

Aug. 24, 1965

P. F. MARKSTROM

3,202,803

BOWLING SCORING AND DISPLAY DEVICE AND MEANS FOR
GATHERING, STORING, PROCESSING AND REPRODUCING
INFORMATION THEREFROM

Filed April 13, 1961

7 Sheets-Sheet 1

FIG. 1.

DISPLAY PANEL		
PLAYER	FRAME	SCORE
	1 2 3 4 5 6 7 8 9 10 11 12	
1 JONES	X-7-X-X-7-X-X-X	160-100
2		
3		TEAM SCORE 947 100
4		
5		

FIG. 2.

CLEAR SCORE CORRECT		FRAME		ALPHABET NUMERICAL	
A-16		14		A-17	
		① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫			
PLAYER	BALL	SCORE	CORRECT		
①	19-① ②-19 ¹	①	①	225	
②-13	A-18	②	②-15	CLEARING	
③		③	③	T ₁ o o I ₁	
④		④	④	T ₂ o o I ₂	
⑤		⑤	⑤	T ₃ o o I ₃	
			⑥	T ₄ o o PALL	
CONTROL PANEL					

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7 Sheets-Sheet 2

FIG. 3.

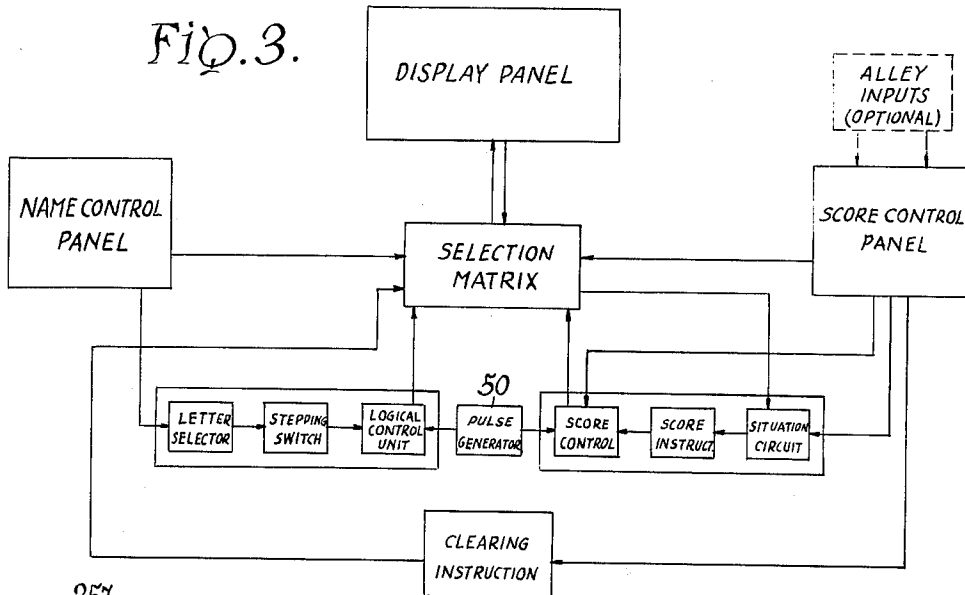
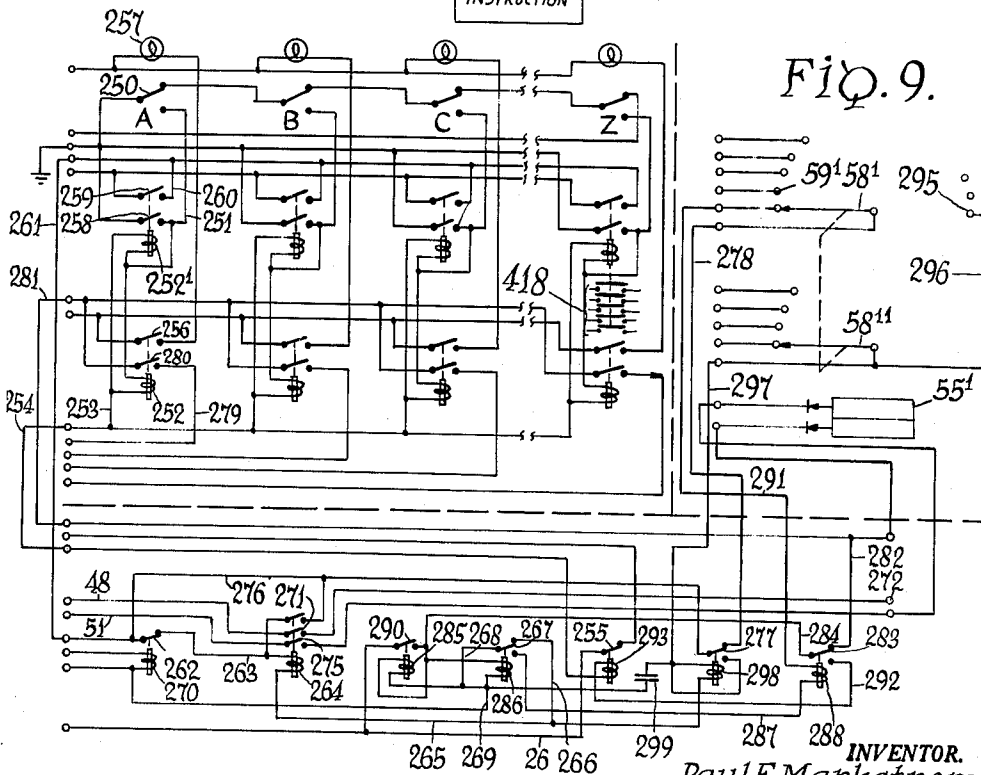


FIG. 9.



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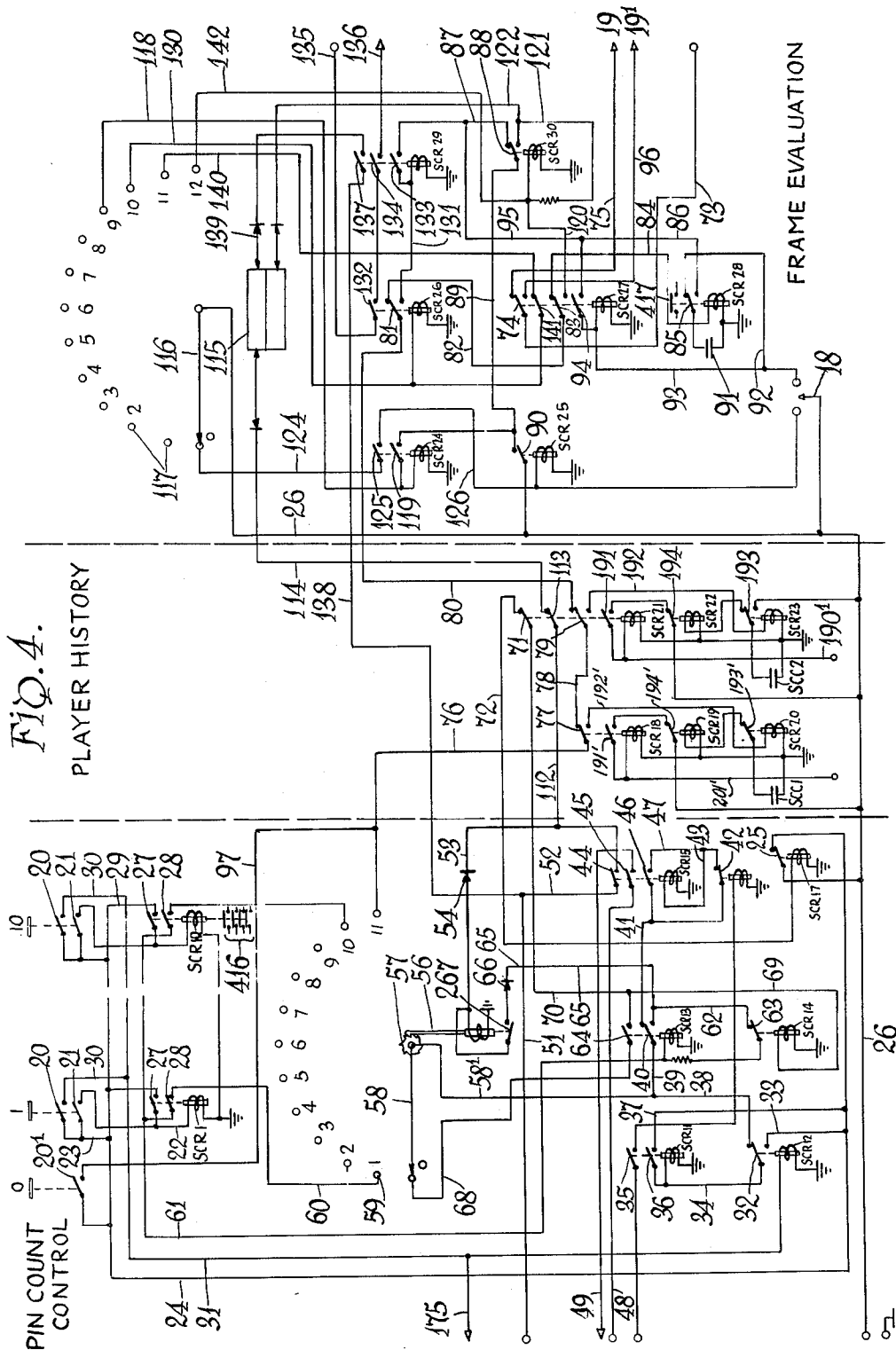
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INFORMATION THEREFROM

