

April 6, 1943.

J. O. IVIE ET AL

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ACTUATING MEANS FOR SCORE BOARD INDICIA

Original Filed Aug. 14, 1934

8 Sheets-Sheet 1

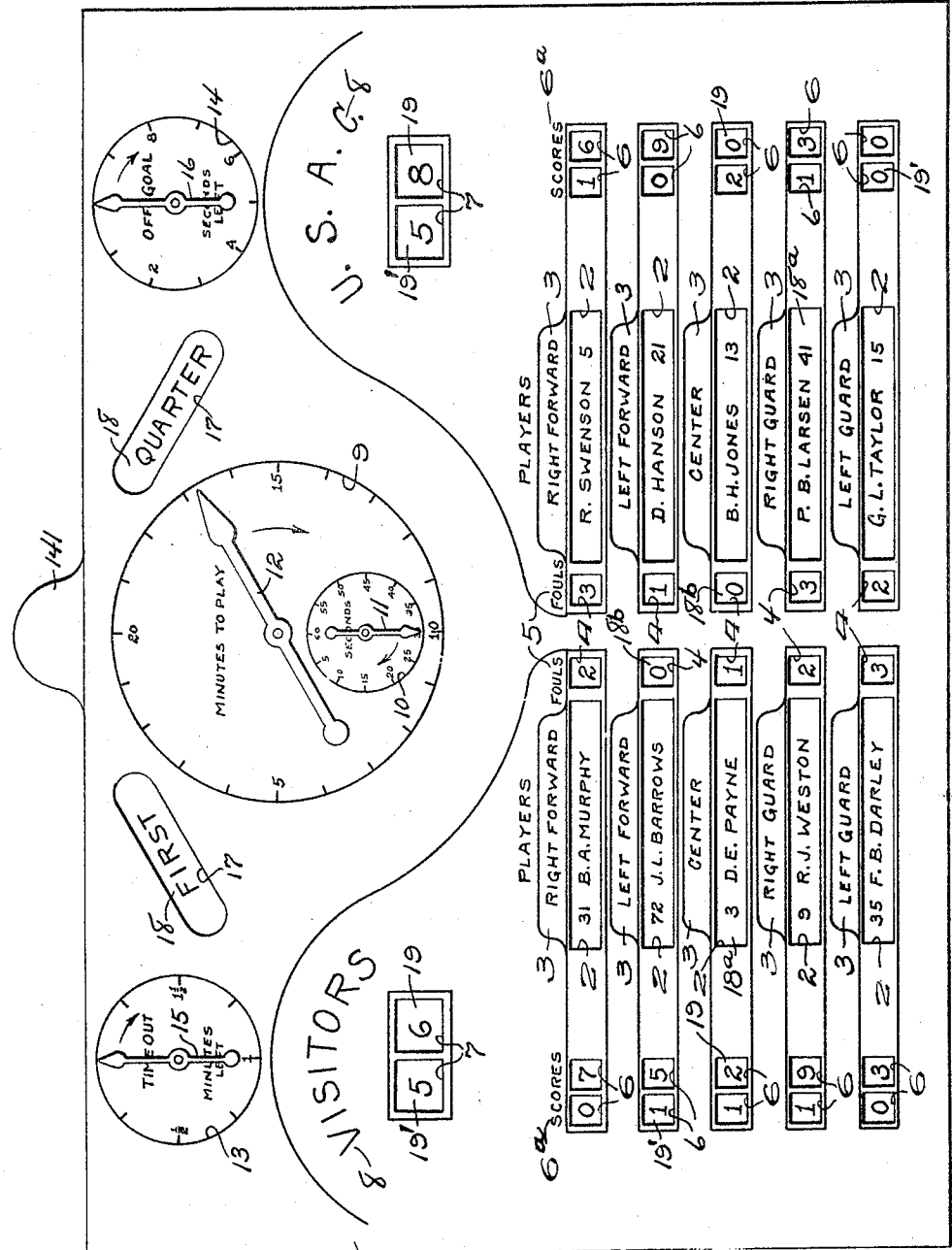


Fig. 1.

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8 Sheets-Sheet 2

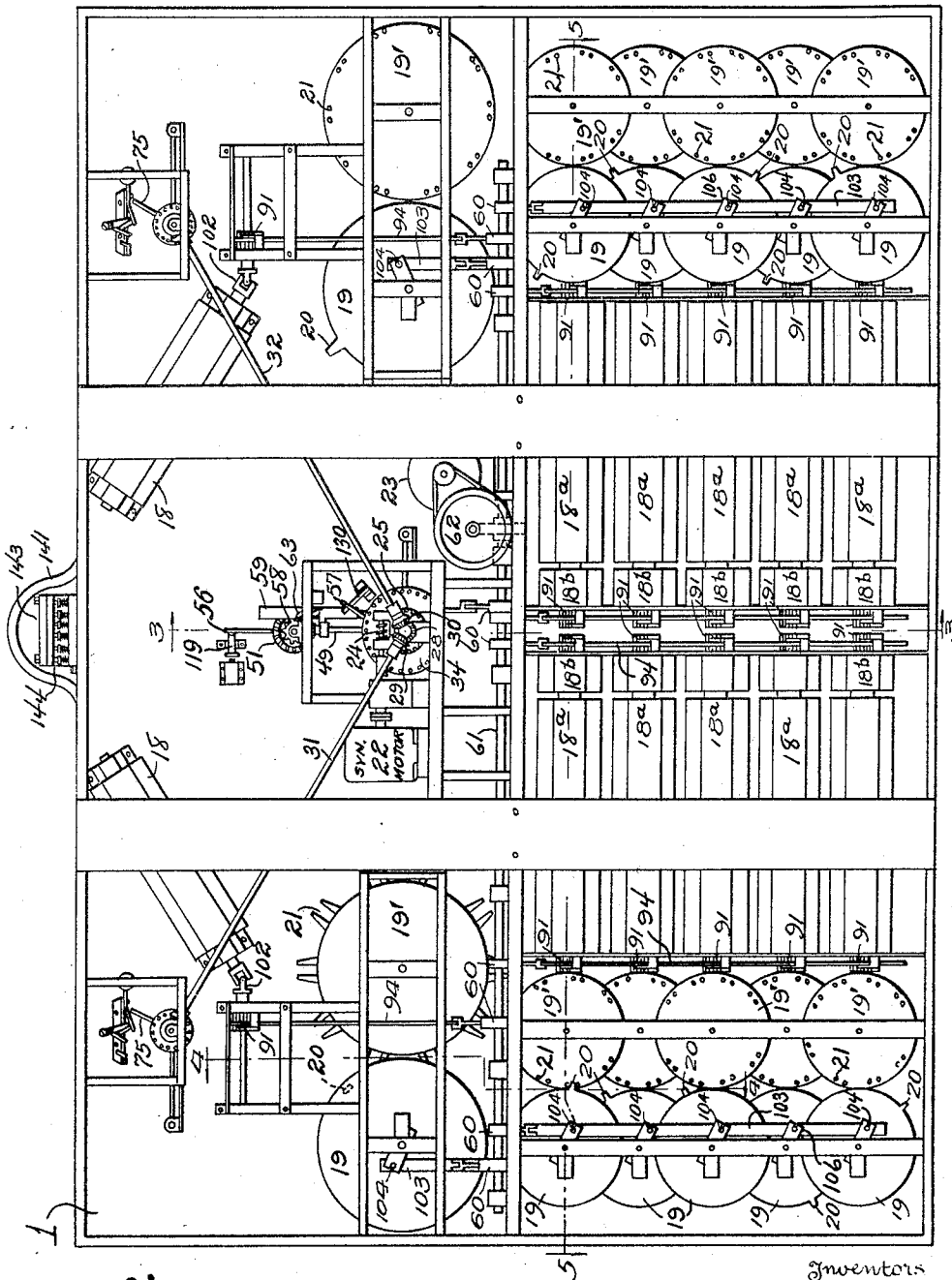


Fig. 2.

