

April 5, 1960

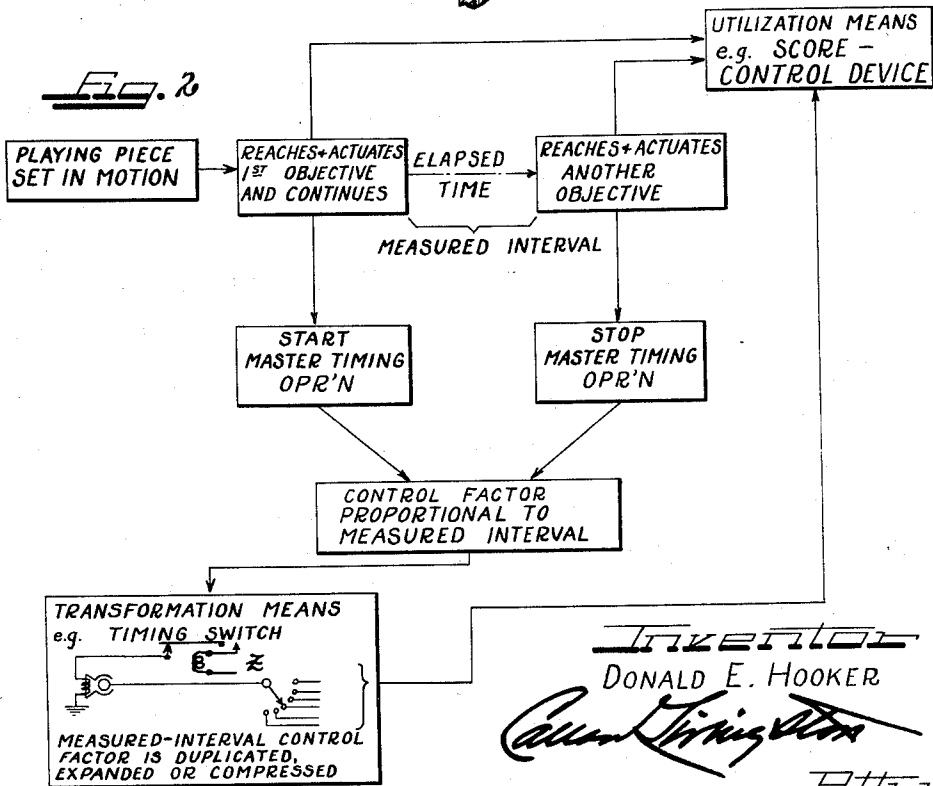
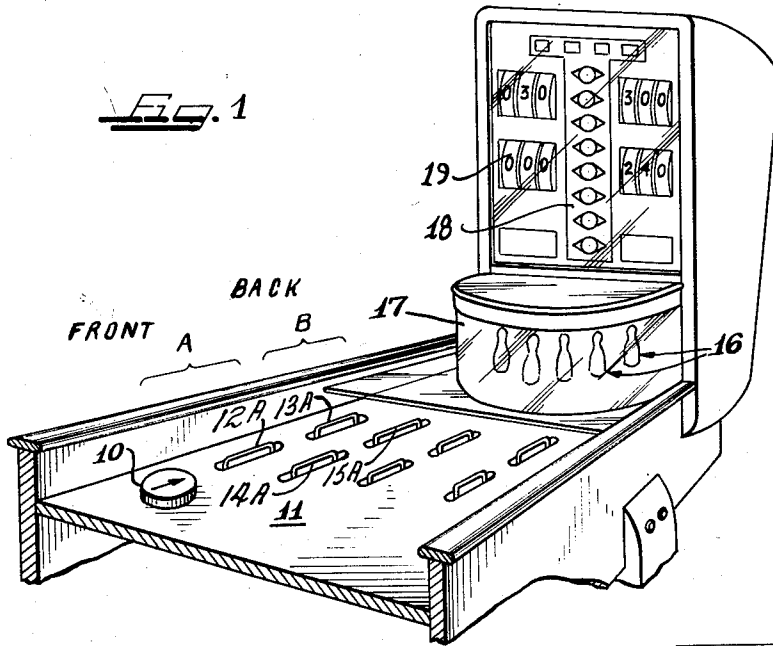
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VELOCITY CONTROLLED GAME CIRCUIT

