

Sept. 22, 1942.

A. F. ECKERT

2,296,508

GAME SCORING APPARATUS

Filed July 15, 1940

2 Sheets-Sheet 1

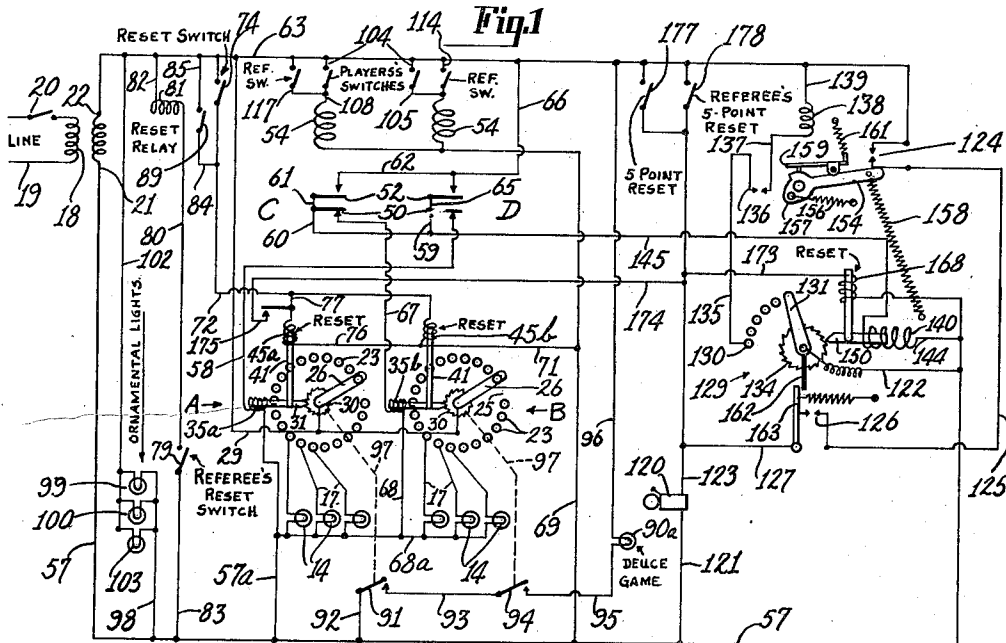
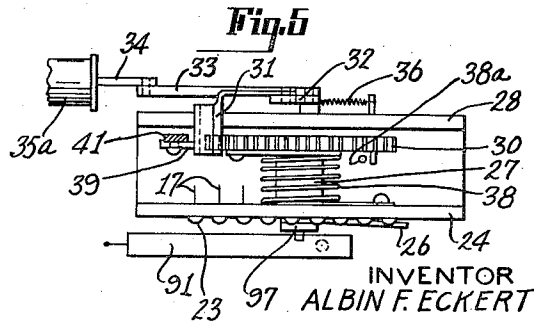
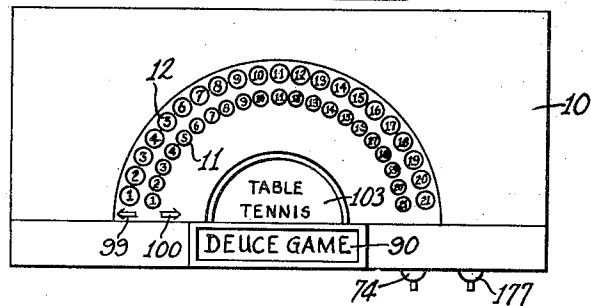
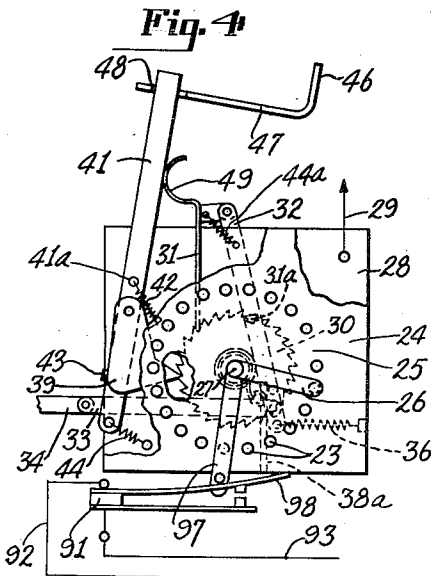


Fig. 3



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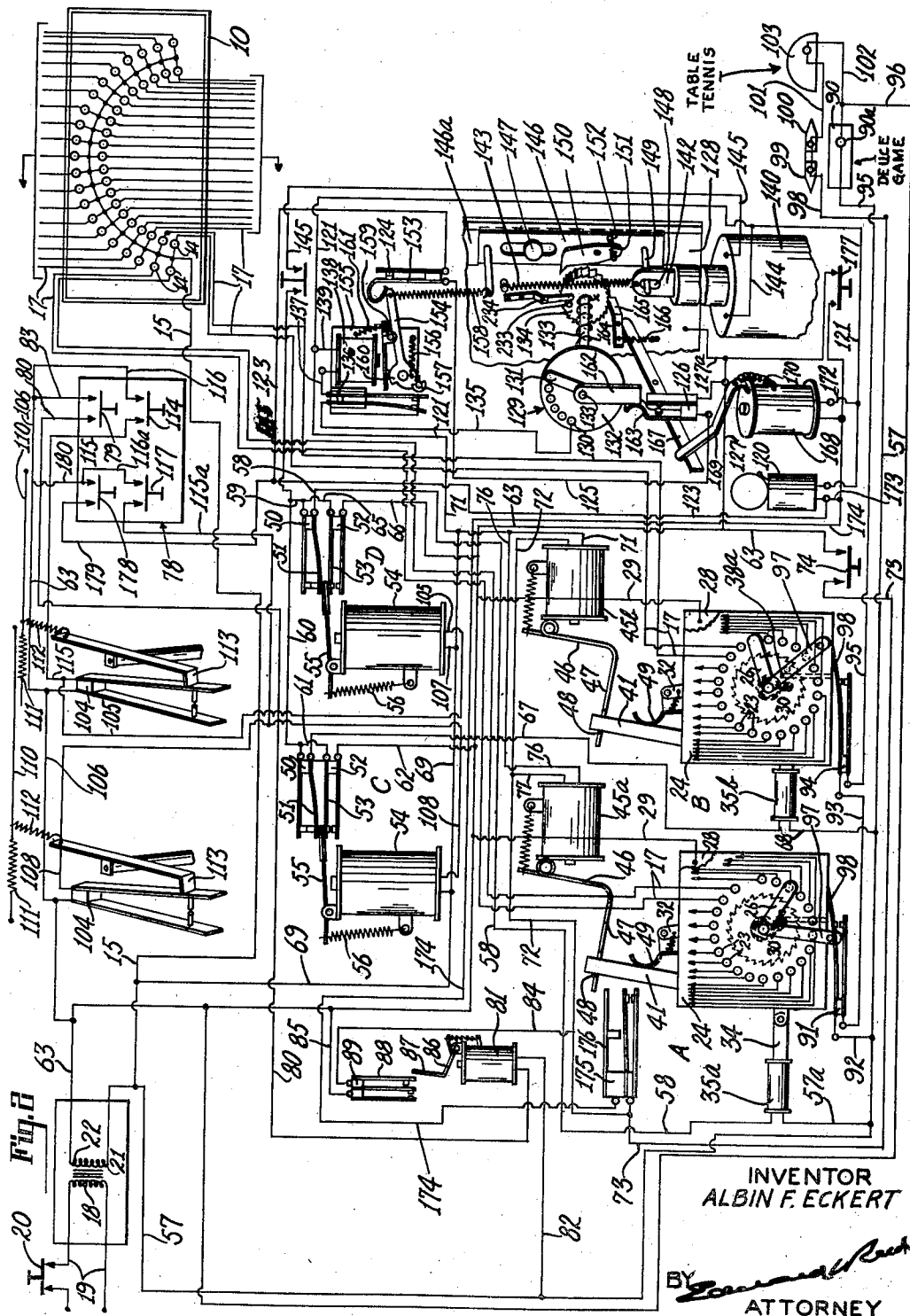
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,296,508

