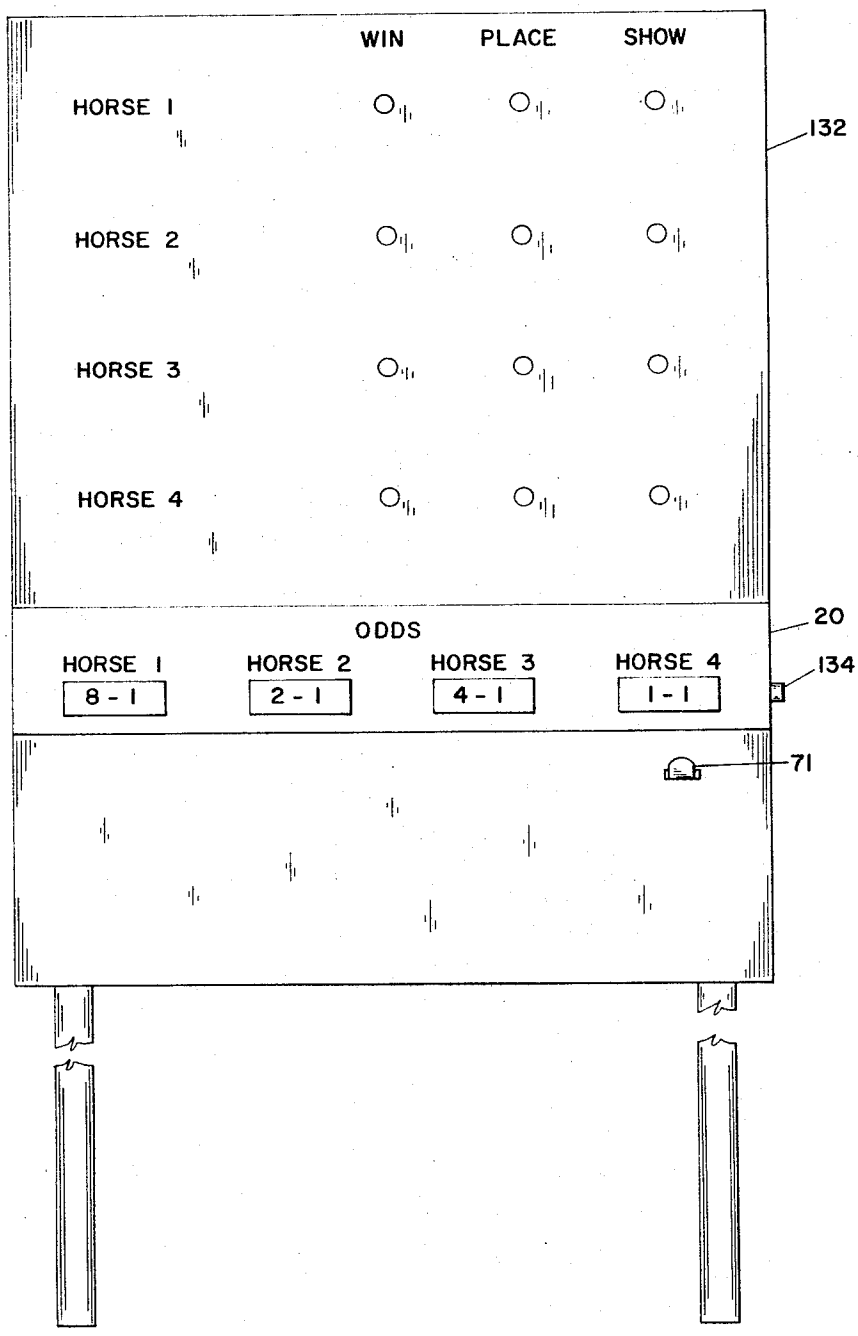



Fig. 2

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RACING GAME

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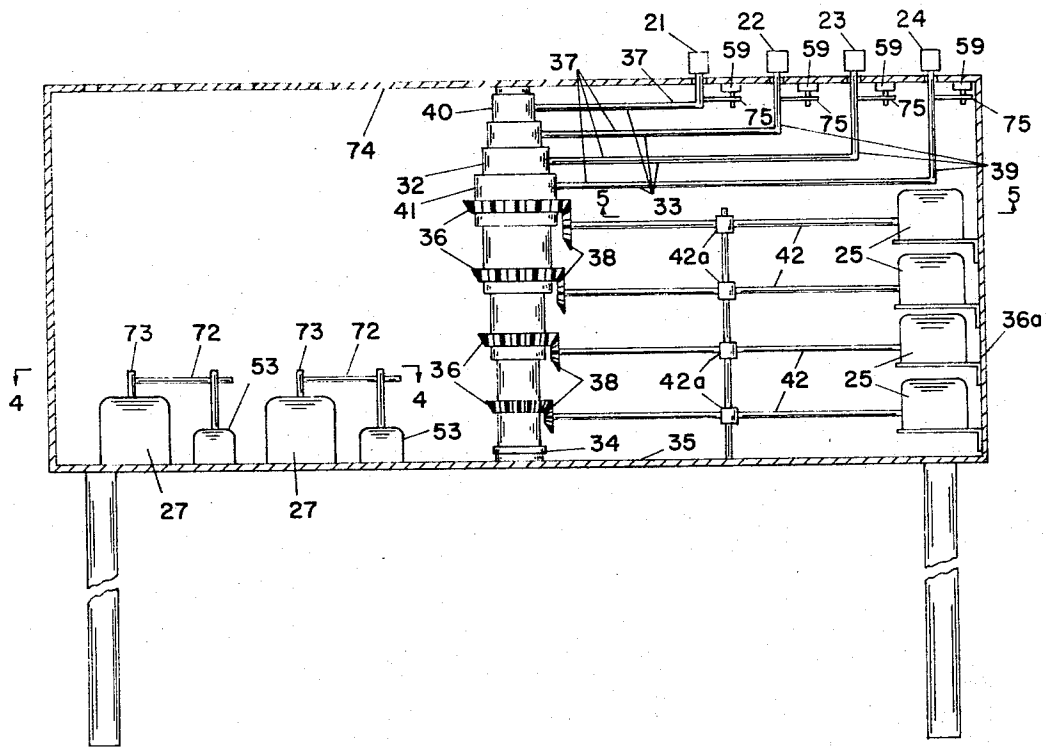



Fig. 3

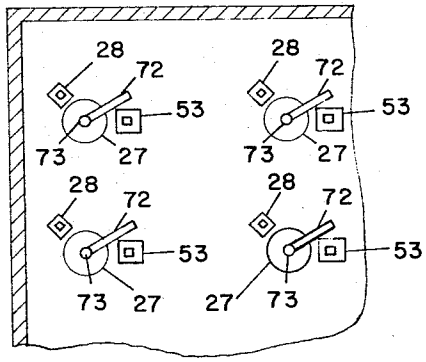



Fig. 4

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RACING GAME

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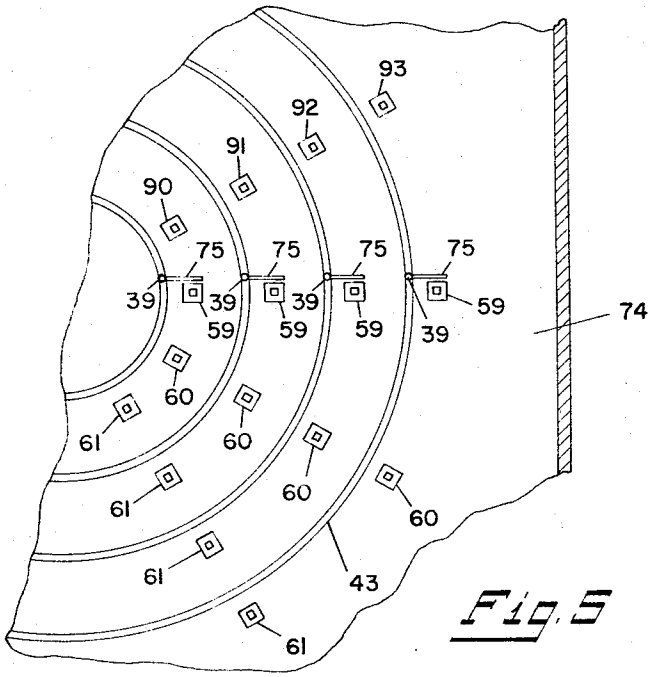



