United States Patent [19]

Labis

[11] **3,729,193**

[45] **Apr. 24, 1973**

[54] ELECTRONIC RACING GAME

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[21] Appl. No.: **116,347**

[52] **U.S. Cl.** .....**273/86 B,** 273/138 A
[51] **Int. Cl.**.....**A63f 9/14**
[58] **Field of Search** .....273/86 B, 86 F, 86 G, 273/138 A

[56] **References Cited**

UNITED STATES PATENTS

2,133,165	10/1938	Eisenberg et al.	273/86 F
2,202,572	5/1940	Casstevens	273/86 F

FOREIGN PATENTS OR APPLICATIONS

1,193,947	6/1970	Great Britain	273/86 F

Primary Examiner—Anton O. Oechsle
Attorney—Martha G. Pugh

[57] **ABSTRACT**

A method and system for racing a plurality of motor driven units along a track which combines a random factor, not subject to control, with manually actuated means for establishing odds between the racing units at the beginning of each race. In a preferred embodiment, the heart of the system comprises two pulse sources operating at substantially different nonharmonic frequencies which are characterized by built-in frequency drifts. The higher frequency pulse source drives a system of stepping selectors through a repetitive cycle. The initial manual arrangement of a group of odds selector dials determines the number of times a power circuit is completed to any specific racing unit as the stepping system proceeds through its cycle. At random contacts during the stepping cycle, depending on the operation of the second pulse source, electrical current passes through one of the power circuits momentarily completed, to drive one or another of the racing units to spurt ahead. This continues until one or more of the units cross an arbitrary finish line. In a preferred embodiment, the racing units are motor driven horses. The odds manually set on each of the horses at the beginning of the race are also indicated on an electronic tote board, which is electronically triggered to indicate Win, Place and Show, at the end of each race, and also, the amount paid on each of the winning horses. Additional features include means for setting and counting races of more than one lap.

24 Claims, 16 Drawing Figures

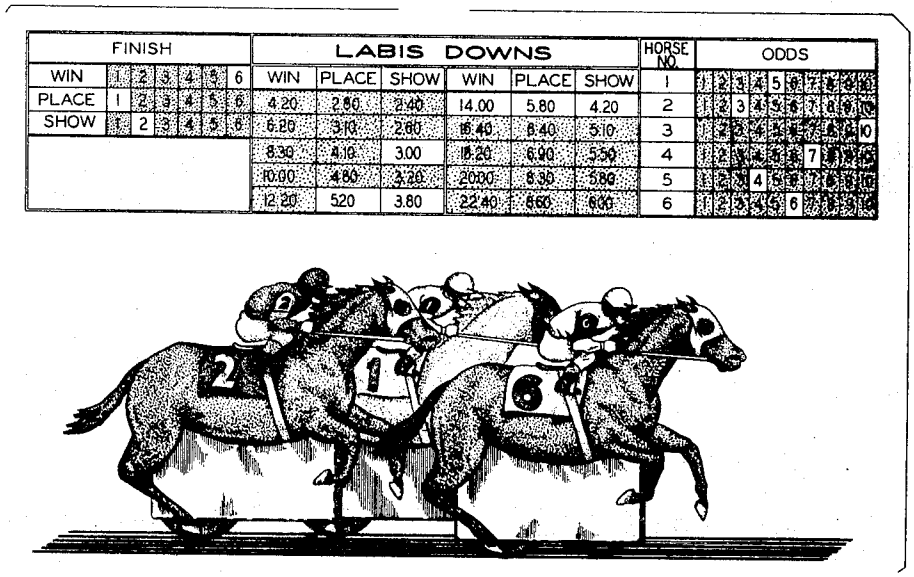

FIG. 1

FINISH						LABIS DOWNS						HORSE NO.	ODDS									
		2	3	4	5	6	WIN	PLACE	SHOW	WIN	PLACE	SHOW		1	2	3	4	5	6	7	8	9	10
WIN																							
PLACE	1	2	3	4	5	6	4.20	2.60	2.40	14.00	5.80	4.20	2	1	2	3	4	5	6	7	8	9	10
SHOW	1	2	3	4	5	6	6.20	3.10	2.60	16.40	8.40	5.10	3	1	2	3	4	5	6	7	8	9	10
							8.30	4.10	3.00	18.20	6.90	5.50	4	1	2	3	4	5	6	7	8	9	10
							10.00	4.80	3.20	20.00	8.30	5.80	5	1	2	3	4	5	6	7	8	9	10
							12.20	5.20	3.80	22.40	8.60	6.00	6	1	2	3	4	5	6	7	8	9	10

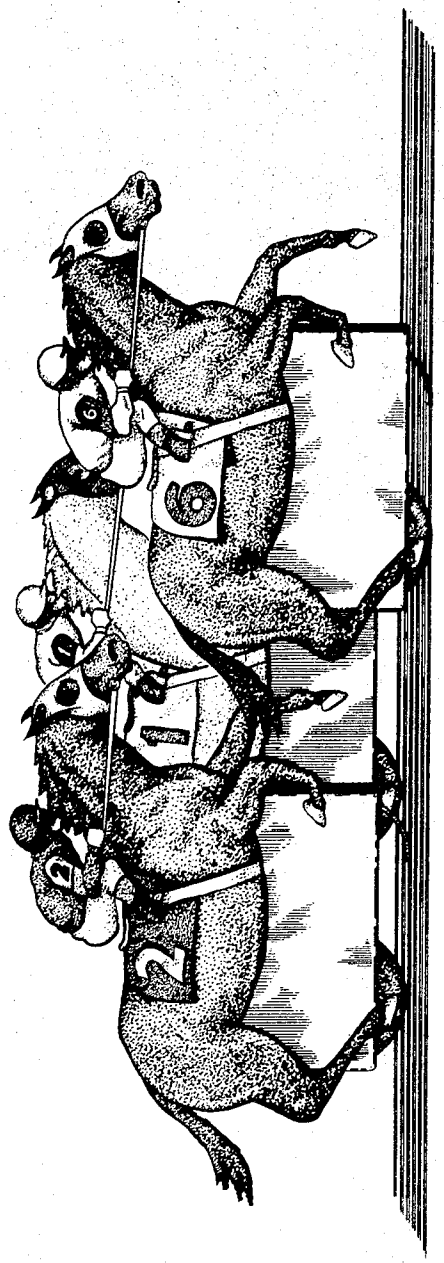

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FIG. 2

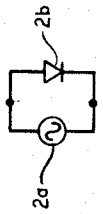

2b
2a

FIG. 3

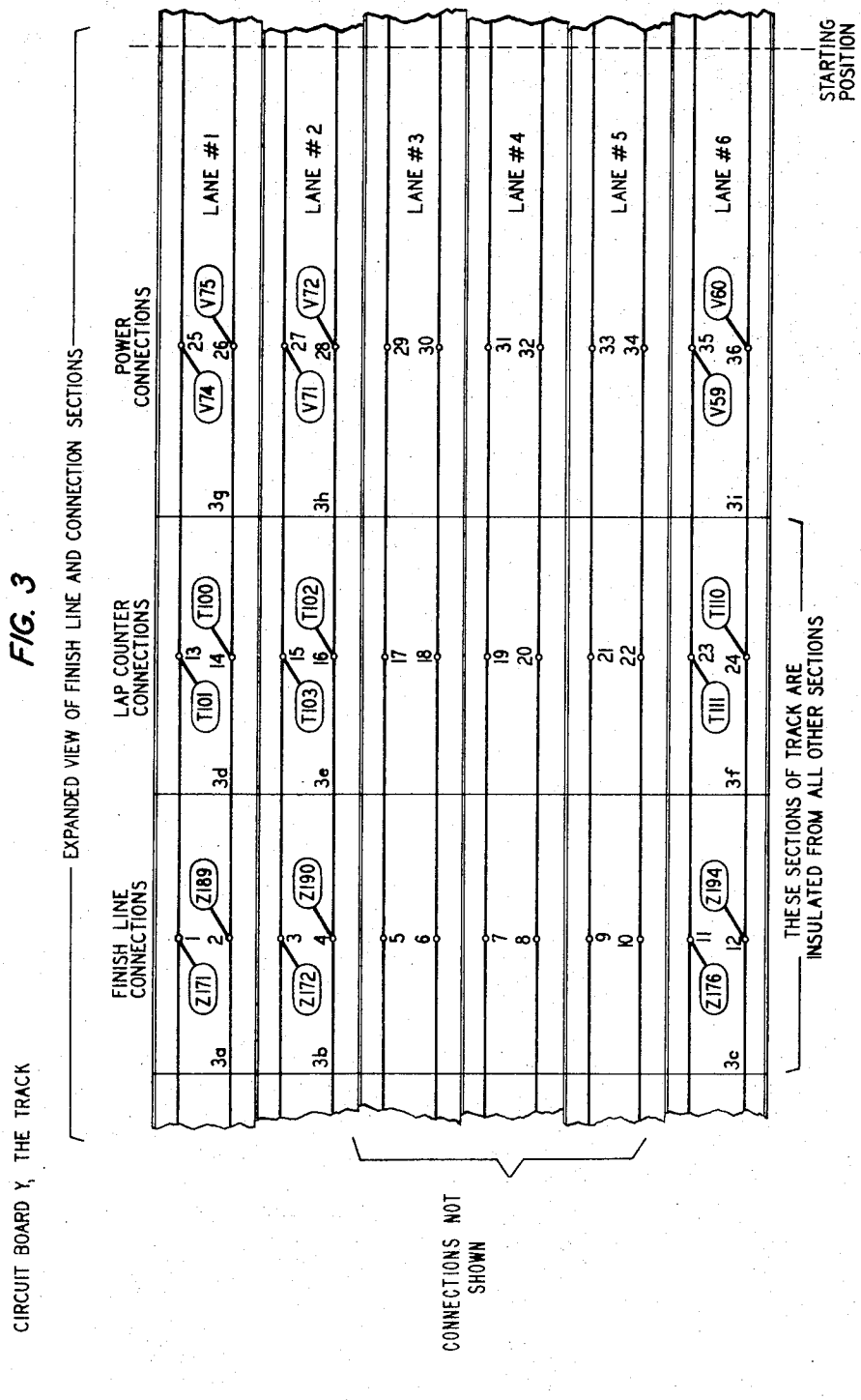
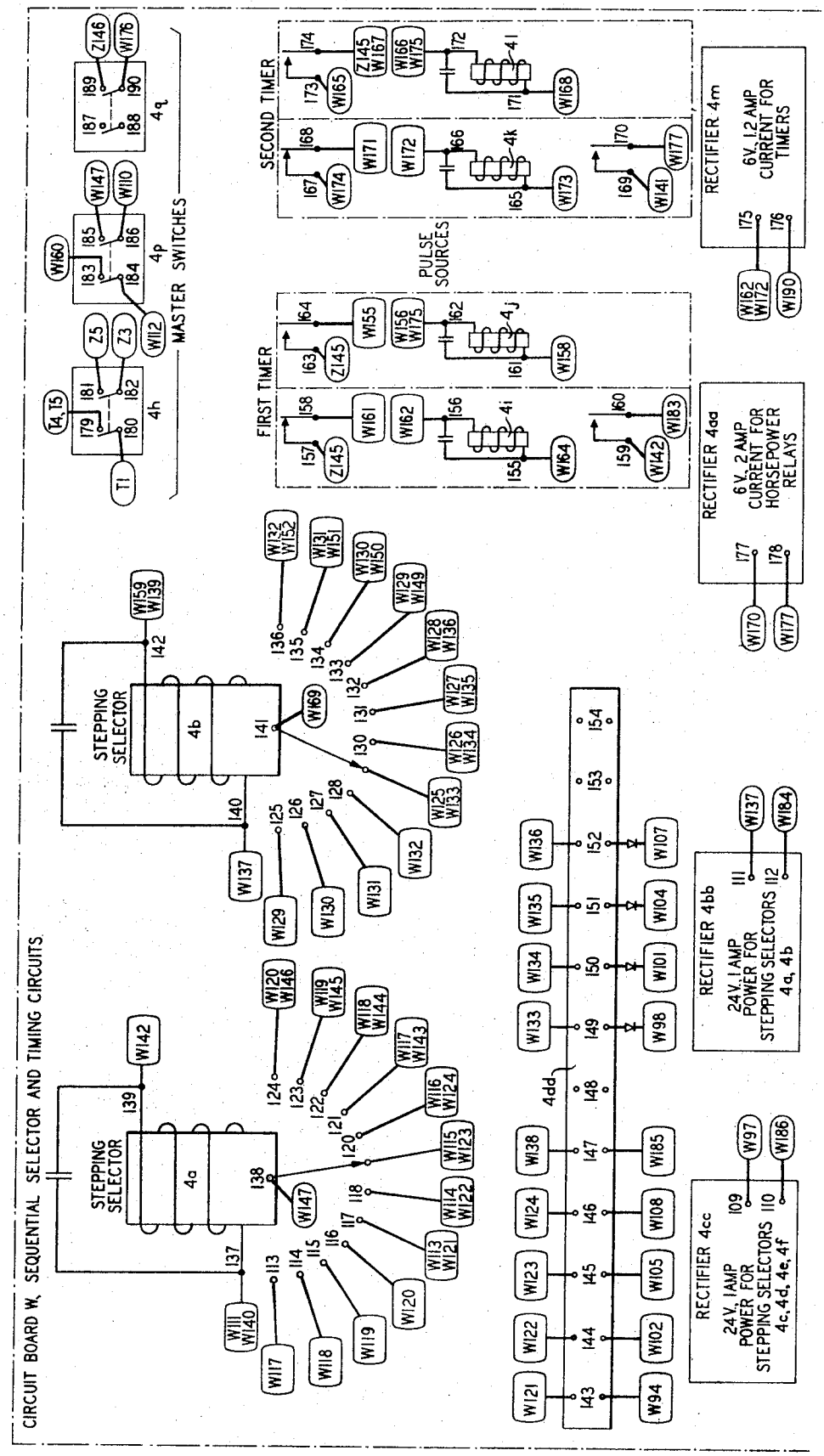

CIRCUIT BOARD Y, THE TRACK
EXPANDED VIEW OF FINISH LINE AND CONNECTION SECTIONS
FINISH LINE CONNECTIONS
LAP COUNTER CONNECTIONS
POWER CONNECTIONS
TRACK CONTINUES AROUND TO FORM 4' X 8' OVAL
STARTING POSITION
LANE #1
LANE #2
LANE #3
LANE #4
LANE #5
LANE #6
Z171
Z189
Z172
Z190
Z176
Z194
T101
T100
T103
T102
T111
T110
V74
V75
V71
V72
V59
V60
3a
3b
3c
3d
3e
3f
3g
3h
3i
CONNECTIONS NOT SHOWN
THESE SECTIONS OF TRACK ARE INSULATED FROM ALL OTHER SECTIONS

FIG. 4A


CIRCUIT BOARD W, SEQUENTIAL SELECTOR AND TIMING CIRCUITS
STEPPING SELECTOR
4a
4b
MASTER SWITCHES
4h
4p
4q
FIRST TIMER
SECOND TIMER
PULSE SOURCES
RECTIFIER 4aa
6 V, 2 AMP CURRENT FOR HORSEPOWER RELAYS
RECTIFIER 4m
6V, 12 AMP CURRENT FOR TIMERS
RECTIFIER 4bb
24 V, 1 AMP POWER FOR STEPPING SELECTORS 4a, 4b
RECTIFIER 4cc
24 V, 1 AMP POWER FOR STEPPING SELECTORS 4c, 4d, 4e, 4f

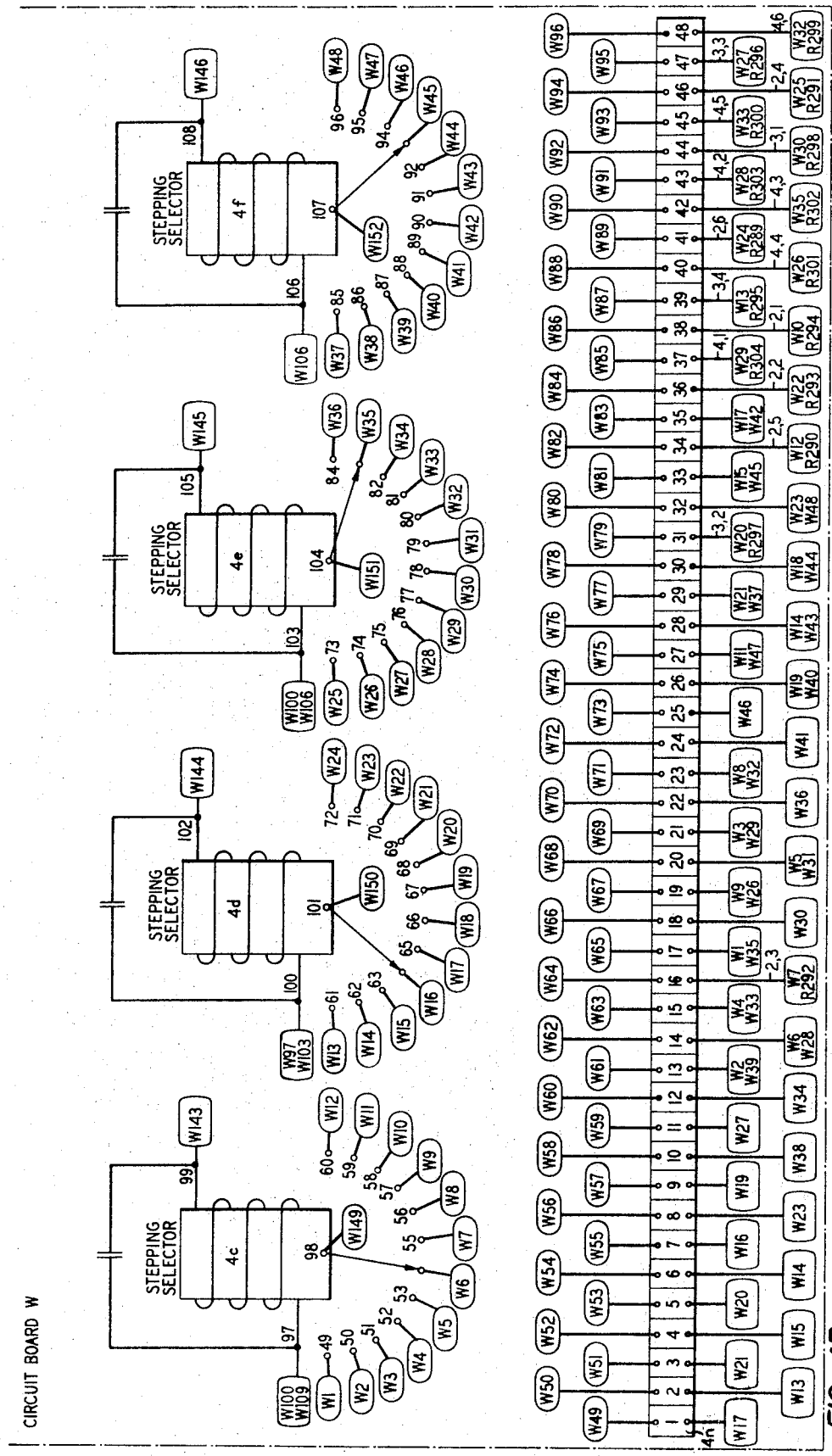

CIRCUIT BOARD W
STEPPING SELECTOR
4c
4d
4e
4f
W1 W2 W3 W4 W5 W6 W7 W8 W9 W10 W11 W12 W13 W14 W15 W16 W17 W18 W19 W20 W21 W22 W23 W24 W25 W26 W27 W28 W29 W30 W31 W32 W33 W34 W35 W36 W37 W38 W39 W40 W41 W42 W43 W44 W45 W46 W47 W48
W100 W109
W97 W103
W100 W106
W106
W150
W151
W152
W143
W144
W145
W146
W292
W293
W294
W295
W296
W298
W299
W300
W301
W302
W303
W304
W42
W43
W44
W45
W46
W47
W48