GAME SCORING APPARATUS

Albin Frank Eckert, Dayton, Ohio

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14 Claims. (Cl. 177-384)

This invention relates to an apparatus for indicating the score in a game, or the like.

One object of the invention is to provide means whereby the score may be progressively indicated by easily operated apparatus.

A further object of the invention is to provide such an apparatus having remote control means for effecting the indication of the scores of the respective players and for resetting the indicator.

A further object of the invention is to provide such an apparatus in which the controlling means for the indicating devices are so arranged adjacent the respective stations of the players that they may be quickly and easily operated by the players.

The present apparatus is designed primarily for indicating the score in the game of table tennis and in that game the "serve" changes after each five points scored.

It is a further object of the invention to provide means controlled by the score indicating apparatus for automatically operating a signal when the last point of each successive group of five points each is scored.

A further object of the invention is to provide a signal operating mechanism which will be automatically reset when the signal has been operated or when the score indicating mechanism is reset at the end of the game.

Other objects of the invention may appear as the apparatus is described in detail.

Fig. 1 is a circuit diagram illustrating the general arrangement of the circuits; Fig. 2 is a schematic view showing the details of the circuits in connection with the mechanical elements; Fig. 3 is a front elevation of the cabinet in which the major portion of the mechanism is enclosed; Fig. 4 is a front elevation, partly broken away, of one of the circuit selecting devices; and Fig. 5 is a top plan view of the circuit selecting device with one of the levers in section.

In these drawings I have illustrated one embodiment of my invention and have shown the same as designed primarily for indicating the score in a game of table tennis but it will be understood that the apparatus may take various forms and may be used for various purposes where comparative indications are desired. In Fig. 1 there is shown a circuit diagram illustrating in a simplified form the general arrangement of the circuits, and in Fig. 2 is shown a complete layout of the apparatus with the circuits in detail and as used in practice.

The indicating elements and their operating

mechanism are preferably enclosed in a casing or box 10 the front wall of which is provided with score indicating elements and which may be mounted in any suitable position where the score will be visible to the players, as on a wall alongside of a table. There are two series of indicating elements adapted to indicate, respectively, the scores of the two players, the elements of each series being numbered progressively from 1 to 21. Preferably the two series of elements are arranged in parallelism and they are here shown as arranged in arcs of concentric circles. These indicating elements may be of any suitable character but I prefer that the indications should be illuminated and to that end the front wall of the casing 10 may conveniently be formed of opaque material, such as glass which is painted on its inner side, and which is provided with two series of transparent spots 11 and 12 on each of which there is placed an opaque numeral, the numerals being preferably on the inner side of the transparent spots so that they can be seen only when illuminated. Each series of indicating elements is provided with identical numerals, the corresponding numerals of the two series being arranged side by side. The number of numerals employed will depend upon the character of the game to be scored. In table tennis the party first scoring twenty-one points, except when the game goes to "deuce" game, wins the game and therefore each series includes twenty-one indicating elements bearing consecutive numerals. The illuminating devices, which form parts of the respective indicating elements, are arranged within the cabinet and, in the present instance, a small electric lamp 14 is arranged back of each spot 11 and 12, the lamps being arranged in parallel series corresponding to the arrangement of the spots and means, such as partitions, being provided to confine the light from each lamp substantially to the spot and the numeral with which it is associated. Partitions may, if desired, be provided to prevent the diffusion of the light from the various lamps but in practice I have not found this to be necessary. The lamps may be connected with a source of current supply in any suitable manner. In the arrangement shown the lamps of each series are connected with a source of current supply by conductors 15 and 17, as will be hereinafter described, and separate devices are interposed between the lamps of each series and the source of current supply to progressively close the lamp circuits, these devices being herein referred to as circuit selecting devices. In the present in-

stance the source of current supply constitutes a transformer 18 which is connected with a main supply line, indicated at 19, in one side of which is inserted a manually operated switch 20. In the simplified diagram of Fig. 1 the lamps are interposed between the circuit selecting devices and the positive terminal 21 of the transformer and are connected through the selecting devices with the negative terminal 22. In the preferred arrangement they are interposed between the selecting devices and the negative terminal, the circuits 17 for the individual lamps being connected with the selecting device, and a common conductor 15 leads from the lamps to the positive terminal.

Interposed between each indicating element of the two series and the transformer are two circuit selecting devices, A and B, there being of course a separate selecting device for each series of indicating elements, and means are provided for actuating one or the other of these selecting devices to progressively illuminate the indicating elements of the respective series as points are scored by the respective players. The term "player" is herein used to indicate either an individual or two or more individuals playing as a team. The two circuit selecting devices are identical in construction and operation and each comprises a plurality of stationary contacts connected with the respective lamp circuits, and a movable contact to successively engage the fixed contacts and thus progressively illuminate the indicating elements. In the present construction (Figs. 4 and 5) the stationary contacts are shown at 23 and are mounted on and insulated from a supporting plate 24 mounted in a fixed position within the casing, the plate being preferably formed of insulating material, and the stationary contacts are arranged in arcs of concentric circles. There are shown twenty-one contacts, one for each indicating element of the corresponding series, and two of these contacts are spaced apart, as shown at 25, to provide a neutral space for the movable contact member. The fixed contacts 23 are connected respectively with the conductors 17 of the lamps of that series with which the selecting device is associated.