Fig. 5

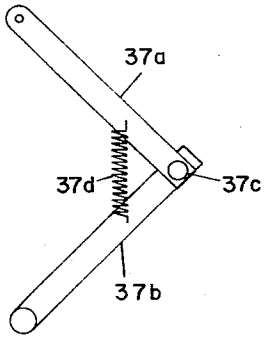



Fig. 9

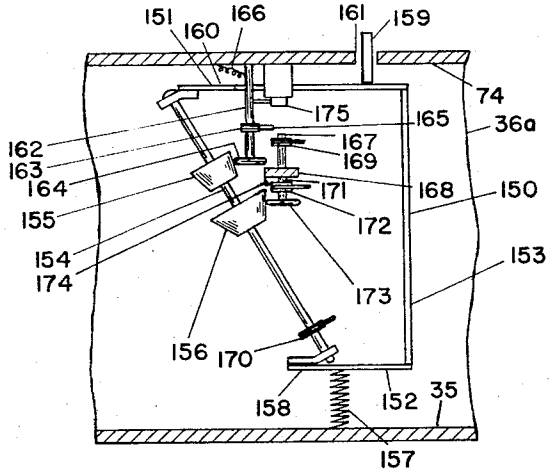



Fig. 10

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RACING GAME

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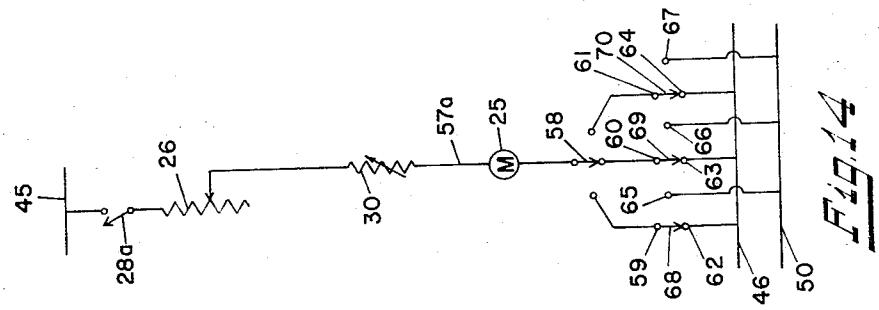



FIG. 14

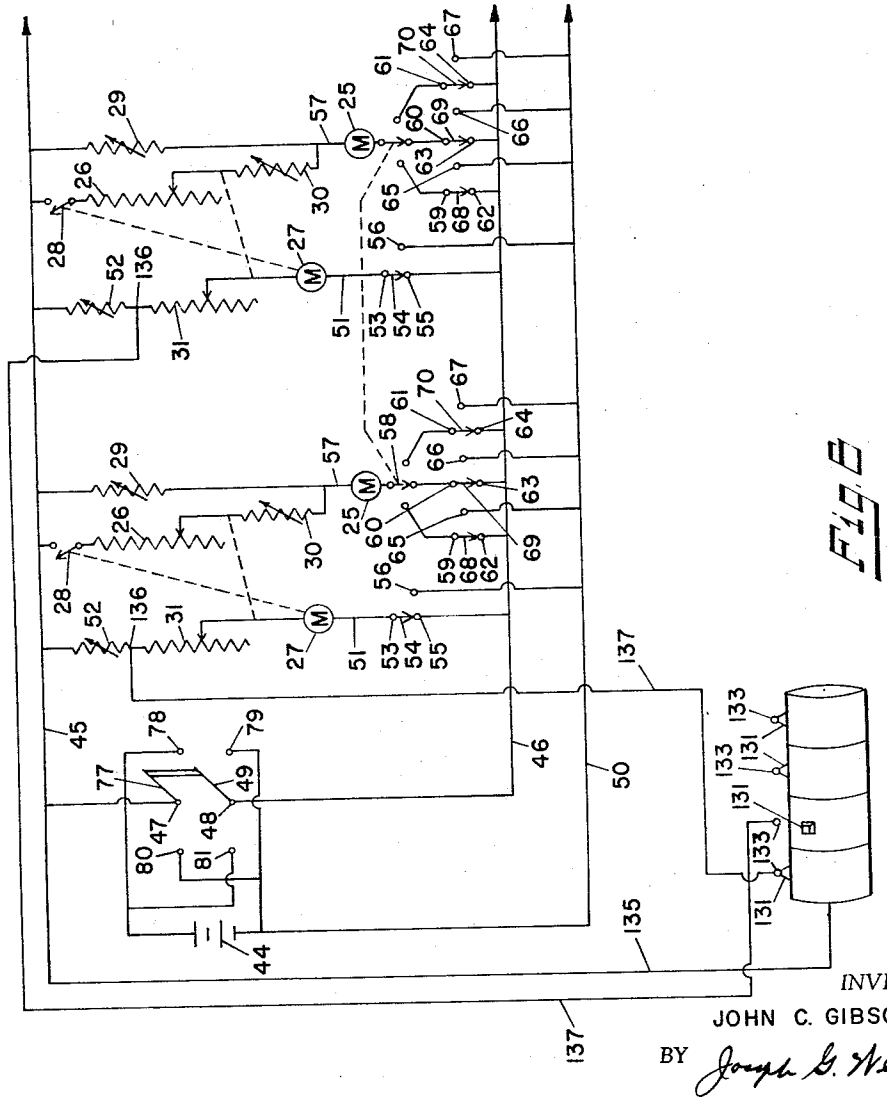



FIG. 8

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RACING GAME

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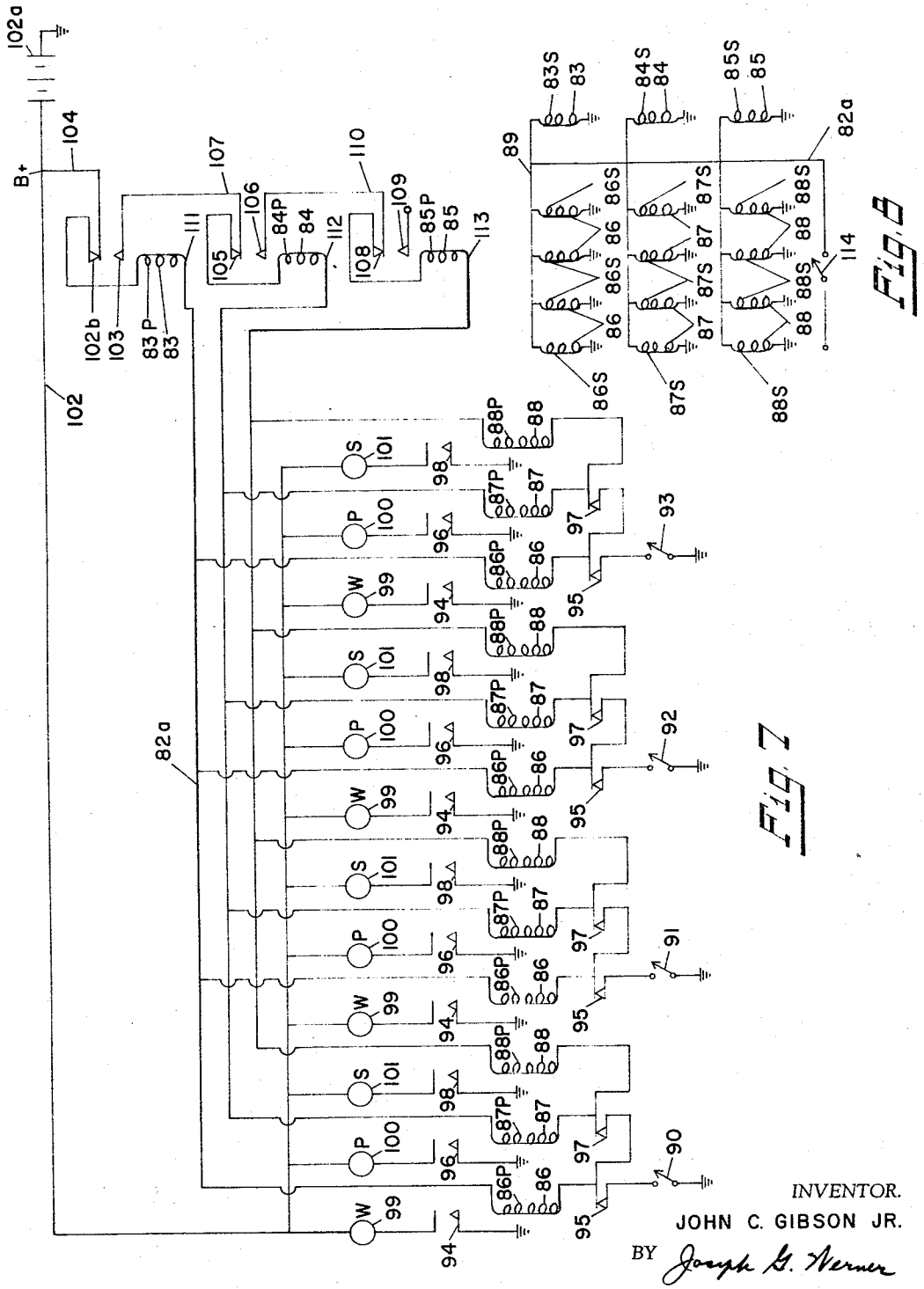