3,202,803

Filed April 13, 1961

7 Sheets-Sheet 3



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INFORMATION THEREFROM

7 Sheets-Sheet 4

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3,202,803

BOWLING SCORING AND DISPLAY DEVICE AND MEANS FOR
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INFORMATION THEREFROM

Filed April 13, 1961

7 Sheets-Sheet 5

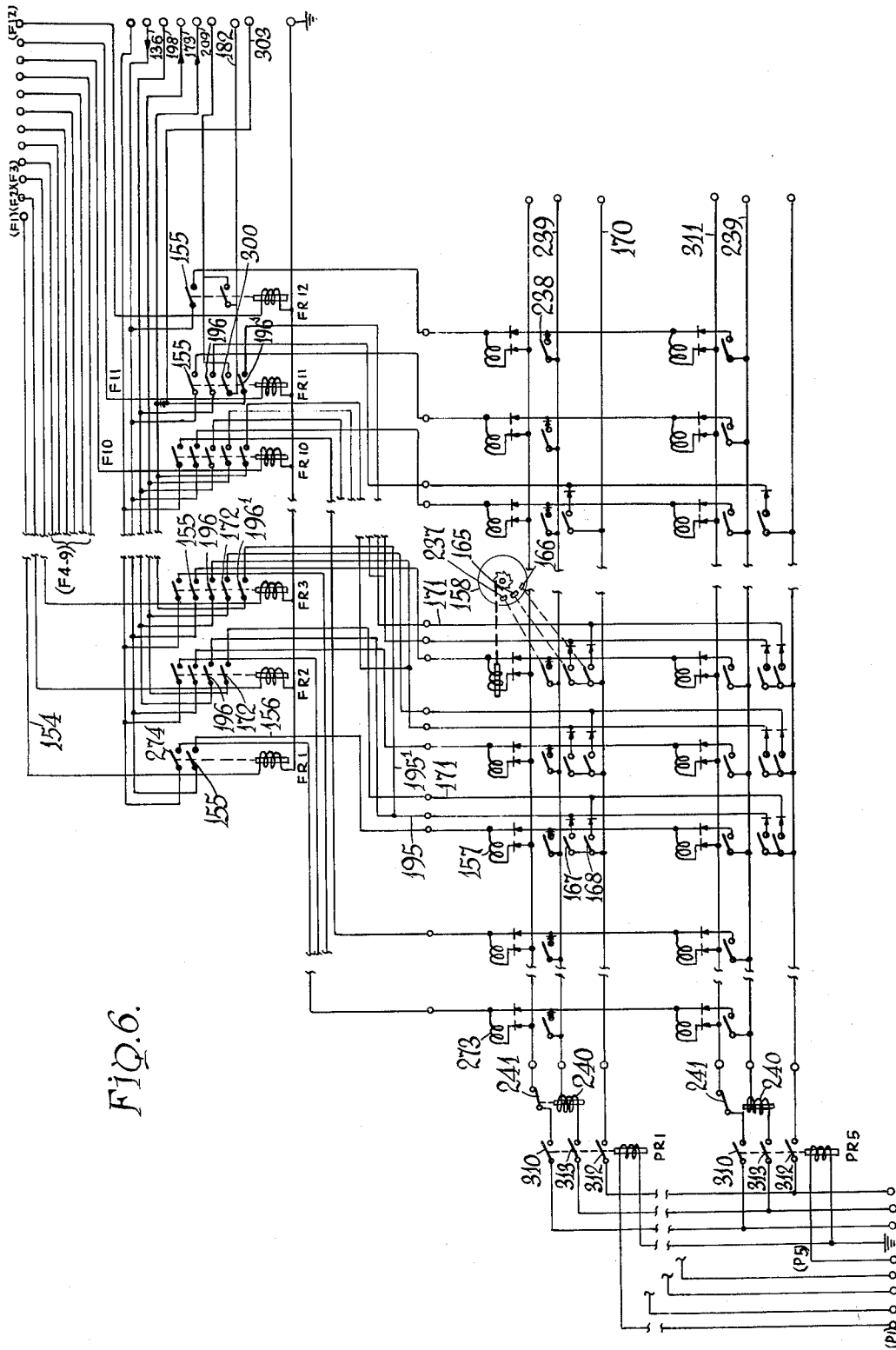


FIG. 6.

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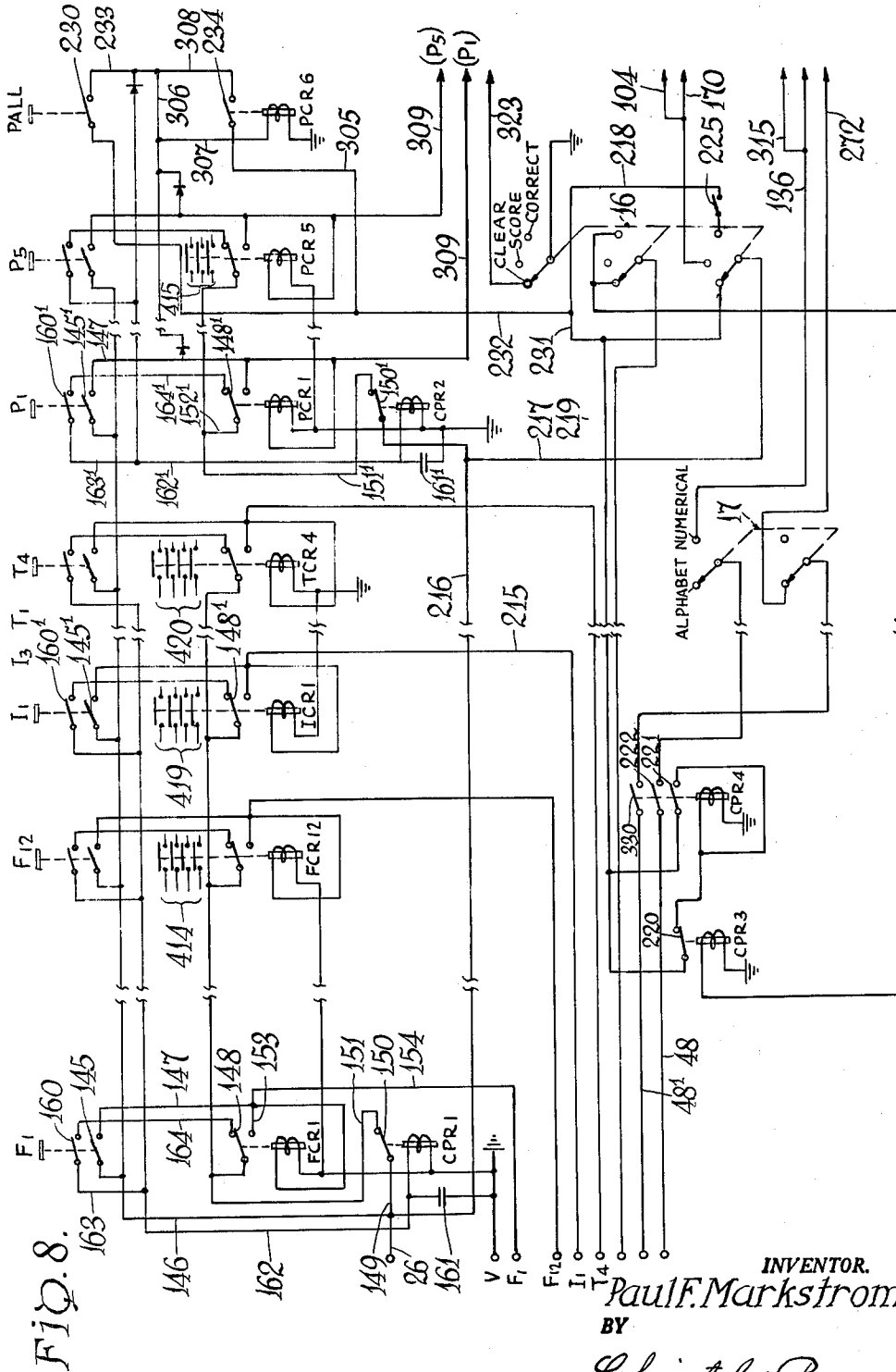
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3,202,803