FIG. 4B

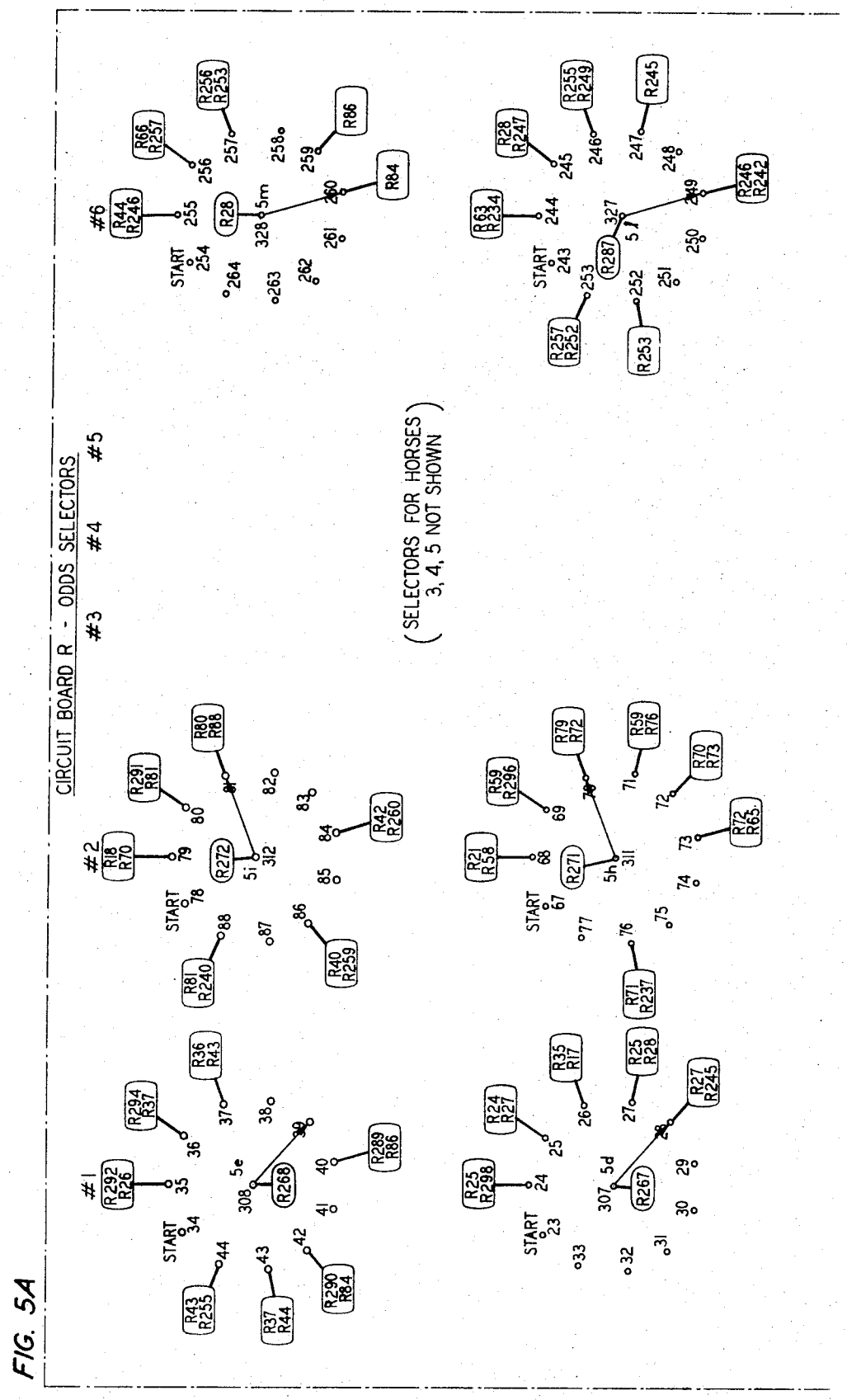

CIRCUIT BOARD R - ODDS SELECTORS
#1
#2
#3
#4
#5
#6
START
R292 R26
R294 R37
R43 R255
R37 R44
R290 R84
R289 R86
R36 R43
R268
R81 R240
R40 R259
R18 R70
R291 R81
R80 R88
R272
R42 R260
R44 R246
R66 R257
R256 R253
R28
R86
R84
R25 R298
R24 R27
R35 R17
R25 R28
R27 R245
R267
R71 R237
R21 R58
R59 R296
R79 R72
R271
R59 R76
R70 R73
R72 R65
R63 R234
R28 R247
R255 R249
R245
R246 R242
R257 R252
R253
R287
(SELECTORS FOR HORSES 3, 4, 5 NOT SHOWN)

FIG. 5A

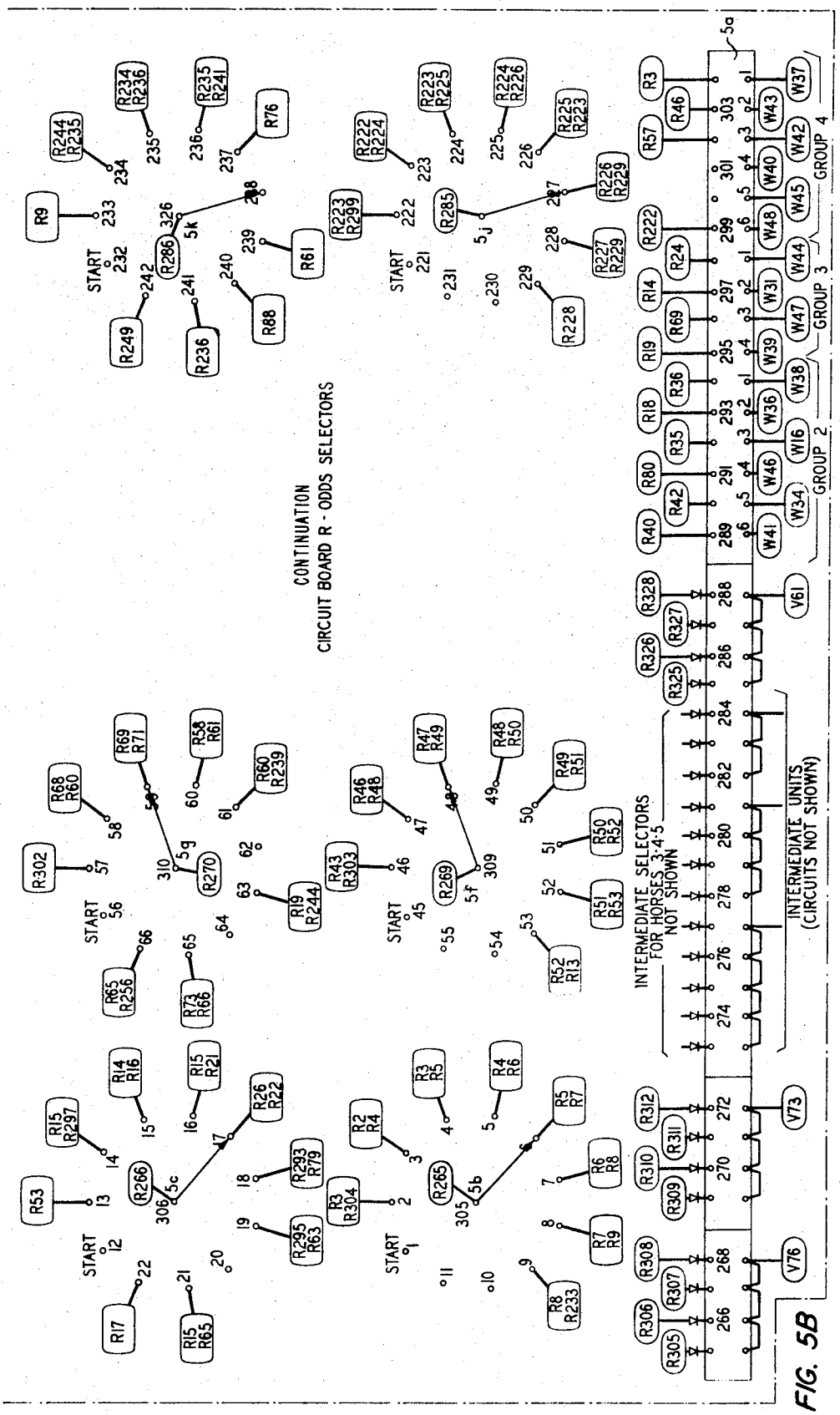

CONTINUATION
CIRCUIT BOARD R - ODDS SELECTORS
INTERMEDIATE SELECTORS FOR HORSES 3-4-5 NOT SHOWN
INTERMEDIATE UNITS (CIRCUITS NOT SHOWN)
GROUP 2
GROUP 3
GROUP 4
START
R9
R53
R302
R68 R60
R69 R71
R58 R61
R60 R239
R46 R48
R47 R49
R48 R50
R49 R51
R50 R52
R51 R53
R52 R13
R43 R303
R19 R244
R65 R256
R73 R66
R15 R297
R14 R16
R15 R21
R26 R22
R293 R79
R295 R63
R3 R304
R2 R4
R3 R5
R4 R6
R5 R7
R6 R8
R7 R9
R8 R233
R17
R15 R65
R266
R265
R270
R269
R249
R236
R88
R61
R76
R235 R241
R234 R236
R244 R235
R286
R285
R223 R299
R222 R224
R223 R225
R224 R226
R225 R223
R226 R229
R227 R229
R228
R222
R24
R69
R36
R35
R42
R40
R80
R18
R19
R14
R57
R46
R3
R326
R327
R328
R325
R312
R311
R310
R309
R308
R307
R306
R305
V76
V73
V61
W34
W16
W38
W47
W44
W45
W42
W37
W41
W46
W36
W39
W31
W48
W40
W43

FIG. 5B

FIG. 6

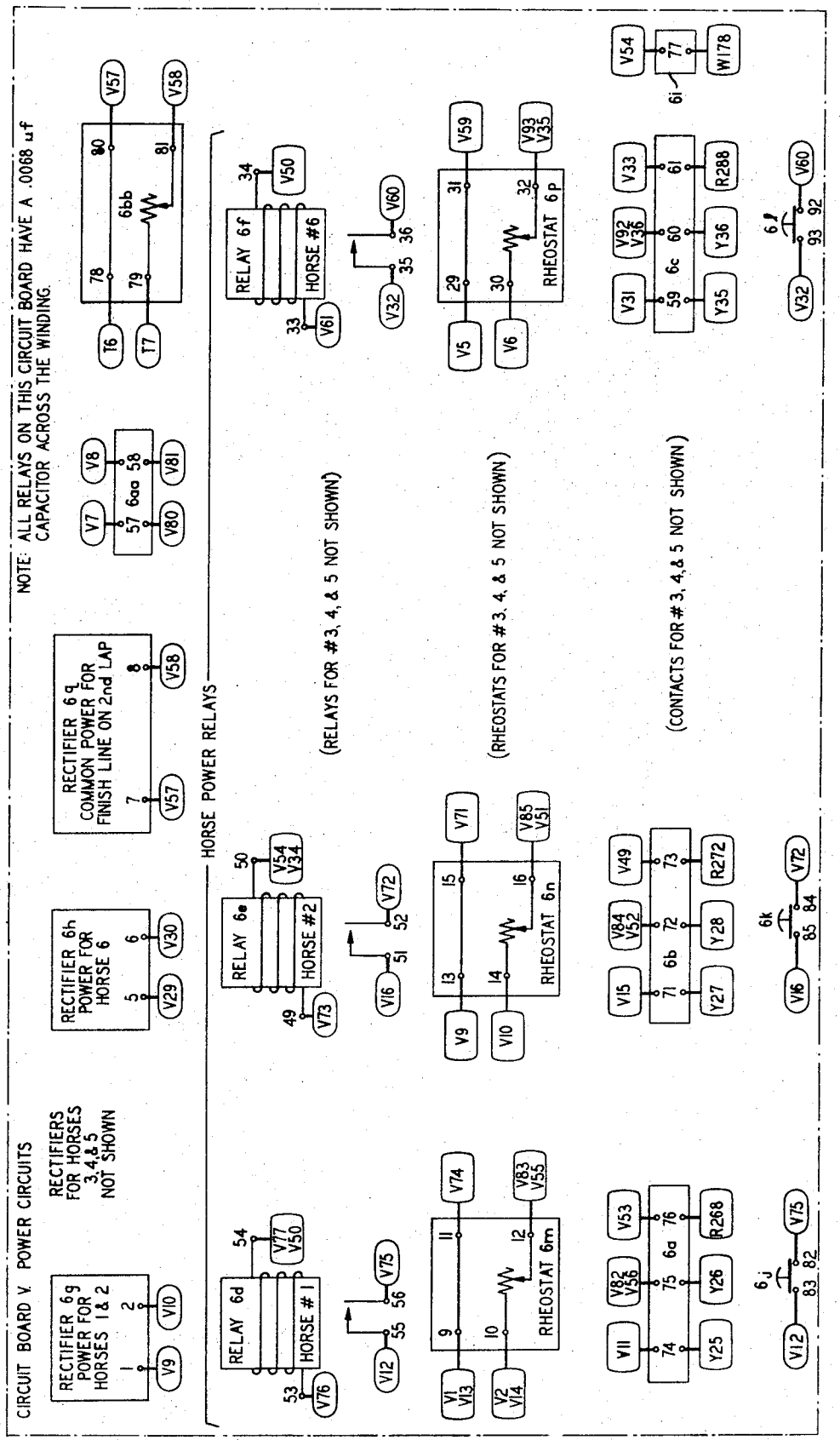
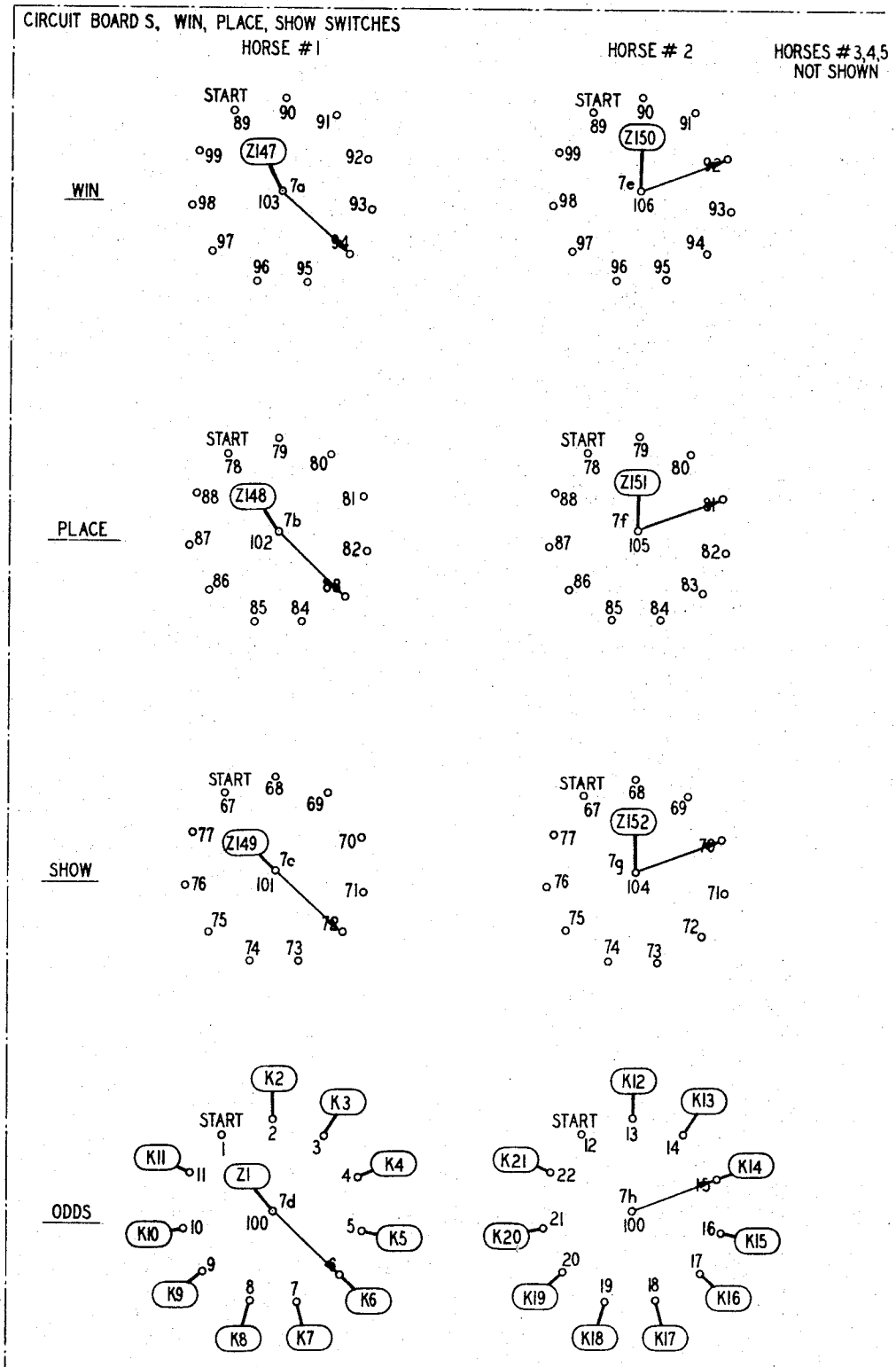
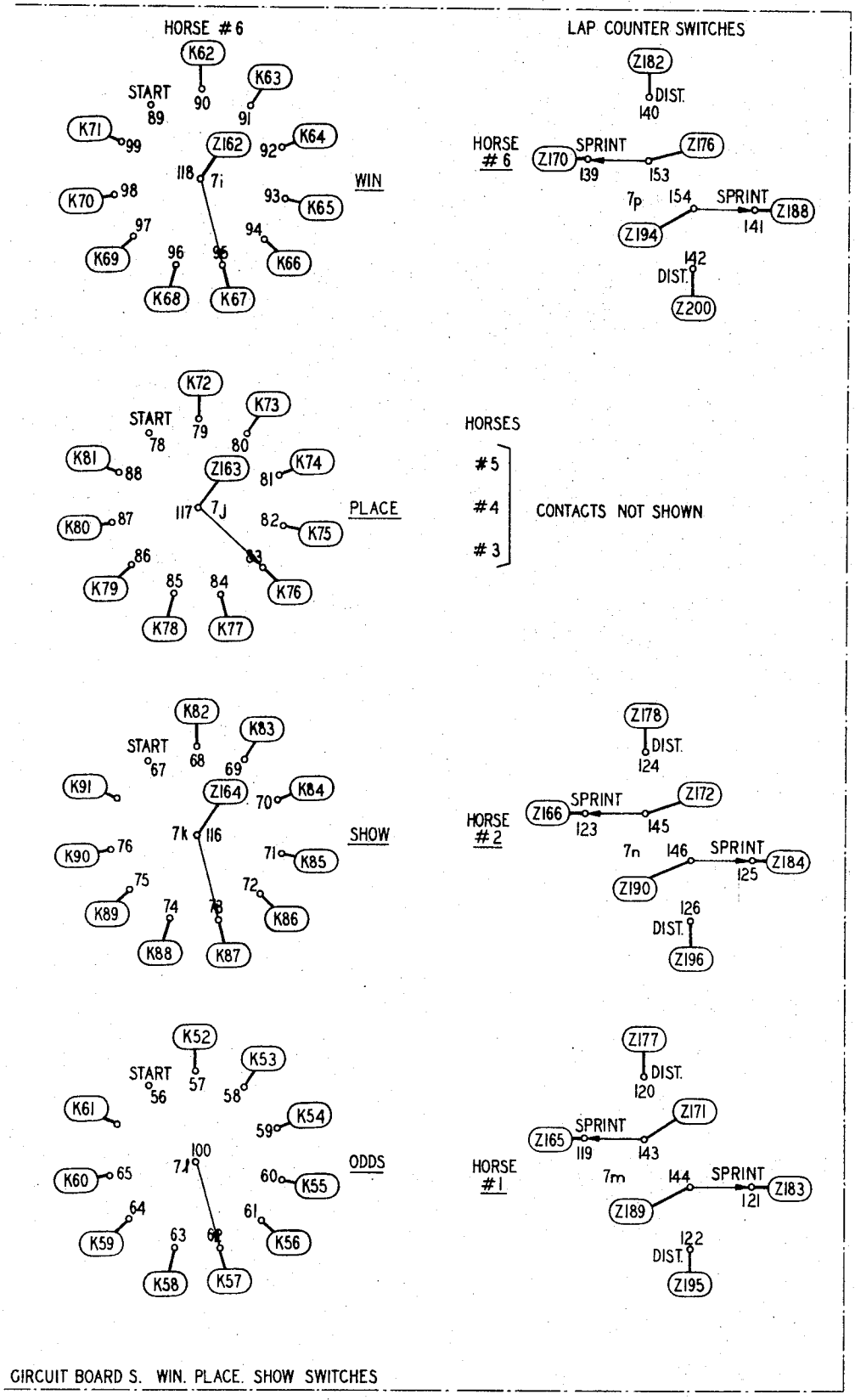