FIG. 8

FIG. 7

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| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| *16 — 1 | 16 — 1 | 8 — 1 | 4 — 1 | *2 — 1 | 16 — 1 |
| 8 — 1 | 16 — 1 | *4 — 1 | *8 — 1 | 16 — 1 | 16 — 1 |
| 16 — 1 | *4 — 1 | 8 — 1 | *16 — 1 | 8 — 1 | 4 — 1 |
| *4 — 1 | 8 — 1 | 16 — 1 | 8 — 1 | 16 — 1 | *16 — 1 |
| 8 — 1 | 16 — 1 | *16 — 1 | 4 — 1 | *4 — 1 | 16 — 1 |
| 4 — 1 | 16 — 1 | *2 — 1 | 16 — 1 | 16 — 1 | *2 — 1 |
| 16 — 1 | 4 — 1 | 16 — 1 | 16 — 1 | *8 — 1 | *4 — 1 |
| 8 — 1 | *8 — 1 | *4 — 1 | 16 — 1 | 16 — 1 | 8 — 1 |
| *2 — 1 | *4 — 1 | 4 — 1 | 8 — 1 | 16 — 1 | 16 — 1 |
| 4 — 1 | 16 — 1 | 8 — 1 | *4 — 1 | *2 — 1 | 16 — 1 |
| 16 — 1 | *2 — 1 | 16 — 1 | 8 — 1 | *4 — 1 | 8 — 1 |
| *8 — 1 | 8 — 1 | 16 — 1 | *2 — 1 | 8 — 1 | 16 — 1 |
| 16 — 1 | *2 — 1 | 16 — 1 | 16 — 1 | 4 — 1 | *8 — 1 |
| 16 — 1 | 16 — 1 | 4 — 1 | *4 — 1 | 16 — 1 | *4 — 1 |
| *2 — 1 | 16 — 1 | *8 — 1 | 16 — 1 | 8 — 1 | 16 — 1 |
| 16 — 1 | 4 — 1 | 16 — 1 | *2 — 1 | *16 — 1 | 4 — 1 |
| *4 — 1 | 8 — 1 | *2 — 1 | 16 — 1 | 16 — 1 | 8 — 1 |
| 16 — 1 | *16 — 1 | 16 — 1 | 16 — 1 | 4 — 1 | *2 — 1 |

Fig. 11

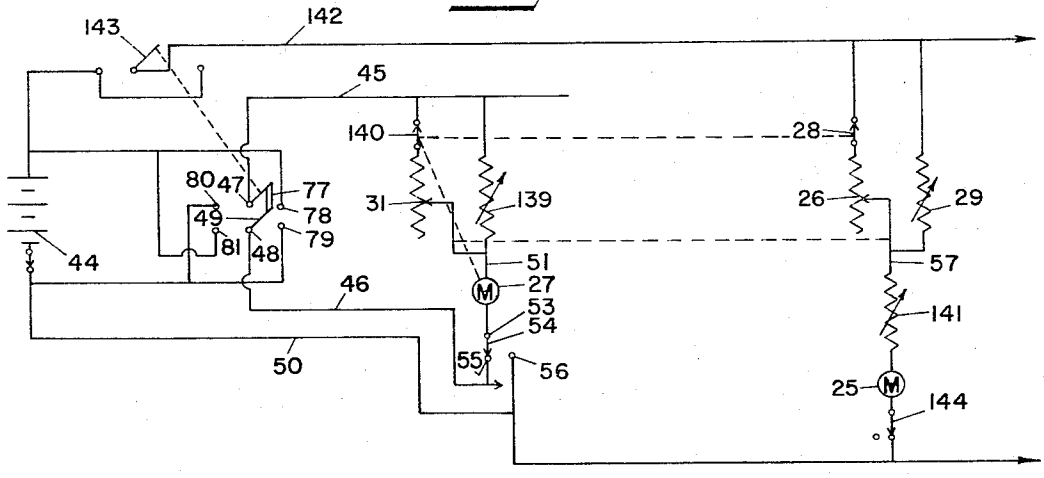



Fig. 12

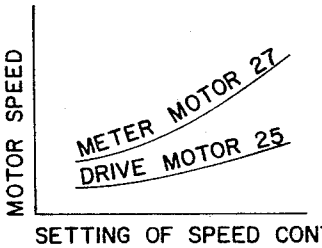



Fig. 13

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United States Patent Office 3,297,323
Patented Jan. 10, 1967



3,297,323

# RACING GAME

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Filed May 20, 1963, Ser. No. 281,628
9 Claims. (Cl. 273—86)

My invention relates to an improvement in racing games, particularly those which may be easily adapted to coin operation.

In the many currently known racing games, the major and perhaps only determinant of the winner of a race is chance or luck. For instance, in some of the games the racing figures or pieces are driven by individual electric motors which are approximately identical. To create an interesting, suspense filled race, the speed of each of the driving motors is continuously varied by increasing or decreasing the resistance connected across its rotor. The Geddes patent, No. 1,889,531, issued November 29, 1932, and the Smith et al. patent, No. 2,604,323, issued July 22, 1952, are examples of this type of racing game. The important fact to observe is that in neither Geddes nor Smith et al. is the magnitude of rotor resistance controlled by the players. The magnitude of the rotor resistance is randomly controlled in both patents. The Eisenberg et al. patent, No. 2,133,165, issued October 11, 1938, illustrates another of the numerous possible ways to randomly vary the speed of the racing figures. It varies by timing rotors the period of time each racing figure intermittently engages a drive shaft.

These few examples are sufficient to demonstrate some of the basic shortcomings of present racing games. While they provide an exciting race in which the winner cannot be known until the race is completed, they provide no opportunity for skillful manipulation of the racing figures by the players. They do no more than mechanically grind out the winner according to their particular mode of operation. They do not accurately mirror, and indeed are not intended to, what is probably the most important factor in any actual race, the concept of pace.

It is well recognized, even by those who have never raced themselves, that most races are not won by trying to run them through completely at top speed. Whatever the racing figure, whether a human runner, a thoroughbred horse or a sports car, it usually does not have the energy, endurance, sturdiness or supply of fuel to run continuously at top speed for any extended period. Realizing his limited endurance, the successful racer paces himself, perhaps by starting the race slowly to conserve his energy for a finishing spurt, or perhaps by starting at his fastest speed to build a lead which he hopes he can maintain when he tires near the finish.

One object of my invention, therefore, is to provide a racing game in which the skill of the player, not mechanical chance, determines the winner.

Another object of my invention is to provide a realistic racing game in which pacing of the racing figures is required to conserve their limited amount of energy.

A further object of my invention is to provide a racing game which has means to stop completely or at least reduce the speed of a racing figure which has exhausted its limited supply of energy.

A still further object of my invention is to provide a racing game in which the length of a race, and therefore the problem of pace, can be changed by varying the position of the starting line.

Another object of my invention is to provide a racing game which has a circuit to dramatically indicate the racing figures which win, place and show in any race.

Yet another object of my invention is to provide a racing game in which certain of the racing figures may be handicapped at the player's discretion.



An additional object of my invention is to provide a racing game which has, in conjunction with the handicapping feature, means for quoting the odds on the handicapped horses.

Other objects and advantages of my invention will be apparent from the following detailed description taken in conjunction with the accompanying drawings wherein a preferred embodiment of the principles of the invention has been selected for exemplification.

In the drawings:

FIG. 1 is a top view of one embodiment of the racing game of my invention.

FIG. 2 is a front view of my invention.

FIG. 3 is a sectional view taken along line 3—3 in FIG. 1.

FIG. 4 is a partial sectional view taken along the line 4—4 in FIG. 3.

FIG. 5 is a partial sectional view taken along line 5—5 in FIG. 3.

FIG. 6 is a circuit diagram of the motor circuitry for the racing game of my invention.

FIG. 7 is a circuit diagram of the finish line circuit for my invention.

FIG. 8 is a circuit diagram for the secondary coils of the relays shown in FIG. 7.

FIG. 9 is a top view of a preferred means for mounting the racing figures when an oval track is used.

