

May 31, 1955

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2,709,593

GOVERNOR CIRCUIT FOR BALL GAMES

Original Filed Aug. 19, 1949

4 Sheets-Sheet 1

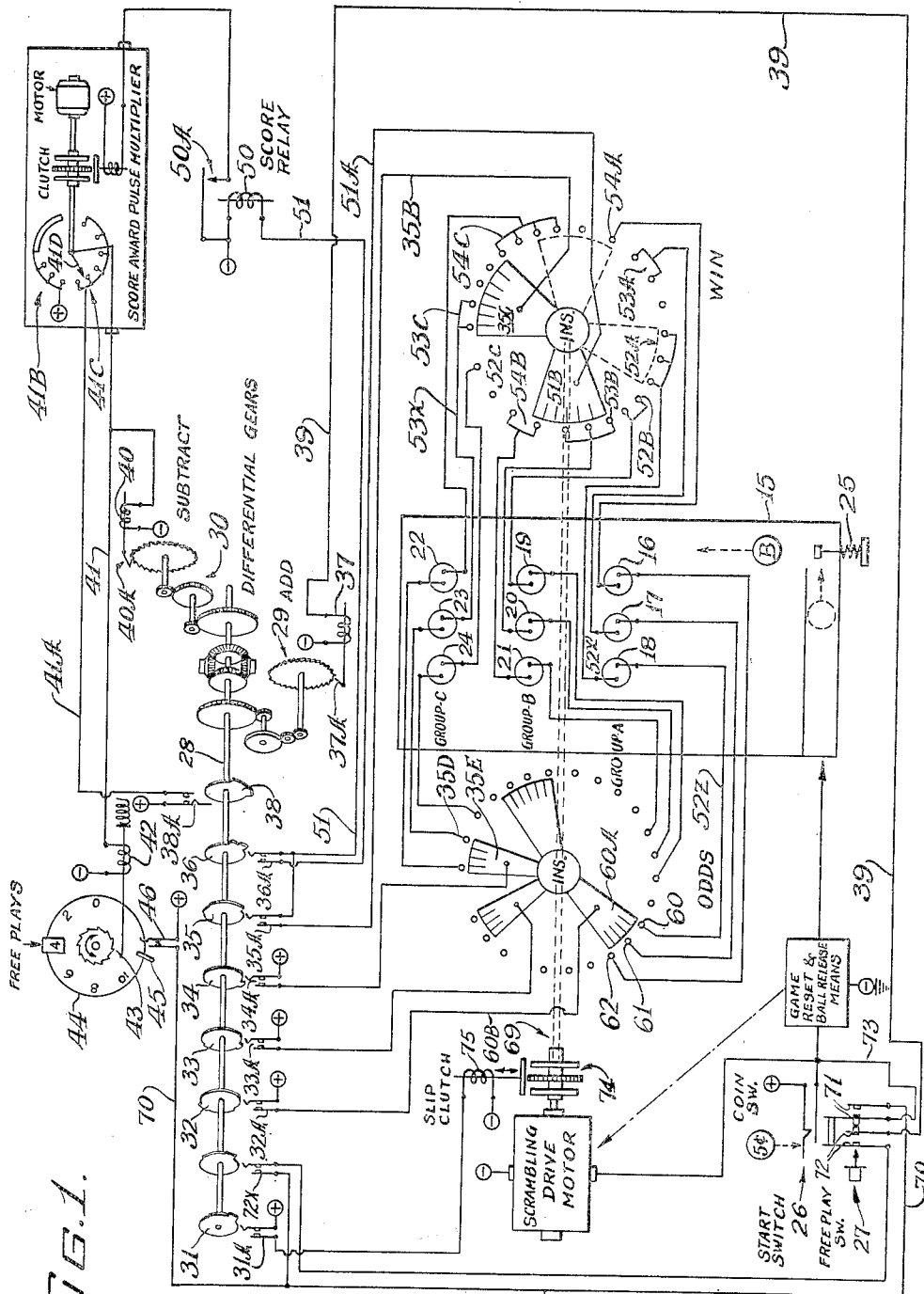


FIG. 1.

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FIG. 2.

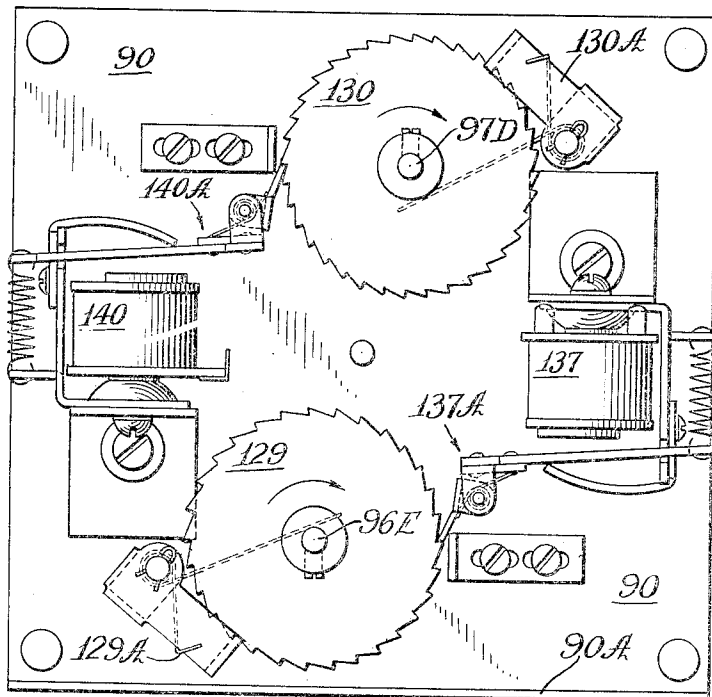
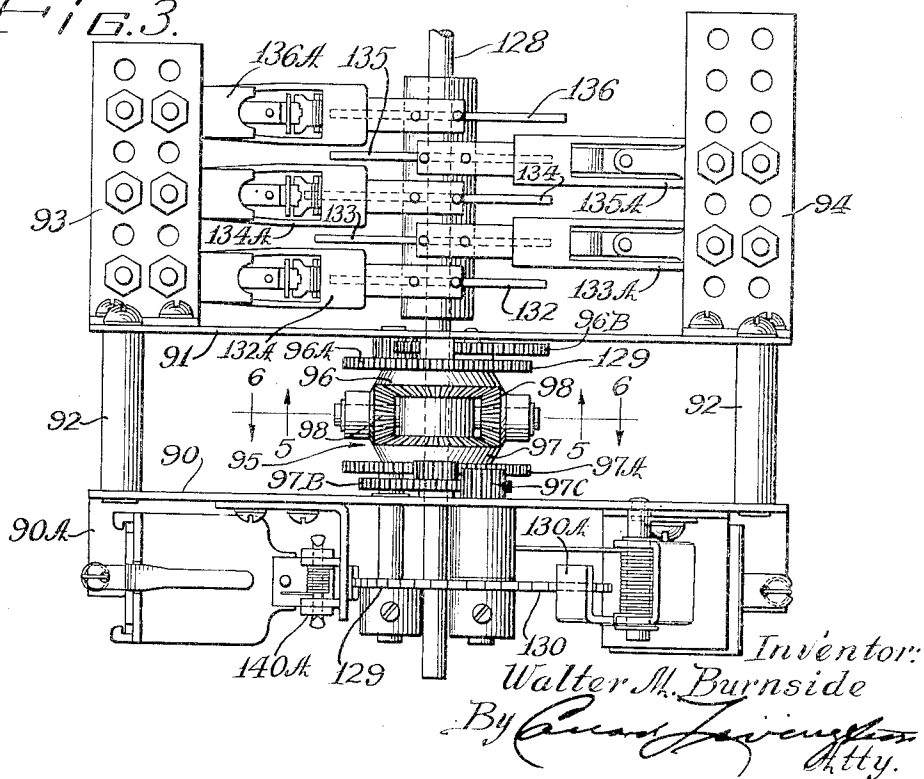