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INFORMATION THEREFROM

Filed April 13, 1961

7 Sheets-Sheet 6



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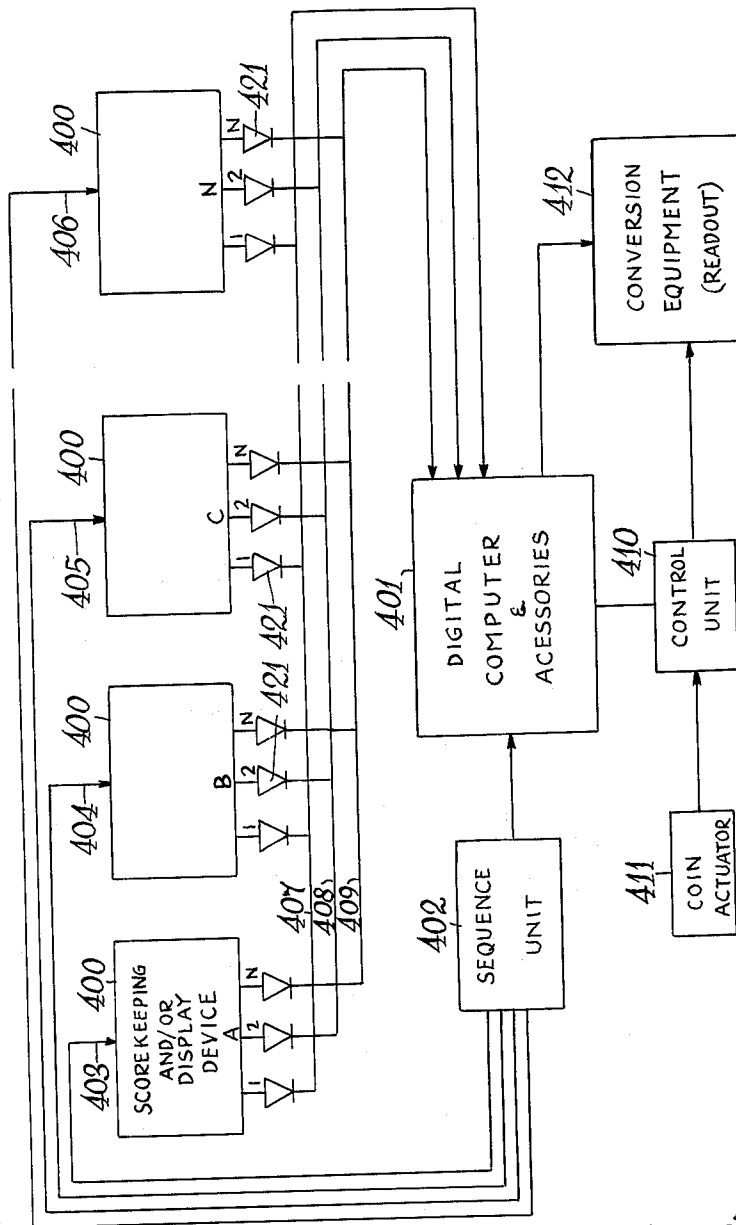
3,202,803

BOWLING SCORING AND DISPLAY DEVICE AND MEANS FOR
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INFORMATION THEREFROM

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7 Sheets-Sheet 7

FIG. 10.



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3,202,803

BOWLING SCORING AND DISPLAY DEVICE AND MEANS FOR GATHERING, STORING, PROCESSING AND REPRODUCING INFORMATION THEREFROM

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Filed Apr. 13, 1961, Ser. No. 102,836
20 Claims. (Cl. 235-92)

This invention relates generally to the bowling art, and more specifically to a new and useful bowling scoring and score display device, with means for gathering scoring information from such devices and storing, processing and reproducing the same.

Interest in bowling has increased tremendously in recent years, and considerable attention has been given to the provision of devices which facilitate playing the game and make it even more enjoyable. One of the most successful of such devices is the automatic pin spotter. However, the scoring of bowling has continued to be handled in the same manner as before, with players' names and scores being written out by hand on a sheet of paper. Attractive stands and boards for supporting pads of score paper have been provided, and a device for displaying an image of such score sheets is available. However, insofar as I am aware there is no commercially available bowling scoring and score display device, operable to compute and display the score without necessity of writing the same out by hand on a score sheet in the usual manner, even though such a device would be highly desirable because it would greatly add to the enjoyment of the game by making the scoring more interesting and convenient. Accordingly, a primary object of my invention is to provide a commercially practicable bowling scoring and score display device which eliminates the usual hand written scoring, and which is relatively simple and inexpensive in construction in view of the functions which it performs.

Another object of my invention is to provide a bowling scoring and score display device which will at all times display the total number of pins which have been scored, without holding back a score in the event of a strike or spare as usually is done.

Another object of my invention is to provide a bowling scoring and display device which will display the complete mark history of all players, in all frames, throughout the game.

Still another object of my invention is to provide a bowling scoring and score display device which could be operated automatically from a pin spotting mechanism but which preferably has provision for player participation in programming the device for computing and displaying the score.

In addition, it is an object of my invention to provide a bowling scoring and display device which has means for displaying the names of the players.

A further object of my invention is to provide a bowling scoring and score display device which has means for correcting each individual display, without affecting the other displays.

It is also an object of my invention to provide, in conjunction with one or more such bowling scoring and score display devices, means for gathering scoring information from such devices for storing, processing and reproducing the same as desired.

In one aspect thereof, a bowling scoring and score display device constructed in accordance with my invention is characterized by the provision of numerical indicia display means for displaying a bowling score, actuator means operable when energized to cause the display means to display a different score, pin count control

circuit means arranged in controlling relation to the actuator means, means for activating the pin count control circuit means in accordance with the number of pins knocked down as each ball is rolled, the pin count control means being operable when activated to complete an energizing circuit to the actuator means for causing the display means to add, to the numerical score displayed, the number of pins for which the pin count control circuit has been activated, whereby the total number of pins which have been scored is displayed at all times.

In another aspect thereof a bowling scoring and score display device constructed in accordance with my invention is characterized by the provision of numerical indicia display means for displaying a score, pulse responsive actuator means for causing the display means to display a score corresponding to the number of energizing pulses received by the actuator means, continuous pulse generating means, pin count control circuit means operable when activated to permit the transmission of energizing pulses from the generating means to the actuator means, selector means for activating the pin count control circuit means in accordance with the pin fall to be scored, and pulse counting means operable to deactivate the pulse control circuit means and thereby interrupt the transmission of energizing pulses to the actuator means when the number of pulses transmitted thereto equals the pin fall for which the pin count control circuit has been activated.

In still another aspect thereof, a bowling scoring and score display device constructed in accordance with my invention is characterized by the provision of mark indicia display means, for displaying a strike or spare, in addition to the numerical indicia display means for displaying the total number of pins scored by a particular player, together with frame evaluating circuit means arranged in controlling relation to the mark display actuating means and operable automatically in response to activation of the pin count control circuit to complete an energizing circuit to the mark display actuating means whenever a strike or spare is rolled, together with history circuit means pre-set by the mark display means and operable automatically upon subsequent activation of the pin count control circuit to cause the appropriate bonus score to be added to the numerical score displayed.

In still other aspects thereof, the bowling scoring and score display device of my invention is characterized by the provision of mark display means associated with each player and each frame, there being provisioned to display the names of each player on a team, together with player and frame selection means for controlling the energization of the actuating means for the mark display means.

In yet another aspect thereof, the bowling scoring and score display device of my invention is characterized by the provision of alphabet display means for displaying the names of the players, the frame selection means being arranged in controlling relation to the alphabet display actuating means, whereby successive frames are caused to correspond to successive letters in the name of a player, with letter selector means operable when activated to complete an energizing circuit to the alphabet display actuating means.

In yet another aspect thereof, the bowling scoring device of my invention is characterized by the provision of means for gathering, storing, processing and reproducing bowling scoring information from several such devices, comprising common computer means operable to store and process the scoring information from each device, sequencing means operable to repeatedly and sequentially interrogate the various devices associated with the respective alleys, with means for transmitting bowling score information from the respective devices to the common computer means upon such interrogation.

The foregoing and other objects, advantages and characterizing features of my invention will become clearly apparent from the ensuing detailed description of one, presently contemplated illustrative embodiment thereof, taken in conjunction with the accompanying drawing illustrating the same wherein like reference numerals denote like parts throughout the various views and wherein:

FIG. 1 is a face view of a display panel, on which the players' names, mark histories and numerical scores, as well as the team score, are displayed;

FIG. 2 is a face view of a control panel, for a scoring operation;

FIG. 3 is a block diagram of the bowling scoring and score display device of my invention;

FIG. 4 is a diagrammatic view of a scoring control circuit;

FIG. 5 is a diagrammatic view of a selection matrix circuit for team and individual score display;

FIG. 6 is a diagrammatic view of a selection matrix circuit for alphabet, strike, spare and error display;

FIG. 7 is a diagrammatic view of a score instruction and situation circuit;

FIG. 8 is a diagrammatic view of a score control panel circuit;

FIG. 9 is a diagrammatic view of an alphabet input and control circuit; and

FIG. 10 is a block diagram of a system of my invention for gathering, storing, processing and reproducing information from multiple scoring devices of my invention.

Briefly stated, the operation of a bowling scoring and display device of my invention is as follows: By use of appropriate controls, the player and frame in which he is bowling is selected on the control panel. When a ball has been rolled, a button corresponding to the number of pins knocked down is depressed. This activates the scoring control circuits and initiates all subsequent scoring action, including the proper multiplication and additions in the event of a previous strike or spare. In addition, this automatically initiates the display of an appropriate mark in the event of a strike or a spare.