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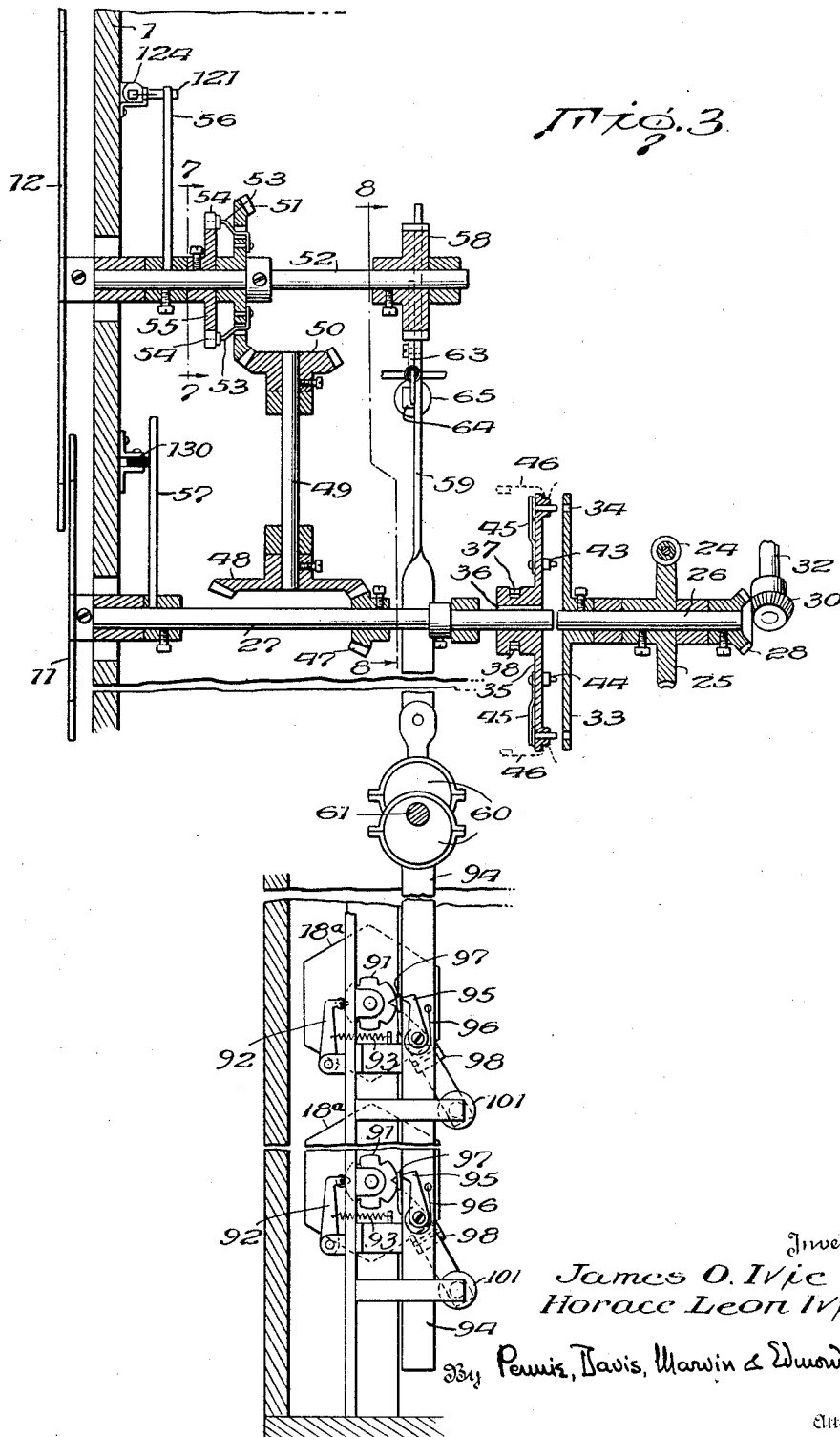
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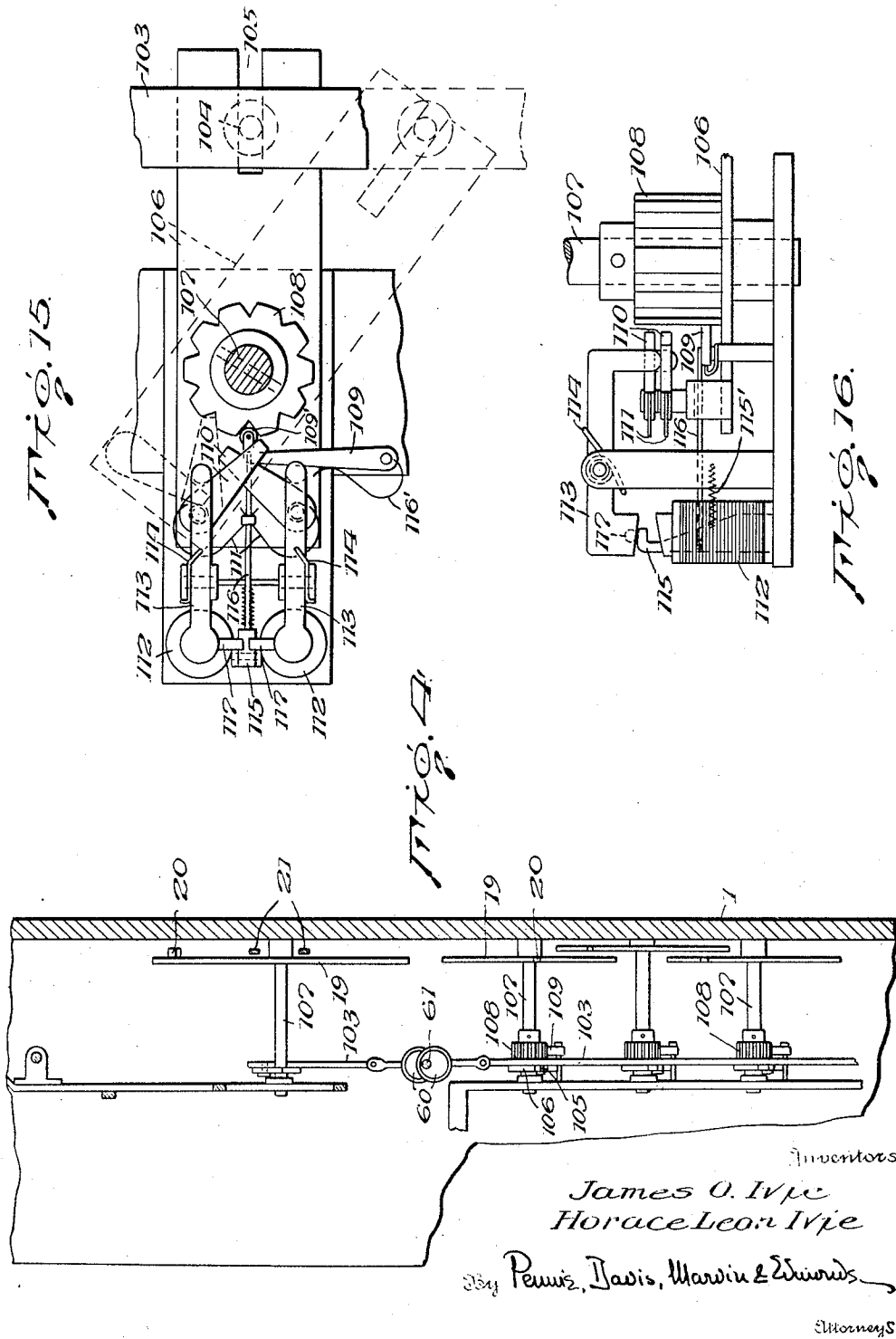
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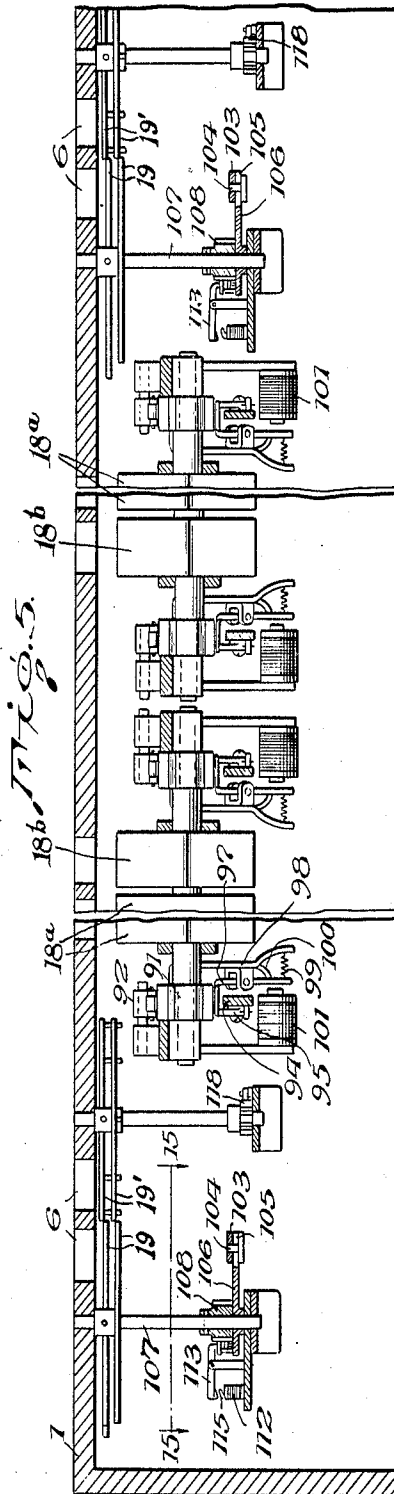