The movable contact is preferably in the form of an arm 26 mounted for rotation about the axis of the circular series of fixed contacts, whereby it will be brought successively into engagement with the fixed contacts. In the present arrangement the contact arm is rigidly secured to and carried by a shaft 27 journaled at its front end in the stationary plate 24 and at its rear end in a metal plate 28. The metal plate 28 is connected by conductors 29 and 63 with the negative terminal 22 of the secondary of the transformer and the contact arm 26 is in electrical connection with the shaft and the shaft is in electrical connection with the metal plate 28, thus as the contact arm 26 engages the successive fixed contacts the circuit will be closed through the indicating element which is connected with that contact. The movable contact member may be actuated in any suitable manner. Preferably a ratchet wheel 30 is rigidly secured to the shaft 27 and an actuating pawl 31 is pivotally connected with a lever 32 which, in the present instance, is pivotally mounted on the plate 28 at 31a, and extends both above and below its pivotal axis, the arrangement being such that upon each complete oscillation of the lever 32 the pawl will advance the ratchet wheel one step, that is, a

distance sufficient to move the contact arm 26 into engagement with the next succeeding fixed contact. Electrically operated means are provided for controlling the action of the lever 32 and, as here shown, that end of the lever opposite the end to which the pawl 31 is attached is connected by a link 33 with the plunger 34 of a solenoid, 35a or 35b. The lever 32 is held normally in its forward position, with the plunger of the solenoid extended, by means of a spring 36. When the solenoid is energized the lever 32 will be moved about its axis in a reverse direction to move the pawl 31 rearwardly with relation to the ratchet wheel and when the solenoid is de-energized and the lever released the latter will be moved forwardly by the spring 36 to advance the ratchet wheel and contact arm.

Spring means are provided for resetting the circuit selecting devices at the end of a game or at such other times as it may be desired to restore the movable contact arm to its initial or neutral position. For this purpose a spring 38 is coiled about the shaft 27 and so connected with the ratchet wheel 30 and the plate 24 that it will be placed under torsion by the successive movements of the shaft by the ratchet wheel. The ratchet wheel and shaft are held against reverse movement by a detent 39 and means are provided for retracting the detent and the actuating pawl when it is desired to reset the selecting device. As here shown, the detent 39 is pivotally mounted on the lower end of a lever 41 pivotally mounted at 41a between its ends on the plate 28. The detent is also connected with the lever by a spring 42 tending to move the same toward the ratchet wheel. A stop 43 on the detent engages the outer edge of the lever to cause the pawl to be disengaged from the ratchet wheel when the lever is moved clockwise. A spring 44 connected with the lower end of the lever 41 and with a fixed part of the apparatus holds the detent normally in engagement with the ratchet wheel, and the spring 42 permits the detent to yield as the ratchet wheel is advanced step by step. When the lever 41 is moved in a clockwise direction about its axis, as shown in Figs. 2 and 4, the pawl will be moved bodily away from the ratchet wheel and into an inoperative position with relation thereto. This movement may be imparted to the lever in any suitable manner but it is preferably operated electrically and, in the present instance, is actuated by a release magnet, the two release magnets being indicated respectively as 45a and 45b. The armature 46 of this magnet has a forwardly extending part 47 provided near its outer end with a shoulder 48 which overlies and is adapted to operatively engage the edge of the lever 41 so that when the magnet, 45a or 45b is energized and the armature 46 actuated the shoulder 48 will act on the lever, which is preferably arranged in an inclined position, to move the same in a direction to disengage the detent 39 from the ratchet wheel. The actuating pawl 31 has a part 49 arranged in the path of the upper portion of the lever 41 so that it will be engaged by that lever when the latter is actuated and moved about its pivotal connection with the lever 32 to disengage the same from the ratchet wheel, thereby completing the releasing of the ratchet wheel and permitting the same to be rotated by the spring 38 to restore the indicator arm to its initial position, as determined by a stop 38a. As soon as the magnet, 45a or 45b is deenergized the spring 44 will return the lever 41 and the de-

tent 39 to their normal positions, and the pawl 31 will be restored by a spring 44a.

The solenoids 35a and 35b and the magnets 45a and 45b may be actuated in any suitable manner to effect the operation and resetting of the circuit selecting devices. In the present arrangement I have provided two controlling devices, one for each selecting device, which are here indicated at C and D, respectively. Each of these control devices comprises switch means for initiating the operation of the respective circuit selecting devices. For reasons which will hereinafter appear it is preferable to provide each controlling device with two switches and to selectively control the energization of those solenoids 35a and 35b might be directly energized by the manipulation of switches at the respective ends of the table. The two controlling devices are identical in construction and operation and each includes a normally closed switch 50, the movable contact 51 of which is biased toward its open position, and a normally open switch 52 the movable contact 53 of which is biased toward its open position. Electrically operated means are provided for opening the normally closed switch and closing the normally open switch. As here shown, this means comprises a magnet 54 the armature 55 of which is in the form of a lever having one end of insulating material which extends between the movable contacts of the switches 50 and 52. A spring 56 acts on the armature lever 55 to normally hold the same in a position to retain the switch 50 closed. When the magnet 54 is energized the lever is moved against the action of the spring 56 to close the normally open switch 52 and to permit the normally closed switch 50 to open.

The circuits for the switches of the two controlling devices C and D are as follows: the positive terminal 21 of the transformer is connected by conductors 57 and 57a with one side of the solenoid 35a and the other side of that solenoid is connected by a conductor 58 with the movable member of the normally closed switch 50 of the controlling device D and the other terminal of that switch is connected by conductors 59 and 60 with one terminal of the normally closed switch 50 of the controlling device C, and the conductor 60 is connected by a conductor 61 with one terminal of the normally open switch 52, of controlling device C, the other terminal of that switch being connected by conductors 62 and 63, with the negative terminal 22 of the transformer. The conductor 59 is connected by a short conductor 65 with one terminal of the normally open switch 52 of controlling device D, the other terminal of that switch is connected by a conductor 66 with the conductor 63 leading back to the transformer. The second terminal of the normally closed switch 50 of controlling device C is connected by a conductor 67 with the return side of the solenoid 35b and the other side of that solenoid is connected by a conductor 68 with the conductor 57.