FIG. 10 is a partial vertical section view of a housing for my racing game illustrating a mechanical means or simulating the concept of pace present in an actual race.

FIG. 11 shows an exemplary odds chart for use with the handicapping feature of my invention.

FIG. 12 is a modified version of the circuit of FIG. 6.

FIG. 13 is an idealized graph of the speed characteristics of the motors in both the circuits of FIG. 6 and FIG. 12.

FIG. 14 is a circuit diagram of one branch of a modified version of the circuit of FIG. 6.

The illustrated racing game **20** shown in FIG. 1 consists of four racing figures, **21**, **22**, **23** and **24**, adapted to travel a circular track **43**. The racing figures may represent horses, human runners, sports cars or any other desired figure, and may be of any desired number.

Each of the racing figures **21**, **22**, **23** and **24** is preferably driven by its own individual drive motor **25**, as shown in FIG. 3. The players of the game may vary the speed of the drive motors **25** by controlling the rheostats **26** connected in their respective rotor circuits, as shown in the circuit diagram of FIG. 6. The speed of the drive motors **25** cannot be increased indiscriminately, however, because of the meter motors **27**, which are adapted to open respectively the switches **28** connected in series with each of the rheostats **26**. Once a switch **28** is open, the resistance in series with its particular drive motor **25** increases to the value of the variable resistance **29** which is in parallel with the series branch consisting of the switch **28**, the rheostat **26** and the maximum speed tuning resistor **30**. The drive motor **25** then runs at a lower speed determined primarily by the magnitude of the resistance **29**. The meter motors **27** in this manner meter or limit the period of time voltages larger than the voltage existing across the motors **25** when the switches **28** are open may be applied to the motors **25**.

As an alternative to merely slowing the speed of the drive motor **25**, the drive motor **25** can be completely stopped. The operation may be conveniently accomplished by adapting a meter motor **27** to open a switch **28***a* directly connected in series between its corresponding motor **25** and the power supply for the drive motor **25**, as shown in FIG. 14.

The meter motors **27** are geared to open their respective switches **28** after their output shafts have rotated a

predetermined number of revolutions or fraction of a revolution. The faster the meter motors 27 run, the sooner the switches 28 open, and the shorter is the period during which a player may supply the larger voltages to the drive motors 25 by controlling their respective rheostats 26. Therefore, in keeping with the observed fact that horses or men can sustain high bursts of energy only for short periods of time, the speed of the meter motors 27 is made to increase more rapidly than the speed of the drive motors 25 by properly ganging the drive motor rheostats 26 and the meter motor rheostats 31. Adjustment of the rheostat 26 to increase the speed of its drive motor 25 results in a corresponding adjustment of the rheostat 31 to provide a greater relative increase in the speed of its meter motor 27. Because of this operation of the meter motors 27, my racing game 20 is a realistic representation of an actual race in which the racers, possessing a limited amount of energy, must skillfully pace themselves to win.

A convenient structure for transmitting the output power of the drive motors 25 to their individual racing figures 21, 22, 23 and 24 is shown in FIG. 3. The structure consists essentially of a plurality of concentric tubes 32, one for each of the racing figures, supported by ball bearing mountings or any other suitable means to rotate independently of each other. Each of the concentric tubes 32 rigidly supports an L-shaped member 33 which supports one of the racing figures 21, 22, 23 and 24. The tubes 32 progress in size from the innermost tube 40, which has the greatest height and the smallest diameter and supports the innermost racing figure 21, to the outermost tube 41, which has the least height and the greatest diameter and supports the outermost racing figure 24. The innermost tube 40 is rotatably mounted in a casing 34 secured to the floor 35 of the housing 36*a* which encloses the concentric tubes 32. For more sturdy support the innermost tube 40 may also be rotatably mounted in a casing 34*a* secured to the ceiling 74 of the housing 36*a*, as is illustrated in FIG. 3. The output power of each of the drive motors 25 is preferably directly applied to its particular tube 32 by means of the engaging bevel gears 36 and 38, one fixed to each of the tubes 32 and one fixed to each of the output shafts 42 of the motors 25. The output shafts 42 may be supported by bearings 42*a* as shown.

As shown in FIG. 3, the relative sizes of each engaged pair of bevel gears 36 and 38 should be the same to insure that all of the tubes 32 will rotate at the same speed for any given speed of rotation of their associated motor output shafts 42. Thus, if all of drive motors 25 were operating at the same speed, all of their associated racing figures would travel completely around the track 43 in the same amount of time.

Although the tower of concentric tubes 32 is best adapted for providing motion to racing figures traveling the circular track 43 shown in FIG. 1, it may be converted for use with an oval or irregularly shaped track by making the horizontal legs 37 of the L-shaped members 33 extendable. A preferred structure, illustrated in FIG. 9, consists of a horizontal leg 37 which is composed of two elements, 37*a* and 37*b*, of approximately equal length hinged together by any suitable connection 37*c*. A compression spring 37*d* preferably connects the two elements 37*a* and 37*b* to facilitate tracing of the oval or irregularly shaped track by the vertical legs 39. If desired, a tension spring may be substituted for the compression spring 37*d*. Other suitable structures include inserting a compression or tension spring as an integral portion of the length of each of the horizontal legs 37, or providing the legs with a telescopic construction which may be lengthened or shortened as the vertical legs 39 of the L-shaped members 33 trace the oval or irregularly shaped track.

While the tower of concentric tubes 32 is preferred as a compact, relatively simple arrangement for transmitting the output power of the drive motors 25 to the racing figures 21, 22, 23, and 24, it is not critical for the succcessful operation of my invention. Any suitable structure for independently transmitting power to each of the racing figures is acceptable and may be substituted for the tubes 32. The tubes 32 themselves may be modified by substituting belt and pulley arrangements for the illustrated bevel gears 36 and 38. Other mechanical equivalents are also possible.

Referring again to the motor circuit of FIG. 6, the energy source for the drive motors 25 and the meter motors 27 may be any suitable direct current source, but is preferably a direct current power supply. For simplicity of illustration only, the energy source shown in the drawings is the battery 44. While a direct current system is described as preferable, it is to be understood that an alternating current system may be employed if desired. Essentially, the principal requirement for converting the illustrated direct current system to an alternating current system is the substitution of alternating current motors with sufficiently sensitive speed responses to provide exciting races for the direct current motor 25 and 27. The direct current power is fed to the drive motors 25 and the meter motors 27 through the supply lines 45 and 46 connected to the terminals 47 and 48 of a double-pole-double-throw switch 49 which is connected across the battery 44. A third supply line 50 is directly connected to the negative terminal of the battery 44.

Each meter motor branch 51 consists of the series connection of a variable resistor 52 for making fine adjustments in the speed of the meter motor 27, the rheostat 31, the meter motor 27 and a switch 53. Each branch 51 is connected between the supply line 45 and either the supply line 46, when the arm 54 of the switch 53 closes with its contact 55, or the supply line 50, when the arm 54 closes with the contact 56.

Each drive motor branch 57 consists of the series connection of the drive motor 25, a switch 58, one of the three switches 59, 60, and 61, and the parallel combination of the variable resistance 29 with the series combination of the switch 28, the rheostat 26 and a maximum speed tuning resistance 30. Each such drive motor branch 57 is also connected between the supply line 45 and either the supply line 46 or the supply line 50. Similar to the switch 53, the switches 59, 60 and 61 each have respective contacts 62, 63 and 64 connected to the supply line 46 and respective contacts 65, 66 and 67 connected to the supply line 50. Depending on which contact each of their respective arms 68, 69 and 70 closes, the drive motor branch 57 is connected to either the supply line 46 or the supply line 50. Meter motor branches 51 and drive motor branches 57 are shown for only two racing figures in FIG. 6. Identical meter motor branches 51 and drive motor branches 57 are provided for each additional racing figure, but for simplicity's sake are not illustrated.

The double-pole-double-throw switch 49 is preferably actuated by the player of the racing game 20 with the coin slide 71, which is best shown in FIG. 1. Other actuating means independent of the coin slide 71 may be provided for actuation of the switch 49 if desired. As illustrated in FIG. 4, each of the meter motors 27 is physically positioned to actuate its associated switches 28 and 53 with a lug 72 extending from its drive shaft 73. The meter motors 27 and the switches 28 and 53 are conveniently mounted on the floor 35 of the housing 36*a*, as shown in FIG. 3. Looking at FIGS. 3 and 5, the switches 59, 60 and 61 are attached to the ceiling 74 of the housing 36*a* for actuation by the lugs 75 extending from each of the vertical legs 39 of the L-shaped members 33 mounting the racing figures 21, 22, 23 and 24. The switches 58, which are ganged as shown in FIG. 6, are operated by a player with the knob 76 shown in FIG. 1. The switches 59, 60 and 61 are starting line switches which correspond respectively to the Starting Lines 1, 2 and 3 shown in FIG.