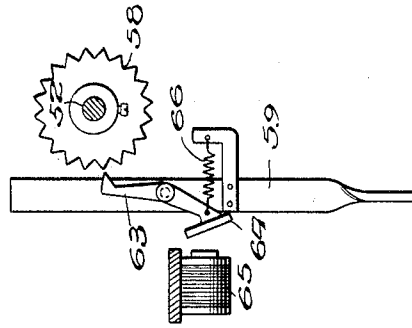
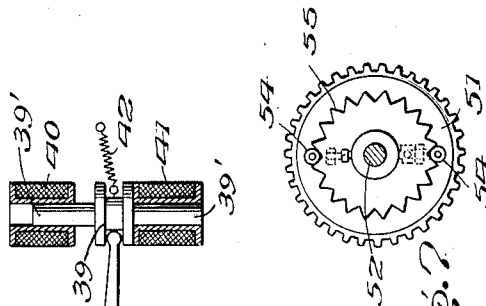
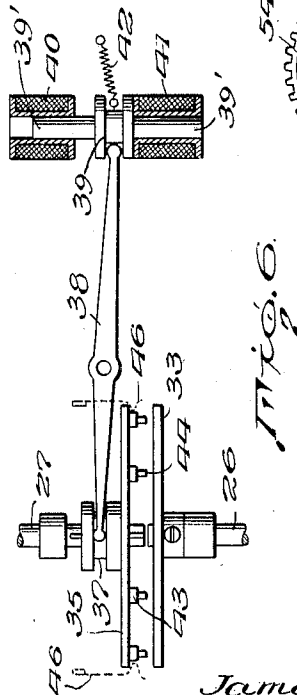
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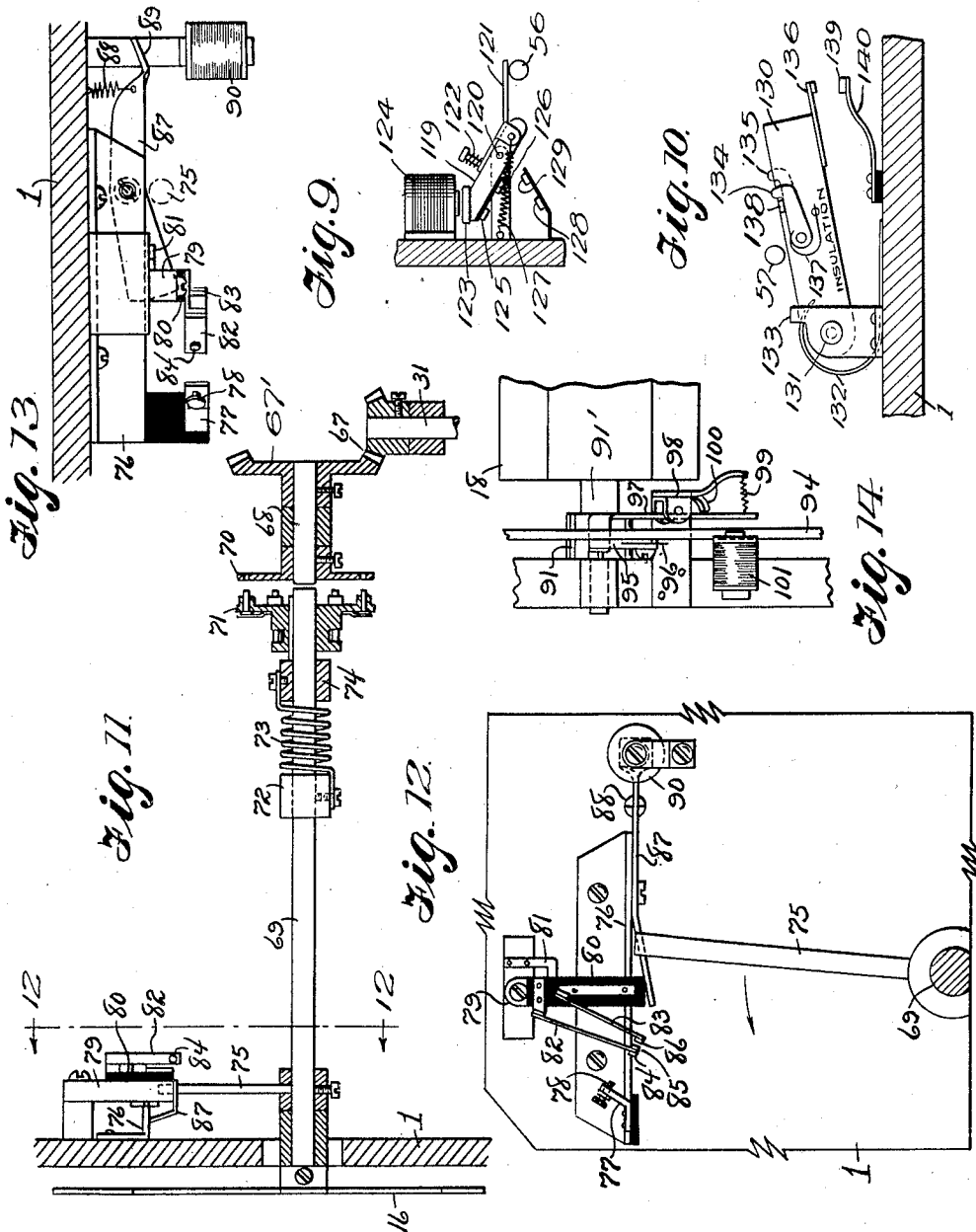
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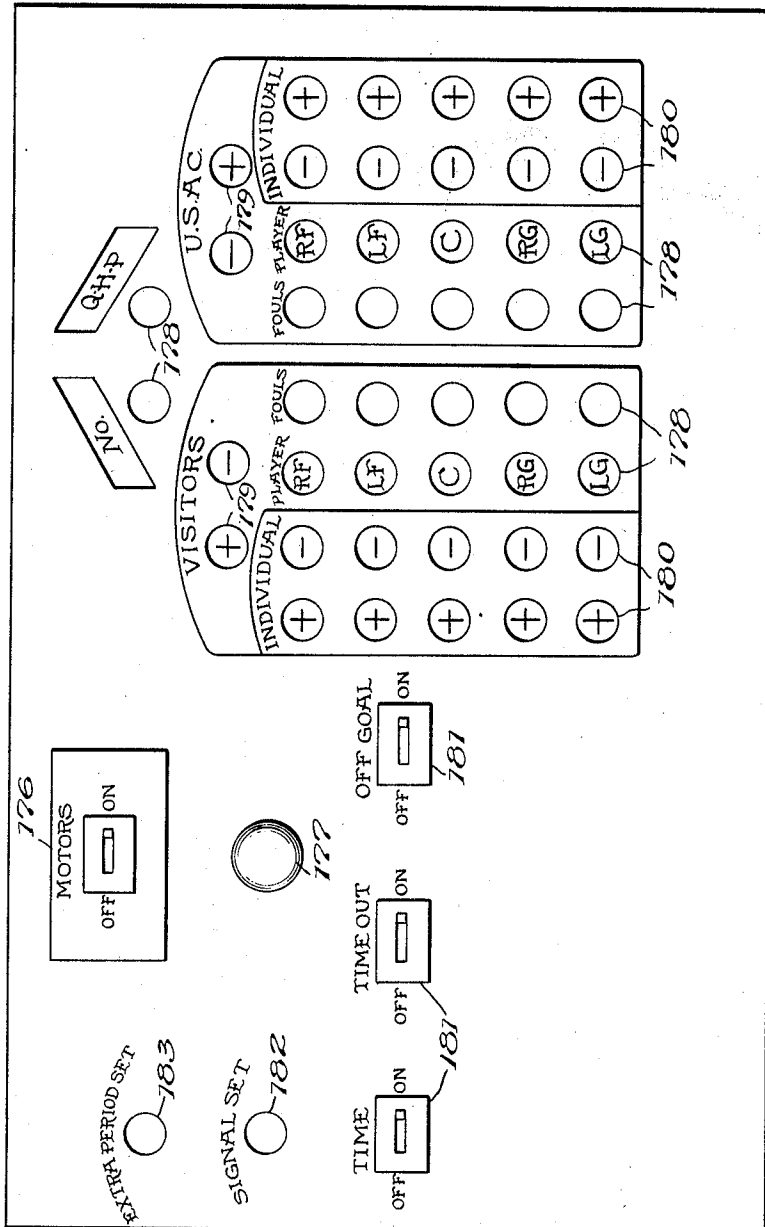