When the magnet 54 of controlling device C is energized the normally open switch 52 of that circuit is closed and the normally closed switch 50 is opened. The current then flows from the transformer through conductor 57, solenoid 35a for the circuit selecting device A, conductor 58 through the closed switch 50 of controlling device D, through the conductors 59, 60 and 61, through the switch 52 of controlling device C, thence through conductors 62 and 63, back to

the transformer, thus the solenoid 35a is energized and the circuit selecting device A caused to advance the contact arm 26 thereof one step. When the magnet 54 of controlling device D is energized the normally open switch 52 thereof is closed and the normally closed switch 50 is opened. The current then flows from the transformer through the conductors 57 and 68 to the solenoid 35b of the circuit selecting device B, thence through conductor 67, through the closed switch 50 of controlling device C, through conductors 60, 59 and 65 to the closed switch 52 of controlling device D, thence through conductors 66 and 63, back to the transformer, thereby causing the circuit selecting device B to be actuated to advance the contact arm 26 one step.

The release magnets 45a and 45b are preferably controlled manually and in the present arrangement the magnet 45b is connected with the positive terminal 21 of the transformer by conductors 57, 15, 69, and 71, and is connected with the negative terminal 22 by conductors 72 and 73, and manually operated switch 74 and conductor 63. The release magnet 45a is connected by a conductor 76 with the conductor 71 and by a conductor 77 with the conductor 72. Consequently upon the closing of the manual switch 74 both release magnets will be energized and both circuit selecting devices reset. The manually operated switch 74 may be of any suitable character and may be arranged in any suitable location. Preferably it is carried by the casing 10, which is located alongside the table, so that the switch can be conveniently actuated by one of the players at the end of the game.

When the game is played before a referee it is desirable that there should be means whereby the referee can control the various operations of the apparatus from his station and I have shown a switch box 78 adapted to be located adjacent the referee's station. This switch box includes a switch 79, here shown as of the push button type, which is connected by a conductor 80 with a magnet 81 which is also connected by a conductor 82 with the conductor 57 leading from the positive terminal 21 of the transformer (Fig. 2). The other terminal of the push button switch 79 is connected by conductors 83 and 106 with the return line 63 leading to the negative terminal 22 of the transformer. The magnet 81 operates a switch 89 which is connected between the conductors 72 and 63 in parallel with the release magnets. This switch is normally open and, as here shown, is connected with the conductor 72 by a conductor 84 and is connected with the conductor 63 by a conductor 85. The armature 86 of the magnet 81 is provided with an arm 87 arranged to engage a switch closing device 88 forming part of the switch 89. Thus when the magnet 81 is energized by closing the push button switch 79 the current will flow from the positive terminal 21 of the transformer through conductors 57, 69, 71, 76, 72, 84, switch 89, conductor 85, and conductor 63 to the negative terminal 22 of the transformer, thereby energizing both release magnets. It will be obvious that the referee's switch 79 could be directly connected with the circuit for the release magnets but in practice it has been found preferable to interpose the relay 81-89 in order to provide a more powerful current for the operation of the release magnets, the two magnets being operated simultaneously. The referee's switch is remote from the indicator and is connected therewith by long fine wires which restrict the flow of the current and in

which there is a loss of energy. The relay permits a more direct connection between the release magnets and the transformer and avoids the necessity of using a large capacity transformer and heavier conductors.

In table tennis the game is won by the player first scoring twenty-one points, provided both players do not at the same time have a score of twenty points. When this happens it is necessary in order to win the game for one of the players to score two successive points, this being known as deuce game. The present apparatus was designed to indicate twenty-one points only but means are provided for indicating that it is deuce game. As here shown, the casing 10 is provided with an illuminated panel 90 bearing the legend "Deuce game" and the lamp 90a for illuminating this panel is connected in circuit with the circuit selecting devices so that it will be illuminated whenever the score of twenty is indicated by the score indicating elements of both series. A normally open switch 91, associated with the circuit selecting device A, is connected by conductors 92 and 57 with the positive terminal of the transformer and is connected by a conductor 93 with a similar normally open switch 94 associated with circuit selecting device B, the switch 94 being connected by a conductor 95 with the lamp 90a of the deuce game indicator, and a return circuit 96 extends from the lamp 90a to conductor 63 which is connected with the negative terminal of the transformer. Rigidly connected to the shaft 27 of each circuit selecting device in fixed relation to the contact arm 26 of that selecting device is an arm 97 so arranged that when the contact arm is moved into engagement with the twentieth fixed contact the arm 97 will engage and close the associated switch in the deuce game circuit. Thus if twenty points are first scored by the circuit selecting device A the switch 91 will be closed but the two switches being in series the circuit will not be closed unless and until the twenty points are also scored by the selecting device B and the switch 94 closed. The movable contact member of each of the switches 91 and 94 is provided with an extension 98 of such length that the actuating arm 97 of the associated selecting device will remain in engagement with the movable member of the switch when the contact arm 26 is moved to its twenty-first position, thus preventing the movable member of the switch from moving into the path of the arm 97 and preventing the reverse movement thereof.

The front of the casing 10 is also provided with two illuminated arrows 99 and 100, associated with the respective series of indicating elements and which point toward the end of the table at which is stationed the player whose score is being indicated by the associated series of indicating elements. These arrows are so connected in the circuit that they will be illuminated whenever the switch 20 is actuated to connect the transformer with the supply line. As shown in Fig. 2, these arrows are connected by the conductor 98 with the conductor 57 which leads from the positive terminal 21 of the transformer and by conductors 101 and 102 with the conductor 96 of the deuce game circuit which leads back to the negative terminal of the transformer. In the present instance, an illuminated panel 103 bearing the legend "Table tennis" is connected in series with the arrows so that both the arrows and the legend "Table tennis" are illuminated when the score indicating apparatus is operative.