The control panel is provided with a control for correcting the display panel, in case of an error, and for clearing the same for a new game, and means are provided for individually correcting each display element, independently of the others.

A full understanding of the nature and operation of my invention will become apparent from the following detailed description of one illustrative embodiment thereof.

Scoring

Assume, for example, that player #1 has just rolled ball #1 in frame #1, and knocked down one pin. This score is displayed as follows:

The control panel (FIG. 2) is checked, to make certain that control member 16 is set in scoring position and that control member 17 is set for numerical operation. Player button #1 and frame button #1 are pressed, setting the computer for player #1 in frame #1. Score control button #1 then is depressed, causing the following sequence of operations, with particular reference to the scoring control circuits of FIG. 4.

Depressing score control button #1 closes switches 20 and 21. Switch 21 completes an energizing circuit for relay SCR1, through lead 22, switch 21, leads 23 and 24, normally closed switch 25, and input lead 26 from an appropriate source V, for example, 24 volts D.C. Energization of relay SCR1 closes switches 27 and 28. Switch 27 completes a holding circuit for relay SCR1 through lead 29, to maintain relay SCR1 energized when score control button #1 is released. Switch 20 completes an energizing circuit, through leads 23, 30 and 31, for energizing relay SCR12. Energization of relay SCR12 moves switch 32 to close an energizing circuit through leads 33 and 34 to a relay SCR11. Energization of relay SCR11 closes switches 35 and 36. Switch 36 completes a holding circuit

for relay SCR11 through lead 37. Switch 35 completes an energizing circuit from a phase control input to a relay SCR16, for a purpose which will become apparent.

The score control buttons #1-10 all produce the foregoing result, and are intended to be released as soon as the associated relay SCR1-SCR10 is energized through its holding circuit. Upon releasing the score control button, switches 20 and 21 open, and opening of switch 20 deenergizes relay SCR12. This moves switch 32 to its normal position, shown in the drawing, in which switch 32 completes an energizing circuit through leads 38 and 39, switch 40, lead 41, switch 42 and lead 43 to a pulse gate mechanism comprising relay SCR15 and its associated switches.

Energization of relay SCR15 closes switches 44, 45 and 46, which latter completes a holding circuit through lead 47. Switch 45 connects a pulse output lead 48 to a pulse input lead 49 from a continuous pulse generator, indicated at 50 in FIG. 3. In this way, pulses from generator 50 are permitted to pass through the gate switch 45 to the score display wheel driver, for actuating the latter as will be explained hereafter.

It is a particular feature of my invention that generator 50 continuously generates pulses, with the control being over the transmission of such pulses, and it should be noted that phasing control relay SCR16 and associated switch 42 control the energizing circuit of relay SCR15 so that the latter is not energized in the middle of a pulse. In this way, only complete pulses pass through gate switch 45.

Simultaneously with the passing of a pulse through lead 48 to the display wheel, a corresponding pulse is permitted to pass from a continuous pulse generator, which can be the generator 50, through another input lead 51, lead 52, switch 44, lead 53, and diode 54 to a stepping switch, generally designated 55 which can comprise a solenoid carrying a pawl 56 for reciprocating motion. Pawl 56 engages a ratchet 57 connected to a moving contact 58 which is adapted to sequentially engage a series of fixed contacts 59, there being a fixed contact 59 associated with each score control button #1-10.

Consequently, it has been seen that for each pulse permitted to pass gate switch 45 to the display wheel driver, a pulse is transmitted to stepping switch 55 which steps the moving contact 58 from the zero fixed contact 59 first to the #1 contact 59 associated with the score control button #1. Contact 58 is energized, through lead 58', and upon engaging the #1 contact 59 completes a circuit through lead 60, switch 28 and lead 61 for energizing relay SCR13. Energization of relay SCR13 moves switch 40 to break the holding circuit for relay SCR15, and to complete a holding circuit for relay SCR13 through lead 62 and switch 63, and closes a switch 64. Deenergizing relay SCR15 opens switches 44 and 45, thereby closing the pulse gate, whereby no additional pulses are transmitted either to the score display wheel driver, or to the stepping switch 55.

Thus, stepping switch 55 is advanced one step for each pulse transmitted to the display wheel driver. Each step of switch 55 corresponds to a pin-fall, and the transmission of pulses is interrupted as soon as the switch 55 has advanced the number of steps corresponding to the score control button which initiated the operation. Switch 40 then completes a stepping switch shorting circuit, through lead 65 and diode 66 and normally closed switch 67, which energizes the stepping switch to step from the #1 contact 59 to the #2 contact 59. This stepping action opens switch 67, permitting the pawl 56 to return to a position of rest which then closes switch 67, to repeat the action. Stepping switch 55 is caused to step around until it reaches the zero contact 59, at which time it completes a circuit through lead 68, switch 64 and lead 69, to energize relay SCR14, and through lead 70, switch 71 and lead 72 to energize relay SCR17. Energization of relay SCR17 opens switch 25. Energization of relay SCR14 opens switch 63, which deenergizes relay SCR13.

5

At this point, the various parts are in their condition of rest, shown in the drawing, ready for a subsequent scoring control operation.

It will be appreciated that the operation of the scoring control circuit as thus far described is the same, regardless of which of the score control buttons #1-10 was depressed. The circuits are the same, as indicated by the break between the score control buttons #1 and #10, each button having associated therewith switches 20 and 21 and a relay SCR1-10 with its switches 27, 28 and associated leads 22, 23, 29 and 30.

When scouring ball #1 in a frame, that fact is indicated by an illuminated indicia-bearing member 19 on the control panel. A second illuminated indicia-bearing member 19' is provided for ball #2. The light sources for illuminating members 19, 19' are not illustrated, but are energized from a suitable source through an input lead 73, switch 74 and lead 75, in the case of ball #1. After scoring ball #1, member 19', signifying ball #2, is automatically illuminated as follows:

As contact 53 of stepping switch 55 is stepped around on its way to zero position, it momentarily engages the #11 fixed contact 59 and closes an energizing circuit through lead 76, switch 77, lead 78, switch 79, lead 80, switch 81, lead 82, switch 83 and lead 84 to relay SCR28. The momentary energization of this relay moves switch 85 to close a circuit through leads 86, 95 and 87, switch 88, lead 89 and switch 90 which charges condenser 91. Upon deenergization of relay SCR28, which is only momentarily energized, switch 85 is moved to discharge condenser 91 through leads 92 and 93 to momentarily energize relay SCR27, which closes switch 94 to complete a holding circuit for the relay through lead 95. Energization of relay SCR27 also moves switch 74 to complete an energizing circuit for ball #2, member 19', through lead 96. Energization of relay SCR27 moves switch 83, to open the energizing circuit to relay SCR28, and conditions a circuit through lead 120, for subsequent energization of relay SCR30.

In the event that no pins are knocked down with ball #1 the zero score control button is depressed to energize relay SCR27 and thereby complete the energizing circuit to ball #2 member 19', through switch 20' and lead 97.

NUMERICAL SCORE DISPLAY

The pulses which are permitted to pass by the gate switch 45, controlled by relay SCR15, and out through lead 49, are transmitted to the selection matrix for team and individual scoring as follows, having reference to FIG. 5. The pulse, or signal is transmitted along lead 49 to the driver coil TD4, which actuates the team score unit display wheel 100 through a suitable mechanism such as a ratchet and pawl 101. This same pulse also is transmitted along lead 49 to the driver coil ID3 which actuates the unit display wheel 100 for player #1, as through ratchet and pawl mechanism 101. In this way, a team score of one is displayed, and a score of one is displayed for player #1, prior to completing the frame by rolling ball #2.

A single set of driver coils TD1-TD4 is provided, one for each of the four team score display wheels. A set of three driver coils ID1-ID3 and score display wheels are provided for each player, making a total of five such sets with switching from one player to another being accomplished by depressing the appropriate player button 13, as will be described. In activating the driver coils, for both player and team score display, the pulses first actuate the unit wheels. Each of the units and tens wheels 100 of the individual score display, and the units, tens and hundreds wheels 100 of the team score display, has a contact 102 or other means for closing a switch 103 which completes a carrying circuit for transmitting the pulses to the next higher display wheel driver, as well. For example, when the team score unit wheels is in nine display position, it closes switch 103 and completes an energizing

6

circuit through lead 104 to relay TR3, which closes switch 105 to thereafter permit the pulses along lead 49 to pass to the display wheel driver coil TD3, through leads 106 and 107, as well as to the display wheel driver TD4. When the display wheel associated with driver coil TD3 reaches a nine position, it will close switch 103 and similarly energize relay TR2, closing switch 105 to thereafter permit the pulse to pass also to the driver coil TD2, and relay TR1 is energized, to energize coil TD1, when the display wheel of coil TD2 reaches a nine position.

The switches 102 are closed by the display wheels in nine units wheel to the tens wheel, and the tens wheel to the hundreds wheel, in the same manner as the team score. The switches 102 are closed by the display wheels in nine position to energize the relays IR2 and IR1 for closing switches 108 to thereafter permit the pulses also to pass to the individual driver coils ID2 and ID1. It will be appreciated that the individual scoring for each player is displayed in the same manner.