1. The players determine the starting line to be used for a particular race by selecting with switch **58** either the circuit of switch **59**, **60** or **61**. These switches **59**, **60** and **61** are physically located directly beneath their respective starting lines. The switches **59** are mounted in line under Starting Line **1**, the switches **60** under Starting Line **2**, and the switches **61** under Starting Line **3**.

To understand the operation of the motor circuit of FIG. 6 assume that the racing figures **21**, **22**, **23** and **24** are driven in the forward or counterclockwise direction, as viewed in FIG. 1, when the arm **77** of the double-pole-double-throw switch **49** is closed with the contacts **78** and **79** and in the reverse or clockwise direction when the arm **77** is closed with the contacts **80** and **81**. Assume similarly that each of the output shafts **73** of the meter motors **27**, as viewed in FIG. 4, rotates counterclockwise when the arm **77** of the double-pole-double-throw switch **49** is closed with the contacts **78** and **79** and clockwise when the arm **77** is closed with the contacts **80** and **81**. The lugs **72** extending from the shafts **73** are shown in FIG. 4 on the counterclockwise side of the switches **53**. This is actually not their position until immediately after the race has begun, but they may be assumed in this position for the sake of simplicity. In routine operation, the lugs **72** are on the clockwise side of the switches **53** before the start of a race, as is subsequently explained. Assume further that the players have chosen Starting Line **2** by selecting with switch **58** the circuit of switch **60**; that the racing figures **21**, **22**, **23** and **24** are in position at Starting Line **2**; that each of the switches **28** is closed; that the arm **54** of each of the switches **53** is closed with the contact **55**; and that the arm **69** of each of the selected switches **60** is closed with the contact **63**.

The players begin a race by operating the coin slide **71** to close the arm **77** with the contacts **78** and **79**. By operating the speed control knobs **82**, which are shown in FIG. 1 and which control the resistance of the rheostats **26** connected in series with each of the drive motors **25**, each player independently controls the speed of his particular drive motor **25** and thereby the speed of his chosen racing figure. Each rheostat **26** is ganged with its corresponding rheostat **31** in such a manner to increase the speed of the meter motor **27** when the rheostat **26** is varied to increase the speed of its drive motor **25**. The player who drives his racing figure at the fastest speed therefore causes the lug **72** attached to the output shaft **73** of his meter motor **27** to rotate the necessary distance to open the switch **28** in his drive motor branch first. The opening of the switch **28** ends the player's control of the speed of the drive motor **25** with the rheostat **26** and decreases the speed of the drive motor **25** to a lower value determined primarily by the magnitude of the resistance **29**. If the player who initially drives his racing figure at the fastest speed has not attained a sufficient lead over the other racing figures by the time his switch **28** opens, the other players who still have control over the speed of their racing figures will beat him.

The relative rates of increase of speed of a drive motor **25** and its corresponding meter motor **27** are vital if the circuit of FIG. 6 is to realistically represent the concept of pace. What must be particularly represented by the circuit of FIG. 6 is the known fact that a runner, for example, loses energy at a faster rate when sprinting than when running at a slower speed. To represent this behavior, the speed of the meter motor **27** must increase at a faster rate than the speed of the drive motor **25**, as is illustrated by the curves in FIG. 13. The speed of the meter motor **27** need not necessarily be everywhere faster than the speed of drive motor **25**, as shown in FIG. 13. However, if the rate of increase of the speed of the meter motor **27** was the same or actually less than the rate of increase of the speed of the drive motor **25**, the racing figure driven initially at its fastest speed would always travel further around the track **43** before the output shaft **73** of its meter motor **27** rotated the necessary distance to open its switch **28** than would another racing figure paced at a slower speed to conserve its limited amount of energy. Hence, the racing figure driven at its fastest speed initially would always win the race. Such behavior obviously would not accurately simulate conditions at an actual race. Actual race conditions are accurately simulated when the rate of increase of the speed of the meter motor **27** is faster than the rate of increase of the speed of the drive motor **25**.

There are many possible ways to achieve this operation of the motors **25** and **27**. In FIG. 6, it is accomplished by choosing a rheostat **31** that decreases in resistance at a faster rate than does the rheostat **26**. Because the rheostat **31** decreases in resistance at a faster rate, the magnitude of the current fed to the meter motor **27**, and therefore its speed, increases at a faster rate than does the magnitude of the current fed to the drive motor **25**.

While the exact timing is not critical, it may be desirable that the meter motors **27** open their respective switches **28** before the end of a race, even when the rheostats **26** are controlled to rotate the drive motors **25** at their slowest speeds. This operation is easily achieved by appropriately gearing the meter motors **27** or by choosing the proper magnitudes of resistance for the rheostats **31** and the variable resistors **52**. Other schemes for timing the opening of the switches **28** with respect to the length of a race are, of course, possible and are equally acceptable.

One of the drive motor branches **57***a* of a slightly simplified version of the circuit of FIG. 6 is shown in FIG. 14. Corresponding elements in FIG. 6 and FIG. 14 carry the same reference numbers. The circuits of the two figures are identical except for their drive motor branches **57** and **57***a*. The drive motor branch **57***a* consists of the series connection of a switch **28***a*, the rheostat **26**, the maximum speed tuning resistance **30**, the drive motor **25**, the switch **58**, and one of the three switches **59**, **60** and **61**. It is a duplicate of the drive motor branch **57** of FIG. 6 except for the elimination of the variable resistance **29**. Associated with the switch **28***a* is a meter motor **27** (not shown in FIG. 14) which is adapted to open the switch **28***a* in the same manner a meter motor **27** in FIG. 6 is adapted to open its associated switch **28**.

In the circuit of FIG. 6, the opening of the switch **28** by its associated meter motor **27** merely reduces the speed of the racing figure involved. In the circuit of FIG. 14, on the other hand, the opening of switch **28***a* breaks the only electrical path to the drive motor **25** from the supply lines **45** and **46**, and the associated racing figure is stopped completely. The circuit of FIG. 14 is especially effective and realistic for games in which the racing figures are racing cars, for such cars must stop completely when they run out of fuel. Except for the fact that the racing figures associated with FIG. 14 stop completely, the operations of the circuits of FIGS. 6 and 14 are the same.

A finishing line circuit **82***a* which indicates the order in which the racing fiures **21**, **22**, **23** and **24** finish a particular race is shown in FIGS. 7 and 8. The finish line circuit **82***a* has three master relays, the win relay **83**, the place relay **84**, and the show relay **85**. Each of the racing figures has an associated circuit of three relays, a relay **86** corresponding to the win relay **83**, a relay **87** corresponding to the place relay **84**, and a relay **88** corresponding to the show relay **85**. All of these various relays are latching relays, each having a primary coil and a secondary coil which is not electrically connected to the primary coil. In a latching relay, actuation of the primary coil moves the movable contact to a position in which it is mechanically latched. Actuation of the sec-

ondary coil unlatches the movable contact to reset the relay. The coils shown in FIG. 7 are the primary coils. For the sake of simplicity, the circuit 89 for the secondary coils is shown separately in FIG. 8. The primary coils are designated in the description by the number of the relay followed by the letter "P," and the secondary coils by the number of the relay followed by the letter "S."

Finish line switches 90, 91, 92 and 93 are respectively associated with the racing figures 21, 22, 23 and 24. These finish line switches are mounted on the ceiling 74 of the housing 36*a* directly under the finish line for the racing game 20, as shown in FIG. 5. Normally open during a race, the switches are closed by the lugs 75 extending from the vertical legs 39 of the L-shaped members 33 when their respective racing figures cross the finish line.

Each of the relays 86 has two pairs of contacts, 94 and 95. Similarly each of the relays 87 has two pairs of contacts, 96 and 97. Each of the relays 88 has one pair of contacts 98. The pairs of contacts 94, 96 and 98 are normally open during the course of a race and are associated respectively with the win lights 99, the place lights 100 and the show lights 101. All of the lights 99, 100 and 101 are preferably mounted for display in the vertical panel 132 as shown in FIG. 2. The win light circuit for each racing figure is traced from the B+ line 102, to the win light 99, to the pair of contacts 94, to the ground; the place light circuit is traced from the B+ line 102, to the place light 100, to the pair of contacts 96, to the ground; and the show light circuit is traced from the B+ line 102, to the show light 101, to the pair of contacts 98, to ground. The positive terminal of a suitable direct current source, shown for illustrative purposes only as the battery 102*a*, is connected to the B+ line 102.