Fig. 12

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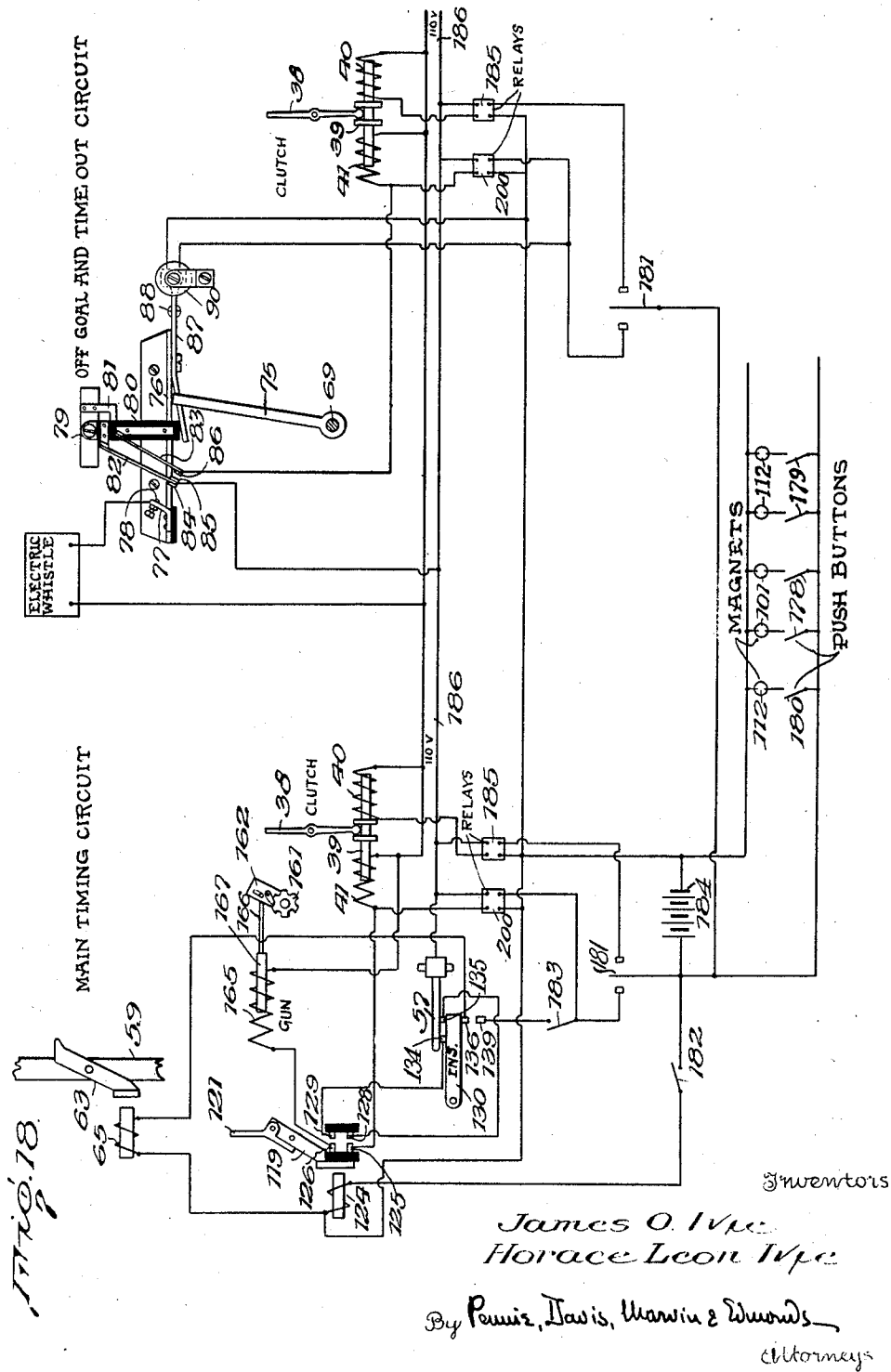
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UNITED STATES PATENT OFFICE

2,315,622

ACTUATING MEANS FOR SCOREBOARD
INDICIAJames O. Ivie and Horace Leon Ivie, Salt Lake
City, UtahOriginal application August 14, 1934, Serial No.
739,822. Divided and this application January
16, 1940, Serial No. 314,188

4 Claims. (Cl. 74-116)

This invention relates to a score board and to a method of operating the same. More particularly, the present invention relates to a score board wherein the score of the game, the time remaining to play, the time remaining in a rest period, the names of the players, the score of the individual players, the period of the game, and other essential information to determine the status of the game may be made known to spectators as the game progresses.

According to the present invention, the score board is provided with alarm means to indicate the termination of a time-out period or of a time interval peculiar to the game being played, and with separate alarm means to indicate the end of the game.

Also according to the present invention, the score board may be operated from a remote station to enable the officials in charge of the game, to control the operation of the score board thereby insuring accuracy of the information displayed thereon.