FRAME EVALUATION

Each frame is evaluated, for actuating the strike, spare and error display wheels when appropriate, as follows, reference being had to FIG. 4. When a score control button is pressed, to display the number of pins knocked down in frame #1, with ball #1, pulses pass from the generator input line 51 to the stepping switch motor 55, as previously described. In addition, such pulses also are transmitted through lead 112, switch 113 and lead 114 to a similar stepping switch motor 115, which also can comprise a ratchet and pawl solenoid actuated device for advancing a moving contact 116 past successive fixed contacts 117, there being a contact 117 for each score control button #0-10, as well as #11 and #12 contacts 117. Stepping switch contact 116 moves in correspondence with stepping switch contact 58, and if the latter stops on the #1 contact 59, for example, assuming as before that #1 score control button was depressed, then the moving contact 116 of the frame evaluation stepping switch 115 stops on the #1 contact 117. However, whereas the stepping switch contact 58 then is advanced to its zero point, as previously described, stepping switch contact 116 stays in the #1 position until the second ball has been thrown.

When the score control button is depressed to activate the scoring mechanism for ball #2 in frame #1 stepping switch contact 58 is advanced in the usual manner, and stepping switch contact 116 is similarly advanced, in additive fashion. That is, contact 116 is advanced from the point corresponding to the number of pins knocked down by ball #1, to add thereto the number of pins knocked down by ball #2.

If less than ten pins have been knocked down in frame 1, the following operation occurs: As stepping switch contact 58 is returned to zero, it engages #11 contact 59 and completes an energizing circuit through lead 76, switch 77, lead 78, switch 79, lead 80, switch 81, lead 82, switch 83 (which then is in ball #2 condition), and lead 120 to relay SCR30 which moves switch 88 to complete a holding circuit through lead 121, and complete an energizing circuit through lead 112 to a short circuiting stepping switch advancing mechanism of the type previously described, which then advances the moving contact 116 back to zero. When contact 116 reaches zero, it completes a circuit through lead 124, switch 125 and lead 126 to energize relay SCR25, which opens switch 90, opening the energizing circuit to the stepping switch mechanism and shutting down the operation. As contact 116 engages the #9 fixed contact 117 it completes a circuit through lead 118 to energize relay SCR24, which closes a switch 119 to complete a holding circuit, and closes a switch 125 to condition the frame evaluating circuit to deenergize itself when it has completed its function for that particular frame.

MARK DISPLAY

Assume that, with ball #2 thrown a total of ten pins has been knocked down. The stepping switch contact 116 stops on #10 contact 117, which closes a circuit through lead 130 to energize relay SCR26, which then moves switch 81 to complete a circuit through lead 131 to relay SCR29. Energization of relay SCR26 also closes switch 132. When stepping switch contact 58 engages #11 contact 59, it closes a circuit through lead 76, switch 77, lead 78, switch 79, lead 80, switch 81, and lead 131, energizing relay SCR29, which closes switch 133 to complete a holding circuit. Relay SCR29 also closes switch 134, to permit a pulse to pass from the input line 135 (from generator 50) to the output line 136 through switch 132 which has been closed by relay SCR26.

Relay SCR29 also closes a switch 137, which completes a circuit through lead 138 to the motor pulse input line 51, and through lead 139 to motor 115, to advance the stepping switch contact 116 from #10 to #11 contact 117. No circuit is established in this instance of a spare, because relay SCR27 is in ball #2 condition, and switch 141 is open. However, the energizing circuit to relay SCR26 now is broken, after transmission of a pulse along lead 136, opening switch 132 and preventing the transmission of additional pulses. Thus, only a single pulse is transmitted to the mark display mechanism, to be described.

If, however, a strike has been scored, stepping switch contact 116 will be on #10 contact 117 with relay SCR27 in its ball #1 condition. Relays SCR26 and SCR29 will be energized, as previously described, permitting a pulse to pass through switches 132 and 134 to the output line 136. As contact 116 is advanced to the #11 contact 117, a circuit is completed through the lead 140, and the switch 141 to again energize relay SCR26, which will permit a second pulse to pass from the input 135 to output 136. Thus, two pulses are transmitted to the mark display wheel driver, to display a strike, as will be described. Stepping switch motor 115 will then be energized through lead 139 to advance the movable contact 116 to the #12 contact 117 which will complete an energizing circuit through lead 142 for relay SCR30, which will move the switch 88 to complete an energizing circuit to the short circuit stepping mechanism to return movable contact 116 to its zero position. The strike and spare pulses are transmitted to appropriate display wheels via the lead 136, in the manner following.

MARK DISPLAY AND FRAME SELECTION

Firstly, it will be recalled that the #1 frame button F1 had been depressed. This button first closes a switch 160 (FIG. 8) which charges a capacitance 161, through leads 162 and 163, switch 160, lead 164, switch 148, leads 152 and 151, switch 150 and lead 149. When capacitance 161 has been charged, relay CPR1 is energized, opening switch 150. Capacitance 161 discharges through relay CPR1. Energization of relay CPR1 opens switch 150 and breaks the energizing circuit to frame control relays FCR1-12. In this way, any frame control relays which have been energized are released, prior to operation of the frame selector circuit. Capacitance 161 prevents chatter in switch 150. Depression of button F1 then closes switch 145, to complete a circuit from voltage line 26 through lead 146, switch 145, and lead 147 to energize relay FCR1. Energization of this relay moves switch 148 to break the energizing circuit for relay CPR1, and complete a holding circuit through a lead 149, switch 150, leads 151 and 152, switch 148 and lead 153.

Switch 148 also completes an energizing circuit, through lead 154, to the strike, spare and error display mechanism for frame #1, shown in FIG. 6. This energizes relay FR1, which closes switch 155. The strike and spare pulses are transmitted via the lead 136 (from the frame evaluation

circuit of FIG. 4) through switch 155 and lead 156 to the driver coil 157 of the mark display wheel 158 associated with player #1 in frame #1, assuming that player #1 button was depressed. The mark display wheel 158 is of the ratchet and pawl type. If its driver coil 157 receives one driving impulse, a spare mark will be displayed, and if it receives two driving impulses a strike mark will be displayed. If it receives no impulses, the wheel remains in a position of rest, displaying an error mark. Each of the display wheels 158 is activated or driven in the same manner for each of the frames 1-12, depending entirely upon which of the frame buttons F1-F12 has been depressed.

BONUS SCORING FOR STRIKES AND SPARES

In addition to displaying the appropriate mark for a strike or spare, it is of course, essential that the numerical score be increased accordingly when the same player rolls the next frame. This is accomplished through a player history circuit which is under control of the mark display wheels 158 themselves, as follows.

Each mark display wheel 158 carries contacts 165, 166, or other means for closing switch 167, in the event of a strike, and switch 168 in the event of a spare. Thus, the positioning, of the mark display wheels regulates the closing of switches 167 and 168 which conditions the player history circuit of FIG. 4 through the instruction and situation circuit of FIG. 7, in the following manner:

Assume that a spare was rolled in frame #1 by player #1. This closes contact 168 and completes an energizing circuit from lead 170 through switch 168 and lead 171 to switch 172 associated with relay FR2 of frame #2. Then, when the player #1 rolls ball #1 in frame #2, relay FR2 is energized by depressing frame selector button F2, closing switch 172 and completing an energizing circuit through lead 173 to the circuit of FIG. 7. Whenever a score control button #1-10 has been depressed, it closes an initial condition circuit through lead 175 (FIGS. 4 and 7). This energizes relay 176 and closes switch 177 so that the spare signal circuit through lead 173 energizes relay 178. Relay 178 closes switch 179, completing a circuit through lead 180, switch 180', lead 181, and switch 181' from energizing line 182, and through lead 183, switch 184 (which has been closed by relay 185 under control of the ball #1 signal, previously described, through lead 75, switch 186 and lead 187) lead 189, switch 190, and lead 190', energizing relay SCR21 in the player history circuit of FIG. 4.

Energization of relay SCR21 completes a holding circuit through switch 191, opens the switches 71 and 113, and moves switch 79 to close an energizing circuit from #11, contact 59 through lead 76, switch 77, lead 78, switch 79, lead 192 to relay SCR23.

Now, assume that in frame #2, player #1, who previously rolled a spare, knocks down one pin with ball #1. A score of ten for frame #1 is already displayed, that being his actual completed score at the end of frame #1. Score control button #1 is depressed, permitting one pulse to pass through switch 45 by relay SCR15, as previously described. This will advance the units display wheel #1 by one, to display a score of eleven. The stepping switch contact 58 will move one step, to engage #1 contact 59, and this will complete a circuit through lead 60, switch 28, lead 61 to relay SCR13, moving switch 40 to deenergize gate relay SCR15, stopping the transmission of pulses, and simultaneously actuate the short circuit stepping mechanism through lead 65 to step the contact 58 around to zero. A bonus score of one has been added to the player's score display, because of his spare in frame #1, but it will be noted that the stepping switch motor 115 in the frame evaluation circuit has not been moved, because the switch 113 was held open by the relay SCR21.