FIG. 3.



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FIG. 4.

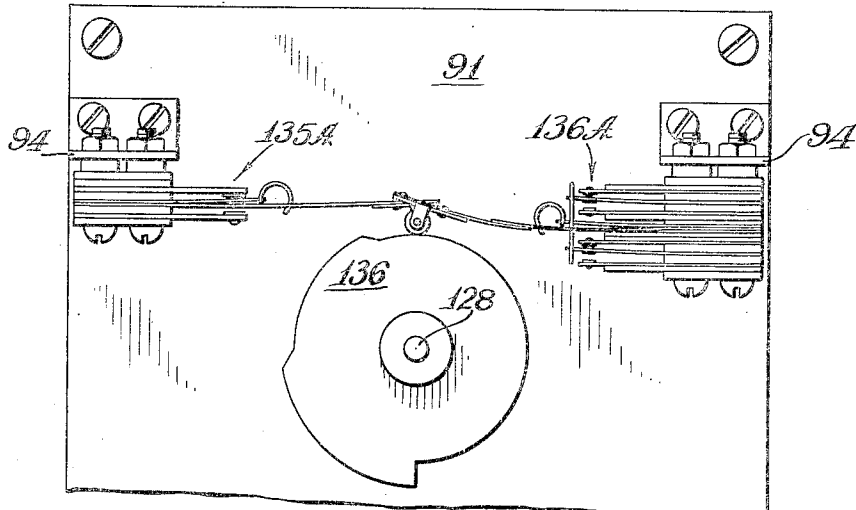


FIG. 5.

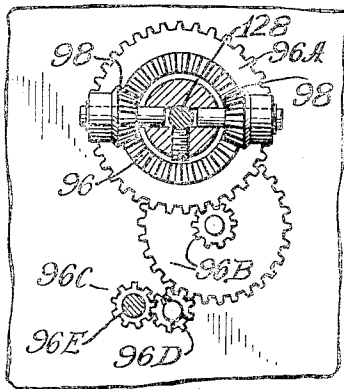


FIG. 6.

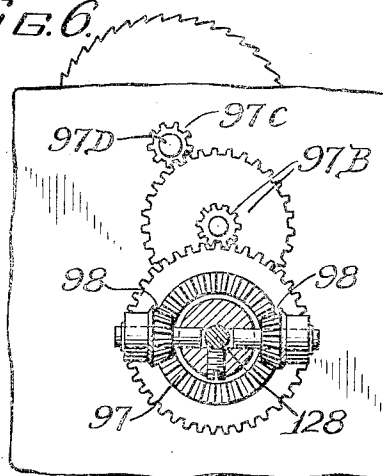
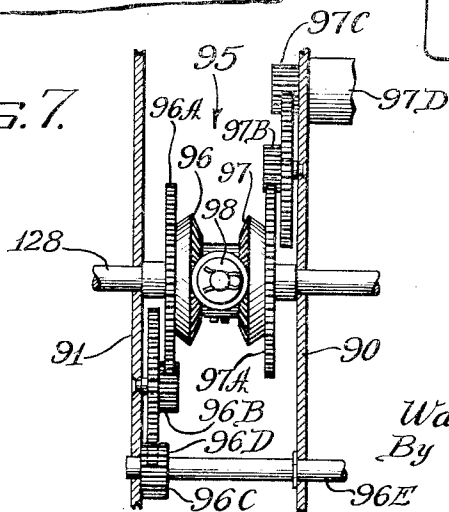


FIG. 7.