Filed Aug. 2, 1954

3 Sheets-Sheet 1



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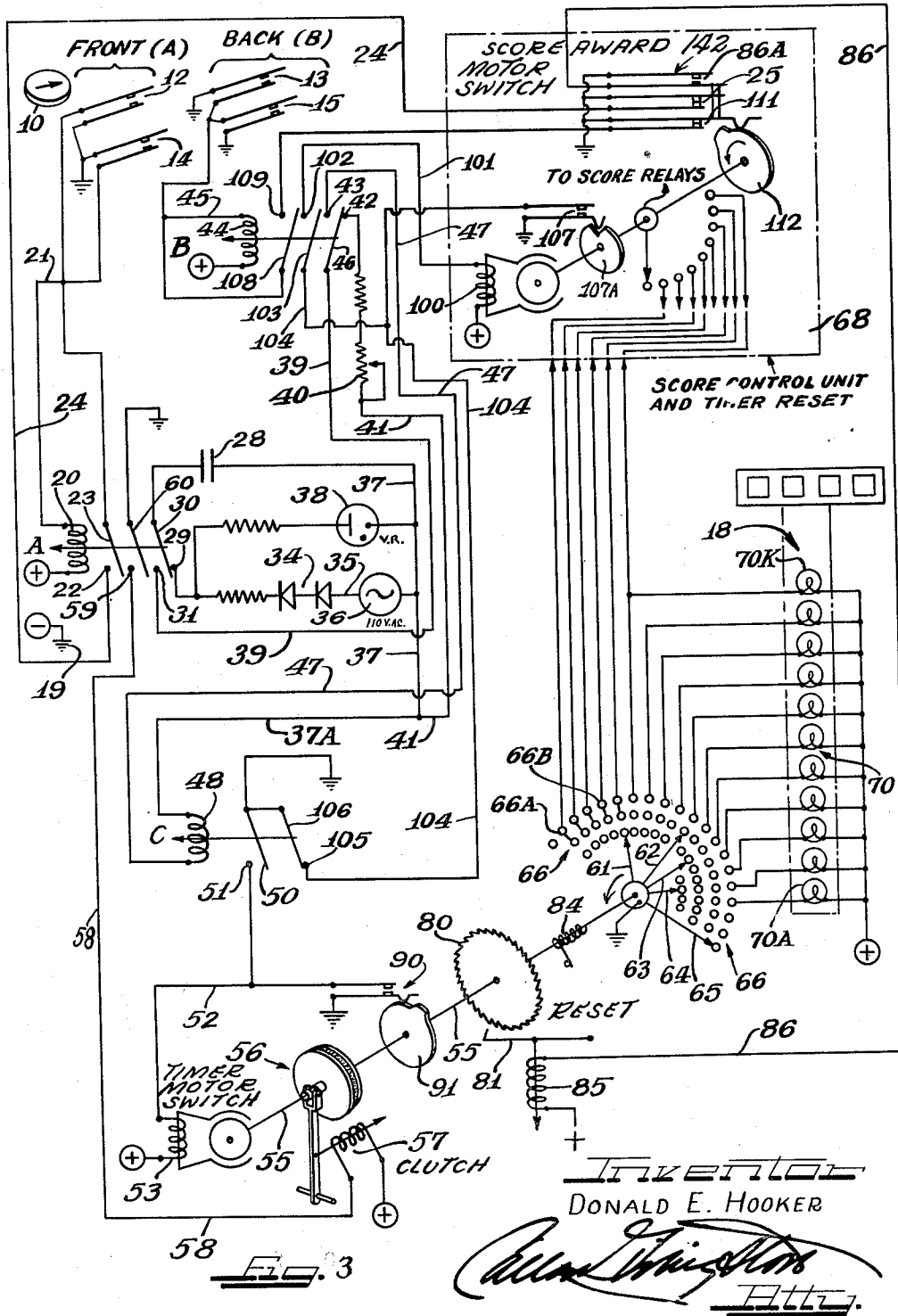
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Fig. 5