As stepping switch contact 58 engages #11 fixed contact 59, it completes a circuit through lead 76, switch 77,

lead 78, switch 79 and lead 192 to energize relay SCR23. This moves switch 193 to close a circuit charging capacitor SCC2. When contact 58 moves off #11 contact 59 and deenergizes relay SCR23, condenser SCC2 is discharged through switch 193 to energize a relay SCR22, which momentarily opens switch 194, deenergizing relay SCR21.

When contact 58 reaches its zero condition, it completes a circuit through lead 68, switch 64, and lead 69 to energize relay SCR 14, which moves switch 63 to open the energizing circuit to relay SCR13. This moves switch 40 to again energize relay SCR15, whereby the stepping switch contact 58 goes around again. This time contact 116 of the frame evaluation circuit is stepped along with contact 58, because relay SCR21 has been deenergized. When contact 58 reaches the #1 fixed contact 59 for the second time, scoring circuits operate as first described, without reference to strike or spare history.

If a strike had been rolled in the previous frame, switch 167 would have been closed, completing an energizing circuit through leads 195 and 195' to switch 196 of the succeeding frame relay FR2, and switch 196' of the next succeeding frame relay FR3, respectively (FIG. 6). The switch 196 closes a circuit through a first strike line 198, for bonus scoring, and this completes an energizing circuit through switch 200 (FIG. 7), closed by the initial condition relay 176, to energize relay 199.

This completes a circuit from the energizing line 182 through switch 201, lead 202, switch 203, lead 204 and switch 204' to energize line 189 on ball #1. This energizes relay SCR21 of the player history circuit (FIG. 4) which adds the bonus score to the player and team score displays, before proceeding with the basic scoring for ball #1.

When the basic ball #1 scoring is completed, assuming that less than ten pins were knocked down, engagement of contact 58 with #11 fixed contact completed a circuit through lead 76, switch 77, lead 78, switch 79, lead 80, switch 81, lead 82, switch 83 and lead 84 to energize relay SCR28 and move switch 74 from ball #1 to ball #2 condition.

When the score control button for ball #2 is depressed, it energizes relay 176 (FIG. 7), completing a circuit through lead 96, switch 207, and lead 208 to energize relay 205. This closes switch 206, to again energize line 189. In this way, a bonus score is added for ball #2, before the basic scoring of that ball.

If player #1 rolls a strike in frame #1, as described immediately above, and a spare in frame #2, he then will have a strike mark displayed in frame #1, a spare mark displayed in frame #2, and a numerical score of thirty. The team score will be thirty, plus the total number of pins knocked down by players #2-5 in frame #1.

When player #1 rolls ball #1 in frame #3, his bonus score will be added as follows:

Energization of relay FR3 will close switches 155, 196, 172 and 196'. Switches 195 and 196' will close circuits through strike #1 line 198 and strike #2 line 209, respectively. This will energize relay 199 (FIG. 7) through line 198, and relay 210 through line 209, switch 211, lead 212 and switch 217'. Output lines 189 and 190' (the "times two" or $\times 2$ line) will be energized on ball #1, through line 182, switch 213, lead 213', switch 214, lead 204 and switch 204', energizing relay SCR21, as previously described. In addition, output line 189' will be energized, through switches 214' and 215', energizing relay SCR18 (FIG. 4) through switch 200' and line 201' (the "times three" or $\times 3$ line). Relays SCR 18, 19 and 20 function in the same manner as player history relays SCR21, 22 and 23, respectively, and the same is true of switches 191', 193' and 194', lead 192' and condenser SCC1. However, when relay SCR18 is energized, it moves switch 77 so that relay SCR21 is not deenergized as stepping switch contact 58 engages #11 contact 59 the first time around, with the result that contact 58 is stepped

around a second time, for an additional bonus scoring, before basic scoring for ball #1 is begun.

Under ball #2 conditions, only relay 205 (FIG. 7), and consequently SCR21 (FIG. 4) are energized, whereby only a single bonus score is added.

If a strike is rolled in frame #10, subsequent energization of relay FR11 will close switch 300, completing a circuit through leads 182 and 301 to energize relay 302. Switch 196 also closes, completing a circuit through lead 198. However, energization of relay 302 opens switches 190 and 200', whereby the player history circuit is not energized and the pins knocked down by ball #3 in frame #10 are counted only once. This is true unless there also was a strike in frame #9, in which case a circuit is completed through switch 196' and lead 303 to energize relay 304 (FIG. 7). This energizes relay SCR21 (FIG. 4), to multiply the pin count of ball #3 in frame #10 by two, as a bonus.

PLAYER SELECTION

The player selection circuits operate in the same manner as the frame selection circuits. Thus, looking first at FIG. 8, depressing any of the player selector buttons P1-P5, first closes a switch 160', charging a capacitance 161', through leads 162' and 163', switch 160', lead 164', switch 148', leads 152' and 151', and switch 150', and then energizing relay CPR2. This opens switch 150' and breaks the energizing circuit to any player control relays PCR1-PCR5 which might happen to be energized. Depression of the player selection button then closes switch 145', to complete a circuit through leads 146 and 147' energizing the associated relay PCR1-PCR5, which then moves switch 148' to open the energizing circuit to relay CPR2 and complete an energizing circuit through lead 309 to the associated player circuit in the selection matrices of FIGS. 5 and 6.

This causes energization of the associated relays PR1-PR5, which closes a switch 310 to complete an energizing circuit through lead 311 to the display wheel driver coils 273 (for the name display, to be described) 157, ID1-ID3 and TD1-TD4. Each of the relays PR1-PR5 also closes a switch 312, to complete the mark history circuit through lead 170 and switches 167 and 168. In this way, the scoring pulses for mark and score display, and the alphabet display pulses to be described, energize only the driver coils associated with the particular player selected.

ALPHABET INPUT

When it is desired to display the players' names, that is accomplished using a letter selector, as follows:

Firstly, on a separate control panel indicated in the block diagram of FIG. 3 there will be provided twenty-six buttons (A-Z), one for each letter of the alphabet, and a switch 250 (FIG. 9) is associated with each button.

When it is desired to display, for example, the letter A, the associated switch 250 is closed to complete an energizing circuit through lead 251 to energize relays 252 and 252', this circuit extending from ground through leads 253 and 254 and switch 255 to the main voltage lead 26. Relay 252 closes a switch 256, to energize a light source 257 indicating that the associated letter is to be displayed. Relay 252' closes switch 258, to complete a holding circuit, and closes switch 259 to complete an energizing circuit through leads 260 and 261, switch 262 and lead 263 to energize a relay 264, this circuit being completed through leads 265 and 266, switch 267, and leads 268 and 269 to ground. It will be observed that energization of relay 264 is controlled by the phasing relay 270, operable in the manner previously set forth to be sure that only complete pulses are transmitted.

Energization of relay 264 closes a switch 271 to permit the transmission of pulses through lead 272, to the selection matrix of FIG. 6, and through switches 274 for energizing the name display wheel driver coils 273, under

control of the frame relays FR1-10. There are ten alphabet display wheels associated with each player, and the particular display wheel to be actuated is selected by depressing the corresponding frame button #1-10. The operation of the alphabet display wheels themselves is the same as described with reference to the score display wheels.

As in the numerical display, a pulse also is transmitted through the lead 51 and switch 275 to a stepping switch motor corresponding to the motor 55' used with the numerical display. The stepping motor 55' moves a contact 58' past fixed contacts 59', and when movable contact 58' engages the fixed contact associated with the letter desired to be displayed, it completes a circuit through switch 259, leads 260, 261 and 276, switch 277, leads 278 and 279, switch 280 (which has been closed by relay 252) and lead 281 to actuate the motor interruptor mechanism, for thereafter stepping the contact 58 around to its zero position. In addition, this completes a circuit through lead 282, switch 283 and lead 284 to energize a pair of relays 285 and 286. Relay 286 moves switch 267 to deenergize relay 264, thereby closing the gate and preventing further transmission of pulses. It also completes a circuit through a lead 287 to a relay 288, which however, is not energized until contact 58' engages zero fixed contact 59'. Relay 285 closes a switch 290, to complete a holding circuit for the relays 285 and 286.

When the contact 58' is moved to its zero position, it completes a circuit through a line 291, to energize relay 288 and move switch 283. This opens the energizing circuit to the motor interruptor, stopping the motor 55'. It also completes a circuit through lead 292 to energize relay 293, opening the switch 255 which opens the energizing circuit for relay 252 restoring the letter selector to its original condition of rest.

Rather than attempting to put twenty-seven contacts 59' (from A to Z and zero) on one stepping switch, ganged switches are provided under the control of motor 55', and means are provided to automatically switch the stepping voltage from one gang to the other at the proper time, as follows:

When the moving contact 58' of the first bank or gang engages its next to last contact 295, it completes a circuit through leads 296 and 297 to energize a relay 298, which moves switch 277 to deenergize the contact 58' and apply the energizing voltage to the second gang contact 58''. Capacitor 299 continues the energization of relay 298, even after switch 277 opens, to insure closing of the energizing circuit to the contact 58''.