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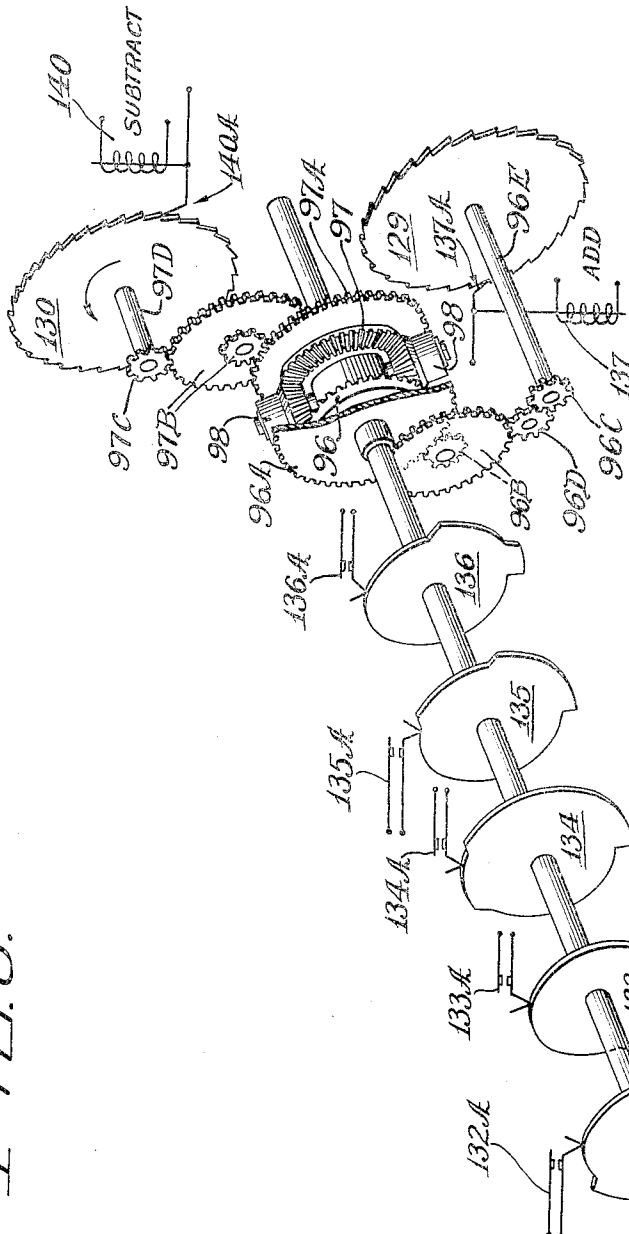
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4 Sheets-Sheet 4



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2,709,593

GOVERNOR CIRCUIT FOR BALL GAMES

Walter M. Burnside, Waukegan, Ill., assignor to
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Substituted for application Serial No. 111,130, August
19, 1949. This application September 10, 1954, Serial
No. 455,217

16 Claims. (Cl. 273—121)

This invention has as its principal object the provision of governor means, for use with ball-rolling games and the like, including circuits for changing the possible winning combinations of ball objectives or targets, and a governor switch for controlling said circuits, the present application being a substitute for application Serial No. 111,130, filed August 19, 1949, now abandoned.

More detailed features and objects relate to the provision of governor means of the class described characterized in that it affords a plurality of switches actuated by corresponding cams driven in opposite directions dependently upon the rotation of a common shaft driven through a differential gearing by separate electromagnetic means and so contrived, by reason of specially selected gear ratios, cam developments, and operating connections for said electromagnetic means, that the turning of the cam shaft in one direction produces a predetermined rate or frequency of change in a positive sense, and in the other direction a possibly different rate in a negative sense, the ultimate object being to actuate the switches in accordance with the frequency of operation of the electromagnetic actuating means at some desired ratio, so that, by way of example, if desired each operation of the electromagnetic means for producing a "positive" displacement of the cam shaft would produce twice or perhaps only one-half as much turning of the shaft as would operation of the electromagnetic means for producing "negative" movement.

A further detailed object is the provision of circuit connections for actuating one of the aforesaid electromagnetic differential drive means by the score awarding circuits in a known type of ball-rolling game; and to actuate the other electromagnetic drive means by the game starting or operating switch, so that the cam switches are actuated in a positive sense by the starting switch each time the game is played and in a negative sense by the score awarding circuits each time the player scores, in order that control circuits may be set up to increase the possibility of scoring the more often the game is operated without attaining a score, and to decrease the possibilities of scoring as a result of the player's successes in scoring, so that the less skillful player is on a more even footing with the skillful player.

Still another aspect of the improvement is the provision, in a game circuit as last above characterized, of switches for changing the odds as well as the winning possibilities in such a game by cutting individual ball switches and groups of said switches into and out of circuit under direct or cooperative control of the novel governor means dependently upon the number of times the game is played and the success or failure of the player in scoring.

In addition to the foregoing objects, the invention also provides a compact governor unit particularly suited for use in the aforesaid governor circuits and also adaptable to other applications where a differential switch action is required responsive to at least two control factors of variable frequency.

Yet another detailed object is the provision in a differ-

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ential switch of the character described of a cam shaft driven in opposite directions through gearing of a differential character, and impulse-operated electromagnetic drive means for actuating said gearing to produce opposite rotations of the cam shaft different angular amounts responsive to single pulses of equal magnitude and which respectively correspond to opposite (e. g. positive and negative) control factors supplied or derived from any source and occurring with the same or different relative frequency.

Additional objects and aspects of the invention pertain to details of the connections, structures, and operation of the illustrative embodiment described hereinafter in view of the annexed drawing in which:

Fig. 1 is a circuit diagram of a governor circuit employing the novel governor unit in conjunction with a coin-operated ball-rolling game with free play scoring circuit;

Fig. 2 is a front elevation of the governor unit;

Fig. 3 is a top plan view of the governor unit;

Fig. 4 is a fragmentary rear elevation of the cam switch means of the governor unit;

Fig. 5 is a fragmentary vertical section of the differential gear means looking in the direction of lines 5—5 of Fig. 3;

Fig. 6 is a fragmentary vertical section of the differential gear means looking in the direction of lines 6—6 of Fig. 3;

Fig. 7 is a fragmentary vertical section through the complete differential gear means of Figs. 5 and 6 looking at right angles to the latter views.

Fig. 8 is a skeletonized perspective of the essential components of the governor switch.

One type of ball-rolling game with which the novel circuit governor is used is shown schematically in Fig. 1, wherein a conventional playing board 15 is provided with suitable ball operated switches 16 to 24 divided into three groups, A, B, and C. The ball B is launched upon the board by any of several well-known means, such for example as the shooter or plunger 25, to be lodged or skillfully directed against or onto any of the said ball switches.

This type of ball game has a starting switch 26, which may be operated by deposit of a coin, and it has in addition a Free Play Control Means, e. g. a free play switch 27, automatically conditioned as a result of winning a certain score (as by operation of certain "winning" ball switches) so that the player may continue to play the game without deposit of coins if he achieves a proper score.

Free Play Control Means are known in the art, and one suitable type is described in U. S. Patent No. Re. 20,698 to William H. Bellah.