CIRCUIT BOARD V POWER CIRCUITS
NOTE: ALL RELAYS ON THIS CIRCUIT BOARD HAVE A .0068 uf CAPACITOR ACROSS THE WINDING.
RECTIFIERS FOR HORSES 3,4,& 5 NOT SHOWN
RECTIFIER 6g POWER FOR HORSES 1 & 2
RECTIFIER 6h POWER FOR HORSE 6
RECTIFIER 6q COMMON POWER FOR FINISH LINE ON 2nd LAP
HORSE POWER RELAYS
RELAY 6d
HORSE #1
RELAY 6e
HORSE #2
RELAY 6f
HORSE #6
(RELAYS FOR #3, 4, & 5 NOT SHOWN)
RHEOSTAT 6m
RHEOSTAT 6n
RHEOSTAT 6p
(RHEOSTATS FOR #3, 4, & 5 NOT SHOWN)
(CONTACTS FOR #3, 4, & 5 NOT SHOWN)

FIG. 7A



LIKE NUMBERS ARE STRAPPED TOGETHER
NUMBERS TO BE STRAPPED ARE: 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100

FIG. 7B



GIRCUIT BOARD S. WIN. PLACE. SHOW SWITCHES

FIG. 8

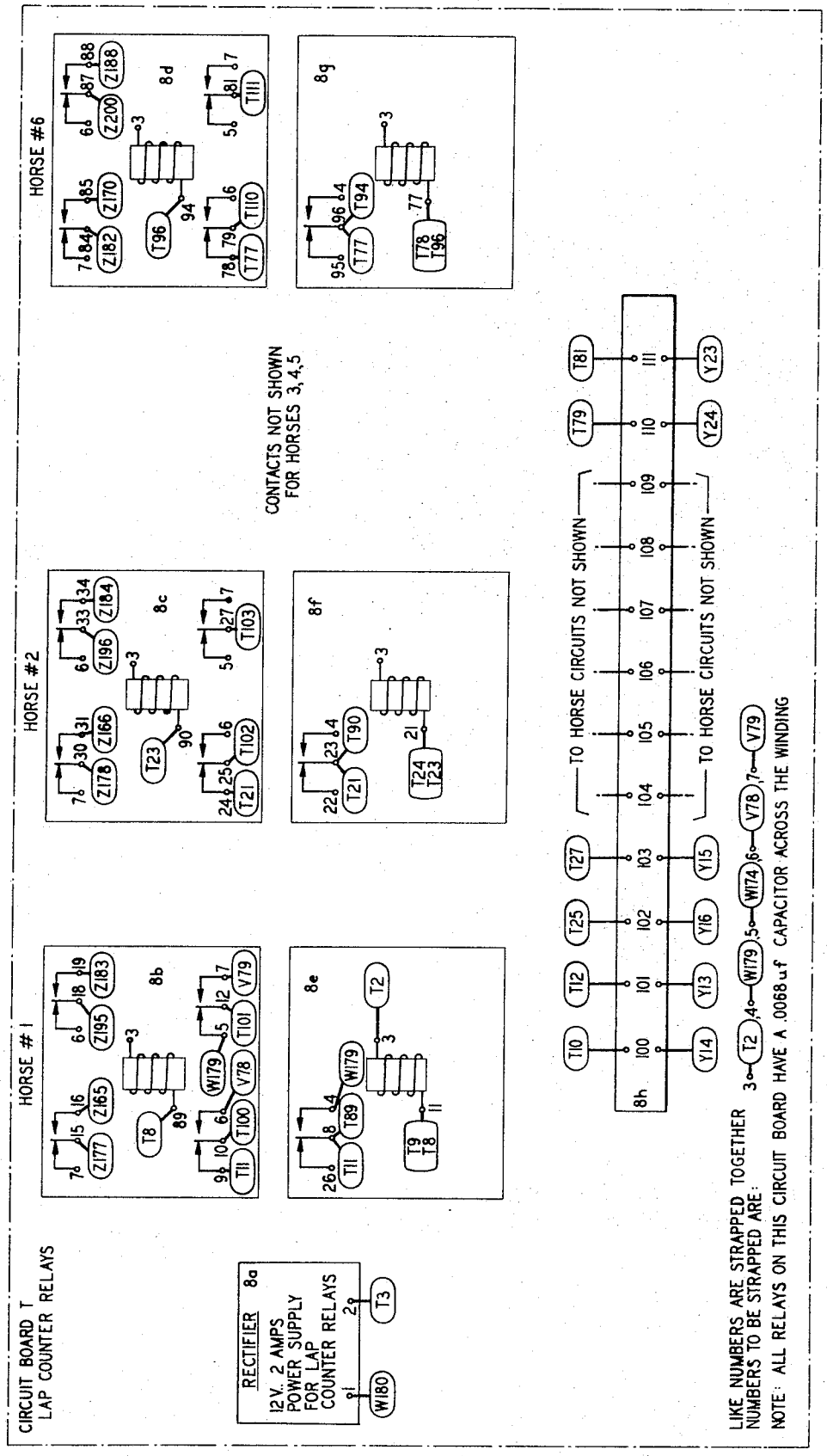
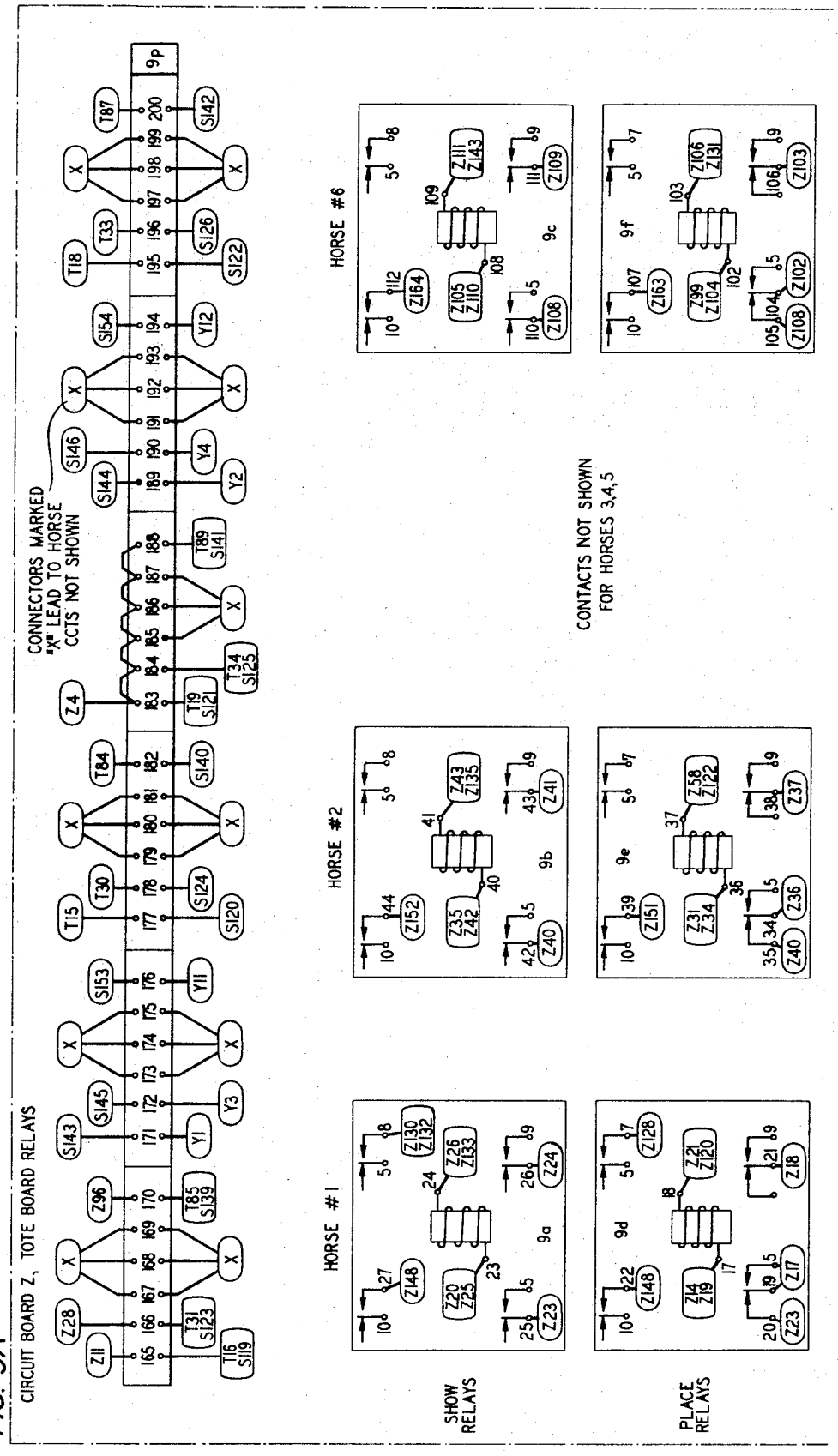

CIRCUIT BOARD T
LAP COUNTER RELAYS
HORSE #1
HORSE #2
HORSE #6
8a
RECTIFIER
12V. 2 AMPS
POWER SUPPLY
FOR LAP
COUNTER RELAYS
8b
8c
8d
8e
8f
8g
8h
CONTACTS NOT SHOWN
FOR HORSES 3,4,5
TO HORSE CIRCUITS NOT SHOWN
TO HORSE CIRCUITS NOT SHOWN
LIKE NUMBERS ARE STRAPPED TOGETHER
NUMBERS TO BE STRAPPED ARE:
NOTE: ALL RELAYS ON THIS CIRCUIT BOARD HAVE A .0068 uf CAPACITOR ACROSS THE WINDING

FIG. 9A


CIRCUIT BOARD Z, TOTE BOARD RELAYS
CONNECTORS MARKED "X" LEAD TO HORSE CCTS NOT SHOWN
HORSE #1
HORSE #2
HORSE #6
CONTACTS NOT SHOWN FOR HORSES 3,4,5
SHOW RELAYS
PLACE RELAYS

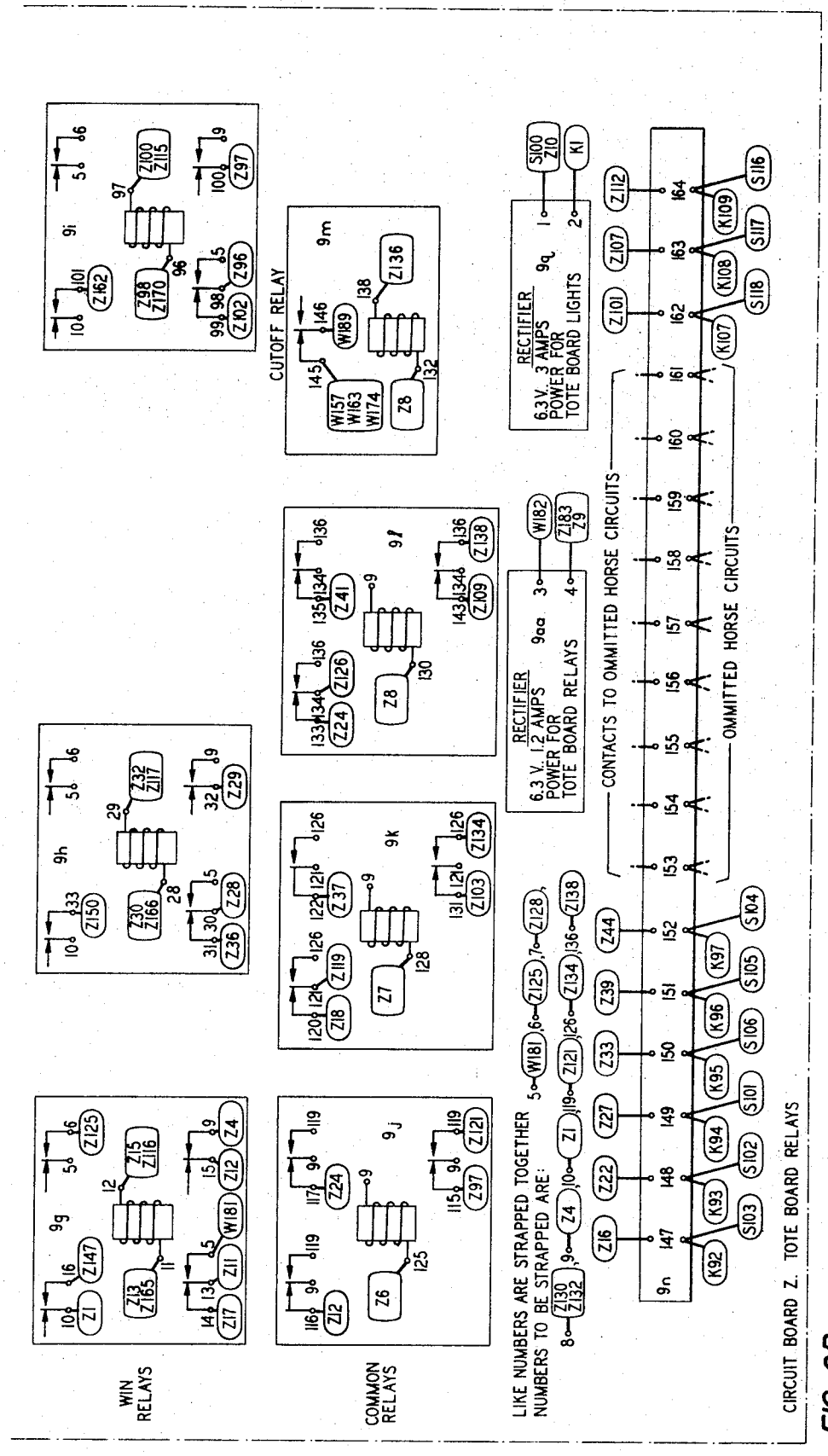

WIN RELAYS
COMMON RELAYS
CUTOFF RELAY
RECTIFIER 6.3 V. 1.2 AMPS POWER FOR TOTE BOARD RELAYS
RECTIFIER 6.3 V. 3 AMPS POWER FOR TOTE BOARD LIGHTS
LIKE NUMBERS ARE STRAPPED TOGETHER
NUMBERS TO BE STRAPPED ARE:
CONTACTS TO OMMITTED HORSE CIRCUITS
OMMITTED HORSE CIRCUITS
CIRCUIT BOARD Z. TOTE BOARD RELAYS