CLEARING

The display board is cleared in the following manner: First, switch 16 is moved to "clear" position. Then, the player button denoted Pall is depressed, closing switch 230 which completes an energizing circuit from lead 216 through lead 217, switch 16, leads 231 and 232, switch 230 and leads 233, 306 and 307 to energize relay PCR6. This completes a holding circuit through lead 305, switch 234 and lead 308, energizing each of the player selection circuits through lead 306 and output leads 309. This energizes each of the player relays PR1-PR5, which close associated switches 310 to complete the circuits for the mark display driver coils 157, the letter display driver coils 273 (described hereafter) and the numerical display driver coils ID1-3 and TD1-3, through line 311, as previously described.

Relays PR1-PR5 also close switches 313, to condition the clearing circuits through power lines 239, for subsequent energization of relays 240.

Relay CPR4 is energized, under control of phasing relay CPR3, through leads 216 and 217, switch 16, lead 219 and switch 220, permitting pulses to be transmitted through leads 136 and 315 to the various display wheel driver coils, as shown in FIGS. 5 and 6.

The transmission of clearing pulses over line 315 to the individual and team score display wheel driver coils is regulated by the clearing selector buttons I1-3 and T1-T4, which function in the same manner as frame selector buttons F1-F12 to first energize relay CPR1 and release any of relays ICR1-3 and TCR1-4 which might be energized. Then, the associated relay ICR1-3 and TCR1-4 is energized, closing an energizing circuit through leads 316 and 317 to selectively energize relays IR1-3 and TR1-4 (FIG. 5).

Energization of relays IR1-3 and TR1-4 closes switches 320 to permit the clearing pulses from line 315 to energize the driver coils ID1-3 and TD1-4. Each score display wheel 100 has, in addition to carry contact 102, a clearing contact or means 235 for closing an associated clearing switch 236 when the display wheel is in zero position. This completes an energizing circuit for relay 240 (FIG. 6), through lead 239, switch 236, lead 321, switch 322, lead 323 and switch 16 (FIG. 8), opening switch 241 and preventing the further transmission of pulses to that driver coil.

Pulses for clearing are transmitted over line 136 to the mark display wheels 158, each of which also carries a contact or other means 237 for closing a switch 238 when that wheel is in its zero position. Clearing of the mark displays proceeds frame by frame under control of the frame selector buttons F1-12, and it will be noted that depressing any frame selector button resets the individual and team score selector buttons I1-I3 and T1-T4 and associated circuits, prior to energization of a particular frame circuit.

When switch 238 is closed, it establishes continuity between the pulse line 136 and clearing line 239 so that a subsequent pulse passes to the relay 240 to open switch 241 and prevent the transmission of further pulses to the driver coils 157.

In this way, the numerical score display is cleared, and the mark display is cleared frame by frame. The individual score and mark displays can be cleared simultaneously for all players, with all the units, all the tens and all the hundreds wheels being cleared, successively, and with all of the player mark display wheels being cleared simultaneously, frame by frame.

When it is desired to clear the name display, switch 17 is moved to the "alphabet" position, whereupon pulses are transmitted to the alphabet display wheels via input 48', switch 330 and line 272. Driver coil energizing pulses are then transmitted via lead 272 to the various name display driver coils under control of frame buttons #1-10.

CORRECTION

If an error has been made in the positioning of any of the various display wheels, that error can be corrected, as follows:

Switch 16 is shifted in the "correct" position, thereby completing a pulse transmission circuit through the lines 136 and 315, assuming that switch 17 is in the "numerical" position. If switch 17 is in the "alphabet" position, the switch 16 completes a pulse transmission circuit through line 272. In either case, the operation is the same as described above in describing the clearing function, except that the transmission of pulses is under the control of the correction button 225. This button comprises a normally open switch, permitting the person making the correction to control the number of pulses passing to the display wheel driver, and thereby controlling the movement of the display wheels to the correct position.

In this way, the position of each display wheel in the system can be individually corrected, without effecting the position of any other display wheel.

PHASING

As previously noted, the various pulse gates can be

closed only between pulses and never during a pulse. This is accomplished by phasing pulses, which can be from generator 50, and which are synchronised with the driver coil pulses by any suitable means which can be of known type.

GATHERING, STORING, PROCESSING AND REPRODUCTION OF SCORING INFORMATION

It is a particular feature of my invention that means are provided in the form of a computer associated with one or more scoring and display devices of my invention, as described above, to gather information from such scoring devices, and store and process the same for reproduction in printed or other form. It is contemplated that, in a typical installation, there will be a scoring and display device associated with each alley. In addition, it is desired to provide means whereby the player's score can be stored, processed and reproduced as required or desired, and in particular to provide means for gathering, storing, processing and reproducing scoring information from several scoring devices.

The information thus gathered can be reproduced in permanent form, as by printing the same on a card which can be given to the player. In addition, such processing means can perform computations associated with bowling league competition, such as team standings, team totals, individual handicaps, and the like. The results of such computations can be reproduced in printed, readable form, on magnetic tape, or the like, and the reproduction can be retained for subsequent competition, and reprocessed for the recomputations necessary in subsequent competition.

Such a recording and reproducing mechanism is indicated diagrammatically in FIG. 10, in which there are shown a number of different scoring and display devices 400, each constructed and functioning in the manner previously described, and each associated with a different alley A, B, C . . . N. A digital computer of known type, generally denoted 401, is associated with a sequence unit 402, also of known type, and sequence unit 402 scans the various scoring devices 400 by sequentially interrogating the same through input lines 403, 404, 405 and 406, it being understood that there is an interrogation line to each device 400. Such interrogation of the individual scoring devices 400 energizes or completes circuits required to transmit the information desired to the computer 401, through the various output leads 407, 408, and 409. Such information can comprise the team and player names, the frame number, the player number, the presence or absence of a mark, the number of pins knocked down, and any other information present in scoring device 400.

In order to adapt the individual scoring devices 400 to provide computer 401 with the desired information upon interrogation, additional circuits are provided, as follows.

A set of four normally open contacts 414 is associated with each of the frame control relays FCR1-12, a set of three normally open contacts 415 is associated with each player control relay PCR1-PCR5, a set of four normally open contacts 416 is associated with each score control relay SCR1-10, and a normally open contact 417 is associated with the score control relay SCR28. In this way, a readout circuit is conditioned to indicate the particular frame, player, pin fall being scored, and whether it is ball #1 or #2. In addition, a set of five normally open contacts 418 is associated with each alphabet relay 252', thereby to condition the readout circuit to indicate the particular player.

In the event the scoring device 400 is cleared or corrected, the readout circuit is given that information through a set of four normally open contacts 419 associated with each relay ICR1-3, and a set of four normally open contacts 420 is associated with each team control relay TCR1-4.

The number of contacts 414-420 is determined by the requirements of the binary input to the computer, and the blocking diode 421 maintains separation between the devices 400 which have a common input to computer 401.

It is contemplated that the sequence unit 402 will scan the various scoring devices 400 with great rapidity, so that it will cause to be transmitted to the computer information as to the particular player, frame and score being processed in device 400 at that particular time. In this way, computer 401 receives the scoring information simultaneously with processing of such information through the scoring devices 400.

When it is desired to extract information stored in computer 401, that can be done under the control of a unit 410 which can be coin controlled, for example, by a coin actuator 411. In any event, control unit 410 will direct computer 401 to process the retained information to the desired form and transmit the same to appropriate conversion equipment, as indicated at 412. Such conversion equipment can comprise an electric typewriter, a paper or magnetic tape device, or a visual display device, or any desired means of reproducing the information contained in the computer.

Accordingly, it is seen that my invention fully accomplishes its intended objects. While only one, illustrative embodiment of my invention has been described in detail herein, it should be understood that such detailed disclosure is by way of illustration only, without thought of limitation, and that my invention does not reside in the specific details of the various circuits but in the relative arrangement and operation thereof.

Having fully disclosed and completely described my invention, together with its mode of operation, what I claim as new is:

1. A bowling scoring and display device comprising numerical indicia display means for displaying a numerical bowling score, actuator means operable when energized to cause said display means to display a different score, pin count control circuit means arranged in controlling relation to said actuator means, and means for activating said pin count control circuit means in accordance with the number of pins knocked down as each ball is rolled, said pin count control circuit means being operable when activated to complete an energizing circuit to said actuator means for causing said display means to add the number of pins for which said pin count control circuit has been activated to the numerical score being displayed, whereby the total number of pins which have been scored by a bowler as of the last ball bowled by him is displayed at all times independently of mark classifications of that bowler and independently of future ball pin-falls.

2. A bowling scoring and display device as set forth in claim 1, together with means automatically operable whenever a mark has been rolled in previous frames to complete an energizing circuit to said actuator means for causing the correct bonus score to be added to the numerical score being displayed when the player who has rolled such strike or spare rolls the succeeding frame.