The magnets 54 of the controlling devices C and D are preferably provided with circuits whereby they may be actuated either by the players themselves or by a referee. As here shown, a normally open switch 104 is connected by a conductor 105 with the magnet 54 of the controlling device D and is connected by conductor 106 with the conductor 63 leading to the negative terminal 22 of the transformer so that when this switch 104 is closed the current will flow from the positive terminal 21 through conductors 57, 69 and 107, to the magnet 54 of the controlling device D, thence through the conductor 105, switch 104 and conductor 106 back to the negative terminal. A second switch of the same character is provided for the magnet circuit of the controlling device C and this switch is connected with the negative terminal in the same manner as the switch 104 but is connected by a conductor 108 with the magnet 54 of the controlling device C. The switch 104 may be of any suitable character but in order to enable the switch to be operated by a player from any position across the end of the table which he may happen to occupy I prefer to stretch a wire 110 crosswise of the table adjacent the player's position and above his head, the intermediate portion of the wire being maintained taut by a spring 111 connected with the wire at a point spaced from one end thereof and also connected with a fixed support and this spring thus maintains a slack in the end portion of the wire which will permit it to yield under the force of a blow. The intermediate portion of the wire is connected, preferably by a spring 112, with an actuating lever 113 for the switch 104. When the player scores a point he reaches up and strikes the wire either with his hand or with his racquet, thereby actuating the lever 113 to close the switch 104 and energize the magnet of the controlling device with which that switch is associated. It will be understood that such an actuating device is provided at each end of the table. Further, in order that the scoring may be effected by a referee the magnets 54 of the controlling devices C and D are connected with referee's switch box 78 by auxiliary circuits in parallel respectively with the two switches 104 at the ends of the table. The switch box 78 is provided with a switch 114 which is connected by a conductor 115 with the conductor 105 of controlling device D, and is connected by conductors 116 and 106 with the return conductor 63. The switch box also has another switch 117 which is connected by a conductor 115a with conductor 108 leading to the magnet of the controlling device C, and by conductors 116a and 106 with conductor 63.

As has been heretofore explained in the game of table tennis the "serve" changes at the end of each five points and I have embodied in the present apparatus an automatically controlled signal which will indicate to the players, preferably audibly, that the fifth point has been scored. This signal may be of any suitable character but it is here shown as an ordinary electric bell 120. The operating mechanism for the signal comprises a signal circuit and a controlling circuit. The signal circuit comprises a conductor 121, which is connected with the positive terminal 21 of the transformer by conductors 69 and 57, and with one side of the signal. The other side of the signal 120 is connected with the negative terminal of the transformer by conductors 123, 125, 127 and 63, and a normally closed switch 124 and a normally open switch 126 are con-

nected in series in the circuit between the signal and the conductor 63. In the diagram of Fig. 1 the normally open switch 126 is connected with the signal by conductors 123 and 127 and the normally closed switch 124 is connected with the switch 126 by conductor 125, and with conductor 63, but in the preferred layout of Fig. 2 the conductor 123 leads directly to the switch 124 and conductor 127 connects the switch 126 with the conductor 63. The conductor 127 is also connected by a conductor 127a with a base plate 128 which serves as a ground for other parts of the mechanism. Thus it will be noted that this signal circuit contains a normally closed switch and a normally open switch which must be manipulated in timed relation in order to effect the operation of the signal. The means for controlling the switches in the signal circuit include a selector switch 129 which, as here shown, comprises a fixed contact 130 and a movable contact or arm 131 movable step by step toward the fixed contact and adapted to be moved into circuit closing engagement therewith upon the last of a predetermined number of movements. In the present arrangement the fixed contact is carried by a plate or disk of insulating material 132 mounted in a fixed position in the apparatus. A shaft 133 is journaled at one end in the plate 132 and at the other end in the base plate 128 with which it is electrically connected. The contact arm 131 is rigidly secured to the shaft 133 and the latter has secured thereto a ratchet wheel 134 adapted to be actuated in a manner hereinafter described to advance the contact arm 131 step by step. The fixed contact 130 is connected by a conductor 135 with a normally open switch 136 which switch is connected by a conductor 137 with one side of releasing magnet 138, the other side of which is connected by a conductor 139 with the transformer. In the layout of Fig. 2 conductor 139 is connected with the positive terminal by conductors 121, 69 and 57, the movable contact 131 being grounded, but in the diagram of Fig. 1 conductor 139 is connected with the negative terminal and the movable contact 131 is connected with the positive terminal by conductors 122 and 57. This mechanism is controlled by a magnet, here shown as a solenoid 140, the core or plunger 141 of which is provided with a lug 142 which in turn is connected by a spring 143 with the base plate 128, the arrangement being such that the plunger 141 is returned to and held in its extended position when the solenoid is deenergized. In Fig. 2 the solenoid is connected with the positive terminal 21 of the transformer by a conductor 144 which is connected with the conductor 121 which in turn is connected with the positive terminal of the transformer and in Fig. 1 conductor 144 is connected directly with conductor 57. The solenoid is connected with the negative terminal 22 of the transformer through the switches of both the controlling devices C and D so that it will be energized when either one of those controlling devices is actuated. As here shown, it is connected by a conductor 145 with the conductors 59 and 60 of the controlling mechanisms for the circuit selecting devices. Consequently if the normally closed switch 50 of the control device D is open and the normally open switch 52 is closed current will pass from the conductor 145 through conductors 59, 65, switch 52, conductors 66 and 63, to the negative terminal 22. If, however, the normally closed switch 50 of controlling device C is open

and normally open switch 52 is closed current will flow from the conductor 145 through conductors 60, 61, switch 52, conductors 62 and 63, to the negative terminal 22. Consequently upon each operation of either controlling device the operating solenoid 140 for the signal mechanism is energized. The plunger 141 of the solenoid 140 is operatively connected with a slide bar 146 which is here shown as slidably mounted in a vertical guideway 146a in the base plate 128, and is retained in the guideway by a headed stud 147. In the present instance the lug 142 of the plunger 141 is provided with a slot 148 through which extends a pin 149 secured to the lower portion of the slide bar 146. Pivotaly mounted on the slide bar is a pawl 150 arranged to engage and actuate the ratchet wheel 134. This pawl is biased toward the ratchet wheel by a spring 151 and its movement toward the ratchet wheel is limited by a stop 152, with which one end of the spring is connected. The arrangement of the pawl is such that when the parts are in their normal positions, that is, the operating magnet is deenergized and the plunger 141 is in its elevated position, the nose of the pawl will be retained out of engagement with the teeth of the ratchet wheel but will overhang a portion of those teeth so that when the plunger is drawn downward, by the energization of the operating magnet, the pawl will engage one of the teeth of the ratchet wheel and when the solenoid is deenergized the spring 143, by raising the plunger and slide bar, will cause the pawl to advance the ratchet wheel and the contact arm 131 one step. The contact member 131, when in its initial position, is spaced such a distance from the fixed contact 130 that it must be advanced a predetermined number of steps, in the present instance five, before it can engage the fixed contact.