The win relay 83 has stationary contacts 102*b* and 103, and a movable contact 104 connected to the B+ line 102. The place relay 84 has stationary contacts 105 and 106, and a movable contact 107 connected to the stationary contact 103 of the win relay 83. The show relay 85 has stationary contacts 108 and 109, and a movable contact 110 connected to the stationary contact 106 of the place relay 84.

Each primary coil 86P is connected in series between the normally closed pair of contacts 95 and the terminal 111 of the primary coil 83P; each primary coil 87P is connected in series between the normally closed pairs of contacts 97 and the terminal 112 of the primary coil 84P; and each primary coil 88P is connected in series between the pairs of contacts 97 and the terminal 113 of the primary coil 85P.

To understand the operation of circuit 82*a*, assume that the racing figure 21 wins the race. As the figure 21 crosses the finish line, the lug 75 extending from the L-shaped member 33 supporting the figure 21 closes the finish line switch 90, thereby completing a circuit consisting of the switch 90, the normally closed pair of contacts 95, the primary coil 86P, the primary coil 83P, the stationary contact 102*b*, the movable contact 104, and the B+ line 102. Completion of this circuit activates the primary coils 83P and 86P, causing the engagement of movable contact 104 with stationary contact 103, the opening of the pair of contacts 95, and the closing of the contacts 94 to complete the win light circuit and energize the win light 99 associated with the finish line switch 90. The operation of these various contacts takes place substantially simultaneously. The primary coil 86P is timed to open the pair of contacts 95 before the place primary coil 84P is activated by a circuit completed through the finish line switch 90, the pairs of contacts 95 and 97, and the primary coil 87P. Such timing prevents actuation of the place relay 84P by the winning racing figure. If the place relay 84P were so actuated, the place light for the winning racing figure would be energized and the place light for the actual placing figure would be incapable of energization.

Assuming that the racing figure 22 crosses the finish line in the place position, the finish line switch 91 is next closed to complete a circuit consisting of the switch 91, the pair of contacts 95, the normally closed pair of contacts 97, the primary coil 87P, the primary coil 84P, the stationary contact 105, the movable contact 107, the stationary contact 103, the movable contact 104, and the B+ line 102. Completion of the place circuit activates the primary coils 84P and 87P to cause the engagement of the movable contact 107 with the stationary contact 106, the opening of the pair of contacts 97, and the closing of the pair of contacts 96 to complete the place light circuit and energize the place light 100 associated with the finish line switch 91. Again, the operation of these contacts occurs substantially simultaneously. The primary coil 87P is timed to open the pair of contacts 97 before the show primary coil 85P is activated through a circuit nicluding the finish line switch 91, the pairs of contacts 95 and 97, and the primary coil 88P. Such timing is necessary to prevent actuation of the show primary coil 85P by the placing racing figure. If coil 85P were now actuated, the show lights for the placing racing figure would be energized and the show lights for the actual showing figure would be incapable of energization.

If the racing figure 23 finishes in the show position to close the finish line switch 92, a show circuit is completed which consists of the switch 92, the pair of contacts 95, the pair of contacts 97, the primary coil 88P, the primary coil 85P, the stationary contact 108, the movable contact 110; the stationary contact 106, the movable contact 107, the stationary contact 103, the movable contact 104, and the B+ line 102. Completion of this show circuit activates the primary coils 85P and 88P to cause the engagement of the movable contact 110 with the stationary contact 109, and the closing of the pair of contacts 98 to complete the show light circuit and energize the show light 101 associated with finish line switch 92.

Any order of finish other than the one assumed will cause energization of the proper win, place and show lights in a manner exactly analogous to that just described.

When a race is completed, the players return the racing figures 21, 22, 23 and 24 to the desired starting line by moving the arm 77 of the double-pole-double-throw switch 49 into contact with the contacts 80 and 81, which are seen in FIG. 6. This reverses the polarity of the voltages applied to the meter motors 27 and the drive motors 25, thereby reversing the direction of rotation of their drive shafts. Each of the meter motors 27 rotates in the reverse direction until the lug 72 extending from its drive shaft 73 moves the arm 54 of the switch 53 from the contact 55 to the contact 56. The closing of the arm 54 with the contact 56 short circuits the meter motor 27 to the negative terminal of the battery 44 to stop the motor. During the course of its reverse rotation the lug 72 also closes the switch 28 to put that switch in the proper position for the start of a new race.

Each of the drive motors 25 rotates in the reverse direction until the lug 75 extending from the vertical leg 39 of its particular L-shaped member 33 moves the arm 69 of the switch 60 from contact 63 to contact 66, still assuming that the players have selected the circuit of switch 60 and its associated Starting Line 2 with the ganged switches 58 operated by the knob 76. Once the arm 69 closes with the contact 66, the motor 25 is short circuited to the negative terminal of the battery 44 and is thus stopped. Moreover, since the switches 60 are physically located directly beneath their associated Starting Line 2, the racing figures 21, 22, 23 and 24 driven by the motors 25 are stopped at Starting Line 2, in a position for the new race. The players may, of course, choose

any starting line by selecting the circuit of the desired starting line switch, either 59, 60 or 61. If the circuit of switch 59 is selected each motor 25 and its particular racing figure are stopped at Starting Line 1. If the circuit of switch 61 is selected, each motor 25 and its particular racing figure are stopped at Starting Line 3. The switches 59 and 61 are actuated by the lugs 75 in a manner analogous to the actuation of the switch 60 just described. The finish line switches 90, 91, 92 and 93, which are shown in FIG. 7, are opened by the lugs 75 during the reverse rotation of the motors 25.

The reversal of the motors 25 and 27 places all elements of the motor circuit of FIG. 6 in position for the start of a new race except the switches 53 and the chosen starting line switches 60. The arm 54 of each of the switches 53 is closed with the contact 56 instead of the contact 55; the arm 69 of each of the switches 60 is closed with the contact 66 instead of the contact 63. The resetting of each of the arms 54 to its contact 55 and the resetting of each of the arms 69 to its contact 63 occurs substantially simultaneously with the start of the race. Movement of the arm 77 of the double-pole-double-throw switch 49 into contact with the contacts 78 and 79 connects the positive terminal of the battery 44 to each of the motors 25 and 27 through the supply line 45. The negative terminal of the battery 44 is directly connected to each of the meter motors 27 through the supply line 50 and the contact 56 of the switch 53. It is directly connected to each of the drive motors 25 through the supply line 50 and the contact 66 of the switch 60. A voltage is thus applied to the motors 25 and 27 which, under the conditions assumed for their operation, drives them in the forward or counterclockwise direction. The reverse or clockwise rotation of the motors 25 and 27 has placed the lugs 72 extending from the output shafts of the motors 27 just to the clockwise side of the switches 53 and the lugs 75 extending from the L-shaped arms 33 just to the clockwise side of the switches 60. The counterclockwise rotation of each of the meter motors 27 therefore causes each of the lugs 72 to move the arm 54 to the contact 55 at the same time the counterclockwise rotation of each of the drive motors 25 causes each of the lugs 75 to move the arm 69 to the contact 63. During the brief period that each of arms 54 is moving from the contact 56 to the contact 55 and each of the arms 69 is moving from the contact 66 to the contact 63, both the motors 25 and 27 are disconnected from the negative terminal of the battery 44. The motors have sufficient inertia and the switches 53 and 60 are sufficiently sensitive, however, to insure that each of the arms 54 reaches the contact 55 and that each of the arms 69 reaches the contact 63. The actuation of the contacts 55 and 63 reconnects to motors 25 and 27 to the negative terminal of the battery 44. This actuation places all motor circuit elements in condition for the race and starts the race in earnest. The players then operate the unique pacing controls in the manner previously described.

The coin plunger 71 is adapted to actuate both the double-pole-double-throw switch 49 and the reset switch 114 shown in FIG. 8. Operation of the coin plunger 71 at the start of the race closes the reset switch 114 to activate the secondary coils 86S, 87S, 88S, 83S, 84S and 85S, thereby resetting the various contacts in the finish line circuit 82 to the position shown in FIG. 7. After resetting occurs, the switch 114 must be opened in order to place the primary coils in condition for operation at the finish of a race. One convenient way of accomplishing this is to adapt one of the lugs 75 extending from the L-shaped members 33 mounting the racing figures to open the switch 114 soon after the start of a race. Another way is to gang the switches 49 and 114 in such a manner that the switch 114 is closed when the switch 49 is closed with the contacts 80 and 81 to move the racing figures in the reverse direction, and opened when the switch 49 is closed with the contacts 78 and 79 to move the racing figures in the forward direction.