3. A bowling scoring and display device as set forth in claim 1, together with mark indicia display means for displaying a strike or spare, actuator means for said mark display means, and frame evaluating circuit means arranged in controlling relation to said mark display actuator means, said frame evaluating circuit means being operable automatically in response to activation of said pin count control circuit means to complete an energizing circuit to said mark display actuator means if a strike or spare is rolled thereby to cause said mark display means to display such strike or spare.

4. A bowling scoring and display device as set forth in claim 3, wherein said pin count control circuit automatically deactivates itself upon completing the scoring of a particular pin fall, together with history circuit means

pre-set by said mark display means and operable automatically upon subsequent activation of said pin count control circuit means to prevent deactivation thereof until the appropriate bonus score has been added to the numerical score being displayed.

5 5. A bowling scoring and display device comprising means for displaying the name of each player on a team, numerical indicia display means associated with each player name display for displaying the numerical bowling score of that player, actuator means for each numerical display means operable when energized to cause said numerical display means to display a different score, pin count control circuit means arranged in controlling relation to said actuator means, individual player selection means arranged in controlling relation to said actuator means for controlling the energization thereof, means for activating said pin count control circuit means in accordance with the number of pins knocked down as each ball is rolled, said pin count control circuit means being operable when actuated to complete an energizing circuit under control of said player selection means to the actuator means for the numerical display means associated with the selected player to add the number of pins for which said pin count control circuit means has been activated to the numerical score being displayed for that player, whereby the total number of pins scored by any one player as of the last ball bowled by that player is displayed at all times independently of mark classifications and independently of future pinfalls.

6. A bowling scoring and display device as set forth in claim 5, together with additional numerical indicia display means for displaying the team score, actuator means for said team score display means operable when energized to cause a different team score to be displayed, said pin count control circuit means also being arranged in controlling relation to said team score display actuator means, said pin count control circuit means being operable when actuated to complete an energizing circuit to said team score display actuator means for causing said team score display means to add the number of pins for which said pin count control circuit means has been actuated to the team score on display whereby the total number of pins scored by the team as of the last ball bowled by any player on that team is displayed at all times independently of mark classifications and future pinfalls.

7. A bowling scoring and display device as set forth in claim 5, together with correcting means selectively operable to change the display of any one of said display means independently of the other ones of said display means.

8. A bowling scoring and display device as set forth in claim 5, together with mark indicia display means associated with each player name display for displaying the strike and spare history of each player, there being a mark display means for each frame, actuator means for said mark display means operable when energized to cause the same to display a strike or spare mark, individual frame selection means arranged in controlling relation to said mark display actuator means for controlling the energization thereof, said player selection means also being arranged in controlling relation to said mark display actuator means, and frame evaluating means operable automatically in response to activation of said pin count control circuit means to complete an energizing circuit under control of said player and frame selection means to the actuator means for the mark display means associated with the selected player and frame whenever a strike or a spare is rolled.

9. A bowling scoring and display device as set forth in claim 8, wherein said means for displaying the name of each player comprise alphabet indicia display means, actuator means for each alphabet display means operable when energized to cause said alphabet display means to display different letters of the alphabet, said frame and player selection means being arranged in controlling rela-

tion to said actuator means for controlling the energization thereof with said frame selection means controlling the correspondingly located alphabet display means for each player's name, and letter selector means operable when actuated to complete an energizing circuit to the selected alphabet display actuator means.

10. A bowling scoring and display device as set forth in claim 9, together with means for correcting any one of said display means independently of the others thereof.

10 11. A bowling scoring and display device as set forth in claim 8, together with clearing means operable when actuated to energize said display actuator means under control of said frame and player selection means to reset the associated display means to a null position, said clearing means automatically deactivating itself when the selected display means are in null position, together with clearing player selection means enabling clearing of all player mark display means associated with a particular frame simultaneously under control of said frame selection means.

12. A bowling scoring and display device comprising means for displaying the name of a player, numerical indicia display means associated with said name display for displaying the numerical score of that player, actuator means operable when energized to cause said numerical display means to display a different score, pin count control circuit means arranged in controlling relation to said numerical display actuator means, means for actuating said pin count control circuit means in accordance with the number of pins knocked down by each ball rolled, said pin count control circuit means being operable when activated to complete an energizing circuit to said numerical display actuator means for causing said numerical display means to add the number of pins for which said pin count control circuit means has been activated to the numerical score displayed, whereby the total number of pins scored by that player is displayed at all times as of the last ball bowled by that player independently of marks which have been scored and independently of future pinfalls, mark indicia display means associated with said name display for displaying the mark history of that player in each frame, actuator means for said mark display means operable when energized to cause said mark display means to display a strike or a spare, frame selection means arranged in controlling relation to said mark display actuator means for controlling the energization thereof, frame evaluating circuit means operable automatically in response to actuation of said pin count control means to complete an energizing circuit to the selected mark display actuator means whenever a strike or spare is rolled causing the display of an appropriate mark.

13. A bowling scoring and display device as set forth in claim 12, wherein said name display means comprise alphabet indicia display means and actuator means therefor operable when energized to cause said alphabet display means to display different letters of the alphabet, said frame selection means being arranged in controlling relation to said alphabet display actuator means to enable selection of successive letters in a player's name, and letter selector means operable when actuated to complete an energizing circuit to the selected alphabet display actuator means.

14. A bowling scoring and display device comprising numerical indicia display means for displaying a numerical bowling score, pulse responsive actuator means for causing said display means to display a score corresponding to the number of energizing pulses received by said actuator means, continuous pulse generating means, pin count control circuit means operable when activated to permit the transmission of energizing pulses from said pulse generating means to said pulse responsive actuator means, pin count selector means for activating said pin count control circuit means in accordance with the pin fall to be scored, and pulse counting means operable to deactivate said pulse control circuit means and thereby

17

interrupt the transmission of energizing pulses from said generating means to said actuator means when the number of pulses transmitted to said actuator means equals the pin fall for which said pin count control circuit means has been activated whereby the total number of pins scored as of the last ball bowled is displayed independently of mark classifications and future pinfalls.

15. A bowling scoring and display device as set forth in claim 14, together with mark display means for displaying strike and spare marks, actuator means for said mark display means, frame evaluating circuit means arranged in controlling relation to said mark display actuator means, said frame evaluating circuit means including second pulse counting means operable to count the total number of pulses transmitted to said numerical display actuator means during the scoring of each frame, and means operable to complete an energizing circuit to said mark display actuator means whenever said second pulse counting means indicates a pin fall of ten in a particular frame.

16. A bowling scoring and display device comprising numerical indicia display means for displaying a numerical bowling score, pulse responsive actuator means for causing said display means to display a score corresponding to the number of energizing pulses received by said actuator means, continuous pulse generating means, pin count control circuit means operable when activated to permit the transmission of energizing pulses from said pulse generating means to said pulse responsive actuator means, pin count selector means for actuating said pin count control circuit means in accordance with the pin fall to be scored, first pulse counting means operable to deactivate said pulse control circuit means and thereby interrupt the transmission of energizing pulses from said generator means to said actuator means when the number of pulses transmitted to said actuated means equals the pin fall for which said pin count control circuit means has been activated, means operable to reset said first counting means to zero when said pin count control circuit means is deactivated, mark indicia display means for displaying strike and spare marks, actuator means for said mark display means, frame evaluating circuit means arranged in controlling relation to said mark display actuator means and operable when activated to complete an energizing circuit thereto, second pulse counting means operable to count the number of energizing pulses transmitted to said numerical indicia display actuator means and activate said frame evaluating circuit means when a strike or spare has been rolled, means generating a control signal each time said pin count control circuit is deactivated, said frame evaluating circuit automatically switching from ball one to ball two condition in response to the first such control signal and automatically resetting said second pulse counting means to zero in response to the second such control signal in each frame.

18

17. A bowling scoring and display device as set forth in claim 16, together with player history circuit means operable when actuated to prevent operation of said second pulse counting means and deactivation of said pin count control circuit means until a bonus score has been added, activation of said history circuit means being controlled by said mark display means.

18. Means for gathering, storing, processing and reproducing bowling scoring information comprising, in combination with multiple bowling scoring and display devices each comprising numerical indicia display means for displaying a numerical bowling score, actuator means operable when energized to cause said display means to display a different score, pin count control circuit means arranged in controlling relation to said actuator means, and means for activating said pin count control circuit means in accordance with the number of pins knocked down as each ball is rolled, said pin count control circuit means being operable when activated to complete an energizing circuit to said actuator means for causing said display means to add the number of pins for which said pin count control circuit has been activated to the numerical score being displayed, whereby the total number of pins which have been scored by a bowler as of the last ball bowled by him is displayed at all times independently of mark classifications of that bowler and independently of future ball pinfalls, and each operable to compute the bowling score information for a particular alley, common computer means operable to store and process such information, sequencing means operable to repeatedly and sequentially interrogate said devices, means transmitting instantaneous bowling score information from said devices to said common computer means upon such interrogation, and means for reproducing information from said computer means.

19. The combination set forth in claim 18, wherein the input from said devices to said common computer means is on a binary system.

20. The combination set forth in claim 18, wherein said means for reproducing information are coin actuated.

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