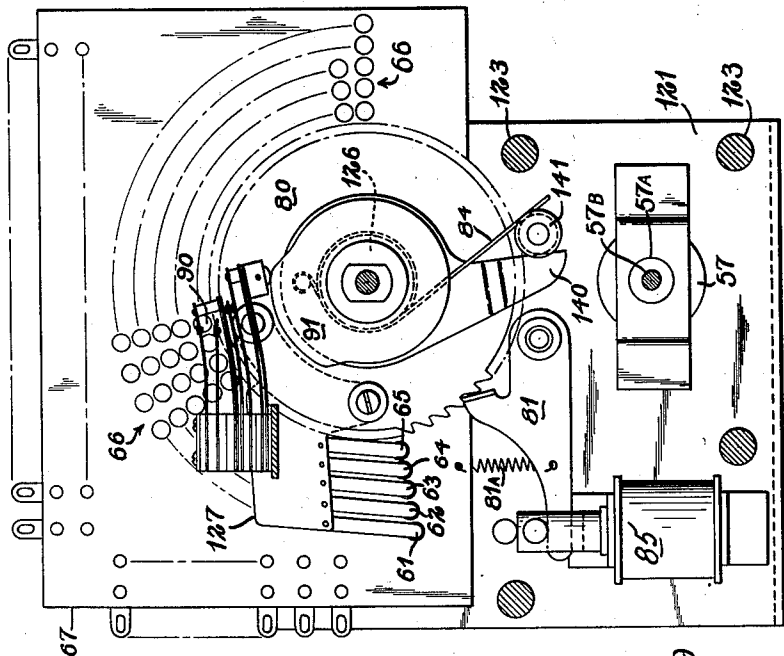
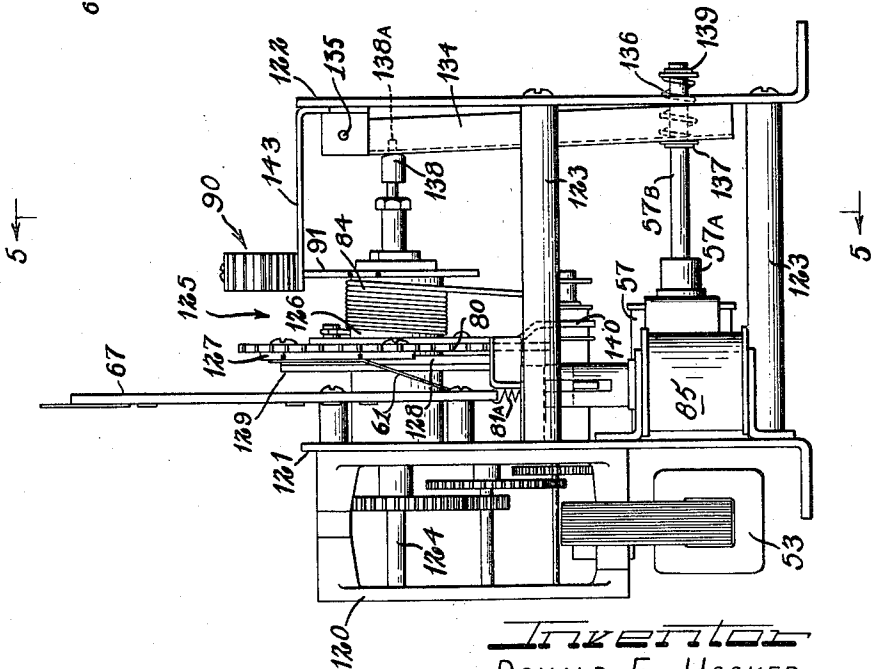


Fig. 4



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VELOCITY CONTROLLED GAME CIRCUIT

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3 Claims. (Cl. 273—118)

This invention has as its principal object the provision of a novel control circuit for use in amusement apparatus such as ball-rolling, table-shuffle, and like games employing a playing piece which is projected at a target or other objective such as a ball bumper, bowling pin, target switch, or the like, the novel control circuit being characterized broadly by the fact that it measures the time interval between the impingement of the ball, shuffle, puck, or other playing piece upon successively engaged target objects, the value of the resulting score being automatically adjusted in accordance with the time interval measured.