In accordance with the present invention, the apparatus comprises a board provided with time dials and with openings through which the names of players, the period of the game, the score of the game, and the scores of the individual players are displayed. The names of the players and the periods of the game are carried on drums adapted to revolve about their axes, each drum being mounted behind an opening in the board, while the numbers indicating the scores are carried on disks adapted to revolve about their axes, each disk being mounted behind an opening in the board. The names and the numbers are so spaced on the drums and on the disks respectively, and are so related to the openings in the board, that when a name or a number is in juxtaposition with its opening in the board, only one name and only one number will be displayed. The time dials, of course, are provided with hands to indicate time.

The hands of the time dials are actuated through a time-controlled driving mechanism comprising an arrangement for stopping automatically the operation of the time-indicating means at the end of predetermined intervals of time and for giving alarms at the end of a given time interval. The operation of the time dials is controlled from a remote control station.

The drums and the disks are revolved through a mechanism operated through a constantly rotating shaft, the operation of each disk and of each drum being likewise controlled from a remote control station.

The preferred embodiment of the invention is shown in the accompanying drawings and will be hereinafter described in detail. The structure shown in these drawings is designed for use in connection with basket ball games, but the principles involved are suited to giving information for other games such as baseball, football and the like, as well as commercial displays. It is to be understood that the invention is not limited to the precise construction and arrangement shown, as modifications and changes are contemplated and such must be considered to be included within the scope of the claims.

In the drawings:

Fig. 1 represents a front elevation view of a score board embodying the invention.

Fig. 2 represents a rear elevation view of the score board, the back walls of the casing being removed.

Fig. 3 is a section view taken on line 3-3 of Fig. 2.

Fig. 4 is a section view taken on line 4-4 of Fig. 2.

Fig. 5 is a section view taken on line 5-5 of Fig. 2, but with parts broken out.

Fig. 6 is a view of the clutch actuating means of the time mechanism.

Fig. 7 is a section view taken on line 7-7 of Fig. 3.

Fig. 8 is a section view taken on line 8-8 of Fig. 3.

Figs. 9 and 10 are detail views of switches forming parts of the time mechanism, Fig. 9 being a view taken from the bottom.

Fig. 11 is a section view taken on line 11-11 of Fig. 2.

Fig. 12 is a section view taken on line 12-12 of Fig. 11.

Fig. 13 is a plan view of the mechanism shown in Fig. 12.

Fig. 14 is a side view of the drum operating mechanism.

Fig. 15 is a section view taken on line 15-15 of Fig. 5.

Fig. 16 is a plan view of the mechanism shown in Fig. 15.

Fig. 17 is a plan view of the control board, and Fig. 18 is a diagram of the electrical wiring.

Preferably, and as shown in the drawings, the score board comprises a casing having a front wall 1, Fig. 1, which may be ornamented as desired, and the lower portion of which is divided vertically into halves, one half displaying information concerning the visiting team, and the other half displaying information concerning the

home team. Suitable legends 8 are placed at the top of each half to identify the teams. Each half of the wall 1, is provided with a column of horizontally-extending openings 2 through which the names and numbers of the players are displayed. Legends 3, naming the position played by each player, are placed above each opening.

To indicate the number of fouls charged against each player, each half of the wall 1 is provided with a column of openings 4, horizontally aligned with the openings 2, through which numerals corresponding to the number of fouls committed by each player may be displayed. To display the numerals indicating the score made by each player, each half of the front wall 1 is also provided with a column of pairs of openings 6, each pair being horizontally aligned with one of the openings 2.

Suitable legends 6a and 5 are placed above each column of openings displaying the score and fouls of individual players.

The total scores of the home team and of the visiting team are displayed through pairs of openings 7 in each half of the front wall 1, positioned below the legend 8. Numerals are displayed through these openings to indicate the total score of each team playing.

The time remaining to play in any period of the game is shown by a pair of time-dials 9 and 10, bearing the legends "Minutes to play" and "Seconds" respectively, and centrally located in the upper portion of the front wall 1. Hands 11 and 12 are adapted to rotate about the centers of the dials 10 and 9 respectively, and in conjunction with the graduated margins of the dials, indicate the minutes and seconds left to play in any period of the game.

The time taken out by a team is measured by a dial 13 located in the upper left-hand portion of the wall 1 and bearing the legend "Time out—minutes left." A hand 15 is adapted to rotate about the center of the dial 13 and in conjunction with the graduated margin of the dial, indicates the minutes remaining in the allotted time-out interval.

The time permitted for a team to carry the ball from its back-court to the forward court is measured by a dial 14 located in the upper right-hand portion of the wall 1 and bearing the legend "Off goal—seconds left." A hand 16 is adapted to rotate about the center of the dial 14 and in conjunction with the graduated margin of the dial, indicates the seconds remaining in the time-interval allotted to a team to bring the ball from its back court to the forward court.

To designate the instant period of the game being played, the front wall 1 is provided with two openings 17, symmetrically disposed on opposite sides of the dial 9. Legends 18 bearing the number and the name of the period of the game being played respectively, such as "First," "Third," and "Period," "Half," "Extra period," etc., are displayed through the openings 17.

The legends designating the instant period of the game being played, the names and numbers of each player, and the numbers for indicating the number of fouls committed by each player, are carried on drums 18, 18a, and 18b, respectively, Fig. 2, which preferably are hexagonal in cross-section. Different indicia and different names of players appear on each rectangular surface of a given drum. As shown in Fig. 2, the drums 18, 18a, and 18b are mounted behind the wall 1 and are adapted to rotate about their

longitudinal axes, each drum being mounted behind and in juxtaposition with one of the openings 2, 4 or 17, depending upon the indicia on the drum, the size and shape of a given opening being so related to the rectangular surface of the drum mounted behind it, that for any given setting of a drum, the name of only one player or only one of the indicia will be displayed there-through. Since each of the drums 18a may carry up to six names, and since each opening 2 for such drums 18a has its individual legend 3, each one of these drums may carry the names of five substitute players in addition to the name of the regular player for a given playing position on each team.

The numbers for indicating the total team score and the numbers for indicating individual player score are carried on unit disks 19 and tens disks 19'. As shown in Fig. 2, the disks 19 and 19' likewise are mounted behind the wall 1 and are adapted to rotate about their axes, each disk being mounted so that one of the indicia carried thereon is behind and in juxtaposition with one of the openings 6 or 7, depending upon the indicia on the disk, the size and shape of a given opening likewise being so related to the size of the indicia, that for any given setting of a disk, only one of the indicia will be displayed there-through.

To operate the hands 11, 12, 15 and 16 of the time-dials 10, 9, 13 and 14, respectively, a time-controlled mechanism is provided which preferably is actuated by a synchronous motor 22, shown in Fig. 2. The motor 22 drives a speed reducing mechanism which carries a worm 24 meshing with a worm gear 25, Fig. 3, secured on a shaft 26 which is suitably mounted on a fixed member of the supporting frame of the apparatus. When the score board is in use, the motor 22 rotates the shaft 26 constantly.

To operate the hand 11, a clutch disk 33 having uniformly-spaced openings 34 close to and throughout its periphery is rigidly secured to one end of the shaft 26. The shaft 26 is aligned longitudinally with another shaft 27 extending through an opening in the front wall 1 and located at the center of the dial 10. The extremity of the shaft 27 projecting through the front wall 1, carries the hand 11 of the "Seconds" time-dial 10. A mating clutch disk 35 is splined upon the inner end of the shaft 27, as shown at 36, Fig. 3, permitting the clutch disk 35 to slide longitudinally upon the shaft 27, but constraining it to rotate therewith. The surface of the clutch disk 35 presented to the face of the clutch disk 33 is provided with six pins 44 projecting perpendicularly therefrom and adapted to engage the openings 34 in the clutch disk 33. To reduce the maximum angular motion lost when a coupling of the clutch disk is effected, the spacing of the pins 44 is staggered so that only one of the pins 44 will engage an opening 34 in the clutch disk 33. To permit only one of the pins 44 to engage an opening 34 when a coupling of the two clutch disks is effected, the six pins 44 are slidably mounted within six bosses 43 and are yieldably carried by springs 45 secured to the disk 35, so that when a mating of the clutch members occurs, the remaining pins striking the disk 33 will yield.