In order to add interest and variety to this game, the present invention provides an automatic governing means acting to connect the various ball objectives or target switches variously in and out of circuit at different times with the winning register and free play control, and to do so in some predetermined ratio or dependence related to the frequency with which the game is operated and the frequency with which winning combinations or scores are achieved.

Accordingly, the novel governor circuit includes a shaft 28 (Fig. 1) driven through a differential gearing generally designated at 29 and 30.

Fixed upon the governor shaft 28 are a plurality of switch cams numbered 31 through 36, each of which actuates an associated governor switch 31A . . . 36A.

Some of the governor switches (e. g. 35A, 36A) are connected in control circuits with certain ball switches to condition the same to "win," that is, to render the associated ball switch "alive" for scoring purposes at different times, while others of the governor switches are con-

nected in "odds" circuits which increase or decrease the number of possible "winning" switches at a given time or in a given group on the ball playing field. Mechanism is provided, preferably, to indicate to the player which switches are conditioned for scoring, but to simplify the circuit illustrated these features are omitted.

The frequency or order of addition or subtraction of winning or scoring objectives is intended to be a function of the frequency of operation of the game and the number of winning scores achieved by one or another player.

Thus the achievement of a winning score in the game is automatically rendered easy or difficult at different times, and in general, the more the game is played without scoring a free play the greater the possibilities become for achieving such a score; but the facility for scoring a free play is also reduced in a desired ratio to the frequency of winning.

For illustrative purposes, the differential gearing designated at 29 may be considered the positive or additive governing factor, and this is so controlled as to advance the shaft 28 in a positive direction each time the game starting or conditioning switch 26 is actuated.

This is accomplished by electromagnetic ratchet means 37 (add) connected by conductor 39 to be energized upon each closure of switch 26, so as to attract the step-up-pawl 37A to advance the gear train 29, whereby all of the switch cams 31-36 are rotated in small steps with the object ultimately of variously opening and closing the several governor switches through cumulative action.

On the other hand, the governor shaft 28 will be rotated in an opposite negative or subtractive sense by the gearing 30 through the agency of electromagnetic step-up coil 40 and conductor 41 in parallel with the step-up coil 42 of a free play award unit so designated. The latter unit may be of the type shown in U. S. Patent 2,281,262 to Charles T. Breitenstein, and includes a step-up ratchet pawl 43 actuated by the coil 42 to advance the free play register disc 44 from a zero or starting position so that pin 45 moves away from switch 46 to permit the latter to close the free play circuit and thereby render the free play control or switch 27 effective for free operation of the game so long as switch 46 remains closed, it being well understood in the art that each time a free play is taken off by the player (by closing switch 27) the free play award unit steps back once (by step-back means not shown) toward zero position. Thus, if a player is awarded four free plays, the coil and pawl means 42-43 will step the disc (and hence the switch pin 45) four steps away from zero so that it will require four reverse steps (corresponding to taking off four free plays) back to zero before switch 46 is opened again to disable the free play switch.

In the governor circuit shown, each time the free play step-up coil 42 is energized the negative or subtracting governor coil 40 is energized to impart a subtracting motion to shaft 28.

EXAMPLE I

As one example of the governor action in adjusting the "win" frequency, it will be observed that a score relay coil 50 is connected in an operating circuit by conductor 51, governor switch 36A, and conductor 51A to the wiper contact 51B of a rotary "win" switch having groups of contacts, e. g. 52A, 53A, 54B, 54C, etc., variously connected to groups A, B, C, of ball switches 16 to 24.

In the example illustrated in Fig. 1 the contacts 52A are connected by conductor 52X to one terminal of ball switch 18 in group A.

Under these conditions, if a ball scores by closing switch 18, a circuit is closed via conductor 52Z to a contact 60 on the "odds" and since at this time the odds switch wiper 60A happens to be on this contact and governor switch 32A is assumed to be closed, a

circuit is completed from odds wiper 60A, conductor 60B, switch 32A to power (plus), thereby energizing the score relay coil 50 via the "win" stepping switch—particularly one of its contacts 52A, wiper 51B assumed to be in dotted line position, conductor 51A, governor switch 36A, assumed closed, and conductor 51 to relay coil 50, which results in closure of relay contacts 50A (to energize the clutch coil in the "pulse multiplier" unit), and energization via conductor 41 and wiper 41D of the score register or free play coil 42, resulting in turn in the stepping of disc 44 clockwise to move pin 45 away from the zero-open free play switch 46, so that the latter closes, conditioning the game, say, for four free plays, with other results to be described.

In the illustrative embodiment the number of free plays awarded depends upon how long the clutch in the pulse multiplier remains operated, and hence how far the contact 41D travels, and also whether switch 38A is open or closed. If closed, the bank of contacts 41C with six pulsing contacts is operative to pulse coil 42 each time contact 41D sweeps over a contact 41C, while the four contacts 41B afford additional pulses. If switch 38A is open then contacts 41C are dead, but the four contacts 41B remain alive and free play coil 42 can be pulsed four times therefrom.

The free play award switch 46, now closed, connects operating power to conductor 70, so that if the free play button switch 27 is pushed contacts 71 close to apply power to conductor 73 and actuate the conventional game reset and ball release unit to condition the game for another round of play.

In the present embodiment the game is intended to be played with one ball; whether or not the played ball scores, any of the several contrivances well-known in the art returns it ultimately to position before the shooter or plunger 25 as a result of operation of the game reset and ball release unit.

At this juncture a further result of closing the free play switch 27 is noted: contacts 72 also close, applying power to conductor 39 and the governor "add" coil 37 (provided the governor switch 72X is closed), which causes governor shaft 28 to be turned with a possible actuation of one of the governor switches 31A-36A.

Still another important occurrence should be noted in the foregoing example: When the score relay means 50, 50A was actuated, not only was the award coil 42 energized, but the governor subtract coil 40 was also energized, resulting in a negative rotation of the governor shaft 28.

Now, since the differential gear means 29-30 is calculated to turn the shaft different amounts in opposite directions according to a predetermined ratio, and since the score values of the various ball switches are different, the aforesaid closure of ball switch 18 in group A can be presumed to result in applying, for example, four score pulses (through the pulse multiplier, so designated) to conductor 41, resulting in four steps of the free play indicator dial 44, and four pulses to the governor "subtract" coil 40.