Viewed from another aspect, the invention provides a novelty control circuit for games of the class described characterized in that the speed with which the playing piece is propelled has a regulatory effect upon the resultant score.

In an illustrative embodiment of the invention as applied to a shuffle game, a plurality of target switches are arranged in the shuffle alley such that the player propels the puck in an effort to engage a pair of aligned target switches successively by skillful aiming and with a premeditated initial velocity so that the puck will engage the second target switch neither too soon nor too late after having engaged the first target switch, the ultimate result being that the novelty control circuit will measure the time interval between the actuation of the pair of target switches and adjust the playing score accordingly.

More detailed features and objects relate to the provision of a simple timing circuit and switch mechanism cooperable therewith for accurately timing the successive engagement of pairs of target switches and for giving a visual indication of the time interval to the player and setting up control circuits for cooperation with the master scoring apparatus.

Still another feature is the provision of circuit means for producing a first or master control factor, for instance a charge in a condenser, which is proportional to the measured time interval between impingements of a playing piece upon successive game objectives; and to provide further circuit means for converting or transforming the master factor into a secondary control factor which is preferably longer in time aspect than the original factor and in form to control some instrumentality such as a switch to actuate the same for a period which will bear a predetermined time-duration relationship to the original or master factor.

The foregoing objects as well as additional aspects of novelty and utility are achieved in one of several possible embodiments of the invention as described hereinafter in view of the annexed drawings, in which:

Fig. 1 is a fragmentary perspective of a simulated bowling game embodying the invention;

Fig. 2 is a block diagram;

Fig. 3 is a schematic circuit diagram of the timer control circuit;

Fig. 4 is a side elevation of the timer switch unit;

Fig. 5 is a vertical section through the timer switch

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unit showing parts in elevation, as seen in the direction of lines 5—5 of Fig. 4.

The amusement game shown in Fig. 1 is a form of table shuffle game in which the player slides a puck 10 along the alley 11 toward any pair of front and back target objectives 12 and 13 the latter being the operating levers for corresponding target switches 12 and 13 (Fig. 3) situated beneath the alley in the well-known manner.

The type of game partly illustrated in Fig. 1 is a simulated bowling game of a kind well-known in the art in which simulated pins 16 are pivotally carried beneath the hood 17, there being usually one pair of switch levers 12A, 13A in linear alignment with each pin 16, so that if the player is skillful in directing the puck to pass over any pair of said switch levers, he may be enabled to score very much as in actual bowling, depending upon the choice of arrangements possible in certain automatic score control mechanism (not shown in detail) which will cause the resulting score to be exhibited by the indicating means associated with the back panel, as at 19 (Fig. 1).

The novelty score control circuit disclosed herein may be used in conjunction with such a control mechanism and is so contrived that the player will achieve different scoring results depending upon how fast he propels the puck 10 toward the target objectives, i.e. a pair of target-switch operating levers 12A and 13A, for example; or, more precisely, how long an interval ensues between the engagement of the first target objective or lever 12A and the second objective 13A, this interval obviously being a function of how fast the puck is travelling and hence how hard the player flings the puck in the first instance.

The time interval between hitting of the first and subsequent target objectives in most games is too rapid (e.g. 600 milliseconds) to use for visual and like utilizations, so that, as illustrated in the block diagram of Fig. 2, the measured interval is used as a factor and transformed or spread out by special means such as the timing switch and circuit to be described.

For convenience, the two rows of target objectives or switch-operating levers which extend crosswise of the alley are referred to as the front and back switches, and one of the objects in playing the game is not only to aim the puck 10 accurately so that it will engage a properly aligned pair of front and back switch levers, but to regulate by skill and judgement the initial velocity of the puck to achieve a desired critical lapse of time before the last or back switch lever is struck, since it is contemplated that in the actual games the score control means is especially contrived to reward the player with a higher score for a skillfully played time interval of intermediate duration rather than in direct proportion to the duration of the interval, and in other words, to arrange a score award so that the player's score does not get higher as the time interval is shortened; on the contrary, an extremely fast shot may reward the player with a relatively low score, whereas a shot of intermediate speed may produce the highest possible special award.