FIG. 12 illustrates a slightly modified version of the circuit of FIG. 6. Corresponding elements in the two figures are given the same reference numerals. Additions to the circuit of FIG. 6 which are evident in FIG. 12 include the variable resistor 139 in parallel with the rheostat 31 in the meter motor branch 51, the switch 140 in series with the rheostat 31, and the variable resistor 141 in the drive motor branch 57. Also evident is the substitution of the single starting line switch 144 for the switches 58, 59, 60 and 61 in FIG. 6; the disconnection of the supply lines 45 and 46 from the drive motor branch 57; and the connection of a supply line 142 from the positive terminal of the battery 44, through the switch 143, which is ganged with the double-pole-double-throw switch 49, to the drive motor branch 57. The modifications of the circuit of FIG. 6 which are shown in FIG. 12 may also be adapted to the circuit of FIG. 14, if desired.

The basic operation of the circuit of FIG. 12 with regard to the pacing concept is the same as the operation of the circuit of FIG. 6. The rheostats 26 and 31 are so ganged that a decrease in the resistance of the rheostat 26 to increase the speed of the drive motor 25 results in a corresponding decrease in the resistance of the rheostat 31 to increase the speed of the meter motor 27 and thereby hasten the time at which the meter motor 27 opens the switch 28. The speed of the meter motor 27 increases at a faster rate than the speed of the drive motor 25 because of the effect of the variable resistor 141, as is subsequently explained. The lug 72 extending from the drive shaft 73 of the meter motor 27 is also adapted to open the switch 140 in a smilar manner. The opening of the switch 140 slows the speed of the meter motor 27 to a value determined primarily by the magnitude of the resistance of the variable resistor 139. While such slowing is convenient for practical reasons, it is not essential to the operation of the circuit. Accordingly, switch 140 and variable resistor 139 may be omitted, if desired, and the variable resistor 52 of FIG. 6 may be used instead.

The players begin a race with the circuit of FIG. 12 by operating the coin slide 71 to close the arm 77 of the double-pole-double-throw switch 49 with the contacts 78 and 79 and to simultaneously close the switch 143 and starting line switch 144. Any suitable means may be employed to adapt the coin slide 71 to operate these various switches. Alternatively, actuating means independent of the coin slide 71 may be used. The race then proceeds in the manner previously described. When the racing figures finish the race and again reach the starting line, the lugs 75 extending from the L-shaped arms 33 which support the figures open the starting line switches 144, disconnecting the drive motors 25 from the battery 44 and stopping them. The starting line switches 144 are physically positioned directly beneath the starting line in a similar manner to the positioning of the switches 59, 60 and 61 in FIG. 5. Consequently, the racing figures are stopped at the starting line, in proper position for the start of the next race. If desired, the starting line switches 144 may be adapted for movement in order to provide for a plurality of possible starting lines. Unlike the racing figures in the circuit of FIG. 6, which are moved in the reverse direction to properly position them for the start of a new race, the racing figures for the circuit of FIG. 12 always move in the forward direction, moving in that direction after the finish of a race until they again reach the starting line.

The procedure for the resetting of the meter motors 27 for the start of a new race is the same in FIG. 12 as in FIG. 6. The players reverse the direction of rotation of the drive shafts 73 of the meter motors 27 by reversing the double-pole-double-throw switch 49 with the coin slide 71. The meter motors 27 then rotate in the reverse direction until they operate the switch 53 in the manner previously explained.

As previously stated, the faster rate of increase of the speed of the meter motor 27 in comparison to the rate of increase of the speed of the drive motor 25, shown by the curves in FIG. 13, is achieved in the circuit of FIG. 12 by the use of the variable resistor 141. Because the ganged rheostats 26 and 31 in FIG. 12 are identical for economy of production, the relative rates of increase of the speed of the motors 25 and 27 would be substantially the same in the absence of a resistor like the variable resistor 141. In such a case, the difference in speed between the meter motor 27 and the drive motor 25 would be approximately constant at every setting of the speed control knob 82. In FIG. 12, the variable resistor 141 is of sufficient magnitude to slow the rate of increase of the speed of the drive motor 25 an appreciable amount below that of the meter motor 27.

The racing game 20 as presently described is essentially a game of skill, as all of the corresponding operational elements for each racing figure, especially the drive motors 25 and the meter motors 27, are made as nearly equal as possible. If desired, however, the element of chance may be added to the racing game 20 by means of the conductive cylinder 130 shown in FIG. 6. The cylinder 130, which is rotatably mounted within the vertical panel 132 of the racing game 20 shown in FIG. 2, is divided into four columns, one for each of the four racing figures, 21, 22, 23 and 24. Associated with each column is a contact 131 affixed to the cylinder 130. Contacts 133 corresponding to the contacts 131 are fixedly mounted within the vertical panel 132 in such a pattern that only some of the contacts 131 engage some of the contacts 133 when the cylinder 130 is rotated by a player of the game by means of the dial 134, shown in FIG. 2. The conductive cylinder 130 is electrically connected by the line 135 to the supply line 45, which is a common terminal for the variable resistors 52 in the meter motors branches 51. Each of the contacts 133 is connected to the terminal 136 of one of the resistors 52 by the lines 137.

The conductive cylinder 130 in effect handicaps certain of the racing figures, 21, 22, 23 and 24. At each setting of the cylinder 130 certain of its contacts are in engagement with the stationary contacts 133, and certain ones are not. Those resistors 52 like the left one in FIG. 6, whose contact 133 is in engagement with the corresponding contact 131, are shorted out of the meter motor branches 51. The removal of the resistor 52 increases the speed of its associated meter motor 27 and consequently shortens the time during which the switch 28 will remain closed. The racing figures associated with these resistors 52 are therefore handicapped because the time during which higher voltages may be applied to their drive motors 25 is shortened. In contrast, those resistors 52 like the right one in FIG. 6, whose contact 133 is not in engagement with the corresponding contact 131, remain an effective part of the meter motor branches 51. Their meter motors 27 do not increase in speed. Accordingly, their associated racing figures become the favorite in the race. A plurality of the contacts 133 is required for each of the resistors 52 to obtain a wide range of handicapping possibilities.

A further refinement of the racing game 20 may be made by printing the odds on the handicapped racing figures on the cylinder 130 for display through the windows 138 in the vertical panel 132, as shown in the FIG. 2. While the actual odds may be quoted for each setting of the cylinder 130, a more suspense filled race is achieved if the actual favorite is occasionally quoted as the long shot. An exemplary odds chart 138 for such a system of quoting the favorite as the long shot is shown in FIG. 11. The odds chart 138 is for a racing game of six racing figures in which the contacts 133 are so positioned that in any one race four of the figures are handicapped and two are favored. Eighteen race combinations are covered by the chart 138. The two figures whose odds are marked with the asterisk in each combination are the favorites. It may be noted that the favorite is sometimes quoted at the proper odds of 2–1, but is occasionally quoted at odds as high as 16–1 for the particular chart illustrated. For that particular race, then, the 16–1 long shot is the actual co-favorite. However, over the total of eighteen race combinations, the 16–1 quotations are mathematically correct in that there are eight quotations of 16–1, but only one of the racing figures with that quotation is actually co-favored and has one out of two chances of winning. Thus, of all the eight racing figures carrying 16–1 odds, only the co-favored one should theoretically win. The odds that any particular one of the eight will win is correctly stated as 16–1. This method of quoting the odds keeps the players from realizing which racing figures are actually favored and thus sustains their interest and enthusiasm for the game.

A mechanical alternative to the electrical circuit of FIG. 6 for realistically simulating the concept of pace in an actual race is schematically shown in FIG. 10. The structure for the mechanical alternative comprises a rigid frame 150 with an upper horizontal member 151 and a lower horizontal member 152 joined by a vertical member 153. Rotatably mounted at a suitable angle to the horizontal between the horizontal members 151 and 152 is a shaft 154 carrying a conical drive wheel 155 and a concial meter wheel 156. A large coil compression spring 157 extending from the bottom 158 of the lower horizontal member 152 is secured to the floor 35 of the housing 36*a* to adapt the rigid frame 150 for vertical movement within the housing 36*a*. The frame 150 is maintained in the substantially erect position shown in FIG. 10 by the handle 159 extending from the top 160 of the upper horizontal mmeber 151 through the guide hole 161 in the ceiling 74 of the housing 36*a*.