Yet, when the player takes off a free play by switch 27 (the conventional take-off coil and circuit is not shown) and pulses the conductor 39, and hence the "add" coil 37 only once, the net result, so far as rotation of the governor shaft 28 is concerned, may be to rotate the governor cams a lesser amount in a positive direction than they were displaced in a negative direction by the preceding award of four free plays, with the ultimate result that the possibility of scoring free plays becomes less likely by reason of the successful free-play score which the player has achieved.

Assume, further, that the ball switch 18, which the player has succeeded in hitting in the latter example, were assigned a value of 10 free plays and, accordingly, the pulse multiplier were adjusted to pulse the conductor 41 and "subtract" coil 40 ten times instead of only four,

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then the negative or subtractive action of the governor switch would be considerably in excess of any additive action resulting from operation of either the free play switch 27 or the regular starting or coin switch 26.

It will be appreciated that the ratios involved in the differential gearing 29—30 may be selected to produce a wide range of possibilities in governing the negative and positive turning of the shaft 28 different amounts in relation to the actuating or control pulses, whether the latter result from scoring or from the number of times the game is started or played, either by a coin or token or the free starting means.

Odds control

By way of illustrative example, attention is called to the fact (Fig. 1) that in the foregoing example, each of the group A ball switches 16, 17, 18, is connected to a contact 60, 61, or 62 on the "odds" switch, and the "odds" wiper 60A is at this time engaged with each of said contacts, so that the latter are in a power circuit (governor switch 32A being closed) with the score relay through the "win" contacts 52A, and governor switch 36A closed, the "win" wiper 51B being assumed in the dotted line position.

Thus, a ball approaching the group A targets has three times the opportunity of scoring that it would have if the "odds" wiper rested only on the contact 60.

However, if the "odds" switch were in the described condition, but the "win" switch were in the full-line position, none of the group A ball switches would be in circuit and no Free Play score could be made at all by hitting any of the targets 16, 17, 18.

Moreover, if either of the governor switches 32A or 36A were open in the foregoing examples the scoring would not be the same; if switch 32A were open, there would be no Score Award in Group A; if switches 35A and 36A were open, there would be no Free Play Award.

EXAMPLE II

Assuming the full-line condition of the parts in Fig. 1, it is now understood that a ball lodged against any of the Group A targets could not score.

But suppose the ball to engage ball switch 23 in Group C, a score will be awarded only if the governor switches 34A and 35A are closed; this being assumed, an award circuit is completed for score relay coil 50 via conductor 51, governor switch 35A, conductor 35B, "win" wiper contact 35C, contacts 53C, conductor 53X, ball switch contacts 23, "odds" contact 35D, "odds" wiper 35E, and governor switch 34A.

Moreover, under the foregoing conditions, the ball, if played into the Group C objectives, could score Free Plays on either ball switch 22 or 23, but the position of the win switch wiper 35C (as well as "odds" wiper 35E) eliminates ball switch 24 at this time.

The position of the "odds" and "win" switch wipers is varied by means of a motor-driven slip-clutch scrambling drive unit, so designated, turning the switch wipers through an intermittently driven shaft means 69, which changes the positions of said switch wipers without regard to score or playing frequency factors.

It will now be apparent by inspection of Fig. 1, that in the full-line condition of the parts, the Group A ball switches are dead because the "win" control switch eliminates them from the scoring circuit, although the "odds" control would have rendered one of these Group A switches effective had the "win" wiper 51B been on contacts 52A, for example.

Conversely, some of the Group B ball switches (i. e. 20, 21) are conditioned by the "win" switch to score, but not one of the Group B switches is included in the score circuit by the "odds" switch.

Accordingly, it is believed that the illustrative circuit connections of Fig. 1 as described reveal the possibilities for a multitude of arrangements for changing the scoring connections so that different ball switches, or groups

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thereof, as well as different numbers of said switches in different groups, may be rendered effective or ineffective at different times by the action of the "odds" and "win" switches under control of the governor means, which may or may not be correlated in operation with the scrambling means.

In the example shown, it is preferred that the slip clutch operating coil 75 for the slip clutch means 74 which interconnects the drive motor with the "odds" and "win" wiper shafting 69, shall be governed by the cam switch 31A, while the scrambling motor is controlled by the game reset unit (as indicated by the dash-dot arrow), the latter causing the motor to run whenever the game is reset, and the governor determining when the clutch 74 is to be operated. If desired, the scrambling control may be independent of the governor as by having switch 31A controlled by the game reset unit instead of cam 31.

In practice, there are generally more ball switches than shown in Fig. 1, and the "odds" and "win" circuits are connected to have a greater scope of permutation and combination than shown, the illustrative circuits having been simplified to the utmost for demonstration of the principle of the invention and the manner and means by which it is to be practiced.

For purposes of making it relatively easy or difficult to score, the possibilities open to the player may be varied either in the number of ball switches rendered effective in the various groups, or in the number of score points or values to be awarded for any particular ball switch or group of ball switches.

EXAMPLE III

The foregoing two examples involved mainly a change in the positions of the scoring switches and the ball-switch connections set up thereby.

However, the contacts on the score award pulse multiplier unit, so designated in Fig. 1, may be connected by governor switch 38A, when closed, to increase the number of pulses, resulting from closure of the score relay 50, it being noted that there are four contacts 41B on the multiplier switch, which are normally effective (connected to power as indicated); but closure of governor switch 38A applies power to another group of six contacts 41C, so that the pulse wiper 41D, upon each cycle of travel, may yield four or ten score pulses under control of the governor switch. The actual range of score pulse values afforded in practice is much greater than in the foregoing simple example.

Governor switch unit

The governor switch is constructed as a compact unit, as will appear from the top plan view in Fig. 3 wherein the structure is seen to include a pair of frame plates 90 and 91 secured in spaced relation by means of spacers 92, plate 90 having an offset mounting flange 90A. Brackets 93 and 94 are bolted to plate 91 to serve as mounts for the several snap switches 132A . . . 136A, which ride the corresponding cam discs 132 . . . 136 fast on the governor shaft 128, the relative positions of the cams and switches being illustrated in Fig. 4.