FIG. 9B

FIG. 10

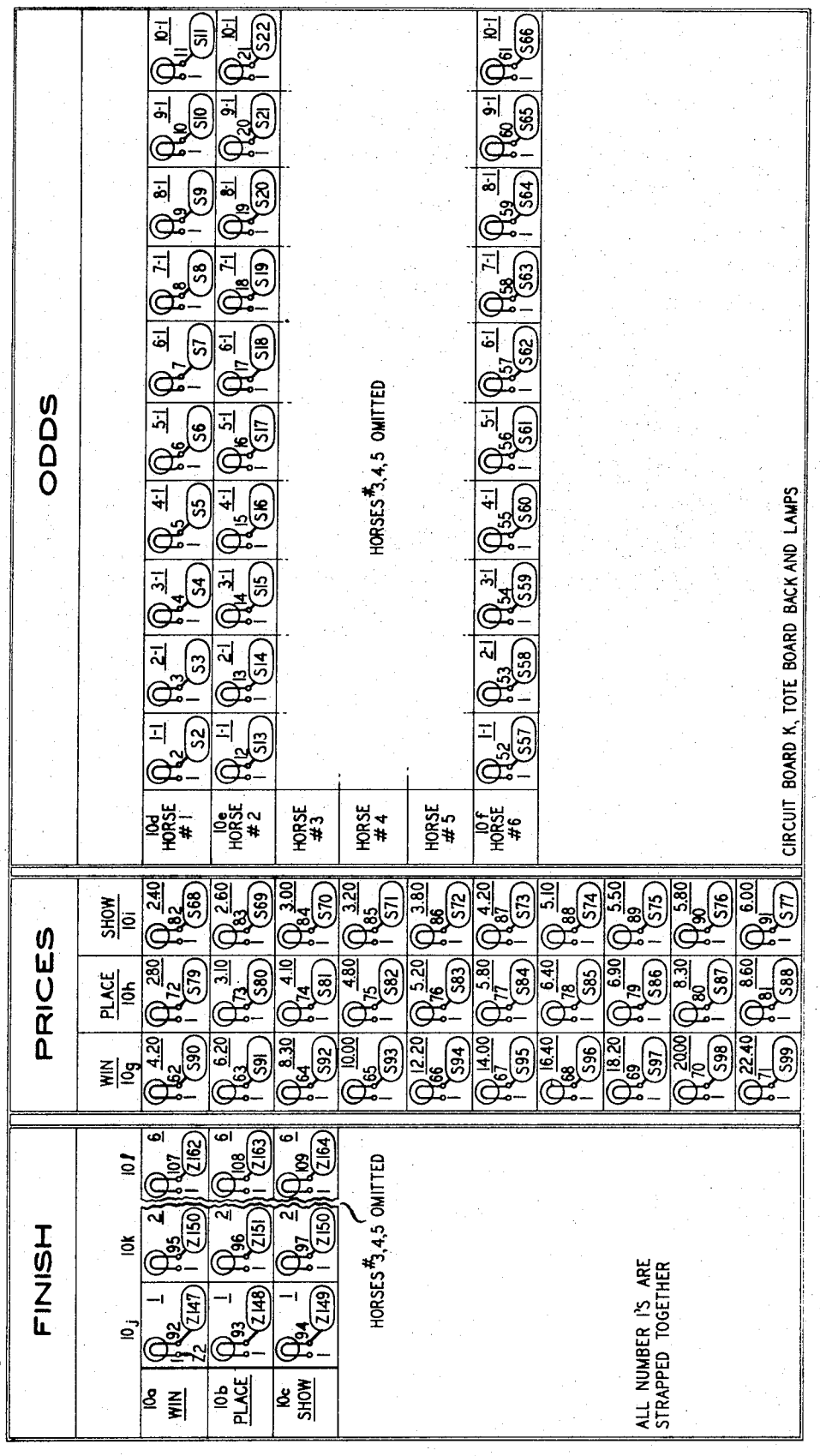

FINISH
PRICES
ODDS
10a WIN
10b PLACE
10c SHOW
10j
10k
10l
WIN 10g
PLACE 10h
SHOW 10i
10d HORSE #1
10e HORSE #2
HORSE #3
HORSE #4
HORSE #5
10f HORSE #6
HORSES #3,4,5 OMITTED
HORSES #3,4,5 OMITTED
ALL NUMBER 1'S ARE STRAPPED TOGETHER
CIRCUIT BOARD K, TOTE BOARD BACK AND LAMPS

FIG. 11

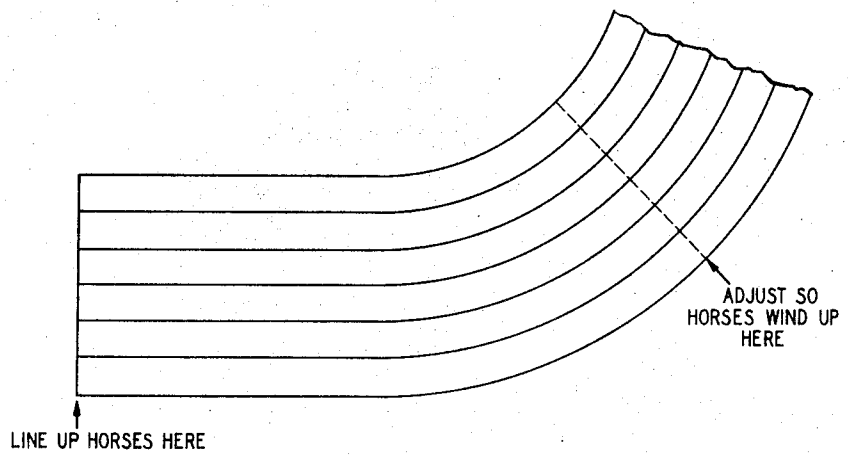
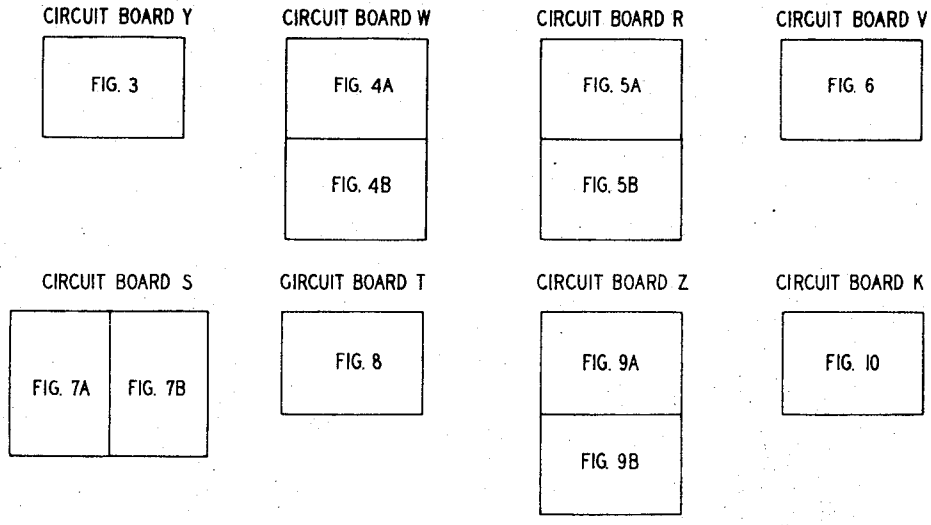


FIG. 12

SUMMARY OF CIRCUIT BOARDS



ELECTRONIC RACING GAME

BACKGROUND OF THE INVENTION

This invention relates in general to electronic methods and apparatus for random selection, and more specifically, to electronically controlled races, specifically simulated horse races, operating at preselected odds.

Horse racing and various other games of chance rely on the unpredictability of the result to attract the interest and bets of participants. In attempting to simulate the chance factor of an actual race, various means have been employed, such as the spinning of a wheel, the throwing of dice, etc. Such means are, at best, crude, and, at worst, lend themselves to patterned repetition which is predictable, and which can be dishonestly manipulated by the operator and others. Furthermore, such methods of chance selection cannot be combined readily with the preselective setting of odds for individual racing units, which is a salient feature of an actual horse race.

Accordingly, it is a general object of this invention to provide a method and apparatus for random selection of contest winners which is highly unpredictable, and not readily subject to patterned repetition or manipulation. A more specific object of the invention is to provide an electronic racing game in which the racing units can be operated at preselected odds, but without the winner being predictable, and more particularly, one which closely simulates by electronic means the random factors, together with techniques for preselecting odds, which combine to generate interest and betting on horse races.

SUMMARY OF THE INVENTION

These and other objects and features are attained in the present invention by operating a pair of pulse actuated timing sources at two substantially different nonharmonic frequencies, each subject to a slight frequency drift, to control a plurality of racing units by means of a complex system of stepping selectors which move through a repetitive cycle of steps. Random bursts of power for moving one or another of the racing units forward are derived whenever there is a coincidence between the pulses of the two timing sources. Each of the racing units may have associated with it a switch which, at the onset of the race, can be positioned to vary the odds between the respective racing units by changing the number of steps during the stepping cycle at which a specific unit is connected to receive the random bursts of power.

The illustrative embodiment under description takes the form of an electronic horse race having six motor driven horses, each of which moves on an individual pair of conducting rails around an oval race track. For the sake of simplicity, circuits relating to only three of the horses are described. It will be understood that the principle of the invention can be applied to systems having a larger number or smaller number of horse units. In the system under description, each horse unit has an associated dial, by which its individual odds can be preset between one-to-one and 10-to-one, at the beginning of each game. Adjacent the finish line is a tote board which lights up to show the odds on each horse and which also lights up to indicate instantaneously, as they cross the finish line, which of the horses

are in the Win, Place and Show positions, and the money payable to the bettors on each. Additional circuits are included which provide for the possibility of multiple laps around the track, and means for indicating the results of the multilap races on the tote board.

These and other objects, features and advantages will be apparent to those skilled in the art, upon a detailed study of the present invention in connection with the attached drawings.

SHORT DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective showing of the finish line of a race track, in accordance with the present invention, with horses in Win, Place and Show positions and the corresponding indications on the tote board;

FIG. **2** is a schematic showing of the circuit of individual driving units used in connection with the horses shown in FIG. **1**;

FIG. **3** (Circuit Board Y) shows in schematic a track section near the finish line with circuit connecting points to the individual horse circuits of FIG. **1**;

FIGS. **4A**, **4B** (Circuit Board W), combined as indicated in FIG. **12**, show schematically the First Timer and the Second Timer, the pulse sources and the Sequential Selector system for controlling the racing units of FIG. **1**;

FIGS. **5A**, **5B** (Circuit Board R), combined as indicated in FIG. **12**, show schematically the Odds Selectors, ganged in groups of four, for controlling connection to the power circuits of the individual racing horses of FIG. **1**;

FIG. **6** (Circuit Board V) shows schematically the individual power relays and related circuits for driving the horses of FIG. **1**;

FIGS. **7A**, **7B** (Circuit Board S), combined as indicated in FIG. **12**, are schematic showings of the manually actuated Win, Place and Show switches wired to the tote board, and Lap Counter Switches for the race track of FIG. **1**;

FIG. **8** (Circuit Board T) shows schematically the Lap Counter Relays for the race track of FIG. **1**;

FIGS. **9A**, **9B** (Circuit Board Z), combined as indicated in FIG. **12**, show schematically the Tote Board Relays and interconnections for the tote board indicated in FIG. **1**;

FIG. **10** (Circuit Board K) constitutes a schematic showing of the back of the tote board in lamps for the race track of FIG. **1**;

FIG. **11** illustrates the line up of the horses for calibrating speeds prior to beginning the race; and

FIG. **12** is a coordinated list of the Circuit Boards and the Figure numbers, showing how the latter are combined.

DETAILED DESCRIPTION OF THE DRAWINGS

PRELIMINARY DESCRIPTION

To simplify the description of the complex circuitry of the present illustrative embodiment, the circuit has been divided into eight Circuit Boards, each designated by an identifying capital letter and a specific Figure number, as indicated in FIG. **12** of the drawings. To clarify reference characters, a separate set of numbers is used on each Circuit Board. When tracing circuits which lead from one Circuit Board to another, the

reference number is preceded by a capital letter, indicating the Circuit Board, as "W180," although the identifying letter is omitted when it is clear that the cited reference numerals are on the same Circuit Board.

In the embodiment under description, the game consists of six motor driven plastic horses; but it can be modified to accommodate a greater or lesser number, all disposed on an eight foot by four foot, six lane, two rail oval track. Each horse has a selector switch associated with him which can vary his odds from one-to-one to 10-to-one. (This can also be modified to accommodate greater odds.) The greater the odds on the horse the less chance he has to win; but he nevertheless has some chance to win. The odds for each horse light up on a tote board at the time they are selected prior to the race. When the race is started, the horses race in short bursts of speed around the track until they reach the finish line. Upon crossing the finish line, the first three horses automatically light up their numbers on the tote board in their respective order of finish, Win, Place and Show. The prices associated with the odds of these three horses also light up automatically for Win, Place and Show. The third horse to cross the finish line also turns the game off; but the numbers and prices remain lighted on the tote board until the tote board reset switch is activated.

OVERALL ARRANGEMENT

FIG. 1 of the drawings is a perspective showing of three horses crossing the finish line in the electronic racing game in accordance with a described embodiment of the present invention, with the electronically actuated tote board in the background, showing the selected odds, indicating which of the horses is in Win, Place and Show position, and the winning money to be paid on each.

In the embodiment under description, as actually constructed, there are six separate pairs of tracks, one pair for each of the six horses in the race. The two tracks forming each pair, which are spaced five-eighths inch apart, are formed of highly conductive, durable metal, each track having a highly polished, low friction upper surface designed to provide substantially uniform electrical contact with the slidably engaging lateral contact members on the two ends of an individual horse circuit of the form shown in FIG. 2. In the present embodiment, the outermost track (Horse No. 6) forms an external oval about four feet by eight feet, with the innermost track (Horse No. 1) defining an oval about three and one-fourth feet by seven and one-fourth feet. It will be apparent that in the alternative a single, bar rail could be substituted for the two rail track described with reference to the present embodiment.

HORSE MOTOR CIRCUITS

Referring to FIG. 2 of the drawings, there is shown in schematic the driving circuit which fits under each of the plastic shells for Horses No. 1 through No. 6 to drive each horse along its specific lane of the track. Each of the circuits includes a small alternating current motor 2*a* of conventional design, which, for example, may be operated with 0.004 to 0.006 horsepower, drawing one-quarter ampere current, at 10–20 volts. The motor 2*a* is shorted across by a conventional diode 2*b*. The latter permits current for the Tote Board Relays (shown in Circuit Board Z, FIGS 9A, 9B) to bypass the motor 2*a*, while blocking the motor current, forcing it to pass through and run the horse, as will be described hereinafter.

THE TRACK AND CONNECTIONS

Referring now to FIG. 3 (Circuit Board Y), there is shown, as formed in the present illustrative embodiment, six track lanes. For convenience of description hereinafter, the circuits relating to Horses No. 1, No. 2 and No. 6 are described in detail, whereas the circuits relating to Horses No. 3, No. 4 and No. 5 have been omitted in order to simplify the description and reduce repetition.

The track sections indicated in FIG. 3 (Circuit Board Y) include the Finish Line Connections, the Lap Counter Connections and the Power Connections Sections 3*a*, 3*b* and 3*c*, containing the Finish Line Connections, and sections 3*d*, 3*e* and 3*f*, containing the Lap Counter Connections, are each insulated from the other sections of track in each of the lanes so that they do not receive any power from or through the track.

In section 3*a* (Horse Lane No. 1) the finish line contacts 1 and 2 are respectively connected to contacts Z171 and Z189 on Circuit Board Z (FIGS. 9A, 9B); in section 3*b* (Horse Lane No. 2) the finish line contacts 3 and 4 are respectively connected to contacts Z172 and Z190; and in section 3*c* (Horse Lane No. 6) the finish line contacts 11 and 12 are respectively connected to contacts Z176 and Z194. On Circuit Board Z these contacts lead through terminal strip 9p to an appropriate dial on the ganged Lap Counter Switches of Circuit Board S (FIGS. 7A, 7B), ultimately passing through the contacts of the Lap Counter Relays on Circuit Board T (FIG. 8), as will be described hereinafter.

Returning to FIG. 3, the purpose of the Lap Counter Connections indicated in sections 3*d*, 3*e* and 3*f*, for Horse Lanes No. 1, No. 2 and No. 6, respectively, is to provide contacts through the appropriate ganged dials of Circuit Board S (FIGS. 7A, 7B), so that if the operator desires to set the game up for more than one lap, the proper relays will be actuated to carry the horses through the finish line sections on the first lap around without actuating the Win, Place and Show indications on the tote board, the showing of which is deferred until the last lap. The Lap Counter Connections include contacts 13 and 14 on section 3*d* (Horse Lane No. 1) which are respectively connected to contacts T101 and T100 on the terminal strip 8*h* of Circuit Board T. Likewise, on section 3*e* (Horse Lane No. 2) lap counter connections 15 and 16 respectively lead to contacts T103 and T102; and in section 3*f* (Horse Lane No. 6) lap counter connections 23 and 24 respectively lead to contacts T111 and T110. The T connections all lead through the contacts and to the energizing circuits of the Lap Counter Relays which will be described in detail hereinafter with reference to Circuit Board T.

The Power Connections in each of the lanes lead to the power circuits for each of the specific horses which are shown on Circuit Board V (FIG. 6). These power circuits function to energize the motor 2*a* (FIG. 2) in each of the horses, driving a specific horse forward along its track lane. In section 3*g* (Lane No. 1) power

contacts 25 and 26 are respectively connected to contacts V74 and V75 on terminal strip 6a of Circuit Board V (FIG. 6). Likewise, in section 3h (Lane No. 2) power contacts 27 and 28 are respectively connected to contacts V71 and V72 on terminal strip 6b; and in section 3i (Lane No. 6) power contacts 35 and 36 are respectively connected to contacts V59 and V60 on terminal strip 6c. On Circuit Board V, the foregoing contacts lead through switches to the rheostats controlling the speed on each of the individual horses and through the normally open contacts of the horsepower relays, the operation of which will be described hereinafter.

PULSE TIMING AND SELECTOR SYSTEMS

We will now pass from the track sections to a description of the complex electrical circuit which drives the individual racing horses along the track. The heart of this system is shown in detail in FIGS. 4A, 4B which are combined as indicated to form Circuit Board W. This shows the master start-stop switches of the circuit, plus the pulse operated timing circuits, one of which drives a stepping selector system which operates respectively through a total of 48 contacts.

Referring to FIGS. 4A, 4B (combined to form Circuit Board W), there are shown three double-pole manually operated switches 4h, 4p and 4q, which put the set in operating condition. In the tote board reset switch 4h, contact 180 is connected in Circuit Board T (FIG. 8) to one terminal T1 of the 12 volt, 2 ampere rectifier 8a which supplies power for the Lap Counter Relays. Contact 182 is connected to contact Z3, one terminal of the 6.3 volt, 1.2 ampere rectifier 9aa on Circuit Board Z (FIGS. 9A, 9B). When switch 4h is in "off" position, power from these sources to the set is cut off. When this switch is in "on" position, power connections are respectively made between contacts 180 and 179, and between contacts 182 and 181. Contact 179 leads to normally closed contacts T5 of lap counter relays 8b, 8c and 8d (Circuit Board T, FIG. 8), and to normally open contacts T4 of lap counter relays 8e, 8f and 8g. The operation of the lap counter circuits will be described in detail hereinafter. Contact 181 leads to the normally open contacts Z5 (Circuit Board Z, FIGS. 9A, 9B) of the Win, Place and Show relays.