A racing figure shaft 162 carrying a pulley 163 and a friction wheel 164 is rotatably and pivotably mounted by any convenient means to the ceiling 74. The pulley 163 is connected in driving relation to the support for a racing figure by the belt 165. A tension spring 166 normally biases the racing figure shaft 162 to pivot the wheel 164 into frictional engagement with the conical drive wheel 155. A cylindrical drive shaft 167 is rotatably mounted in substantially parallel relation to the racing figure shaft 162 in a block 168 which is rigidly secured to one of the walls of the housing 36*a*. Both the pulley 169 attached to the cylindrical drive shaft 167 and the preferably identical pulley 170 attached to the shaft 154 are connected in driven relation to a main drive shaft (not shown). The block 168 also rotatably mounts a timing shaft 171 which carries a pulley 172 connected to a metering mechanism (not shown) and a friction wheel 173 which is biased into frictional engagement with the conical meter wheel by the tension spring 174.

One of the rigid frames 150 is associated with each of the racing figures. The commencement of rotation of the main drive shaft (not shown) at the start of each race commences movement of the racing figure for each frame 150 by a power transmission path which includes the pulley 170, the shaft 154, the conical drive wheel 155, the friction wheel 164, the racing figure shaft 162, the pulley 163 and the belt 165 connected in driving relation to the support for the racing figure. The tower of concentric tubes 32, shown in FIG. 3, may be easily adapted for use with the belts 165 by substituting pulleys for the bevel gears 36 attached to the tubes 32 in FIG. 3. The commencement of rotation of the main drive shaft also commences operation of the metering mechanism by a power transmission path which includes the pulley 170, the shaft 154, the conical meter wheel 156, the friction wheel 173, the timing shaft 171 and the pulley 172 connected to the metering mechanism.

The player of the racing game can move his racing figure faster by pushing the rigid frame 150 downward against the compression spring 157 with the handle 159

to engage a portion of the conical drive wheel **155** of greater diameter with the friction wheel **164**. Pushing down the rigid frame **150**, however, also increases the speed of the metering mechanism by engaging a portion of the conical meter wheel **156** of greater diameter with the friction wheel **173**.

Increasing the speed of the metering mechanism decreases the period of time the raicng figures may move at higher speeds because after a certain amount of movement the metering mechanism, which may conveniently be a clock mechanism, actuates a relay **175** which pivots the racing figure shaft **162** to move the friction wheel **164** away from the conical drive wheel **155** and into engagement with the cylindrical drive shaft **167**. The racing figure is then able to move only at a lower speed determined by the diameter of the cylindrical drive shaft **167**, which is less than the diameter of any portion of the conical drive wheel **155**. After actuation of the relay **175** the power transmission path for a racing figure includes the pulley **169**, the cylindrical drive shaft **167**, the friction wheel **164**, the racing figure shaft **162**, the pulley **163**, and the belt **165**.

The operational effects of the rigid frames **150** are thus similar to those of the circuit of FIG. 6. For the initial portion of a race the player is able to set the speed of his racing figure at one of the speeds in the range of relatively high speeds determined by the various diameters of the conical drive wheel **155** by moving the rigid frame **150** up and down with the handle **159**. Before the end of the race, however, he loses control of his racing figure because the metering mechanism actuates the relay **175** to the net result of setting the speed of the racing figure at a lower speed determined by the diameter of the cylindrical drive shaft **167**. During the period the player has control, he can increase the speed of his racing figure only by simultaneously increasing the speed of the metering mechanism and thereby hastening the time at which the relay **175** will be actuated to relieve him of control of the speed of the racing figure. To accurately simulate pace, the speed of the metering mechanism must increase at a faster rate than the speed of its associated racing figure. A preferred way of achieving this necessary speed relation is to make the conical meter wheel **156** of more rapidly increasing diameter than the conical drive wheel **155**.

Many additions and variations may be made in a complex racing game such as that described above. One beneficial addition, for example, is a clock which records the time of the winning racing figure in each race. Such a clock makes the game interesting for a single player because it challenges him to see how fast a time he can achieve.

It is understood that my invention is not confined to the particular construction and arrangement of parts herein illustrated and described, but embraces all such modified forms thereof as come within the scope of the following claims.

I claim:

**1.** In an electric racing game of skill having a plurality of racing figures, a motor control circuit for each of said racing figures, each of said motor control circuits comprising electric supply lines, an electric drive motor and a first fixed control connected in series across said supply lines, a series branch consisting of a switch and a first variable control means, said series branch being connected in parallel with said first control means and in series with said drive motor, said switch being closed at the start of a race, said first variable control means being adapted to vary the speed of said drive motor above a lower limit substantially determined by the value of said first fixed control means, an electric meter motor and a second variable control means connected in series across said supply lines, means ganging said first and second variable control means whereby the variation of said first variable control means to increase the speed of said drive motor results in a variation of said second variable control means to increase the speed of said meter motor disproportionately means connecting said meter motor to the switch which is in series with said first variable control means so that after a fixed number of revolutions of said meter motor, said switch will be opened eliminating said first variable control means as a means of control over the drive circuit thereby reducing the speed of said drive motor to the above said lower speed determined by the said first fixed control means.

**2.** The invention of claim **1** wherein individual reversing switches are included in the meter motor circuits to permit their reversal.

**3.** The invention of claim **1** wherein a means of handicapping comprises supplementary resistances in the meter circuits and a randomly rotatable cylinder with terminals to selectively engage said supplementary resistances in accordance with a mathematical matrix which relates quoted odds to true odds, and printed odds on said cylinder positioned in such relationship to said terminals to display the quoted odds for each race.

**4.** The invention of claim **1** including at least one starting line and switch means located at the starting line are arranged to short circuit the drive motor to stop the racing pieces through physical contact with said racing pieces and to also complete the circuit during the racing cycle.

**5.** The invention of claim **4** including a plurality of starting lines, switch means located at each of the starting lines and wherein ganged switches are placed in the drive motor circuits to allow the selection of the desired set of starting line switches.

**6.** The invention of claim **1** wherein each racing piece is fastened to a hinged arm with a spring located at the hinge.

**7.** In an electric racing game of skill having a plurality of racing figures, a motor control circuit for each of said racing figures, each of said motor control circuits comprising a pair of direct current supply lines, a direct current drive motor and a first resistance connected in series across said supply lines, a series branch consisting of a switch and a first rheostat, said series branch being connected in parallel with said first resistance and in series with said drive motor, said switch being closed at the start of a race, said first rheostat being adapted to vary the speed of said drive motor above a lower speed substantially determined by the value of said first resistance, a direct current meter motor and a second rheostat connected in series across said supply lines, means ganging said first and second rheostats whereby the variation of said first rheostat to increase the speed of said drive motor results in a variation of said second rheostat to increase the speed of said meter motor disproportionately, means connecting said meter motor to said switch which is in series with said first rheostat so that after a fixed number of revolutions of said meter motor said switch will be opened eliminating said first rheostat as a control over the drive circuit thereby reducing the speed of said drive motor to the above said lower speed determined by said first resistance.

**8.** A racing game comprising, a plurality of racing figures, mounting means for each of said racing figures, a first shaft engaged in driving relation with each of said mounting means, a cylindrical drive shaft and a conical drive wheel adapted to drive each of said first shafts, means driving said cylindrical shafts at a constant speed independent of manual control, every point on the circumference of said conical drive wheels having a greater lineal velocity than any point on the circumference of said cylindrical drive shafts, each of said first shafts being engaged in driving relation with said respective conical drive wheel at the start of a race, means to selectively drive each of said first shafts from portions of said respective conical drive wheel having different diameters to thereby vary the speed of said driven first shafts, means

responsive to said selective drive means for independently limiting the duration each of said first shafts is in driving relation with said conical drive wheel during a particular race, and means responsive to said limiting means to engage each of said first shafts in driving relation with said respective cylindrical drive shaft at the end of said duration.

9. In an electric racing game of skill having a plurality of racing figures, a motor control circuit for each of said racing figures, each of said motor control circuits comprising electric supply lines, an electric drive motor, a first fixed control, a switch, and a first variable control means connected in series across said supply lines, said switch being closed at the start of a race, said first variable control means being adapted to vary the speed of said drive motor, an electric meter motor and a second variable control means connected in series across said supply lines, means ganging said first and second variable control means whereby the variation of said first variable control means to increase the speed of said drive motor results in a variation of said second variable control means to increase the speed of said meter motor disproportionately, means connecting said meter motor to the switch which is in series with said first variable control means so that after a fixed number of revolutions of said meter motor, said switch will open thereby stopping said drive motor.




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