In order to afford the player some visual representation of the relative speeds of his shots, a column of lights is located behind the area 18 on the glass back panel, and these lights are successively illuminated by a timer switch to measure the interval, as will presently appear, the height of the last lamp standing illuminated in the vertical column at 18 being an index to the player of the relative speed of the puck so that he can gauge subsequent shots with some degree of accuracy rather than by mere trial and error.

Referring to Fig. 3, the novel control circuit is shown in simplified form to include only two pairs of front and back target switches 12 and 13 or 14 and 15, it being

understood that each such switch has associated with it an operating lever, such as indicated at 12A or 13A in Fig. 1, to be engaged by the puck 10. In commercial forms of the game, there will be at least 10 switches in each of the two front and back rows, and the group of switches in each row are connected in parallel (as in Fig. 3). However, for purposes of simplification only two such groups are described in detail.

If it be assumed that the puck 10 properly actuates the pair of switches 14 and 15 (Fig. 3) the timing circuit will operate through the instrumentalities now to be described, it being understood that the particular kind of power employed, whether direct or alternating current, or from battery, transformer or other source is of no concern except as may be hereinafter particularly pointed out. For convenience and simplification of the wiring diagram, the power supply here is indicated simply as positive and negative terminals, the latter being connected to a common return at ground 19.

As a result of the closure of front switches 12 or 14 the coil 20 of a first or A relay will be energized via conductor 21, and will establish its own holding circuit via its contacts 22, 23, conductor 24, and the normally closed cam-switch breaker contacts 25 at the score motor switch 142.

Actuation or pulling-in of the A relay starts the master timing operation by opening normally closed contacts 29, 30, and closing contacts 30 and 31, which disconnects the timing condenser 28 from its normal charging circuit and connects it in a discharge or bleeder circuit.

When relay A is in normal condition with its contacts 29, 30 closed, one terminal of the energy-storing means or condenser 28 is thereby connected to one terminal of a rectifying means 34, the remaining terminal of which connects via conductor 35 to one side of an alternating current source 36 at about 110 volts, the remaining terminal of said source connecting in turn via conductor 37 to the remaining terminal of the condenser.

When the relay A pulls in to open its contacts 29, 30 and close contacts 30, 31, as aforesaid, one side of the condenser is connected via conductor 39 and normally closed B relay contacts 42, 46 to one terminal of a discharging or dissipating means in the form of resistance, including an adjustable resistor 40, which connects via conductor 41 to one terminal of the C relay coil 48 in common with one terminal of the capacity 28, while the remaining side of this coil 48 connects upon energization of relay B to the remaining side of the condenser via conductor 47, B relay contacts 43, 103, conductor 39, A relay contacts 30—31, to condenser 28.

It is to be remembered that the condenser is discharging through the resistor means 40 during the interval following actuation of relay A and before relay B has pulled in to conclude the master timing interval or operation (which is to say during the interval of passage of the puck 10 from a front switch to a back switch) and this interval at maximum in the usual operation is not sufficient to discharge the condenser below a desired critical residual charge level by reason of selection of a value of resistance 40 with this object in mind; however, between the limits of minimum and maximum dissipation or bleeder discharge of the timing condenser 28, the change in residual charge is a measure of the elapsed time in the transit of the puck from the front to the back target switch, and this residual timing charge is utilized following the hitting of the back target switch as a control factor to actuate transformation means, for instance the C relay and the timing switch, and give a visual indication of the relative length of the time interval stretched-out, so to speak, so that the player will have time to see it, and also to condition the main score control unit for award of the appropriate score value to the player.