Referring still to Fig. 3, it will be observed that the differential gear unit generally indicated at 95 is disposed between the mounting plates, and as shown in the detail of Fig. 7, consists of bevel gears 96 and 97 meshing with a pair of planetary pinions 98 carried on stub shafts fixed on the governor shaft 128. The bevel gear 96 is driven (Figs. 5 and 8) from stub shaft 96E through a train of gears 96A, 96B, 96C, 96D; whereas the other bevel gear 97 and its companion gear 97A are similarly driven through intermediates 97B from drive pinion 97C on stub shaft 97D.

The gear ratios for the gears associated with the differential gears 96, 97 are not the same, so that for equal displacements of the stub shafts 96E and 97D the rotation of shaft 128 will be different.

As seen in Fig. 2, the stub shaft 96E is driven by the

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ratchet gear 129 fast thereon, while the other stub shaft 97D is driven by ratchet gear 130, there being separate electromagnets 137 and 140 mounted on the plate 90 with corresponding pawl means 137A, 140A for stepping said ratchets to produce the aforesaid opposite ro-
tative movements of the governor shaft, each ratchet having a corresponding holding pawl 129A, 130A to prevent retrograde movement.

The operation of the governor may be understood from the skeletonized view of Fig. 8 in which the electro-
magnet 137 may be energized from a circuit such as described for the "add" coil 37 of Fig. 1 thereby moving the ratchet gear 129 one step for each impulse to the coil, the resulting motion of stub shaft 96E being trans-
mitted through pinions 96C, 96D, and the intermediate gearing 96B to gear 96A and its bevel gear 96, with a resultant displacement of the planetary pinions 98, which are carried for planetary rotation on the governor shaft 128.

Impulsing of the electromagnet 140 produces a similar step-by-step movement of the stub shaft 97D, which motion is transmitted through the gearing 97C, 97B, 97A to the differential bevel gear 97, resulting in a reverse movement of shaft 128 from that produced by actuation of coil 137.

The gear ratios mentioned heretofore, as well as the mathematical development or evolution of the several cams 132 . . . 136 and angular locating thereof will produce the desired operations at different times responsive to rotation of the governor shaft, said operations being averaged on computed frequency tables based upon a desired or predicted frequency of operation of the drive means or electromagnets 137 and 140, depending upon the desired performance required of the unit and which will form the basis for the selection of said ratios and cam characteristics.

It is contemplated that the invention shall not be limited to any precise details of structure, arrangement, operation or circuit plan or connection, excepting as may be specifically required by the appended claims.

I claim:

1. Governor means for a ball-rolling game comprising: the combination, with a plurality of ball switches, of a game-operating circuit for the game; a score award circuit; a starting switch for said game circuit; a win switch connected for operation in said game circuit to connect and disconnect said ball switches in said award circuit; an odds switch connected for operation to vary the number of said ball switches connected in the award circuit as aforesaid; drive means having control connection with said game circuit for automatically actuating said win and odds switches; a differential governor switch including governing switches connected to cut said win and odds switches variously in and out of the award circuit; actuating means for said governing switches including oppositely movable differential drive means with selectively operable electromagnetic actuating means for producing reverse movements of the differential drive means; the latter including coaxing gear means producing a differential drive which is faster in one direction than in the other responsive to any selective operation of said actuating means as aforesaid; and circuit connections including said starting switch and said electromagnetic actuating means for energizing the latter to produce the faster differential drive responsive to each operation of the starting switch; together with circuit connections including said award circuit and said electromagnetic actuating means for energizing the latter to produce the slower differential drive responsive to each award energization of the award circuit, whereby operation of the governing switches effected by the starting switch proceeds at a faster rate than such operation when effected by the award circuit.

2. In a ball-rolling game, in combination, ball score switches; a game operating circuit including a starting

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switch operable to condition the game for a round of play; a score award circuit, scrambler switch means operated under control of said game circuit to connect and disconnect said ball switches variously in increased or decreased numbers or changed grouping in said award circuit; a governor switch including a plurality of switching devices each having a movable actuating part and severally connected for cooperation with said scrambler switch means and said award circuit to change connections for the scrambler switch means and thereby modify the connecting and disconnecting operations thereof as aforesaid; differential means for said governor switch intermittently movable in reverse directions, designated as positive and negative, for moving said actuating parts different amounts respectively in the said reverse directions; a first governor-switch operating means connected for actuation under control of said starting switch to operate said differential means in the positive direction, and a second governor-switch operating means connected for actuation under control of said award circuit to operate said differential means in the negative direction responsive to each score awarding energization of the award circuit.

3. In a ball-rolling game, a game circuit, a starting switch for said circuit, a scoring circuit, a plurality of ball switches, permutation switch means actuated in said game circuit for cutting said ball switches variously into and out of said scoring circuit, and a governor switch operable in steps and having control connections with said permutation switch means and said governor switch being actuated under control of said starting switch in a cumulative series of steps toward a first condition to increase the number of ball switches connected by said control connections in circuit by said permutation switch means, said governor switch also being actuated in a cumulative series of steps under control of said scoring circuit in scoring operation to decrease the number of ball switches connected for scoring by said permutation switch.

4. In a ball-rolling game of the known type which has a game circuit, a coin-controlled starting switch for said circuit operable to condition same for a cycle of play responsive to deposit of a coin, and a plurality of ball-operated scoring switches adapted to be switched in and out of the game circuit from time to time, improvements comprising, to wit: a pulse-operated free-play award-storing means and a scoring circuit for pulsing said storing means; a free-play starting switch connected for control by a free-play circuit means to condition said game circuit for a cycle of operation independently of said coin switch; free-play circuit means controlled by said storing means and conditioned by the latter for effective operation to condition the starting switch as aforesaid, provided one or more free-play awards are stored thereby; permutation switch means connected in said game circuit and operating under control thereof to switch said ball switches in and out of said scoring circuit from time to time as aforesaid; score-award pulse-multiplier switch means activated under control of said scoring circuit responsive to scoring operation of certain of said ball switches which are connected in said scoring circuit as aforesaid; and a governor switch mechanism having circuit connections with said permutation switch to modify the aforesaid switching operations thereof as to the number and/or grouping of scoring switches connected or disconnected thereby; a first actuating means for said governor-switch mechanism operated under control severally of said coin switch and said free-play starting switch; a second and pulse-operated actuating means for said governor switch mechanism and operated under control of said scoring circuit responsive to scoring pulses produced therein; said governor switch including circuit means to switch different groups of pulse contacts in said multiplier switch means in and out of cooperative connection

with said scoring circuit to modify the number of pulses from said multiplier switch means.