To operate the hand 12, the shaft 27 is provided with a beveled pinion 47 meshing with a beveled gear 48 secured to the lower end of a vertical shaft 49 which is journaled in bearings suitably located on the frame of the apparatus. A beveled

gear 50 is secured to the upper end of the shaft 49 and meshes with a companion beveled gear 51 loosely mounted on a horizontal shaft 52. A pair of laterally projecting springs 53 are secured in diametrically opposed relationship to one face of the gear 51. The free extremities of the springs 53 are provided with rollers 54 and are adapted to bear upon, as shown in Fig. 7, the periphery of a notched disk or ratchet wheel 55 which is rigidly secured to the horizontal shaft 52. The pressure of the springs 53 on the rollers 54 holds the rollers in the notches, so that rotation of the gear 51 will be transmitted to the disk 55 and to the shaft 52. The number of the notches in the periphery of the disk 55 is equivalent to the number of minutes in a playing interval of the game being played, or to the number of graduations in the margin of the dial 9. The shaft 52 extends through an opening in the front wall 1 located at the center of the dial 9, and the extremity of the shaft 52 projecting therethrough carries the hand 12 of the "Minutes to play" time-dial 9. The relative sizes of the hub 47 and of the gear 48 are such that for one complete revolution of the hand 11 over the time-dial 10, the hand 12 will move through a fraction of a complete revolution corresponding to a minute on the graduated margin of the time-dial 9.

When the necessity arises, the hand 12 of the "Minutes to play" time-dial 9 may be moved back from any position on the dial 9. To reset the hand 12, the inner end of the shaft 52 is provided with a wheel 58 provided with a plurality of notches the number of which is equivalent to the number of graduations or minutes in the margin of the time-dial 9. As shown in Fig. 8, the wheel 58 is adapted to be engaged by a dog 63 operatively mounted on a reciprocating bar 59 which reciprocates constantly when the score board is in use. The reciprocating bar 59 is actuated by an eccentric 60 mounted on a shaft 61 which is driven through suitable gearing, by an induction motor 23. The lower end of the dog 63 is equipped with a pole piece 64 which serves as an armature for an electromagnet 65. Normally, the magnet is not energized and a spring 66 maintains the dog 63 out of engagement with the notched wheel 58. When the magnet 65 is energized, the pole piece 64 is attracted by the magnet and the dog 63 is swung into operative position to engage the periphery of the notched wheel 58. The dog 63 is so shaped that it is adapted to operatively engage the notched wheel 58 only during the up-stroke of the reciprocating bar 59. Thus, when the magnet 65 is energized, the dog 63 will turn the wheel 58 through an arc equivalent to the distance between two notches in the periphery of the notched wheel 58 for each up-stroke of the reciprocating bar 59. Thus the hand 12 will be set back one minute for each up-stroke of the reciprocating bar 59. The turning of the notched wheel 58 will cause the shaft 52 and the notched disk or ratchet wheel 55 to rotate, but gear 51 will not rotate because of the resistance offered thereto by the train of gearing cooperating with the gear 51, with the result that the rollers 54 will merely slip into the adjacent notches of the notched disk or ratchet wheel 55, see Fig. 7, to hold the hand 12 in set position.

When the score board is in use, the shaft 26, as already explained, is rotating constantly. When a coupling of the clutch disks 33 and 35 is effected, the hands 12 and 11 of the dials 9 and 10 respectively, are put into operation. The cou-

pling of the clutch disks, is effected by sliding the splined clutch disk 35 upon the shaft 27. To effect the movement of the splined clutch disk, as shown in Fig. 6, the hub of the latter is provided with an annular groove 37 operatively engaging the forked end of a lever 38 which is fulcrumed between its extremities and whose other end operatively engages a slide 39 located between a pair of longitudinally aligned solenoids 40 and 41. To actuate the slide 39, the latter is provided with a pair of oppositely extending and longitudinally aligned projections 39' which constitute the cores of the solenoids 40 and 41. Only one of the solenoids is energized at any given time, the slide moving, of course, toward the solenoid that is energized. The motion thus imparted to the slide 39, will rock the lever 38 to shift the splined clutch disk 35 into or out of engagement with the clutch disk 33, depending upon whether the hands 11 and 12 are to rotate or not.

To guard against accidental shifting of the clutch disk 35, a plurality of spring detents 46, see Fig. 3, are secured to the frame of the apparatus, adjacent the disk 35 to engage the periphery thereof and to yieldably hold it in either the mated or open positions.

To stop the hands 11 and 12 of the time-dials 10 and 9 respectively, automatically at the end of a playing period, the shaft 52 is provided with a circuit-closing finger 56, rigidly mounted thereon and adapted to operate a switch mechanism secured to the front wall 1 of the apparatus. Referring to Figs. 3 and 9, the switch mechanism comprises a plate 119 pivoted at 120 and carrying at one end thereof, an operatively mounted bent lever 121, one end of which extends into the path of the finger 56 and the other end normally resting against the plate 119 under the influence of a spring 122. The end of the plate 119 remote from the lever 121, carries an armature 123 which is adapted to cooperate with an electromagnet 124. The plate 119 is also provided with two contact points 125 and 126 which are insulated from the plate 119 and from each other. Two additional contact points 128 and 129 are mounted on the front wall 1 of the apparatus on the side of the plate 119 remote from the electromagnet 124 and are adapted to be engaged by the contact points 125 and 126 respectively, when the plate 119 is swung away from the electromagnet 124. A spring 127 yieldably holds the plate 119 in either position in which it may be set. Referring to Fig. 9, when the finger 56 moves upwardly, it abuts the lever 121 and rocks the same and the plate 119 to swing the contact points 125 and 126 into contact with the contact points 128 and 129 respectively. Continued motion of the finger 56 will clear the lever 121 and pass onto the other side of the same. If the "Minutes to play" hand 12 is being set back, as for an extra period, the finger 56 will impinge upon the opposite side of the lever 121 which will swing about its pivot 120 and permits the finger 56 to pass without changing the position of the plate 119. Likewise, the shaft 27 is provided with another circuit-closing finger 57, rigidly mounted thereon and adapted to operate another switch mechanism also secured to the front wall 1 of the apparatus.

Referring to Fig. 10, the switch mechanism comprises a bar 130 of insulating material having one end pivoted to the front wall 1 at 131 and the other or free end adapted to be yieldably held away from the front wall 1 through the action of a spring 132, the outward movement of the free end of the bar 130 being limited by a lug 133. The

outer surface of the bar 130 is provided with two contacts 134 and 135 pivoted thereon and yieldably held outwardly by springs 137, the outward movement being limited by lugs 138. The underside of the free end of the bar 130 is provided with a spring-mounted contact 136 adapted to engage another contact 139 yieldably mounted on a spring 140, the other end of which is mounted on an insulating block secured to the front wall 1 of the apparatus. The contacts 134 and 135 make electrical contact with the finger 57 every time it passes, the finger 57 being connected to the grounded side of the power circuit which will be described later, while the pressure of the finger 57 riding over the bar 130, forces the contact 136 against the contact 139 to close another circuit to be described later.