When the puck reaches and operates the appropriate back target switch (in this example switch 15) the master timing operation is at an end and relay B will pull in

from a pulse received by its coil 44 from said switch via conductor 45, and thereby connect the timing condenser 28 directly across the winding 48 of a third or C relay, also referred to as the "D.C. relay" by reason of its being energized only by the residual direct current received from the timing condenser.

This connection of the C relay is effected by closure of contacts 43, 46 of the B relay to connect, from conductor 39, one side of the timing condenser via conductor 47 to one terminal of coil 48 of said relay, the remaining terminal of which is at all times connected to the opposite side of the condenser via conductors 37A, 37. Thus, operation of the B relay by one of the back game or target switches utilizes the residual condenser charge to energize the third or C relay and start the transformation timing and produce the secondary factor expanded or spread-out as aforesaid into a longer interval which the player will be enabled to visualize.

Operation of the C relay closes its contacts 50, 51 thereby connecting operating power via conductor 52 to the winding 53 of the timer motor which will at once drive the main timer-switch shaft 55 by reason of the clutch means 56 being pulled in at this time because the clutch coil 57 is energized via conductor 58 and contacts 59 and 60, now closed, on the locked-in A relay.

Rotation of the main timer switch shaft will cause the timer switch wipers 61, 62, 63, 64, 65 to sweep over the contacts 66 in the several banks on an insulating panel 67 (shown in Figs. 4 and 5) and thereby, among other things, successively illuminate a number of the timer flash lamps 70, beginning with lamp 70A at the bottom of the area 18 and ending possibly with the top-most lamp 70K, provided the measured transit interval of the puck has been a maximum.

As a further incident of the aforesaid operation of the timer switch unit, score control circuits will be set up, as by timer wiper contacts 62, 65, engaging contacts such as 66A or 66B, for example, which connect into the score control unit 68 to affect the score award suitably. The timer wipers 61 . . . 65 come to rest upon stoppage of the motor means 53 and shaft 55, which occurs when the residual condenser charge drops to a value insufficient to hold up the C relay any longer.

The advance of the shaft 55 and its associated timer switch wiper contacts and cams is held by ratchet means including a ratchet disc 80 and pawl 81 acting to hold the gain of the shaft against a return spring indicated schematically at 84. When the game or scoring cycle is at an end, the ratchet release coil 85 will be energized automatically by the master score control and reset unit via conductor 86 and cam switch contacts 86A, and the spring means 84 will then restore the main shaft and the wipers 61 . . . 65, etc. to normal starting position, e.g. as shown in Fig. 5. Accordingly, it is unnecessary to restore the motor drive shaft to a starting position. The last of the lamps 70 to be illuminated is held, and the display remains visible on the back panel area 18 (Fig. 1) until such time as the ratchet means 80, 81 is released.

Should the player throw an extremely slow puck under conditions where the original charge on the timing condenser had fallen to a very low value capable of holding the C relay up for only an instant, a normally-open, minimum-displacement supervisory switch 90 shunting the contacts 50, 51 of the C relay will be briefly closed by a cam 91 on the timer motor shaft 55 so that the latter will be enabled to move at least a minimum distance until the supervisory switch 90 opens, even though the C relay drops out almost immediately after pulling in, thereby assuring operation even on a slow puck.

When the score motor shaft has turned through its predetermined angular travel, the holding circuit for the A relay will be broken by the breaker switch contacts 25 heretofore mentioned.

Evaluation of the score award as a function of the

speed of the playing piece 10 is effected in the following manner; the winding 100 of the score award motor in unit 68 is controlled by a link circuit through contacts on both the B and C relays, said winding connecting via conductor 101 to a make contact 102 on the B relay, and the companion contact 103 connecting via conductor 104 to a normal contact 105 on the C relay, for which the companion contact 106 is grounded with contact 50. Thus, there is an energizing ground for the score award motor normally set up at C contacts 105, 106, but this circuit is normally broken at the B relay contacts 102, 103; therefore, when the B relay pulls in to operate the C relay, the latter will break the starting circuit for the score award motor, but as soon as the C or D.C. relay drops out, said motor will start and close a positive motor holding circuit through cycle cam switch contacts 107 which shunt the make contacts 102, 103 on the B relay. Meanwhile, the B relay holds up and the score motor has started and this relay sets up its own holding circuit, this being effected by the closed holding contacts 108, 109 on the B relay thereby applying a holding ground thereto through the normally closed trip cam switch contacts 111 opened by the score motor cam 112 at the end of the award cycle.