5. For electromechanical game apparatus having an electrically actuated award circuit means and a plurality of award switches to be actuated in playing the game, together with a master starting switch to be actuated at the start of each round of play, improvements comprising, to wit: a permutation switch mechanism and governor switches connected for cooperation therewith to connect and disconnect said award switches in said award circuit according to a predetermined plan; driven means adapted to be progressively or retrogressively driven in reverse phases for operating the governor switches; drive means operable to actuate said driven means selectively in either one of said progressive or retrogressive phases to effect changes at respectively different rates in the number and grouping of award switches connected in the award circuit by the permutation switch mechanism as aforesaid; mechanism operatively interposed between said driving and driven means for the governor switches for effecting a progressive driving action which is of different rate from the retrogressive action; and circuit means severally controlled respectively by said master switch and said award circuit for selectively actuating said drive means to produce either the progressive or retrogressive driving action depending upon whether the master switch or the award circuit actuates the drive means.

6. In an electrically-controlled game having a starting switch, a plurality of score switches and a score circuit, a new control means comprising, to wit: a plurality of governing switches and circuits controlled thereby to condition said score switches for scoring and non-scoring operations; a reversely operable differential actuating means operable responsive to reverse drive effort applied thereto for actuating said governing switches at different relative rates depending upon the sense of the reverse drive effort applied thereto; electrically controlled drive means selectively operable to apply reverse driving effort to said differential means; a first circuit under control of said starting switch for operating said drive means in a certain directional sense; and a second circuit under control of said score circuit for operating said drive means in the reverse sense.

7. In the type of game apparatus having a game circuit including a starting switch and means actuated thereby to condition said circuit for playing the game, together with a plurality of game switches adapted to be operated in playing the game, and a score circuit controlled by said switches, improvements in score-control means comprising, to wit: an electrically driven and controlled rotary type scrambling switch including driven movable contact means and stationary contact means engaged by the movable contact means, said movable and stationary contact means being connected with said game switches to cut the same into and out of said scoring circuit in a predetermined manner; circuit means for said scrambling switch for driving and controlling the same to effect intermittent switching operations thereof; a circuit governor including a plurality of governing switches and reversible operating means therefor movable in either of two opposite directions to actuate the several switches thereof; said governing switches being connected in a predetermined manner with said scrambling switch contact means to change switching connections for said game switches otherwise established by operations of said scrambling switch; electromechanical differential drive means selectively operable to drive said reversible switch operating means in either direction and acting to move said reversible means faster in one direction than in the other; circuit means controlled by said starting switch and connected to actuate said electromechanical drive means in the direction of slower operation; and circuit means including a switch device controlled by said scoring circuit for actuating said elec-

tromechanical means in the faster direction, whereby the circuit-changing operation of said governor is faster or slower depending upon the relative frequency of operations of the starting switch as compared with the scoring circuit.

8. In an electrically-controlled game having a scoring circuit including a plurality of score switches, and a starting switch; governor means including a reversely-movable rotary switch operating means, a plurality of governor switches actuated by said reversely movable means at different positions of angular displacement thereof, said governor switches being connected in circuits for rendering said score switches effective and ineffective for scoring purposes; drive means selectively operable to drive said reversely movable switch-operating means at relatively different rates of angular displacement in its opposite directions of movement; means controlled by said starting switch for operating said drive means to produce movement of the governor switch operating means in one certain direction; and means controlled by said scoring circuit responsive to scoring operations thereof for operating said drive means to produce movement in the reverse direction.

9. In an electrically controlled game having a starting switch, a plurality of scoring switches and a score circuit adapted to be energized by scoring operations of the scoring switches, improvements comprising, to wit: the combination with said scoring switches of electrically actuated switch means connected and operable to change connections between said scoring switches and said score circuit to enlarge or diminish the number of score switches connected for scoring purposes in said score circuit from time to time; a first circuit means operated under control of said starting switch for actuating said electrically actuated switch means; a second circuit means operated under control of said scoring circuit in scoring operations of the latter to actuate said electrically actuated switch means; and means coacting with said electrically-actuated switch means and said first and second circuit means for causing said electrically actuated switch means to produce circuit changes for said score switches at a different rate when operating under control of the first circuit, compared to its rate when operating under control of said second circuit.

10. In a ball-rolling game, a game cycling circuit, a starting switch for said circuit; a plurality of ball scoring switches; a score award circuit; electrically operated scrambling switch means and electrically controlled governor switch means both connected for cooperation to change scoring potentialities by connecting, disconnecting, and/or interconnecting ball-scoring switches for scoring purposes with said award circuit; a circuit controlled by said starting switch for actuating said scrambling switch means; selectively energizable actuating means for said governor switch means to operate the same at selectively different effective rates; a circuit controlled by said starting switch for selectively energizing said actuating means at a first one of said effective rates; and circuit means controlled by score-award operations of said award circuit for selectively energizing said actuating means at a second and different effective rate, whereby a difference in operating frequency of the starting switch means in relation to the frequency of awarding operations of said award circuit tends to produce changes in scoring potentialities as aforesaid at different rates.

11. In a game circuit, a coin-controlled starting switch operable to condition said circuit for a round of play; a plurality of scoring switches; a score-award circuit including an electrically-controlled replay switch conditioned for effective operation by scoring operation of at least one of said scoring switches connected with said award circuit; electrically controlled commutating switch means and operation-controlling connections therefor with said game circuit, said commutating switch includ-

ing change-over switching connections between said scoring switches and said award circuit whereby the operation of the commutating switch effects connection and disconnection of said scoring switches with said award circuit according to a determined pattern; and governor switch means including electrically operated governor mechanism for actuating the switch means thereof and selectively operable at different rates, said governor switch means including connections with said commutating switch means for changing said pattern of score switch connections; circuit means controlled by said starting switch for operating said governor-actuating means at one of its rates; and circuit connections controlled by said replay switch for operating said governor-switch actuating means at another of its rates, whereby the effective rate of change in said pattern of score switch connections effected under control of the starting switch is rendered different from the effective rate controlled by said replay switch.