In switch 4p, contact 184 is connected to contact W112 of the 24 volt, 1 ampere rectifier 4bb for supplying power to stepping selectors 4a and 4b; and contact 186 is connected to contact W110 of rectifier 4cc for supplying power to stepping selectors 4c, 4d, 4e and 4f. In "off" position, these contacts are open; whereas, in "on" position, contact 184 is connected to contact 183; and contact 186 is connected to contact 185. Contact 183 leads through the normally open contact W160 of relay 4i of the First Timer, which closes periodically when the latter is energized. Contact 160 leads in parallel through energizing coils of relays 4a and 4b of the Primary Stepping Selectors. Thus, when coil 4i of the First Timer is actuated, current will pass from rectifier 4bb to simultaneously step both of the primary stepping selectors 4a and 4b.

Contact 185 leads to contact W147 of the terminal strip 4dd, which is ultimately connected to the selector arm W138 of stepping selector relay 4a. Thus, when the switch 4p is closed, power is provided through selector arm 138 and through whichever contact it rests on at the time, to energize the corresponding auxiliary selector 4c, 4d, 4e or 4f, causing it to move through a single step at the beginning of the race. This will break up the formation of any repetitive pattern of operation from one race to the next.

In switch 4q, contact 190 is connected to contact W176 of the 6 volt, 1.2 ampere rectifier 4m, which supplies current for the First Timer and the Second Timer. When this switch is in an "on" position, current passes from rectifier 4m through contact 189 which leads through the normally closed contacts Z146 and Z145 of the cut-off relay 9m shown on Circuit Board Z (FIGS. 9A, 9B). This circuit is connected to both the normally closed and normally open contacts W157 and W163 of relays 4i and 4j of the First Timer, each of which is interconnected with the energizing circuit of the opposite relay. Also, the circuit through the normally closed contacts Z146 and Z145 of the cut-off Relay (Circuit Board Z) is connected both to the normally closed and normally open contacts W167 and W174 of relays 4k and 4l of the Second Timer (Circuit Board W, FIGS. 4A, 4B), each of these contacts being connected through the energizing circuit of the opposite coil. The return circuit passes from contacts W156 and W162 at the ends of the relay coils 4i and 4j, to contact W175 at the other pole of rectifier 4m. Thus, when the switch 4q is closed, the relay coils 4i and 4j of the First Timer and 4k and 4l of the Second Timer are energized and deenergized in tandem relation in each Timer, at pulse rates which are controlled in each case by the size of the condensers across each of the respective coils.

In the First Timer, a 45 microfarad condenser is connected between points 156 and 155 across the energizing coil of relay 4i; and a 75 microfarad condenser is connected between points 162 and 161 across the energizing coil of relay 4j. In operation, the First Timer produces a mark pulse of one-half second, and a space pulse of slightly less than one-half second, pulsing at a rate of 68 to 70 pulses per minute.

In the Second Timer, a 115 microfarad condenser is connected between contacts 166 and 165, across the energizing coil of relay 4k; and a 150 microfarad condenser is connected between points 172 and 171 across the energizing coil of relay 4l.

In operation, the Second Timer produces a mark pulse of one-half second, and a space pulse of one second, and pulses at a rate of 38 to 40 pulses per minute.

A most important feature of each of the pulse Timers is that the pulse rates are nonharmonic, and each of the pulse sources has a built-in frequency drift, whereby the frequency of each varies one or two beats per second. This increases the randomness of the operation.

It will be understood that in place of the First Timer and the Second Timer, of the form indicated, there can be substituted other types of pulsing circuits, of forms well known in the art, such as, for example, multivibrator circuits, adjusted to produce pulses of the desired pulse widths and relative frequencies, and each including a built-in drift of one or two beats per second as in the present system.

Whenever coil 4i of the First Timer is energized, closing contacts 159 and 160, a power circuit is completed from contact W112 of rectifier 4*bb*, supplying 24 volt, 1 ampere current, through switch 4*p* to W contacts 142 and 139 which are respectively connected to the parallel energizing circuits of primary stepping selector relays 4*a* and 4*b*, driving each of them to step in concert through a repetitive cycle of 12 contacts each. Primary stepping selector 4*a* steps through its contacts 113 through 124, making contact by means of selector arm 138. Second primary stepping selector 4b steps through its contacts 125 through 136, making contact by means of selector arm 141. The stepping selector 4*a* is, in turn, connected to energize and cause to step, in sequence, four additional stepping selectors 4*c*, 4*d*, 4*e* and 4*f*, of 12 contacts each, as will be explained with reference to FIG. 4B.

The two selector coils of 4*a* and 4*b* are connected in parallel, contact 139 being connected to contact 142 at one end of the two coils, and contact 137 being connected to contact 140 at the other coil terminals. The common connection from contact 137 is connected to contact 111 of rectifier 4*bb* to supply 24 volt, 1 ampere current to the Stepping Selectors. Each of the selector coils 4*a* and 4*b* is shorted by a 0.25 microfarad condenser. The stepping selectors 4*a* and 4*b* respectively have selector arms 138 and 141. Stepping selector arm 138 is connected to contact W147 on the terminal strip 4*dd*, which leads through the switch 4*p* back to contact W110 of rectifier 4*cc*, when the switch is closed, supplying 24 volt, 1 ampere current to drive the stepping selectors 4*c*, 4*d*, 4*e* and 4*f*, as will be explained. The stepping selector arm 141 is connected to contact W169 of the Second Timer, the function of which connection will be explained presently.

Contacts 113 through 124 of primary selector 4*a* are interconnected together in groups of four, so that 113 through 116 are respectively connected to 117 through 120; and the latter group of four is respectively connected to contacts 121 through 124. Contacts 121 through 124 are respectively connected, in order, to four W contacts 143 through 146, along the terminal strip 4*dd*.

The four auxiliary selectors 4*c*, 4*d*, 4*e* and 4*f*, which are operated in sequence by the selector 4*a*, have each of their coils shorted across by a 0.25 microfarad condenser. Selector coil 4*c* is connected between contacts 99 and 97; selector coil 4*d* is connected between contacts 102 and 100; selector coil 4*e* is connected between contacts 105 and 103; and selector coil 4*f* is connected between contacts 108 and 106. Contacts 99, 102, 105 and 108, at one end of each of the aforesaid coils 4*c*, 4*d*, 4*e* and 4*f*, are respectively connected to W contacts 143, 144, 145 and 146 on the terminal strip 4*dd*. The other terminals 97, 100, 103 and 106 of each of these respective coils are all connected together to complete the circuit to W contact 109 of rectifier 4*cc*. Thus, the four coils 4*c*, 4*d*, 4*e* and 4*f* are energized to step in consecutive sequence, so that when primary selectors 4*a*, 4*b* take four steps, each of the auxiliary selectors takes one step in sequence.

Auxiliary stepping selector contacts 49 through 96 are respectively connected, in numerical order, to W contacts 1 through 48 on terminal strip 4*n*. These contacts are then combined by strapping into sixteen groups, consisting of six groups of four contacts each, four groups of three contacts each, and six groups of two contacts each. Each of these groups is connected to a specific one of contacts R289 through R304 on terminal strip 5*a* of Circuit Board R (FIGS. 5A, 5B). These connections are indicated in Table I, which follows.

TABLE I

Circuit Board W / Circuit Board R Group Designation	Interconnected W Contacts	Grouping of Contacts For Regulation of Odds: Corresponding R Contact
4_1	W37, W29, W21, W3	R304
4_2	W43, W28, W14, W6	R303
4_3	W42, W35, W17, W1	R302
4_4	W40, W26, W19, W9	R301
4_5	W45, W33, W15, W4	R300
4_6	W48, W32, W23, W8	R299
3_1	W44, W30, W18	R298
3_{1c}	W31, W20, W5	R297
3_3	W47, W27, W11	R296
3_4	W39, W13, W2	R295
2_1	W38, W10	R294
2_2	W36, W22	R293
2_3	W16, W7	R292
2_4	W46, W25	R291
2_5	W34, W12	R290
2_6	W41, W24	R289

The grouped contacts from the terminal strip 4*n*, arranged in the manner indicated in Table I, are connected to terminal board 5*a* of Circuit Board R (FIGS. 5A, 5B), which shows the Odds Selector Dials which are set up to control the number of individual circuit wires connected in succession to each of the horsepower circuits during a specific selector cycle. This will be described presently.

Before passing to a description of Circuit Board R, let us return to Circuit Board W (FIGS. 4A, 4B) for a description of the function of the Second Pulse Timer, which in the present embodiment is arranged to provide pulses at the rate of 38 to 40 pulses per minute, as opposed to a pulsing rate of 68 to 70 pulses per minute for the First Timer. As previously described, the latter energizes the two primary stepping selector coils 4*a* and 4*b* to step through their simultaneous cycle of twelve steps, operating to energize, in tandem, coils 4*c*, 4*d*, 4*e* and 4*f* of the auxiliary stepping selectors to control the sequential stepping of these selectors through their steps 49–96.

Stepping selector coil 4b actuates selector arm 141 to step through steps 125 through 136, while selector arm 138 of coil 4*a* is stepping through steps 113 through 124. It will be apparent that selector steps 125 through 136 are also connected in groups of four, each of which groups is connected to a contact on terminal strip 4*dd*. Thus, W contacts 125, 129 and 133 are connected to W contact 149 on terminal strip 4*dd*; contacts 126, 130 and 134 to terminal strip contact 150; contacts 127, 131 and 135 to terminal strip contact 151; and contacts 128, 132 and 136 to terminal strip contact 152. Each of the terminal strip contacts 149, 150, 151 and 152 is respectively connected through a diode to the respective selector arms 98, 101, 104 and 107 of the four auxiliary selectors 4*c*, 4*d*, 4*e* and 4*f*.

It will be apparent that when relay coil 4*k* in the Second Timer is energized, closing its contacts 169 and 170, a 6 volt, 2 ampere current passes from contact 177 of the rectifier 4*aa*, through selector arm 141, into one

of the four selector arms **98**, **101**, **104** or **107** of the auxiliary selectors, and into one of the 48 contacts **49** through **96**, depending upon which step the auxiliary selector has reached at that moment.

This random shot of current passes through one of the 48 contacts of terminal strip **4***n*, selected by pure chance, and into the horsepower circuit of one of the horses on the track, causing it to move forward. The number of times the driving circuit for any specific horse will be in position to receive a shot of current from the random pulse source, Second Timer, will be determined by the manual arrangement of the Odds Selector Dials, which will now be described with reference to Circuit Board R (FIGS. **5**A, **5**B).

ODDS SELECTOR SYSTEM

Referring now to Circuit Board R, there is shown a plurality of manually operated rotary selector dials, each of which is equipped with eleven contacts and a selector arm which is manually movable in a clockwise direction from a null position, with no connection, to engage any of the remaining positions which are connected in a manner to set up the desired odds. The rotary selectors are arranged in sections or gangs of four, one selector being assigned to each of the horses running in the race. The selector arms of each section of four are ganged together so that the four arms simultaneously make contact at the same angular position on the face of the dial. As seen, the dial contacts are numbered in order, clockwise around the dials, reading from bottom to top of each of the columns of dials.

In the illustration under description, detailed circuit arrangements are indicated for the dial selectors connected to the horsepower circuits No. **1**, No. **2** and No. **6** (from left to right on Circuit Board R, FIGS. **5**A, **5**B), the selector dial contacts for horsepower circuits No. **3**, No. **4** and No. **5** having been omitted in order to simplify the description. It will be understood, however, that the connections not shown will be substantially similar in arrangement to those indicated with reference to Horses No. **1**, No. **2** and No. **6**.

Each of the selector dial arms shown on Circuit Board R is respectively connected to a contact on the terminal strip **5***a*. For example, ganged selector dial arms **305**, **306**, **307** and **308**, relating to Horse No. **1**, are respectively connected to R contacts **265**, **266**, **267** and **268** on terminal strip **5***a*; ganged selector dial arms **309**, **310**, **311** and **312** relating to Horse No. **2** are respectively connected to R contacts **269**, **270**, **271** and **272** on terminal strip **5***a*; selector dial arms **325**, **326**, **327** and **328** relating to Horse No. **6** are respectively connected to contacts **285**, **286**, **287** and **288** on terminal strip **5***a*. It will be noted that each of the mentioned contacts on terminal strip **5***a* has a diode connected between it and the designated selector dial arms, to maintain unidirectional current passing from the selector dial arm into the terminal strip.

Contacts **265** through **268** on terminal strip **5***a* are connected together to contact **V76** on Circuit Board V (FIG. **6**) leading to the energizing circuit of the horsepower relay **6***d* of Horse No. **1**, as will be described later; contacts **269** through **272** on terminal strip **5***a* are connected together to contact **V73** on Circuit Board V, leading to the energizing circuit of the horsepower relay **6***e* of Horse No. **2**; and contacts **285** through **288** on terminal strip **5***a* are connected together to contact **V61** on Circuit Board V leading to the energizing circuit of the horsepower relay **6***f* of Horse No. **6**.

As indicated previously, the dial selectors for the Horse circuits No. **3**, No. **4** and No. **5** have been omitted; and likewise, the intermediate connections on terminal strip **5***a* to the contacts **273** through **284** relating to these omitted horses have not been shown or described, although it will be understood that they are substantially similar to the circuits shown.

The contacts at the right-hand end on the lower side of terminal strip **5***a*, numbered **289** through **304**, lead from terminal strip **4***n* of Circuit Board W (FIGS. **5**A, **5**B). These are grouped as indicated in Table I hereinbefore, so that the first six contacts **289** through **294** are respectively connected to each of the six two-wire groups, designated as 2_6, 2_5, 2_4, 2_3, 2_2 and 2_1, respectively; the next four contacts **295** through **298** are connected to each of the four three-wire groups designated as 3_4, 3_3, 3_2 and 3_1, respectively; and the last six contacts on the terminal strip, namely **299** through **304**, are connected in order to each of the six four-wire groups, designated as 4_6, 4_5, 4_4, 4_3, 4_2 and 4_1, respectively.

In order to better understand the theory behind the operation of the odds selectors, one is referred to Table II. It will be understood that although in Table II specific numerical odds have been assigned to the wire total for each cycle, a particular wire total can readily be adjusted on the tote board to produce a higher or lower percentage of wining favorites at any given odds.

TABLE II

Theoretical Grouping of Circuits for Odds Selection

Horse No. 1

Wire Groups			Wire Total	Odds
4	3	2	13	1-1
1,2	1	3	12	2-1
1	1,2	1	11	3-1
1	2	1,3	10	4-1
1	1,2		9	5-1
1	1	3	8	6-1
1		2,6	7	7-1
1	4		6	8-1
1		5	5	9-1
	2	1	4	10-1
		1,3		

Horse No. 2

Wire Groups			Wire Total	Odds
4	3	2	13	1-1
2,3	2	2	12	2-1
2	2,3	4	11	3-1
2	3	2,4	10	4-1
2	2,3		9	5-1
2	2	2	8	6-1
2		2,5	7	7-1
2	4		6	8-1
2		6	5	9-1
	3	2	4	10-1
		2,4		

Horses Nos. 3,4, and 5 have been omitted.

Horse No. 6

Wire Groups			Wire Total	Odds
4	3	2	13	1-1
6,1	4	1	12	2-1
6	1,4	2	11	3-1
6	4	1,2	10	4-1
6	1,4		9	5-1
6	3	6	8	6-1
6		1,5	7	7-1
6	2		6	8-1
6		4	5	9-1
	4	2	4	10-1
		1,2		

This Table includes a section for each of the horses under description (No. **1**, No. **2** and No. **6**), showing, in

each case, how the grouped contacts from the right-hand end of terminal strip **5***a* add up to a total which varies from **13**, when the odds are one-to-one, to four, when the odds are 10-to-one. The totals given represent, in each case, the total number of contacts from terminal strip **4***n* of Circuit Board W (FIGS. 4A, 4B), which are in a position to receive power in each horse circuit during one complete cycle through the 48 steps of selectors **4***c*, **4***d*, **4***e* and **4***f*.

As seen from Table II, when the odds selector dials relating to a given horse circuit are put in the position of one-to-one odds, the number of contacts in that specific horse circuit which are positioned to receive power during one complete cycle of the selector system add up to thirteen. As the selected odds are progressively increased by setting the dials, the number of the contacts positioned to receive power is progressively reduced to twelve contacts, eleven contacts, ten contacts, etc., down to a minimum of four, in the case of 10-to-one odds. The selector contact arrangement is shown in Table III.

In order to make up these totals, as shown in Table III, corresponding contacts on the four ganged odds selector dials connected to each horse must be so chosen that they add up in each case to the number indicated at Total Wires. For example, let us refer to the ganged selector dials **5***e*, **5***d*, **5***c* and **5***b* which control the odds selection for Horse No. **1**. Contacts **34** on selector **5***e*, **23** on selector **5***d*, **12** on selector **5***c* and **1** on selector **5***b*, each indicate the null or starting position. In order to indicate a position of one-to-one odds (a total of 13 grouped contacts per cycle), the four ganged selector arms of these dials are moved clockwise one step. In this position the selector arm **308** of selector dial **5***e* is positioned on contact **35**; selector arm **307** of dial **5***d* is positioned on contact **24**; selector arm **306** of dial **5***c* is positioned on contact **13**; and selector arm **305** of dial **5***b* is positioned on contact **2**.

Tracing the circuits it will be seen that contact **35** is connected to contact **292** on terminal strip **5***a*, which leads to the 2_3 group of contacts. Contact **24** in odds

TABLE III

[Selector contact arrangement (FIGS. 5A, 5B) for odds selection in accordance with Table II]

	Contact number	Wire gr.	Contact number	Wire gr.	Contact number	Wire gr.	Contact number	Wire gr.
Horse #1								
	35	2_3	36	2_1	37	2_1	38	
	24	3_1	25	3_1	26	2_3	27	3_1
	13	4_2	14	3_2	15	3_2	16	3_2
	2	4_1	3	4_1	4	4_1	5	4_1
Total wires		13		12		11		10
	39		40	2_5	41		42	2_5
	28	3_1	29		30		31	
	17	2_3	18	2_2	19	3_1	20	
	6	4_1	7	4_1	8	4_1	9	4_1
Total wires		9		8		7		6
	43	2_1	44	2_1				
	32		33					
	21	3_2	22	2_3				
	10		11					
Total wires		5		4				
Horse #2								
	79	2_2	80	2_1	81	2_1	82	
	68	3_2	69	3_1	70	2_2	71	3_3
	57	4_3	68	3_2	59	3_1	60	3_2
	46	4_2	47	4_2	48	4_2	49	4_2
Total wires		13		12		11		10
	83		84	2_5	85		86	2_6
	72	2_2	73	2_2	74		75	
	61	3_2	62		63	3_1	64	
	50	4_2	51	4_2	52	4_2	53	4_2
Total wires		9		8		7		6
	87		88	2_1				
	76	3_3	77					
	65	2_2	66	2_2				
	54		55					
Total wires		5		4				
Horse #6								
	255	2_1	256	2_2	257	2_2	258	
	244	3_1	245	3_1	246	2_1	247	3_1
	233	4_1	234	3_4	235	3_1	236	3_4
	222	4_6	223	4_6	224	4_6	225	4_6
Total wires		13		12		11		10
	259	2_6	260	2_5	261		262	
	248		249	2_1	250		251	
	237	3_3	238		239	3_2	240	2_4
	226	4_6	227	4_6	228	4_6	229	4_6
Total wires		9		8		7		6
	263		264					
	252	2_2	253	2_2				
	241	3_1	242	2_1				
	230		231					
Total wires		5		4				

selector dial 5*d* is connected to contact 298 on terminal strip 5*a*, which corresponds to the 3_1 contact group. In dial 5*c* contact 13 leads to contact 53 in dial 5*f*; the latter, in turn, leads to contact 52 which leads to contact 51, etc., around the dial, to contact 46, which is ultimately connected to contact 303 on terminal strip 5*a*, corresponding to the 4_2 group. On dial 5*b*, contact 2 leads directly to contact 304 on the terminal strip 5*a*, which corresponds to contact group 4_1. Thus, the grouped contacts 2_3 plus 3_1 plus 4_2 plus 4_1 add up to a total of 13.