The initial energization of the operating magnet, that is, the first operation of each successive group of five operations each, in addition to advancing the movable member of the selector switch one step, will also effect the opening of the normally closed switch 124 and the closing of the normally open switch 126 in the signal circuit, and the closing of the normally open switch 136 in the control circuit. In the present arrangement of the mechanism the movable member 153 of the switch 124 is biased toward its open position and is held normally in its closed position by contact with one end of a lever 154, pivotally mounted on a plate 155 and retained in its normal position by a spring 156. The movable member 153 of the switch is provided with a cam surface which is engaged by the end of the lever 154 when that lever is moved to its normal or elevated position. The other end of the lever 154 is provided with a cam surface 157 so arranged that when the lever is moved about its axis the cam will act on and close the switch 136. At the same time the outer end of the lever is moved away from the movable contact 153 of the switch 124 and that switch opens by its own resiliency. The lever 154 is connected with the slide bar 146 by a spring 158 so that upon the initial energization of the operating magnet the lever 154 will be actuated to close the switch 136, and open the switch 124. It is then locked in that position by means of a latch 159 engaging a shoulder 160 on the hub of the lever 154. This latch constitutes the armature of the release magnet 138 and is held normally in its retracted position by a spring 161. Thus the

energization of the magnet 138 will retract the latch thereby releasing the lever 154 and causing the switches 124 and 136 to be restored to their initial conditions. It will be understood that when the lever 154 is in its latched position the spring 158 is under little or no tension and will not prevent the movement of the lever 154 by the spring 156.

The movable contact member of the normally open switch 126 in the signal circuit is biased toward its closed position but the switch is held open, so long as the contact arm of the selector switch is in its initial position, by an arm 162 rigidly secured to the shaft 133 and so arranged that when the movable contact 131 is in its initial or neutral position the arm 162 will be in engagement with a part 163 of the movable contact of the switch 126 and will hold that movable contact in circuit opening position. Upon the first movement of the movable contact 131 the arm 162 will move away from the movable member of the switch 126 to permit the latter to move to its circuit closing position.

Thus it will appear that at the end of the first operation of the magnet 140 the switches of the signal circuit have been reversed, that is, switch 124 is open and switch 126 is closed. The controlling switch 136 has been closed but the selector switch is still open. The only effect of the next three energizations of the operating magnet will be to advance the contact arm of the selector switch from its first position to its fourth position, the other switches remaining in the positions in which they have been set. Upon the fifth energization of the operating magnet the contact arm 131 of the selector switch engages the fixed contact 130 thereof and the control circuit is closed, thereby energizing the release magnet 138 and causing the switch operating arm to be released, the movement of this arm to its normal position serving to close the switch 124 in the signal circuit and to open the switch 136 of the control circuit. The switch 126 having been previously closed, the signal circuit is now complete and the signal is operated.

The selector switch is then restored to its first position and the cycle of operations is completed. The restoring of the selector switch to its initial position may be effected in any suitable manner but is preferably automatic and in the present instance a spring 164 is coiled about the shaft 133 of the selector switch and is connected with the ratchet wheel 134 and with the switch plate 132 in such a manner that the rotation of the ratchet wheel and shaft will place the spring under torsion. The ratchet wheel is held normally against reverse movement by a pivoted detent 165 which is held in contact with the ratchet wheel by a spring 166. A lever 167 is pivotally mounted between its ends and one end thereof extends beneath the outer or tail portion of the detent pawl 165, so that when the lever is rocked about its axis it will engage the detent and move the same to an inoperative position. In the present instance the rocking of the lever is effected by a magnet 168, the armature 169 of which is held normally in its retracted position by a spring 170 and has a part extending across the lever 167 and so arranged that when the armature is actuated by the energization of the magnet 168 it will rock the lever about its axis and thus actuate the detent to release the ratchet wheel, and permit the latter to be moved in a reverse direction by its spring 154 until a stop pin 233 thereon engages a fixed stop 234

on the base plate. The magnet 168 is connected with the signal circuit so as to be energized upon each operation of the signal and, as shown in Fig. 2 it is connected with conductor 121 of the signal circuit, as shown at 172, and is connected with conductor 123 of the signal circuit by a conductor 173, so that the magnet 168 will be energized upon each operation of the signal but the signal will operate before reverse movement can be imparted to the selector switch to open the normally open switch 126 and thus open the signal circuit.

In order that the signal may operate for an appreciable length of time and that the detent 165 may be retained in its inoperative position long enough to permit the contact finger 131 to be returned to its initial position, the signal and the pawl actuating or resetting magnet 168 are directly controlled by the signal circuit, which remains closed for a brief interval after the selector switch 129 has been opened. If the signal 120 and the resetting magnet 168 were deenergized immediately upon the opening of the selector switch the operation of the signal would be very short and the detent 165 would again engage the ratchet wheel before the contact finger 131 had returned to its initial position. With the circuit arrangement here shown the energization of the operating magnet 140, upon the first of each series of operations, retracts the plunger 141 and thereby opens the switch 124 and closes the switch 136. When the magnet 140 is deenergized the spring 143 causes the pawl 150 to advance the contact finger 131, of the switch 129, one step, thereby withdrawing the arm 162 and permitting the switch 126 to close. The circuits remain in this condition during the successive movements of the contact finger 131 until that finger engages the contact 130, thereby energizing the release magnet 138 which opens the switch 136 and closes the switch 124 and thus completes the circuit through the signal and the resetting magnet 168 independently of the switch 129. The energization of the resetting magnet releases the ratchet wheel 134 and the contact finger is returned by the spring 164, but the switch 126 remains closed and therefore the resetting magnet holds the detent 165 in its inoperative position until the contact finger is returned to its initial position and the arm 162 opens the switch 126 and thus deenergizes the resetting magnet and the signal.