12. In a ball game control circuit, in cooperative combination, a plurality of ball-operated switches; a score-registering circuit means, a starting circuit including a coin-controlled switch means and connections conditioning said score-registering circuit for operation by one or more of said ball switches responsive to operation of said coin-controlled switch means; normally ineffective replay-switch means and connections therefor with said scoring circuit to condition said replay switch means for effective operation responsive to a predetermined score-registering operation of said score-registering circuit means so that said starting circuit may be actuated independently of said coin-controlled switch means; and selectively operable electro-mechanical switch means and an operating circuit therefor including connections controlled by either said starting switch means or said replay switch means for selectively actuating said electromechanical switch means whereby to effect changes in connections of said ball switches in said score-registering circuit means by the electromechanical switch means, according to a predetermined arrangement in which a maximum or a minimum number of said ball switches or some intermediate number thereof will be connected in said registering circuit means at a given time, said electromechanical switch means including governor-switch means cooperable therewith and connections effected thereby in a cumulative sequence of operations of the governor-switch means, at least, to increase the number of said ball switches connected for scoring operation as aforesaid in response to operation of said coin-controlled switch means, and to decrease the number of said ball-switch connections in response to operations of said replay switch means.

13. In a coin-controlled, electrically-operated ball game of the type having a game circuit including ball-operated score switches, a score-award circuit adapted to be controlled by said score switches, a coin switch connected for operation to condition the game circuit for a round of play, and free-play switch means coacting with said score-award circuit for operation to condition the game for a round of play independently of the coin switch, improvements comprising, to wit: governor means including a plurality of governor switches connected for operation to cut said score switches in and out of said score award circuit, means including shaft means adapted to be turned in opposite directions for actuating said governor switches, separate electromagnetic means operable for turning said shaft means in said opposite directions; and connections between said coin switch and one of said electromagnetic means, and between the remaining electromagnetic means and said score award circuit for actuating said electromagnetic means depending upon the relative frequency of operation of the coin switch and award circuit to effect corresponding turning of said shaft means.

14. In an electrically-controlled game apparatus in

combination: a game circuit including a plurality of ball-operated scoring switches; a score award circuit and means connecting the same with some, at least, of said ball switches for scoring actuation responsive to ball operation of one or more of the latter; a master control circuit including starting switch means operable to condition said game circuit for a round of play; and means for making it harder or easier to score depending upon the number of times the starting switch means is operated and the number of appertaining score awards achieved, said means including a rotary member, governor switch means actuated by operation of the rotary member in either direction of rotation, and electromagnetic means selectively operable to rotate said rotary member in either direction; selective-operation circuit connections between said electromagnetic means and said starting switch means and said score award circuit, respectively, for actuating said electromagnetic means to produce reverse rotations of said rotary member depending upon whether the starting switch means or the score-award circuit is actuated; and connections between said governor switch means, said ball switches, and said award circuit for cutting said ball switches variously in and out of said award circuit responsive to reverse angular displacement of the rotary member as aforesaid.

15. Electrically controlled ball game apparatus including a plurality of ball-operated switches to be actuated as a result of playing the game; a scoring circuit with which said switches are to be operatively connected and disconnected to modify the possibilities for scoring; a master control circuit means operable to condition the game apparatus for a round of play; governor switch means including a plurality of switching instrumentalities connected for actuation and control to operatively connect and disconnect predetermined ball switches with said scoring circuit for the purposes aforesaid; a coin-controlled switch connected for operation to actuate said master control circuit means for initiating a round of play; a normally ineffective free-play switch and connections therewith controlled by said scoring circuit dependently upon predetermined scoring operation of the latter for rendering the free-play switch effectively operable to actuate said master control circuit means to condition the game for a round of play as aforesaid independently of said coin-controlled switch; rotatively movable governor switch-operating mechanism including shaft means therefor adapted to be turned in opposite directions to effect operation of said governor switch operating mechanism for the purpose of effecting changes in the circuit connections between certain ball switches and said scoring circuit, as aforesaid; at least two independently operable electromechanical shaft-actuating mechanisms cooperable with said shaft means and respectively operable to turn said shaft means for the purpose aforesaid; together with circuit connections for actuating a first one of said electromechanical shaft-actuating mechanisms as an incident to an operation of said coin-controlled switch; and additional circuit connections for operating another of said electromechanical shaft-actuating mechanisms as an incident to said predetermined operation of said scoring circuit; the aforesaid connection of ball switches in the scoring circuit by said governor switch means which is effected incidentally to operation of the coin-controlled switch as aforesaid being different from the said connection of ball switches which is effected incidentally to operation of the scoring circuit, as aforesaid, with respect to the number, or identity, or both, of the ball switches thereby affected, the amount of movement of said shaft means respectively produced by said actuating mechanisms being different to control operation of the governor switch means to produce the different ball switch connections aforesaid.

16. In combination with a ball-rolling game including an operating circuit having a starting switch, ball-operated switches, a free-play award circuit means, and winning circuits set up through said ball switches for award

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operation of said free-play circuit means, improvements comprising, to wit: control means including a win switch, an odds switch, electric drive mechanism controlled by said operating circuit for automatically actuating said win and odds switches for connecting and disconnecting said ball switches with said free-play circuit means in predetermined manner for effecting award operations of said free-play circuit means; together with governor means including governor switches having circuit connections with said win and odds switches and operative to modify the aforesaid ball-switch connecting and disconnecting operations of said odds and win switches; at least two step-operated actuating devices each respectively operable to step an unlike amount relative to the other to effect resultant operations of said governor switches responsive to the respective stepping operations thereof; selectively operable electric drive means for said actuating devices; means controlled by said starting switch for operating the drive

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means for one of said devices, and means controlled by said award circuit for operating the drive means for the other actuating device, for the purpose of producing resultant operations of said governor switches in accordance with whether the award circuit or the starting circuit is operated a predominant number of times in operation of the game.

References Cited in the file of this patent

UNITED STATES PATENTS

1,678,573	Nakashima	July 24, 1928
1,906,260	Gibbs	May 2, 1933
1,965,092	Zenkner	July 3, 1934
2,073,330	Zingg	Mar. 9, 1937
2,192,596	Durant	Mar. 5, 1940
2,200,190	Plouvier	May 7, 1940
2,423,725	Poole	July 8, 1947