Both motors 53 and 100 are of the built-in reduction gear type well-known in the art. The motor 53 drops out when the C relay drops out, and motor 100 stops itself at the end of each score cycle when cam 107A again opens the holding switch 107.

In general, the timer selector-switch means 65—66—66A, 66B, 62, etc. sets up score and indicating control-circuit connections, as to lamps 70 and for "score relays" on contacts in unit 68, but it is contemplated that other utilizations may be made of the control-circuit connections set up by the means 53—65—66 etc.

The timer motor unit is shown in detail in Figs. 4 and 5, and includes a small geared-down motor 120 of conventional design and having the winding 53 mentioned in view of Fig. 3, said motor being mounted on a back frame plate 121 tied to a front plate 122 by spacers 123 with the motor drive shaft 124 extending inwardly through said back plate to the clutch and ratchet assembly generally indicated at 125 and comprising a main hub member 126 which floats free on the motor shaft 124.

Assembled as part of the hub structure are the cam 91 at one end, and the ratchet disc 80 at the opposite end, the latter having affixed to one side thereof a pendant stop arm 140, and to the opposite face thereof a switch wiper carrier arm 127 (Fig. 5 also) as well as a clutch facing plate 128 which coacts with a companion clutch plate 129 pinned fast on the motor shaft.

The return torsion spring 84 is carried on the main or floating hub part 126 and tends to turn the latter and its associated cam, ratchet and wiper plate appendages to the normal or zero position shown in Fig. 5.

Lever means for actuating the clutch includes a long lever 134 (Fig. 4) pivotally mounted at 135 on the inner face of the front frame plate and extending downwardly to a level opposite its operating solenoid coil 57, from the plunger 57A of which extends a long pin 57B projecting through the clutch lever and the frame plate, as well. Interposed between the lever and a washer 139 on plunger 57B is a buffer spring 136 which yieldingly transmits the thrust of the solenoid plunger to the lever; and an internal spring (not seen) in the solenoid normally urges the plunger and pin toward the right and presses a washer means 137 on the pin against the lever to urge the latter counterclockwise.

Close to the pivot of the clutch lever is a floater pin 138 threaded into the end of the hub and having a reduced end 138A which floats in a hole in the lever 134.

When the clutch coil 57 is energized, the pin 57B shifts toward the left (Fig. 4) and a washer assembly 139 on pin 57B bears against the buffer spring and pivots the lever 134 clockwise, thereby imparting a leftward

thrust to the floater pin 138 and the appertaining hub structure to press its driven clutch plate 128 against the companion or driving clutch plate 129 and turn the associated ratchet disc, cam, and switch wipers 61 . . . 65 in the timing operation of the circuit means as heretofore described.

The advance or gain of the rotating assembly is held by engagement of the holding pawl 81 in the teeth of the ratchet disc 80 until such time as the reset solenoid coil 85 is energized to pivot the pawl counterclockwise against the action of its normal spring 81A and free the disc for return to starting position by the torsion spring 84, which position is determined by a stop arm 140 bearing against a stop pin 141 (Fig. 5).

A supervisory switch assembly generally indicated at 142, and including switch contacts 95 and 90 (Fig. 3), is carried on a bracket 143 to overlie the cam 91.

While the described timer switch is suitably fast and otherwise highly satisfactory in operation for the intended and other applications, the time interval for the usual puck transit from the first to the subsequent target objective is so rapid that it is desirable in fairness to the player to energize the clutch in advance of the timing action of the timer switch, as by energizing the clutch coil 57 by contacts 59—60 on the A relay and holding this condition until the conclusion of the timing operation by dropping out of the A and B or the C relay in the manner described, thus eliminating any slight lag that might be involved in the response of the hub assembly and switch wipers 61 . . . 65 to the driving effort of the motor once the clutch is fully engaged.