In a similar way, as the four ganged selector arms are moved through the next step in a clockwise direction, the contacts engaged are 36 on dial 5*e*, 25 on dial 5*d*, 14 on dial 5*c* and 3 on dial 5*b*. It will be seen by tracing the circuits that contact 36 is ultimately connected to group 2_1, 25 to group 3_1, 14 to group 3_2 and 3 to group 4_1; all of which add up to a total of 12 contacts on terminal strip 4*n* of Circuit Board W.

Table III shows the contact arrangements of the odds selector dials for each of Horses No. 1, No. 2 and No. 6, indicating the specific contact groups of 2's, 3's and 4's corresponding to each of the positions on the dials in clockwise succession, corresponding to ascending odds. It will be understood that either electronically or manually, the dials of FIGS. 7A, 7B (Circuit Board S) relating to the tote board will be set up to correspond exactly to the selector settings indicated in FIGS. 5A, 5B (Circuit Board R). The wiring of the tote board dials (FIGS. 7A, 7B) will be described in detail at a later point.

In the specific illustration under description, the following odds have been selected and the dials set accordingly: Horse No. 1, five-to-one; Horse No. 2, three-to-one; and Horse No. 6, six-to-one. Thus, for Horse No. 1, ganged rotor arms 308, 307, 306 and 305 are respectively set on contacts 39, 28, 17 and 6, whose wire total, as shown by Table III, is nine. For Horse No. 2, ganged rotor arms 312, 311, 310 and 309 are respectively set on contacts 81, 70, 59 and 48, whose wire total, as shown by Table III, is 11. For Horse No. 6, ganged rotor arms 328, 327, 326 and 325 are respectively set on contacts 260, 249, 238 and 227, whose wire total is shown by Table III, to be eight. This arrangement may be varied at the beginning of each race.

HORSEPOWER CIRCUITS

The description will now pass to Circuit Board V (FIG. 6) which details the power circuits for driving the individual horses on the tracks. As indicated previously, the connections from the left-hand end of terminal strip 5*a* (Circuit Board R, FIGS. 5A, 5B) consist of connected groups of four contacts each, from the ganged selector arms corresponding to each horse. These groups are respectively connected to R contacts 268, 272 and 288, which are, in turn, respectively connected to contacts V76, V73 and V61 on terminal strips 6*a*, 6*b* and 6*c* (Circuit Board V).

Contact 76 on terminal strip 6*a* relating to Horse No. 1 is connected to the energizing circuit of horsepower relay 6d through contact 53. Likewise, contact 73 on terminal strip 6*b* is connected to the energizing circuit of relay 6*e* through contact 49; and on terminal strip 6*c*, contact 61 is connected to the energizing circuit of relay 6*f* through contact 33. The energizing circuits of horsepower relays 6*d*, 6*e* and 6*f*, relating to Horses No. 1, No. 2 and No. 6, respectively, are connected together in parallel relation through contacts 34, 50 and 54. The latter is connected through V contact 77 on terminal strip 6i to contact W178 of the 6 volt, 2 ampere rectifier 4*aa* on Circuit Board W (FIGS. 4A, 4B), as described hereinbefore, which supplies current to energize each of the relays 6*d*, 6*e* and 6*f*.

When each of these three relays is energized, it respectively closes its normally open contacts completing the driving circuits of the individual horses. Relay 6*d* closes contacts 55 and 56; relay 6e closes contacts 51 and 52; and relay 6f closes contacts 35 and 36. These relay contacts, when closed, complete the driving circuits through the track to each of the individual horse motors as follows.

Horses No. 1 and No. 2 both derive power from rectifier 6*g* whose terminal 2 is connected in parallel to V terminals 10 and 14 on the rheostat boards 6*m* and 6*n*, respectively.

For Horse No. 1, slider 12 of rheostat board 6*m* is connected through closed contacts 55 and 56 of horsepower relay 6*d*, through contact 75 on terminal strip 6*a* to track power contact Y26 on Circuit Board Y (FIG. 3), which contacts one terminal of the motor of Horse No. 1. The return from the other terminal of that motor leads from track contact Y25, through contact 74 on Circuit Board V (FIG. 6), contact 11 on rheostat board 6*m*, and back to terminal 1 of rectifier 6*g*.

For Horse No. 2, slider 16 of rheostat board 6*n* is connected through the closed contacts 51 and 52 of horsepower relay 6*e*, through V contact 72 on terminal strip 6*b* to track power contact Y28 on Circuit Board Y (FIG. 3), which contacts one terminal of the motor of Horse No. 2. The return from the other terminal of this horse motor leads from track contact Y27 through V contact 71 of terminal strip 6*b*, and contact 15 of rheostat board 6*n* to terminal 1 of the rectifier 6*g*.

In the case of Horse No. 6, power is supplied from rectifier 6*h*. Terminal 6 of the latter is connected to V terminal 30 of rheostat board 6*p*. The slider 32 of the latter is connected through the closed contacts 35 and 36 of horsepower relay 6*f* through V contact 60 of terminal strip 6*c* to the contact Y36 on the track (Circuit Board Y, FIG. 3), contacting one terminal of the motor of Horse No. 6. The return track contact Y35 from the other terminal is connected through V contact 59 of terminal strip 6*c*, contacts 31 and 29 of rheostat board 6*p*, to the terminal 5 of rectifier 6*h*.

Manually actuated switches 6*j*, 6*k* and 6*l* respectively short the contacts of relays 6*d*, 6*e* and 6*f*, permitting the horses to be powered manually, when necessary. The speeds of the individual Horses No. 1, No. 2 and No. 6 can be adjusted or calibrated at the initial set up of the game by manipulating the sliders 12, 16 and 32 on the respective rheostats 6*m*, 6*n* and/or 6*p*. The purpose of this is to permit the speed of the horses to be so regulated initially that they complete the trip around the track in the same time, absent odds and chance factors, notwithstanding the fact that the outside track is slightly longer than the inside track. This will be explained further, hereinafter, with reference to FIG. 11.

It will be apparent that, as in the descriptions of previous figures, the contacts and circuits corresponding to Horses No. 3, No. 4 and No. 5 have not been shown.

The rectifier 6*q*, which provides common power for the finish line on the second lap, is connected through its contacts 7 and 8, which respectively pass through

contacts **57** and **58** of terminal strip **6***aa*, to V terminals **80** and **81** (the slider) of rheostat board **6***bb*. Terminals **78** and **79** of the latter are respectively connected to terminals T6 and T7, common contacts of the Lap Counter Relays on Circuit Board T (FIG. **8**), which will be discussed hereinafter.

ROTARY TOTE BOARD SWITCHES AND TOTE BOARD CONNECTIONS

Prior to the race, when odds for each horse are selected on the Odds Selectors of Circuit Board R (FIGS. **5**A, **5**B), the Win, Place and Show switches of Circuit Board S, which are indicated in FIGS. **7**A, **7**B, must be dialed to exactly correspond, so that the indications on the tote board (Circuit Board K, FIG. **10**) show the same odds as indicated for the horsepower circuits. FIGS. **7**A, **7**B show four ganged rotary switches **7***a*, **7***b*, **7***c* and **7***d* for Horse No. **1**; **7***e*, **7***f*, **7***g* and **7***h* for Horse No. **2**; and **7***i*, **7***j*, **7***k* and **7***l* for Horse No. **6**. The switches relating to Horses No. **3**, No. **4** and No. **5** having been omitted as in previous circuits.

It will be understood that instead of the separate switches on Circuit Board R and Circuit Board S being ganged together in groups of four in the manner shown, they could alternatively be ganged together as a single eight gang rotary switch, for simplicity of manipulation.

Passing now to the corresponding tote board back and lamps, which are indicated in FIG. **10** (Circuit Board K), it will be seen that the selected odds are indicated on row **10***d*, indicating from left-to-right the odds one-to-one to ten-to-one for Horse No. **1**; row **10***e*, indicating from left-to-right the odds one-to-one to 10-to-one for Horse No. **2**; and row **10***f*, indicating from left-to-right the odds one-to-one to ten-to-one for Horse No. **6**. (Horses No. **3**, No. **4** and No. **5** have been omitted.) It will be noted that the noncommon terminals of each of the indicating lamps in row **10***d* are progressively numbered from two through 11; in row **10***e*, from 12 through 21; and in row **10***f*, from 52 through 61. The common number one terminals to each of these lamps are connected together to the energizing source terminal Z2 of the 6.3 volt, 3 ampere rectifier **9***q* of Circuit Board Z (FIGS. **9**A, **9**B).

Contacts to the lamps in the Odds section of the tote board (Circuit Board K, FIG. **10**) are lighted up at the appropriate indications in accordance with the odds settings of the dials on Circuit Board S (FIGS. **7**A, **7**B), which in the present illustration are five-to-one for Horse No. **1**, three-to-one for Horse No. **2** and six-to-one for Horse No. **6**. The contacts on the bottom dials **7***d*, **7***h* and **7***l* (Horses No. **1**, No. **2** and No. **6**) are connected in succession to the appropriate connections in the Odds section of Circuit Board K, rows **10***d*, **10***e* and **10***f*, as shown in the following Table IV:

TABLE IV

Corresponding Horse	Dial (Circuit Board S)	S-Starting Contact Number (Null)	S-Contact Numbers	K-Contact Numbers
No. 1	7*d*	1	2–11	2–11
No. 2	7*e*	12	13–22	12–21
No. 6	7*l*	56	57–66	52–61

On Circuit Board S, the other end of the circuit for the Odds lamps passes through contacts **100** on the rotor arms of dials **7***d*, **7***h* and **7***l*, respectively, which contacts are connected together to contact Z1 of the rectifier **9***q* on Circuit Board Z (FIGS. **9**A, **9**B). The latter is normally connected to each of the common contacts **10** of the Win, Place and Show tote board relays **9***a*, **9***b*, **9***c*, **9***d*, **9***e*, **9***f*, **9***g*, **9***h* and **9***i* on Circuit Board Z. Thus, current is directed through the selector arms **100** (Circuit Board S, FIGS. **7**A, **7**B) to light up the selected Odds lights on Circuit Board K (FIG. **10**). This also sets up a power contact which will be actuated on operation of the Win, Place and Show relays on Circuit Board Z, in a manner to be explained hereinafter.

Let us refer, now, to the corresponding Prices schedules on Circuit Board K, comprising columns **10***g*, **10***h* and **10***i*. It will be seen that in the Win column **10***g*, winning amounts for odds one-to-one through 10-to-one are successively indicated by small lamps, each having one terminal represented by contacts **62** through **71**; in the Place column **10***h*, winnings for odds one-to-one through ten-to-one are indicated by small lamps whose terminals have contacts **72** through **81**; and in the Show column **10***i*, winnings for odds one-to-one through 10-to-one are indicated by lamps having contacts **82**–**91**.

It will be noted that on the upper three of the four ganged columns of dials for each horse, as shown on Circuit Board S, the corresponding dials have similarly numbered contacts; and each of the similarly numbered contacts is connected together to a common circuit.

The interconnections between the contacts on the upper three dials of Circuit Board S, representing each of the horses, and the corresponding contacts on the Prices columns **10***g*, **10***h* and **10***i* of Circuit Board K (FIG. **10**) are shown in the following Table V.

TABLE V

Corresponding Horse	Dials-Circuit Board S	S-Starting Contact Number (Null)	S-Contact Numbers	K-Contact Numbers
No. 1	7*a*			Win Col. 10*g*
No. 2	7*e*	89	90–99	62–71
No. 6	7*i*			
No. 1	7*b*			Place Col. 10*h*
No. 2	7*f*	78	79–88	72–81
No. 6	7*j*			
No. 1	7*c*			Show Col. 10*i*
No. 2	7*g*	67	68–77	82–91
No. 6	7*k*			

The common contacts 1 of each of the indicating lights in columns **10***g*, **10***h* and **10***i* are connected together to terminal Z2 of the 6.3 volt, 3 ampere rectifier **9***q* on Circuit Board Z (FIGS. **9**A, **9**B).

Completing these circuits, it will be noted on Circuit Board S (FIGS. **7**A, **7**B) that in the ganged rotary switches relating to the tote board indications for Horse No. **1**, the rotary arm **103** of rotary switch **7***a*, rotary arm **102** of rotary switch **7***b*, and rotary arm **101** of rotary switch **7***c*, are respectively connected to Z contacts **Z147**, **Z148** and **Z149** of the terminal strip **9***n* on the Circuit Board Z, which is shown as FIGS. **9**A, **9**B. Similarly, of the ganged rotary switches on Circuit Board S relating to Horse No. **2**, rotary arm **106** of rotary switch **7***e*, rotary arm **105** of rotary switch **7***f* and rotary arm **104** of rotary switch **7***g* are respectively connected to contacts **Z150**, **Z151** and **Z152** on the terminal strip **9***n* (Circuit Board Z). Likewise, of the ganged rotary switches on Circuit Board S relating to Horse No. **6**, rotary arm **118** of rotary switch **7***i*, rotary arm **117** of rotary switch **7***j* and rotary arm **116** of ro-

tary switch 7*k* are respectively connected to contacts Z162, Z163 and Z164 on terminal strip 9*n* (Circuit Board Z).

Let us refer to the Finish schedule, indicated in columns 10*j*, 10*k* and 10*l* of Circuit Board K (FIG. 10).

In column 10*j*, contacts 92, 93 and 94 (for Horse No. 1) are respectively connected to contacts Z147, Z148 and Z149 of the terminal strip 9*n* of Circuit Board Z (FIGS. 9A, 9B).

In column 10*k* (Circuit Board K), contacts 95, 96 and 97 (for Horse No. 2) are respectively connected to contacts Z150, Z151 and Z152 on terminal strip 9*n* of Circuit Board Z.

In column 10*l* (Circuit Board K), contacts 107, 108 and 109 (for Horse No. 6) are respectively connected to contacts Z162, Z163 and Z164 on terminal strip 9*n* of Circuit Board Z.

As with the other tote board lights on Circuit Board K, the common contacts 1 of each of the indicating lights in columns 10*j*, 10*k* and 10*l* are connected together to terminal Z2 of rectifier 9*q* on Circuit Board Z, which furnishes the power for the tote board lights.

Contacts Z147, Z148 and Z149 (for Horse No. 1) on terminal strip 9*n* of Circuit Board Z are respectively connected to normally open contact 16 for Win relay 9*g*, to normally open contact 22 for Show relay 9*d*, and to normally open contact 27 for Place relay 9*a*.

Contacts Z150, Z151 and Z152 (for Horse No. 2) are respectively connected to normally open contact 33 for Win relay 9*h*, to normally open contact 39 for Place relay 9*e* and to normally open contact 44 for Show relay 9*b*.

Contacts Z162, Z163 and Z164 (for Horse No. 6) are respectively connected to normally open contact 101 for Win relay 9*i*, to normally open contact 107 for Place relay 9*f* and to normally open contact 112 for Show relay 9*c*.

When any of the aforesaid relays is energized, the respective contacts mentioned above are closed to make connection with common contacts 10, which are all connected together to contact 1 of the rectifier 9*q*, to establish an energizing circuit through the appropriate lights in the Finish and Prices columns on the tote board, Circuit Board K (FIG. 10).

LAP COUNTER SWITCHES

In addition to the Win, Place and Show rotary switches on Circuit Board S (FIGS. 7A, 7B) are a series of additional rotary switches, one corresponding to each horse, which are designated the Lap Counter Switches.

Each of these ganged, double-poled switches has a pair of rotor arms, each of which is simultaneously set at one of two positions, Sprint or Distance, depending on whether one or two laps is desired for the race. Table VI, which follows, shows the corresponding connections between dials 7*m*, 7*n* and 7*p* of Circuit Board S and terminal strip 9*p* of Circuit Board Z (FIGS. 9A, 9B).

TABLE VI

		Rotor Contacts				Peripheral Contacts	
				Sprint		Distance	
Dial	Interconnections	S	Z(Strip 9*p*)	S	Z(Strip 9*p*)	S	Z(Strip 9*p*)
7*m*	1st Rotor	143	171	119	165	120	177
Horse No. 1	2nd Rotor	144	189	121	183	122	195
7*n*	1st Rotor	145	172	123	166	124	178
Horse No. 2	2nd Rotor	146	190	125	184	126	196
7*p*	1st Rotor	153	176	139	170	140	182
Horse No. 6	2nd Rotor	154	194	141	188	142	200

(1st and 2nd rotors are ganged)

TOTE BOARD RELAYS

Referring in detail to Circuit Board Z (FIGS. 9A, 9B), power for the Tote Board Relays is furnished from the 6.3 volt, 1.2 ampere rectifier 9*aa*, having terminal contacts 3 and 4.

Circuit Board Z shows an array of Win, Place and Show relays for each of the horse circuits, and in addition, three common relays for Win, Place and Show and a cut-off relay.

The connections to the energizing circuits for each of the four-pole double-throw Win, Place and Show relays, for each of the Horses No. 1, No. 2 and No. 6 are indicated in tabular form on Table VII, together with the connections to the six-pole double-throw common Win, Place and Show relays, which have one set of contacts for each horse in the race. In the present illustration, three sets of contacts are omitted from each of the common relays 9*j*, 9*k* and 9*l* as Horse circuits No. 3, No. 4 and No. 5 are not shown.