To operate the hands 15 and 16, the shaft 25 is provided, as shown in Figs. 2 and 3, with a bevel gear 28 meshing with a pair of bevel gears 29 and 30 secured to the lower ends of shafts 31 and 32 respectively. As shown in Fig. 11, the upper ends of the shafts 31 and 32 are provided with bevel gears 67 meshing with companion bevel gears 67', each rigidly mounted on one end of a horizontal shaft 68, whose other end is provided with a rigidly mounted clutch disk 70. Since the shaft 25 rotates constantly when the apparatus is being used, the shaft 68 likewise will rotate constantly. The shaft 68 is aligned longitudinally with another shaft 69 extending through an opening in the front wall 1 located at the center of the dial 14. The hand 15 of the "Off goal—seconds left" dial is rigidly mounted on the extremity of the shaft 69 projecting through the front wall 1. A mating clutch disk 71 is splined upon the inner end of the shaft 69 permitting the clutch disk 71 to slide longitudinally upon the shaft 69, but constraining it to rotate therewith. The mechanism for controlling the operation of the hands 15 and 16 through the shifting of the clutch disks is similar in every detail to that for the hands 11 and 12.

To return the hand 16 to initial starting position when the clutch disks are disengaged, the shaft 69 is provided with a coiled torsion spring 73 having one end secured to a collar 72 rigidly mounted on the shaft 69 and the other end secured to a stationary member 74 of the frame of the apparatus. When the clutch disks are engaged, the shaft 69 will rotate to operate the hand 16 and to wind the spring 73. When the clutch disks are disengaged, the spring 73 will unwind and will return the hand 16 to its initial starting position. The shaft 69 and the hand 16 may make only one complete revolution and if the hand 16 is not returned to its initial starting position before completing a revolution, it is stopped automatically at the end thereof.

To stop the hand 16 at the end of a revolution, the shaft 69 is provided with a finger 75 rigidly mounted thereon and adapted to engage at the end of a revolution of the shaft 69, a switch mechanism secured to the front wall 1 of the apparatus and shown in Figs. 11, 12 and 13. The switch mechanism comprises a shelf 76 having at one end thereof and insulated therefrom, a plate 77 provided with a contact screw 78 which is electrically connected to an electric signal. A block 79 having insulation 80 on its back surface, is pivotally mounted at its upper end on the front wall 1 and is of such length, that its lower end lies in the path of the finger 75. A stop 81 is provided to limit the extent of the swing of the block 79 away from the contact screw 78. Leaf

springs 82 and 83 are mounted on the insulation 80, the spring 82 having double contact points 84 and 85 at its free end and the spring 83 having a single contact point 86 at its free end. Electric conductors are attached to the elements 77, 82 and 83 to connect them to circuits which will be described later. The underside of the shelf 76 carries a pivotally mounted dog 87, one end of which is provided with an armature 89 adapted to cooperate with an electromagnet 90. When the electromagnet 90 is deenergized, the end of the dog 87 remote from the electromagnet is projected into the path of the finger 75 under the influence of a spring 88. Movement of the finger 75 will swing the dog 87 under the shelf 76 and will push the block 79, the dog 87 swinging back to its starting position through the action of the spring 88. The continued movement of the finger 75 will push the block 79 through an additional distance whereupon the contact 84 is brought against the contact screw 78, thereby starting an electric signal; a slight additional swing of the block 79 will cause the spring 82 to bend until the contacts 85 and 86 meet. At this point, the shaft 69 driving the finger 75 ceases to rotate and the finger falls back against the end of the dog 87 projecting from under the shelf 76. Thus, the contacts 85 and 86 will separate, but the contacts 78 and 84 will remain in engagement. The various parts of the switch mechanism will remain in this position until the magnet 90 is energized. Energization of the magnet will swing the dog 87 under the shelf 76 to release the finger 75 which, due to the action of the torsion spring 73, will then rotate with the shaft 69 back to its starting position against the opposite side of the block 79, the impact moving the block so that the contacts 78 and 84 will be separated to stop the electric signal. Thus, the finger 75 sets off an electric signal which will continue to operate until the finger and the hand 16 are returned to their initial starting position. If the clutch disks 70 and 71, are disengaged before the hand 16 reaches the signaling position, the hand merely returns to the initial starting position through the effort of the spring 73.

The mechanism for operating and controlling the "Time out—minutes left" indicator 15 is similar in every detail to that described above for the "Off goal—seconds left" indicator 16, with the exception that the hand 15 and the equivalent circuit-closing finger 75 swing around once in two minutes, while the hand 16 and the finger 75 of the "Off goal—seconds left" indicator swing around once in ten seconds.

The mechanism for setting the drums 18 indicating the period of play, the drums 18a carrying the names of the players, and the drums 18b indicating the number of fouls against each player is operated by a plurality of bars 94 reciprocated by a plurality of eccentrics 60 rigidly mounted on the shaft 61 which, as shown in Figs. 2 and 3, is driven through suitable gearing by the induction motor 23. When the score board is in use, the shaft 61 rotates constantly and consequently the bars 94 reciprocate constantly. Referring particularly to Figs. 3 and 14, the axle 91' of each drum 18a or 18b is provided with a notched disk or ratchet wheel 91, the notches in the periphery of each disk or ratchet wheel 91 corresponding in number and location to the number and position of the faces of the drums 18a or 18b. To hold a drum 18a in a set position, a detent 92 is yieldingly held to the notched disk 91 by a spring 93. To turn the drums, each

reciprocating bar 94 is provided with a dog 95 pivoted thereon and adapted to engage one of the notched disks or ratchet wheels 91 through the effort of a spring 96. The dog 95 is so shaped that it will operatively engage the notches in the periphery of the ratchet wheel 91 only on the up-stroke of the reciprocating bar 94. On each up-stroke of the reciprocating bar 94, the ratchet wheel 91 and its associated drum will be turned through an arc corresponding to the distance between two adjacent notches of the ratchet wheel 91. Normally, however, and through the effort of a spring 99, the dog 95 is held out of engagement with its associated ratchet wheel by a guard lever 97 covering the notch that otherwise would be engaged by the dog 95. The spring 99 is secured to a bracket 98 mounted on the framework of the score board, said bracket being provided with a lug 100 to limit the movement of the lever 97 when the latter swings into guarding position. To uncover the notch of the ratchet wheel 91 to effect the engagement of the dog 95 with the same, the lever 97 is pivoted on the bracket 98 and the end of the lever 97 remote from the working end serves as an armature for an electromagnet 101. When the electromagnet 101 is energized, it will attract the lower end of the lever 97 to swing it out of guarding position, thereby permitting the dog 95 to engage the ratchet wheel. It is to be understood that each reciprocating bar 94 carries as many dogs 95 as there are drums, and of course, no drum will be turned unless the associated guard lever 97 is swung out of guarding position. The selective energizing of the electromagnets 101 will effect the turning or setting of the desired drum.

The drums displaying the playing period legends through the openings 17 are operated in the same manner, except that the notched disks or ratchet wheels 91 are not mounted directly on the axles of the drums, but are connected thereto by gymbal joints 102 as shown in Fig. 2.