Preferably, the first few contacts 66 on the timer switch panel are not used in order that there may be a slight delay in the illumination of the speed indicator lamps 70 to afford the player a chance to glance up and see the visual representation of the action of the puck.

Circuit constants and values may be varied for different games; but for the illustrative embodiment described, the condenser 28 may have a value of about 108 mfd. and be charged from a 110 volt line source through an ordinary selenium or like rectifying means 34 in series with a 1000-ohm protective resistor. Preferably, a voltage regulator 38 of the gaseous discharge type, for example a type OB-3 tube, is shunted across the D.C. source. The total bleeder resistance in series with conductor 41 and relay contact 42 will lie between 1200 and 2500 ohms; and the timing condenser in the so-called transformation timing discharges through an impedance of about 5000 ohms represented by the winding 48 of the C relay, which gives sufficient delay for the normal playing range to hold up the motor 53 and give a substantial light-up in the display lamp banks 70.

It is contemplated that other forms of game could utilize the transformation factor, e.g. the residual condenser charge, in duplicated or compressed duration compared with the measured interval instead of expanded as by the 5000-ohm D.C. relay winding, in which case the latter value may be suitably altered or reduced, or the capacity of condenser 28 and charging voltage or dissipation rates changed to give the desired magnitude of secondary time interval after the master timing operation is concluded.

The D.C. relay preferably has a spring adjustment affording a limited range of drop-out margin. For example, if the timing condenser is bled down to about 30 volts residual the C relay may be set to drop-out between 12 and 3 volts.

I claim:

1. In a game score circuit, first and second game objective switches adapted to be actuated by movement of a playing piece in sequence in the course of operation of the game; a first and a second motor driven multi-contact score control switch means; a first relay means connected for actuation under control of game operation of said first objective switch; a second relay means connected for actuation under control of game operation of said sec-

ond objective switch; a third relay means; a lapsed time circuit connected for operation under control of said first and second relay means to actuate said third relay means for a period of time having a certain maximum limit and proportional to the lapsed time between actuation of said first and second objective switches; circuit connections controlled by the second relay means for starting said first motor switch means responsive to objective switch operation of the second relay means; and circuit connections controlled by the third relay means for starting the second motor switch means only under the conditions where the first, second, and third relay means are operated as aforesaid; together with means for stopping the first motor switch means at the end of a fixed predetermined time interval constituting an operating cycle, said interval being at least as long as said maximum limit for the cycle of the first motor switch; and multiple score circuit connections at least some of which are jointly controlled by both of said motor switch means.

2. In a game score circuit, at least two electrically driven, multi-contact selecting switches having master score control contacts interconnected to establish various score circuits dependently upon their respective conditions of operation relative to a starting position; circuit means including at least two game switches connected to start said selecting switches in operation responsive to sequential actuation of said game switches; circuit means for continuing operation of one of the started selecting switches through an operating cycle of predetermined duration; means including a timing circuit operably controlled by said game switches for continuing operation of the other started selecting switch for a measured period proportioned to the time lapse between the actuation of the first and second game switches; and means for positioning said selecting switches at said starting positions at the conclusion of each said operating cycle.

3. A velocity-factor timing circuit comprising first and second sequence switches adapted to be actuated in succession by a velocity object moved relative thereto; corresponding first and second relay means connected to be actuated by operation of said first and second switches respectively; a first electrically-driven, multi-contact, cyclically-operable switch means having a predetermined time cycle of operation and connected for actuation to initiate a cycle by said first relay means; a third relay means connected for operation by actuation of said second relay means; a second start-stop electrically-driven, multi-contact switch means connected to be started by operation of said third relay means; a timing transformation circuit having a starting phase and a stopping phase and connected with said first and second relay means to be started by the former and stopped by the latter to establish a time control factor depending in value upon the lapsed time between successive operations of said sequence switches; and means connecting said second multi-contact switch means to be started and stopped by said timing circuit to operate for periods proportional to said control factor; and control circuits connectable through contacts on both multi-contact switch means responsive to concurrent operation of the latter.

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