Means are also provided for resetting the five point signal mechanism when the circuit selecting devices are reset, regardless of the position of the contact arm of the selector switch. For this purpose the conductor 173 which connects the resetting magnet 168 with the signal circuit is connected by a conductor 174 with one side of a normally open switch 175, the other side of which is connected with the conductor 72 of the release magnets for the circuit selecting devices. The switch 175 includes an actuating member 176, the outer end of which extends beneath the arm 47 of the armature for the release magnet 45a so that when that magnet is energized the switch 175 will be closed, thereby energizing the resetting magnet 168. A manually operated switch 177 is also connected in circuit with the resetting magnet 168, in parallel with the other controlling devices therefor, so that the selector switch may be reset at any time and for any reason. The referee's switch box 78 is also provided with a switch 178 whereby the signal circuit may be completed independently of the control circuit

and the mechanism restored to its initial position by the referee. For this purpose the switch 178 is connected by a conductor 179 with the signal circuit in advance of the switch 124, and the other side of the switch 178 is connected by a conductor 180 with conductor 106 leading to the negative terminal 22 of the transformer. Thus when the referee's switch 178 is operated the magnet 168 is energized and the selector switch restored to its initial position.

It is essential that the operating magnet 140 shall be so connected with the circuits for the controlling devices C and D that it will be energized when either controlling device is actuated. It is equally important that the connection shall be of such a character that the closing of the circuit through the magnet of one controlling device will not close the circuit through the magnet of the other controlling device and thus cause both selecting switches to be operated. In the present arrangement this is accomplished by providing each controlling device with a normally closed switch 50 and a normally open switch 52, both switches being controlled by the magnet for that controlling device and the arrangement being such that when the normally open switch of one controlling device is closed, to actuate its selecting switch, the current will flow from the transformer to the operating magnet 140 through line 121 and will flow back to the transformer through line 145 and the normally open switch which has been open thus closed, thus passing through the magnet of the other controlling device, the normally closed switch of the latter being connected with the positive terminal of the transformer.

It will be understood, of course, that when the apparatus is used for scoring a game in which the five point signal or a similar indication is unnecessary the five point signal mechanism will be disconnected, and, if the apparatus is constructed solely for scoring such a game the five point signal mechanism may be omitted.

While I have shown and described one embodiment of my invention I wish it to be understood that I do not desire to be limited to the details thereof as various modifications may occur to a person skilled in the art.

Having now fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a game scoring apparatus, a plurality of series of score indicating elements, separate means for progressively actuating the indicating elements of the respective series, separately operable means for controlling the operation of the respective actuating means, a signal, and means controlled by the operation of said controlling means for actuating said signal when a predetermined number of score indicating elements of either or both series have been actuated.

2. In a game scoring apparatus, a plurality of series of score indicating elements, separate means for progressively actuating the indicating elements of the respective series, separately operable means for controlling the operation of the respective actuating means, a signal, means including a movable element for actuating said signal when said movable element has been moved to a predetermined position, and means controlled by said controlling means to advance said movable element a predetermined distance upon the operation of either of said controlling means.

3. In a game scoring apparatus, a plurality of

series of score indicating elements, separate means for progressively actuating the indicating elements of the respective series, separately operable means for controlling the operation of the respective actuating means, a signal, means including a movable element for actuating said signal when said movable element has been moved to a predetermined position, means controlled by said controlling means to advance said movable element a predetermined distance upon the operation of either of said controlling means, and means for restoring said movable element to its initial position after each operation of said signal.

4. In a game scoring apparatus, a plurality of series of score indicating elements, separate means for progressively actuating the indicating elements of the respective series, separately operable means for controlling the operation of the respective actuating means, a signal, means including a movable element for actuating said signal when said movable element has been moved to a predetermined position, and means controlled by said controlling means to advance said movable element a predetermined distance upon the operation of either of said controlling means and for restoring said movable element to its initial position after it has been moved to said predetermined position and said signal has operated.

5. In a game scoring apparatus, a plurality of series of electrically operated score indicating elements, an individual circuit for each indicating element, electrically operated means for selectively closing and opening the individual circuits of the respective series of indicating elements, separate means for controlling the operation of the respective electrically operated means, a signal, electrical means for operating said signal including a normally open circuit closing device, and an electrically operated device connected in circuit with both said controlling means and having means for moving said signal circuit closing device to circuit closing position upon the last of a predetermined number of operations of either or both of said controlling means.

6. In a game scoring apparatus, a plurality of series of electrically operated score indicating elements, an individual circuit for each indicating element, electrically operated means for selectively closing and opening the individual circuits of the respective series of indicating elements, separate means for controlling the operation of the respective electrically operated means, a signal, electrical means for operating said signal including a normally open circuit closing device, and an electrically operated device connected in circuit with both said controlling means and having means for moving said signal circuit closing device to circuit closing position upon the last of a predetermined number of operations of either or both of said controlling means, and also having means for restoring said signal circuit closing device to its initial open position after said signal has been operated.

7. In a game scoring apparatus, a plurality of series of electrically operated score indicating elements, an individual circuit for each indicating element, electrically operated means for selectively closing and opening the individual circuits of the respective series of indicating elements, separate means for controlling the operation of the respective electrically operated means, a signal, electrical means for operating said signal including a normally open circuit closing de-

vice and an electrically operated device connected in circuit with both said controlling means and having means for moving said signal circuit closing device to circuit closing position upon the last of a predetermined number of operations of either or both of said controlling means, means including a magnet for resetting said signal circuit closing device to its initial open position, and means set in operation by said electrically operated device for energizing said magnet when said signal circuit is closed and for maintaining the same energized until said signal circuit closing device has been restored to its initial position.

8. In a game scoring apparatus, a plurality of series of electrically operated score indicating elements, an individual circuit for each indicating element, electrically operated means for selectively closing and opening the individual circuits of the respective series of indicating elements, separate means for controlling the operation of the respective electrically operated means, a signal, electrical means for operating said signal including a normally open circuit closing device and an electrically operated device connected in circuit with both said controlling means and having means for moving said signal circuit closing device to circuit closing position upon the last of a predetermined number of operations of either or both of said controlling means, means for returning said signal circuit closing device to its initial open position, means for normally preventing the return movement of said signal closing device, means including a magnet for releasing said signal circuit closing device for return movement, and means controlled by said signal circuit closing device for energizing said magnet when said signal circuit is closed and for deenergizing said magnet when said signal circuit closing device has been returned to its initial open position.

9. In a game scoring apparatus, a plurality of series of electrically operated score indicating elements, an individual circuit for each indicating element, electrically operated means for selectively closing and opening the individual circuits of the respective series of indicating elements, separate means for controlling the operation of the respective electrically operated means, a signal, electrical means for operating said signal including a normally open circuit closing device and an electrically operated device connected in circuit with both said controlling means and having means for moving said signal circuit closing device to circuit closing position upon the last of a predetermined number of operations of either or both of said controlling means, means for returning said signal circuit closing device to its initial open position, means for normally preventing the return movement of said signal closing device, means including a magnet for releasing said signal circuit closing device for return movement, a normally closed switch and a normally open switch in circuit with said signal and said magnet, means controlled by said electrically operated device for opening said normally closed switch and closing said normally open switch before said signal circuit closing device has moved to circuit closing position, and means controlled by said signal circuit closing device for closing said normally open switch when said signal circuit closing device is moved to circuit closing position, thereby energizing said signal and said magnet, and for opening said normally closed switch when said signal circuit

closing device has been returned to its initial open position, thereby deenergizing said signal and said magnet.