In addition, the cut-off relay 9m is shown on Circuit Board Z (FIGS. 9A, 9B). The energizing circuit of the latter passes from contacts 132 to 138. Contact 132 is connected through the normally open contacts Z8 for each of the Show relays 9*a*, 9*b* and 9*c*. When one of the latter is operated, energizing connection is made through contacts W181 and W182 of master switch 4*h* of Circuit Board W (FIGS. 4A, 4B) to terminal Z3 of rectifier 9*aa* (Circuit Board Z). Contact 138 on relay 9*m* is connected through normally open contact Z136, Z126 and Z119 of the common Show, Place and Win relays 9*l*, 9*k* and 9*j*, in series, ultimately to contact Z4 of rectifier 9*aa*.

When cut-off relay 9*m* of Circuit Board Z is energized, it opens the normally closed contacts 145 and 146 to contact W189 in the on-off power switch 4*q* of Circuit Board W. This shuts off power to the relays 4*i*, 4*j*, 4*k* and 4*l* of the First and Second Timer Circuits thereby cutting off their operation.

At the completion of a race, the first motor driven horse to cross the finish line (Horse No. 6 in the present example) encounters the insulated section of the track, section 3*c* of Circuit Board Y (FIG. 3). The No. 6 Horse is then disposed between contacts Y11 and Y12 of section 3*c*, which are respectively across contacts Z176 and Z194 (terminal strip 9*p*), which are across contacts S153 and S154 to the rotors of the lap counter switch 7*p* on Circuit Board S (FIGS. 7A, 7B). For present purposes, the ganged rotor switch on Circuit Board S is set in Sprint position for all of the horses, with rotor S153 connected to peripheral contact S139, and rotor 154 connected to peripheral contact S141. Contact S139 is connected to contact Z170, and contact S141 to contact Z188, both of the latter, on terminal strip 9*p* of Circuit Board Z (FIGS. 9A, 9B).

Current then flows from contact Z4 of the 6.3 volt, 1.2 ampere rectifier 9*aa*, through contact Z188 of terminal strip 9*p*, contact S141 and rotor arm S154 of lap counter switch 7*p* (Circuit Board S, FIGS. 7A, 7B), to contact Z194 on terminal strip 9*p* (Circuit Board Z) and contact Y12 on one rail of track section 3*c* (Circuit Board Y, FIG. 3). Current passes through the motor-shunting diode 2*b* of the horse circuit (FIG. 2) to con-

TABLE VII.—CIRCUIT BOARD Z—GROUPS OF RELAY CONTACTS

Corresponding horse circuit	Relay	Energizing cets. Terminal	Connections	Terminal	Connections	N.C. contacts	Connections	N.O. contacts	Connections	N.C. contacts	Connections	N.O. contacts	Connections	N.C. contacts	Connections	N.O. contacts	Connections
#1	9g	11	Z13	12	Z15	10	Z1	16	Z147	5	W181	6	Z125	13	Z17	5	Z4
			Z165		Z116									31	Z11		
#2	9h	28	Z30	29	Z32	10	Z1	33	Z150	5	W181	6	Z125	30	Z36	5	Z4
	Win		Z166		Z117									99	Z28		
			Z98		Z100									Z102	Z102		
#6	9i	96	Z170	97	Z165	10	Z1	101	Z162	5	W181	6	Z125	98	Z96	5	Z4
#1	9d	17	Z14	18	Z21	10	Z1	22	Z148	5	W181	7	Z128	20	Z23	5	Z4
			Z19		Z120									19	Z14		
#2	Place 9e	36	Z31	37	Z38	10	Z1	39	Z151	5	W181	7	Z128	35	Z40	5	Z4
			Z34		Z122									34	Z36		
			Z99		Z106									105	Z108		
#6	9f	102	Z104	103	Z131	10	Z1	107	Z163	5	W181	7	Z128	104	Z102	5	Z4
#1	9a	23	Z20	24	Z26	10	Z1	27	Z149	5	W181	8	Z130	25	Z23	5	Z4
			Z25		Z133								Z132				
#2	Show 9b	40	Z35	41	Z43	10	Z1	44	Z152	5	W181	8	Z130	42	Z40	5	Z4
			Z42		Z135								Z132				
			Z105		Z111								Z130				
#6	9c	105	Z110	109	Z143	10	Z1	112	Z164	5	W181	8	Z132	110	Z108	5	Z4
	9j	125	Z6	9	Z4	116→9	Z12	119	Z121	117→9	Z29	119	Z121	115→9	Z97	119	Z121
							Z4				Z4				Z4		
Common	9k	128	Z7	9	Z4	120	Z18	126	Z134	122	Z37	126	Z134	121	Z103	126	Z134
						121	Z119				Z119			121	Z119		
	9l	130	Z8	9	Z4	133	Z24	136	Z138	133	Z24	136	Z138	143	Z109	136	Z138
						134	Z126			134	Z126			134	Z126		

NOTE.—The following relay contacts are strapped together: 5, 6, 7, 8, 9, 10, 119, 126 and 136.

tact Y11 on the other rail of track section 3c (FIG. 3) which leads to contact Z176, on terminal strip 9p of Circuit Board Z. Current then passes through the other rotor arm 153 on lap counter dial 7p on Circuit Board S and to peripheral contact 139, from which it passes to contact Z170 on terminal strip 9p of Circuit Board Z. From this point the current passes to Z96, which is one terminal of the energizing circuit of relay 9i, which is the Win relay for Horse No. 6.

To complete the energizing circuit, the other terminal 97 of the Horse No. 6 Win relay 9i is connected through the normally closed contacts 115 and 9 of the common Win relay 9j to the other terminal Z4 of the rectifier 9aa.

When Win relay 9i is operated, it performs the following functions.

First, it locks up by closing its normally open contacts 100 and 9, making connection to terminal Z4 of the rectifier 9aa; and closing its normally open contacts 98 and 5, making contact to W181 of Circuit Board W (FIGS. 4A, 4B), which ultimately leads through the closed master switch 4h to contact Z3 of rectifier 9aa on Circuit Board Z (FIGS. 9A, 9B).

Secondly, it closes its normally open contacts 10 and 101, thereby connecting terminal 1 of rectifier 9q through Z contact 162 on terminal strip 9n, to contact K107 in the Win column 9l on Circuit Board K (FIG. 10); and contact S118 on dial 7i of Circuit Board S (FIGS. 7A, 7B). This supplies energy to light up a lamp behind a tile indicating Horse No. 6 in the winning position on the tote board.

It will be recalled that the Win, Place and Show switches on Circuit Board S have been positioned prior to the race, in accordance with the selected odds of six-to-one for Horse No. 6, five-to-one for Horse No. 1 and three-to-one for Horse No. 2. Current is caused to pass through the rotor arm 118 of dial 7i on Circuit Board S to K67 in column 10g (Circuit Board K) of the Prices column on the tote board, lighting up the winning price of $14.00. In order to obtain the Place and Show prices on the tote board for the winning horse, one reads horizontally across the row showing the winning price, which in the present case would give $5.80 for Place and $4.20 for Show.

The third function performed by the Win relay 9i (Circuit Board Z) is to break the energizing circuits to the Place and Show relays so that they cannot operate. The circuit to the Place relay 9f is broken by breaking the normally closed contacts 98 and 99, the latter being connected to the terminal of contact 102 of relay 9f and to the terminal of contact 108 (through contacts 104 and 105) of relay 9c. This prevents relays 9f and 9c from energizing.

The fourth and final function performed by operation of Win relay 9i is to close its contacts 5 and 6. The former contact leads through contact W181 on the master switch 4h of Circuit Board W (FIGS. 4A, 4B), ultimately to contact Z4 of rectifier 9aa, to supply power through contact 6 to terminal 125 of relay 9j, causing it to energize.

Again referring to Circuit Board Z (FIGS. 9A, 9B), when the common Win relay 9j operates, it transfers the rectifier current from one side of the coils of the Win bank of relays 9g, 9h and 9i, for each of the horses, to one side of the coils of the corresponding Place bank of relays 9d, 9e and 9f. This is accomplished by breaking contact between its common contacts 9, which lead

to terminal Z4 of rectifier 9*aa*, and contact 116 to the energizing circuit of relay 9*g*, contact 117 to the energizing circuit of relay 9*h*, and contact 115 to the energizing circuit of relay 9*i*. Contact is then made between each of the contacts 9 of relay 9*j* and its normally open contacts 119, which are respectively connected through each of the normally closed contacts 121 of common Place relay 9*k*. The normally closed contacts 121 of the latter respectively lead to: contact Z18 (energizing circuit of Place relay 9*d*); contact Z37 (energizing circuit of Place relay 9*e*); and contact Z103 (energizing circuit of Place relay 9*f*). All of these steps are carried out in milliseconds, conditioning the tote board relays to respond to the second horse crossing the finish line.

In the present illustrative embodiment, the second horse crossing the finish line is Horse No. 1. Upon making contact with the insulated section of track 3*a* at the finish line section for Horse No. 1 (Circuit Board Y, FIG. 3), the horse completes the circuit between contacts 1 and 2 connecting contacts Z171 and Z189 on terminal strip 9*p* of Circuit Board Z (FIGS. 9A, 9B), which are respectively connected to rotor arms 143 and 144 on lap counter dial 7*m* (Circuit Board S, FIGS. 7A, 7B). The latter, being set in Sprint position, contact is respectively made with peripheral S contacts 119 and 121, which are respectively connected to Z165 and Z183 on terminal strip 9*p* of Circuit Board Z. Contact 165 leads to contact Z11 and through the normally closed contacts 13 and 14 of Win relay 9*g* for Horse No. 1 to contact 17 in the energizing circuit of Place relay 9*d*. It will be recalled that Win relay 9*g* cannot operate because common relay 9*j* transferred power from the Win bank of relays to the Place bank of relays. Thus, an energizing circuit is set up through contact Z183, terminal strip 9*p*, to contact Z4 of rectifier 9*aa*, providing power for operation of the Place relay 9*d* for Horse No. 1.

Operation of the latter causes the following functions to be performed:

First, it breaks contact between normally closed contacts 19 and 20 leading to contact Z23 in the energizing circuit of Show relay 9*a* for Horse No. 1, so that the latter cannot function.

Secondly, it lock-operates through its own contacts by closing normally open contacts 21 and 9, thereby applying power from terminal Z4 of rectifier 9*aa* to terminal Z18 of the 9*d* relay windings.

Third, it lights the finish lamp in the Place row 10*b* for Horse No. 1 by closing its normally open contacts 10 and 22. This applies power from contact Z1 of rectifier 9*q* through contact Z148 on terminal strip 9*n* of Circuit Board Z (FIGS. 9A, 9B), which leads to contact K93 on Circuit Board K (FIG. 10).

Contact Z148 also leads to S102 on dial 7*b* of Circuit Board S (FIGS. 7A, 7B). The preset odds for Horse No. 1 having been five-to-one, armature S102 is connected to peripheral contact 83, which leads to K76 in Prices column 10*h* (Circuit Board K), illuminating the light behind a tile reading $5.20 for Place. Reading to the right in column 10*i*, the player can also collect $3.80 for Show.

Fourthly, Place relay 9*d* (Circuit Board Z) closes its normally open contacts 5 and 7, energizing common Show relay 9*k*. To do this, power is applied from contact Z3 of rectifier 9*aa* through the master switch 4*h* on Circuit Board W (FIGS. 4A, 4B) to terminal Z128 of the energizing circuit of common Show relay 9*k* (Circuit Board Z).

When operated, this latter relay functions to transfer current from one side of the coils of Place relays 9*d*, 9*e* and 9*f* (Circuit Board Z) to one side of the coils of the Show relays 9*a*, 9*b* and 9*c*. This is carried out by breaking connection between each of its contacts 120, 122 and 131 and common contacts 121, which leads through contact 9 of relay 9*j* to the source of power at terminal Z4 of rectifier 9*aa*. Contact 121 is then closed to each of its normally open contacts 126, which lead through the normally closed contacts of common Show relay 9*l* to the energizing circuit of each of Show relays 9*a*, 9*b* and 9*c*, conditioning each of these for the third horse to cross the finish line.

In the present illustration, the third horse to cross the finish line is Horse No. 2, for which three-to-one odds were selected prior to the beginning of the race. At this point in the race Horse No. 2 enters the insulated section 3*b* of track as shown in FIG. 3, his circuit disposed across contacts 3 and 4 which are respectively connected between contacts Z172 and Z190 on terminal strip 9*p* of Circuit Board Z (FIGS. 9A, 9B) and corresponding contacts S145 and S146 to the rotors of dial 7*n* of the Lap Counter Switch of Circuit Board S (FIGS. 7A, 7B) which, as in the previous switches, is set at Sprint. The two rotors 145 and 146 are respectively connected to peripheral contacts S123 and S125, which are respectively connected between contacts Z166 and Z184 on Circuit Board Z. Contact 184 of terminal strip 9*p* is connected to contact Z4 of rectifier 9*aa*, and serves to supply power to terminal Z28 of the coil of Win relay 9*a* for Horse No. 2. But the energizing circuit of Win relay 9*h* is broken by the operation of common Win relay 9*j*; and the energizing circuit of Place relay 9*e* is broken by the operation of common Place relay 9*k*. Therefore, power from rectifier 9*aa* is ultimately transferred through the normally closed contacts of relays 9*h* and 9*e* through the energizing circuit from contacts 40 to 41 of Show relay 9*b*. Operation of relay 9*b* causes the following functions to be performed:

First, it closes its normally open contacts 10 and 44, connecting power from contact Z1 of rectifier 9*q* through contact Z152 on terminal strip 9*n* of Circuit Board Z (FIGS. 9A, 9B). This illuminates lamp K97 of Circuit Board K (FIG. 10), indicating that Horse No. 3 is in Show position. Simultaneously, since odds of three-to-one have been preset, energizing current passes through contact Z152 on terminal strip 9*n* of Circuit Board Z to armature S104 of dial 7*g* of Circuit Board S (FIGS. 7A, 7B), and to peripheral contact S70. The latter is connected to contact K84, lighting the lamp under $3.00 in the Show column 10*i* of the Prices schedule on the tote board of Circuit Board K.

Second, Show relay 9*b* lock-operates by closing its normally open contacts 9 and 43, to connect contact Z4 of rectifier 9aa to terminal 41 of its energizing circuit.

Third, it operates its normally open contacts 5 and 8 to energize common relay 9*l* by completing the power circuit from contact Z3 of rectifier 9*aa* through master switch 4*h* on Circuit Board W (FIGS. 4A, 4B) to terminal Z130 of the relay energizing circuit.

When relay 9*l* operates, it removes power from the energizing circuits of each of the Show relays 9*a*, 9*b* and 9*c* by opening connection between its contacts 134 and each of contacts 133, 135 and 143, so that a fourth horse crossing the finish line in close proximity to the

third horse would not register on the tote board. It completes connection of each of its contacts **134** with its respective contacts **136** to the energizing circuit of cut-off relay **9*m***. The latter opens its normally closed contacts **145** and **146**, cutting off power from master switch **4*q*** on Circuit Board W (FIGS. 4A, 4B) to the timing circuits, and thereby turning off the driving mechanism until the following game begins. The numbers and prices of the horses remain illuminated on the tote board (Circuit Board K, FIG. **10**) through the lock-up of relays **9*i***, **9*d*** and **9*b*** on Circuit Board Z (FIGS. 9A, 9B).

The two start-stop switches **4*p*** and **4*q*** of Circuit Board W should then be turned to "off" position. The tote board reset switch **4*h*** is then turned off, deenergizing the locked up relays **9*i***, **9*d*** and **9*b*** by breaking the circuit from their respective contacts **98**, **19** and **42** to their common contact **5**, which leads through switch **4*h***. This causes each of the aforesaid relays to drop its contacts, extinguishing the corresponding tote board lights, and restoring the tote board to normal condition for the next race.

The horses can then be lined up in the start position as indicated on Circuit Board Y (FIG. **3**). Operation of tote board reset switch **4*h*** and the two startstop switches **4*p*** and **4*q*** of Circuit Board W then starts a new race.

Although the indicating means shown on Circuit Board K in the embodiment under description take the form of conventional lamps, it will be apparent to those skilled in the art that other types of indicating means can be substituted for the lamps, such as, for example, digital indicators.

FUNCTION OF LAP COUNTER CIRCUITS AND OPERATION OF TWO LAP RACE

The foregoing description covered a single lap race from start to finish, the ganged lap counter relays **7*m*** (for Horse No. **1**), **7*n*** (for Horse No. **2**) and **7*p*** (for Horse No. **6**) having each been set with their two rotor arms respectively in Sprint position on each of the dials.

If it is desired to have a two lap race, the six ganged rotors on dials **7*m***, **7*n*** and **7*p*** (together with the dials of Horses No. **3**, No. **4** and No. **5**, not shown) are moved to the Distance position, as indicated on the respective dials. These connections are indicated in Table VI hereinbefore.

This serves to transfer the rails of the finish line sections **3*a***, **3*b*** and **3*c*** of Circuit Board Y (FIG. **3**) from their connections with terminal Z4 of rectifier **9*aa*** and the tote board relays of Circuit Board Z (FIGS. 9A, 9B), across contacts V78 and V79 of the common rheostat 6bb of Circuit Board V (FIG. **6**), through the common normally open contacts T6 and T7 of each of the lap counter relays **8*b***, **8*c*** and **8*d*** of Circuit Board T (FIG. **8**).

The energizing connections and the contact connections of lap counter relays **8*b***, **8*c***, **8*d***, **8*e***, **8*f*** and **8*g*** are shown in tabular form in Table VIII.

Rheostat **6*bb*** of Circuit Board V (FIG. **6**) is connected across contacts V7 and V8 of the common power rectifier **6*q***, which functions to furnish common power to the finish line sections **3*a***, **3*b*** and **3*c*** of Circuit Board Y (FIG. **3**) corresponding to each of the horse circuits No. **1**, No. **2** and No. **6**, under description.

TABLE VIII.—LAP COUNTER RELAYS (CIRCUIT BOARD T)

Horse circuit	Relay	Energizing contacts				Relay contacts															
		Terminal	Connections	Terminal	Connections	N.C. contacts	Connections	N.O. contacts	Connections	N.C. contacts	Connections	N.O. contacts	Connections	N.C. contacts	Connections	N.O. contacts	Connections	N.C. contacts	Connections	N.O. contacts	Connections
#1	8b	3	T2	89	T8	15	Z177	16	Z165	18	V78 Z195	19	Z183	10	T11 T100	6	V78	12	W179 T101	7	V79
	8c	3	T2	11	T9 T8	8	T11 T80	4	W179												
#2	8e	3	T2	90	T23	30	Z178	31	Z166	33	V78 Z196	34	Z184	25	T21 T102	6	V78	27	W179 T103	7	V79
	8f	3	T2	21	T24 T23	23	T21 T90	4	W179												
#6	8d	3	T2	94	T96	84	Z182	85	Z170	87	V78 Z200	88	Z188	79	T77 T110	6	V78	81	W179 T111	7	V79
	8g	3	T2	77	T78 T96	96	T77 T94	4	W179												

NOTE.—Like-numbered contacts of the above-identified relays are strapped together. These include contacts numbered 3, 4, 5, 6 and 7. Each of the above-identified relay coils is shunted by a 0.0068 microfarad capacitor.

Thus, constant power appears in all sections of track at the finish line. Consequently, when horses reach the finish line on the first lap of the race, they do not register on the tote board; but their motors receive current which carries them over these sections of track (*3a*, *3b* and *3c*) of Circuit Board Y to the next sections of track (*3d*, *3e* and *3f*) which are also insulated from the other sections of track, and are not connected to any sources of power.

In the example under description, when Horse No. **6** reaches the finish line section *3c* on the first lap, it proceeds to the next succeeding lap counter section *3f*, as previously described. Upon making contact with track section *3f*, Horse No. **6** completes a circuit from terminal **1** of rectifier *8a* of Circuit Board T (FIG. **8**), through the contacts of master switch *4n* of Circuit Board W (FIGS. 4A, 4B), the normally closed contacts **5** and **8** of lap counter relay *8d* on Circuit Board T, contact **T111** on terminal strip *8h* of Circuit Board T to contact **Y23** on one side of track section *3f* (Circuit Board Y). Current passes through the diode across the horse motor to contact **Y24**, which is connected through the normally closed contacts **T79** and **T78**, relay 8d of Circuit Board T, to contact **T77** through the energizing circuit of the corresponding lock-up relay *8g*, completing the circuit to the terminal **2** of rectifier *8a* of Circuit Board T (FIG. **8**).

Lock-up relay *8g* operates and performs a single function. It supplies a constant source of power for its own energizing circuit and for the energizing circuit of lap counter relay *8d*, by closing its normally open contacts **96** and **4**, which connect both of these circuits through the contacts of master switch *4n* on Circuit Board W (FIGS. 4A, 4B) to terminal **1** of rectifier *8a* of Circuit Board T, causing both relays *8g* and *8d* to lock up.

Operation of lap counter relay *8d* performs two functions.

First, it transfers contacts **Y23** and **Y24** on the lap counter rail section *3f* of Circuit Board Y (FIG. **3**) from their connection with rectifier *8a* and lock-up relay coil *8g* of Circuit Board T to the terminals **V78**, **V79** of rheostat *6bb* of Circuit Board V (FIG. **6**). This is done by relay *8d* closing its normally open contacts **6** and **7** to its contacts **79** and **81**, respectively. On Circuit Board V the opposite terminals **V80** and **V81** of rheostat *6bb* are connected across terminals **V7** and **V8** of the common power rectifier *6q* which supplies power for the finish line section on the second lap.

Thus, constant power is now applied to the rails of lap counter section *3f* on the track of Horse No. **6** (Circuit Board Y), enabling the horse to move over this section to section *3i*, where the electricity is distributed in the form of random pulses by the sequential selector of Circuit Board W, in the manner previously described.

The second function performed by operation of relay *8d* on Circuit Board T (FIG. **8**) is to transfer contacts **Y11** and **Y12** in the finish line section *3c* (Circuit Board Y, FIG. **3**) from their connection with rheostat *6bb* and rectifier *6q* on Circuit Board V (FIG. **6**) to rectifier *9aa* and the tote board relays of Circuit Board Z (FIGS. 9A, 9B), so that the next time the Horse No. **6** encounters the finish line section *3c*, the normal sequence of events will occur as described hereinbefore with reference to the one lap race. This function is carried out as follows. Operation of lap counter relay *8d* (Circuit Board T) breaks its normally closed contacts **7** and **84**, and **6** and **87**, and closes its normally open contacts **84** and **85**, and **87** and **88**.

Contacts **84** and **87** of relay *8d* are respectively connected between contacts **Z182** and **Z200** on terminal strip *9p* of Circuit Board Z, which are connected between peripheral contacts **S140** and **S142** on lap counter switch *7p* on Circuit Board S (FIGS. 7A, 7B). Switch *7p* and the corresponding switches for the other horses, now have their rotors placed in the Distance position as indicated on the dials. Thus, contacts **S140** and **S142** are respectively connected between rotors **153** and **154**, which are, in turn, connected between contacts **Z176** and **Z194** on terminal strip *9p* of Circuit Board Z which are across horse circuit terminals **Y11** and **Y12** on finish line section *3c* of Circuit Board Y.

On Circuit Board T, contacts **85** and **88** of relay *8d*, which in the present condition are connected to the horse terminals, are respectively connected between contacts **Z170** and **Z188** on terminal strip *9p* of Circuit Board Z (FIGS. 9A, 9B). Contact **170** leads to terminal **Z96** of the Win relay *9i* for Horse No. **6**; and contact **188** leads to terminal **Z4** of rectifier *9aa* for energizing circuit including the Win relay when Horse No. **6** reaches the finish line section *3c* (Circuit Board Y, FIG. **3**), the second trip around.

It will be appreciated that the sequence of events is similar for each of the horses encountering the finish line on the first and second laps. The third horse to complete two laps actuates its Show relay, which, in turn, actuates cut-off relay *9m* on Circuit Board Z, cutting off the game in the manner previously described with reference to a single lap race.

MISCELLANEOUS FUNCTIONS

The make-when-depressed buttons *6j*, *6k* and *6l* individual to each horse, which are found on Circuit Board V (FIG. **6**), when depressed complete a circuit from the corresponding one of rheostats *6m*, *6n* and *6p* (also Circuit Board V) to the power connection (bypassing the contacts of horsepower relays *6d*, *6e* and *6f*, Circuit Board V) to the track (Circuit Board Y). This supplies constant power to the track causing the corresponding numbered horse to move. In this manner, horses that were stranded in the backstretch, when the game turned off at the end of the race, can be brought back to the start position.

Adjusting the rheostats *6m*, *6n* and *6p* (one for each horse) on Circuit Board V to control the speed of the horses should be performed as follows at the beginning of each game. All of the horses are placed in a straight line on the straight section of track preceding a curve and the individual rheostats *6m*, *6n* and *6p* adjusted so that one pulse of current when the game is turned on, carries all of the horses to a position on the curve so that a straight line can be drawn across their front ends, as illustrated in FIG. **11** of the drawing.

In order to accomplish this, the horse on the outside oval must be travelling faster than the horse on the next inner oval, etc., the horse on the innermost oval travelling at the slowest rate. This is necessary because the innermost horse has less distance to travel than any other horse; and the further the outpost, the further the horse has to travel. This is compensated for by increas-

ing the speed of the horses as you move outward from number one.

At the very beginning of each game, after switches **4***p* and **4***q* of Circuit Board W (FIGS. 4A, 4B) are turned to their "on" positions, in order to increase the randomness of the system, the contact **159** of relay **4***i*, First Timer, is manually depressed to contact **160**, closing the circuit to stepping switches **4***a* and **4***b*, and causing the system to move through a single step. This prevents any possibility of any repetitive pattern being set up, based on that of the last game played.

A particular feature of the present embodiment is that all of the relays are designed for fast operation, after not longer than about one seventy-fifth of a second, and preferably, as fast as one one hundred twenty-eighth of a second. This serves to prevent dead heats from occurring between two or more horses. In the embodiment under description, the relays are preferably designed to operate at 12 volts, although this may be varied, as convenient. In any case, it is undesirable to use high voltages because of the safety factor. In the present embodiment, the following illustrative types of relays were used, as disclosed in the Distributor Stock Catalogue, issued May 1, 1969, by Sigma Instruments, Inc., 299 Forest Avenue, Paramus, N.J. 07625.

Identification of Relay	Circuit Board	FIG. No.	Catalogue No.	Page
Common Relays *9j, 9k, 9l*	Z	9B	62R6-6DC (could be 12DC)	6
Win, Place & Show Relays *9a* through *9i*	Z	9A	62R4-6DC (could be 12DC)	6
Lap Counter Relays *8b, 8c, 8d*	T	8	62R4-12DC	6
Lap Counter Lock-Up *8e, 8f, 8g*	T	8	65F1A-12DC	7
Cut-Off Relay 9m	Z	9B	11F-250G-Sil	3
First & Second Timer Relays *4i, 4j, 4k, 4l*	W	4A	62R2-6DC (could be 12DC)	6
Horsepower Relays *6d, 6e, 6f*	V	6	62R2-6DC (could be 12DC)	6

In the present illustrative embodiment, each of the stepping selector relays **4***a* through **4***f*, as shown on Circuit Board W (FIGS. 4A, 4B) is a continuous operation rotor-relay of the type manufactured by Guardian Electric Co., Chicago, Ill., under the trade name "Rotomite" stepping switch, as item number 1R-705-12P-24D in their catalogue published in 1969. An important feature of this type of selector is that when it reaches the last step in the series, it automatically returns to the first step for recycle, without the actuation of a specific release mechanism.

It will be understood that the present invention is not limited to any of the specific forms or mechanisms shown by way of illustration. For example, although the particular model described is a six horse race, it will be appreciated that any number of horse units can be employed, and furthermore, that the race can be designed to have as many laps as desire. Moreover, although the model described is a horse race, it will be appreciated that the concept of the present invention can be adapted to many different types of racing units, such as, for example, racing cars, boats, men, etc.

As one alternative to the mechanism indicated on Circuit Board W (FIGS. 4A, 4B) in the present illustrative embodiment, a single selector mechanism having **48** contacts (or other convenient number), which is directly driven by the First Timer pulse circuit, could be substituted for the system including primary selectors **4***a*, **4***b* and auxiliary selectors **4***c*, **4***d*, **4***e* and **4***f*. Moreover, it is within the contemplation of the invention that a variable speed motor driven commutator which continuously moves through **48** contacts (or whatever number of contacts is arbitrarily selected) could be substituted for the latter combination. The commutator would have its speed geared down to correspond to the pulsing speed of the Second Timer, acting independently. A further alternative would be to provide a separate motor driven commutator for each horse.

Moreover, as a further alternative, instead of each of the horses, or other racing units, having individual driving motors, a single motor can be connected to energize individual units at different steps of the commutator, whenever there is a coincidence with an independently driven pulsing unit.

More broadly, the concept of the present invention is applicable to other types of systems, such as, for selecting random numbers, and for many and varied purposes.

What is claimed is:

1. A method for playing a game of chance between a plurality of electrically driven units which comprises in combination the steps of:

deriving pulses from two distinct pulse sources operating at substantially different frequencies which are not harmonically related,

employing the pulses from one said source to drive a stepping selector system through a repetitive cycle of steps, each of said steps being connected on contact during said selector cycle to condition a unique circuit to one of said electrically driven units for possible energization by a pulse from the other said pulse source,

utilizing pulses from the other said pulse source, which are applied through random steps of said stepping selector system upon a coincidence between the pulses of said two pulse sources, to energize one or another of said electrically driven units over one of said conditioned unique circuits, for driving said unit along a preselected course,

and utilizing the first said unit reaching a preselected goal on said course to actuate an indicator.

2. The method in accordance with claim **1** wherein at least one said pulse source is constructed with a built-in frequency drift of a few cycles per minute.

3. The method in accordance with claim **2** wherein each of said pulse sources is constructed with a builtin frequency drift of a few cycles per minute.

4. The method in accordance with claim **1** wherein the number of said unique circuits conditioned to energize a specific one or another of said electrically driven units during a single selector cycle can be varied from game to game prior to the playing of said game, thereby to vary the odds of one or the other of said units being a winner.

5. The method in accordance with claim **1** wherein prior to operation of each game a single pulse is supplied to said stepping selector for driving said stepping selector to move through a single step before beginning said game, thereby to increase the randomness of said game.

6. The method in accordance with claim **1** wherein said game is an electronic horse race, and wherein said game is played using electrically driven units which

simulate race horses, which are driven by individual motors to move along a preselected course which simulates a race track, each of said individual motors being disposed in contact with a low friction electrically conducting path for propelling a corresponding one of said simulated race horses along said track.

7. The method in accordance with claim 6 wherein the terminals of the driving unit comprising said individual motors are movably disposed across a double rail electrically conducting track.

8. The method in accordance with claim 6 wherein the finish line track section is insulated from the driving sections of said track, and wherein a circuit including said finish line section is actuated upon contact with a wining horse crossing said finish line to energize a winning display indicator uniquely connected to said winning horse circuit.

9. The method in accordance with claim 8 wherein, in addition to energizing a "winning" display indicator, a winning horse crossing said finish line conditions a "-place" indicating circuit which responds to the second said horse crossing said finish line to energize a "place" display indicator on said tote board; and wherein, in addition, the said second horse crossing the finish line conditions a "show" indicating circuit which responds to the third horse crossing the finish line to actuate a "show" indicator on said tote board, and wherein, in addition, said third horse crossing the finish line conditions a circuit to prevent further indications when additional horses cross the said finish line.

10. The method in accordance with claim 8 wherein a section of the said track designated the "lap counter section" is disposed to immediately follow the finish line section of said track; and wherein said lap counter section is disposed by a manual pregame setting to deactivate the circuit for energizing the winning display indicators corresponding to each of said horses for a preselected number of laps traversed by said horses around said track, and to reactivate the said circuit for energizing said winning display indicators on the last lap of said horses around said track.

11. A game of chance comprising in combination:

a plurality of units having electrical driving means,

said units disposed to be propelled along a preselected course,

a pair of pulse sources operating simultaneously at substantially different frequencies which are not harmonically related,

a stepping selector system connected to be stepped through a repetitive cycle of contacts by the pulses from a first one of said pulse sources,

the driving means of each of said units being connected to one or more discrete contacts of said selector system,

and means responsive to the second one of said pulse sources upon a coincidence with a stepping pulse from said first pulse source to energize a circuit supplying a spurt of power through one of said selector contacts to one said driving means, thereby propelling the unit corresponding to said driving means to move along said preselected course.

12. A game in accordance with claim 11 wherein at least one of said pulse sources has a built-in frequency drift.

13. A game in accordance with claim 12 wherein both said pulse sources have built-in frequency drifts.

14. A game in accordance with claim 11 wherein the selector contacts which are connected to the electrical driving means in each said unit during one cycle of said selector system are connected in circuit relationship with odds selecting means which is adjustable at the beginning of each game to vary the number of selector contacts connected to the driving means of each said unit during one selector cycle, thereby to adjust the winning odds on each said unit.

15. An electronic horse race in accordance with claim 14:

wherein said units simulate race horses, each said electrical driving means comprising an individual motor,

said preselected course comprising a plurality of adjacent individual electrically conducting tracks,

each said horse motor being disposed in electrical contacting relation for propulsion along one of said individual tracks,

said combination including an electrically actuated tote board having indicating means for each said horse connected in circuit relationship with said system and disposed to indicate information in response to the conditions of each race including the first horses to reach a preselected position on each of said individual tracks.

16. An electronic horse race in accordance with claim 15 wherein each of said individual tracks is continuous and comprises a finish line track section insulated from the other sections including the driving sections of said individual tracks,

means connected to said finish line track sections which are actuated upon contact with one or more winning horses crossing said finish line to actuate appropriate winning indicating means on said tote board connected through a corresponding one of said horse circuits.

17. An electronic horse race in accordance with claim 16 wherein said tote board includes indicating lights for "Win," "Place" and "Show" indications individual to each said horse; and wherein first means are connected to said finish line track sections which operate when the winning horse crosses said finish line track section, in addition to energizing a "winning" display indicating means on said tote board, to condition a "place" indicating circuit which responds to the second said horse crossing the finish line to actuate the "place" indicating means on said tote board; wherein second means are connected to said finish line track sections, which operate when the second horse crosses said finish line track section, in addition to energizing a "-place" indicating means on said tote board, to condition a "show" indicating circuit which responds to the third said horse crossing the finish line to actuate "show" indicating means on said tote board; and wherein third means are connected to said finish line track sections, which operate when the third horse crosses said finish line section, in addition to energizing a "show" indicating means on said tote board, to condition a circuit to prevent further indications on said tote board when additional horses cross the said finish line track section.

18. An electronic horse race in accordance with claim 16 wherein each of said individual tracks comprises a lap counter section immediately following said finish line section, each said lap counter section being insulated from said finish line section and from the

remaining portion of each of said individual tracks, relay means connected to said lap counter section which is constructed and arranged in response to a manual pregame setting to deactivate said tote board on the winning display indications corresponding to each of said horses for a preselected number of laps traversed by said horses around said track, and to reactivate said winning display indications on the last lap of each of said horses around said individual tracks.

19. An electronic horse race in accordance with claim 14 wherein said tote board includes means in circuit relation with said odds selector means for indicating the selected odds on each said horse.

20. An electronic horse race in accordance with claim 19 wherein said tote board includes indicating means connected to said odds selector means and each said horse circuit to indicate the amount paid for "Win," "Place" and "Show" at the preselected odds.

21. A game of chance comprising in combination:

means for driving a plurality of racing units including driving means for driving said racing units to traverse a preselected course,

commutating means including a series of contacts, at least one of said contacts being uniquely connected to the driving means for each of said racing units,

means comprising a first pulse source for driving said commutating means to engage the contacts of said series in orderly progression at a regular contacting rate,

a second pulse source independent of said first pulse source constructed to generate pulses at a frequency which is roughly of the same order but a nonharmonic of the pulse rate of a said first pulse source,

a source of power,

and means for utilizing coincidences between the pulses of said second independent pulse source and engagement of one of said contacts by said commutating means to complete one of said unique circuits between said source of power and said driving means for driving a specific one of said units to move in a preselected direction along said course.

22. The combination in accordance with claim 21 wherein said commutating means comprises a system of stepping selectors, and wherein means for driving said racing units comprise motors individual to each said unit, each of said motors uniquely connectable at one or more steps of said selectors to be energized upon a coincidence with a pulse from said independent pulse source to drive the corresponding racing unit a preselected distance on said course.

23. The combination in accordance with claim 22 which includes means for manually varying the number of steps in said selector system uniquely connectable to specific ones of said racing units, thereby to vary the odds on said units.

24. A game of chance comprising in combination:

means for driving a plurality of racing units including driving means for driving said racing units to traverse a preselected course,

commutating means comprising a plurality of motor driven commutators individual to said racing units,

means for driving each of said commutators to move in sequence through a series of contacts in orderly progression at a regular contacting rate for placing each of said racing units in unique circuit relationship on at least one said contact with the means for driving said racing unit,

an independent pulse source constructed to generate pulses at a frequency which is roughly of the same order but a nonharmonic of said regular contacting rate,

a source of power,

and means for utilizing coincidences between the pulses of said independent pulse source and engagement of said one contact by said commutating means to complete one of said unique circuits between said source of power and said driving means for driving a specific one of said units to move in a preselected direction along said course.

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