10. In a game scoring apparatus, a plurality of series of electrically operated score indicating elements, an individual circuit for each indicating element, electrically operated means for selectively closing and opening the individual circuits of the respective series of indicating elements, separate devices for controlling the operation of the respective electrically operated means, a signal, electrical means for operating said signal including a normally open circuit closing device and an electrically operated device connected in circuit with both said controlling devices and having means for moving said signal circuit closing device to circuit closing position upon the last of a predetermined number of operations of either or both of said controlling devices, each of said controlling devices comprising a normally closed switch, a normally open switch and means for reversing the positions of said switches, one terminal of the normally closed switch of each controlling device being connected with said electrically operated device and with one terminal of the normally open switch of the other controlling device, and the other terminal of said normally closed switch being connected with one side of the operating circuit for the corresponding circuit selecting means, the other terminal of said normally open switch being connected with the other side of said operating circuit, whereby the operating circuit of either controlling device will be closed only when the normally open switch of that device is closed and the normally closed switch of the other controlling device is closed, and the closing of the operating circuit of either controlling device will also close the circuit for said electrically operated device for said signal operating means.

11. In a game scoring apparatus, a plurality of series of electrically operated score indicating elements, an individual circuit for each indicating element, electrically operated means for progressively closing and opening the individual circuits of the respective series of indicating elements, separate means for controlling the operation of the respective electrically operated means, a signal, electrical means for operating said signal including a normally open circuit closing device, an electrically operated device connected in circuit with both said controlling means and having means for moving said signal circuit closing device to circuit closing position upon the last of a predetermined number of operations of either or both of said controlling means, and also having means for restoring said signal circuit closing device to its initial open position after said signal has been operated, separate electrically operated means for restoring the respective circuit selecting means to their initial positions, and means for connecting the first mentioned restoring means in circuit with said last mentioned restoring means to cause said signal circuit closing device to be moved to its initial position when said circuit selecting means are moved to their normal positions.

12. In a game scoring apparatus, a plurality of series of electrically operated score indicating elements, an individual circuit for each indicating element, electrically operated means for progressively closing and opening the individual circuits of the respective indicating elements, separate

means for controlling the operation of the respective electrically operated means, an electrically operated signal, a normally closed switch and a normally open switch connected in series in circuit with said signal, a control circuit including in series a normally open control switch and a normally open selector switch having a member movable step by step to circuit closing position, a switch operating device having means to hold the normally closed switch of said signal circuit closed and operable to open said normally closed switch and to close said normally open control switch, an operating magnet connected in circuit with both controlling means for said circuit selecting means and adapted to be energized when either of said controlling means is operated, means controlled by the initial operation of said magnet for actuating said switch operating device, means for locking said switch operating device in a position to retain the normally closed switch of said signal circuit open and the controlling switch of said controlling circuit closed during subsequent operations of said magnet, means controlled by said magnet to close the normally open switch of said signal circuit and to advance the movable member of said selector switch one step upon each operation of said magnet, a second magnet in said control circuit to actuate the locking means for said switch operating device to release the latter, means for actuating said switch operating device when so released to close said normally closed switch of said signal circuit and to open the controlling switch of the controlling circuit, whereby upon each operation of the circuit selecting device for either series of indicating elements said operating magnet will be energized, the first operation of said operating magnet serving to advance the movable member of said selector switch one step and to open the normally closed switch and close the normally open switch of the signal circuit, the subsequent operations of said operating magnet serving to advance said movable member of the selector switch step by step to circuit closing position, whereupon said releasing magnet is energized to cause the normally closed switch of the signal circuit to be again closed, thus completing the signal circuit, and means for restoring said movable member of said selector switch to its initial position.

13. In a game scoring apparatus, a plurality of series of electrically operated score indicating elements, an individual circuit for each indicating element, electrically operated means for progressively closing and opening the individual circuits of the respective indicating elements, separate means for controlling the operation of the respective electrically operated means, an electrically operated signal, a normally closed switch, and a normally open switch connected in series in circuit with said signal, a control circuit including in series a normally open control switch and a normally open selector switch having a member movable step by step to circuit closing position, a

switch operating device having means to hold the normally closed switch of said signal circuit closed and operable to open said normally closed switch and to close said control switch, an operating magnet connected in circuit with both controlling means for said circuit selecting means and adapted to be energized when either of said controlling means is operated, means controlled by the initial operation of said magnet for actuating said switch operating device, means for locking said switch operating device in a position to retain the normally closed switch of said signal circuit open and the controlling switch of said controlling circuit closed during subsequent operations of said magnet, means controlled by said magnet to close the normally open switch of said signal circuit and to advance the movable member of said selector switch one step upon each operation of said magnet, a second magnet in said control circuit to actuate the locking means for said switch operating device to release the latter, means for actuating said switch operating device when so released to close said normally closed switch of said signal circuit and to open the controlling switch of the controlling circuit, whereby upon each operation of the circuit selecting device for either series of indicating elements said operating magnet will be energized, the first operation of said operating magnet serving to advance the movable member of said selector switch one step and to open the normally closed switch and close the normally open switch of the signal circuit, the subsequent operations of said operating magnet serving to advance said movable member of the selector switch step by step to circuit closing position, whereupon said releasing magnet is energized to cause the normally closed switch of the signal circuit to be again closed, thus completing the signal circuit, means for returning the movable member of said selector switch to its initial position, a detent to hold said movable member normally against such return movement, a magnet in said signal circuit, and means controlled by the last mentioned magnet to actuate said detent and release said movable member for return movement.

14. In a game scoring apparatus, two series of scoring indicating elements, a separate actuating device for each series of elements having means for progressively actuating the indicating elements of that series, an electrically controlled supplemental indicating device, two switches connected in series in circuit with said supplemental indicating device, and switch actuating elements connected with and actuated by the respective actuating devices and so arranged with relation to the respective switches that both switches will be closed and said supplemental indicating device actuated only when both actuating devices are positioned to actuate a predetermined score indicating element in both series of score indicating elements.

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