The mechanism for setting the counting disks or dials 19 and 19' for indicating the points scored by each player and those for indicating the total points scored by each team, is operated by a plurality of bars 103 reciprocated by a plurality of eccentrics 60 rigidly mounted on the shaft 61. Referring particularly to Figs. 4, 5, 15 and 16, the reciprocating bars 103 are provided with a plurality of studs 104, each positioned adjacent a dial and each engaging a slot 105 of an associated lever 106 loosely mounted on an axle 107 of an associated unit disk 19. The axle 107 of each disk 19 is provided with a notched disk or ratchet wheel 108 rigidly mounted thereon. To rotate the counting disks 19 in opposite directions, the end of the lever 106 remote from the slot 105 is provided with a pair of pivotally mounted dogs 110 adapted to engage the ratchet wheel 108 through the effort of springs 111. To control the engagement of each dog 110 with the ratchet wheel 108, each unit disk 19 is provided with a pair of rocking arms 113, one end of each of said arms being normally in the path of a dog to hold it in inoperative position, and the other end being adapted to function as the armature of an electromagnet 112. Normally, the electromagnets 112 are not energized and the rocking arms 113 maintain the dogs 110 disengaged from the ratchet wheel 108 through the action of springs 114. To hold a dial in a set position, each ratchet wheel 108 is provided with a detent 109 provided with roller 109' which is adapted to yieldably engage a notch in the periphery of the

ratchet wheel through the effort of a spring 116'. To operate this mechanism, the electromagnets 112 are energized for an instant, and to maintain the guard ends of the rocking arms 113 out of the path of the dogs 110 after one of the electromagnets 112 is thus momentarily energized, the armature ends of the rocking arms 113 are provided with lugs 117 adapted to engage a latch 115 operatively mounted and connected with the detent 109 through a link 116. The latch 115 is maintained in the paths of the lugs 117 through the effort of a spring 115'. Referring particularly to Figs. 15 and 16, when one of the electromagnets 112 is energized, the armature end of the associated rocking arm 113 is drawn downwardly to release the associated dog 110. Under the effort of spring 111, the dog will swing into operative position to engage a notch in the ratchet wheel 108. The reciprocating bar 103, through the lever 106 and the dog 110 engaging the ratchet wheel 108 will then rotate the unit counting dials 19. As the ratchet wheel 108 turns, the roller 109' on the detent 109 is pushed out of the associated notch in the periphery of the ratchet wheel 108 and in so doing, the latch 115 is pushed, through the link 116, out of engagement with the lug 117 on the rocked rocking arm 113 to release the same under the effort of the spring 114.

To impart rotation to the tens counting dials 19', each of the unit counting dials 19 is provided with a lug 20, near its periphery, which is adapted to engage, at the end of each revolution, a pair of lugs 21 projecting from the tens counting dials 19', each ten counting dial being provided with ten pairs of lugs 21. To prevent backward motion of the tens dials 19', the axle of each tens dial is provided with a ratchet wheel, Fig. 5, adapted to be engaged by a spring detent 118' mounted on the frame of the apparatus.

To announce the end of a playing period, the score board is provided with a gun mechanism 144 mounted in a casing 141, Fig. 2, secured to the top of the main frame of the apparatus. The gun mechanism is described in detail in application Serial No. 739,322, filed August 14th, 1934, and now Patent No. 2,190,534, of which this application is a division. As shown in Fig. 18, the operation of the gun mechanism is obtained by energizing a solenoid 165, this being effected automatically at the end of a playing period and being controlled by the actuation of the switches operated by the circuit-closing fingers 56 and 57 on the timing shafts 52 and 27 respectively.

The score board is operated under the direction of an official from a remote control board shown in Fig. 17, a cable of wires connecting the control board with the score board. The board is provided with a plurality of buttons operating a plurality of switches placed in the various electrical circuits controlling the operation of the score board. To control the passage of current for the motors and the switches mounted on the score board, the control board is also provided with a master key switch 176, a pilot light 177 indicating when the current is turned on.

Referring to Fig. 18, when the buttons 178 are depressed, the circuits controlling the operation of the mechanism rotating the drums 18 are closed. Assuming that it is desired to make the legends of the top drums 18 read "First extra period," the button 178 under the legend "No." in Fig. 17, is depressed to cause current to flow through the electromagnet 101, Fig. 14. The magnet thus energized will pull the end of the

lever 97, and in so doing, will remove the guard end of the lever away from the ratchet wheel 91, thereby permitting the dog 95 on the reciprocating shaft 94 to drop into one of the notches of the ratchet wheel 91 and turn the drum 18. The drum is permitted to turn until the reading "First" appears through the opening 17. The button 178 then is released to discontinue the flow of current through the magnet 101, whereby the lever 97 will return to its normal position under the effort of the spring 99, where it will prevent the dog 95 from dropping into the notches of the ratchet wheel 91. The drum 18 then stops revolving. The button 178, on the right, under the legend "Q—H—P", controls the flow of current through the magnet 101 for operating the drum 18 bearing the legends to indicate the periods. This button is released to discontinue the flow of current through the magnet 101 when the reading "Extra period" is displayed through the opening 17.

The same procedure is followed in making the desired changes for the names of the players displayed through the openings 2 of Fig. 1, and the personal fouls called on the players, and displayed through the openings 4, the buttons 173 on the board 175, Fig. 17, under the legends "Players" and "Fouls" controlling the flow of current through the appropriate magnets 101. If, for example, the center of the visiting team commits a foul, the third button down the "Foul" column opposite the button labeled "C" in the "Players" column of the visitors side, is depressed. Referring to Fig. 18, this permits current from the battery 184 to flow through the magnet 101 and causes the particular foul drum to turn. The turning of the foul drum may be stopped by releasing the pressure on the button as soon as the proper number is displayed through the opening 4. Again referring to Fig. 18, if a substitution is made for the right forward of the "U. S. A. C." or home team, the button 178 labeled "RF" on the "U. S. A. C." side of the control board is depressed to cause the current to flow from the battery 184 through the proper magnet 101 to turn the "Right forward" drum 18 on the "U. S. A. C." side of the score board. When the proper name is displayed through the opening 2 of Fig. 1, the button is released to discontinue the flow of current through the magnet 101, and consequently, rotation of the "Right forward" drum ceases.

As already explained, the total scores of the teams are indicated through the openings 7 by means of the dials 19 and 19'. The operation of these dials is controlled by buttons 179 on the control board; the plus buttons adding to the score and the minus buttons subtracting from the score in the event that a correction should be necessary. If, for example, the visitors score a basket, the plus button 179 on the visitors' side of the control board is pressed for an instant. Referring to Fig. 18, this sends an impulse of current from the battery 184 through the magnet 112, Figs. 15 and 16. While the current impulse lasts, the magnet 112 rocks the rocking arm 113 and during this movement the lug 117 on the rocking arm 113 passes under the point of the latch 115 to hold the rocking arm 113 against the magnet 112. With the rocking arm 113 in this position, the dog 110 on the lever 109 will engage a notch in the periphery of the ratchet wheel 108 to rotate the latter and the associated shaft 107 in one direction. As soon as the ratchet wheel 108 moves, as already explained,

the roller 109' on the detent 109 is pushed out of a notch of the ratchet wheel 108 and in so doing the latch 115 is moved by the link 116. The motion of the latch 115 permits the rocking arm 113 to rock back into its initial and normal position under the action of the spring 114, and the dog 110 is thereby prevented from engaging another notch in the periphery of the ratchet wheel 108. Since the ratchet wheel 108 is rigidly mounted on the shaft 107 of the dial 19, the movement of one notch will turn the disk 19 to advance the reading of the score by one number. The two points made by the making of a basket can be displayed by two depressions of the buttons 179, a few seconds apart. If by any chance, the particular basket should be disallowed after it has already been added to the team score, the minus button 179 is depressed to cause current to flow through the opposite magnet 112. By means of the same mechanical action just described for adding to the score, the ratchet wheel 108 will be turned one notch in the opposite direction, and thereby correct the reading of the score.

The same procedure is followed in displaying the individual scores of the players through the openings 6. In this case, the plus and minus buttons 189 under the legend "Individual" of Fig. 17, are depressed to energize the appropriate magnets controlling the operation of the individual score dials. If, for example, the center makes a basket, the plus button 180 on the "C" row of the respective team side of Fig. 17, is depressed to cause current from the battery 184 to flow through the magnet 112, and thereby cause the addition of the appropriate score to the indicator for the particular center. Again, the minus button 180 beside the player's plus button, when depressed, will cause a reduction of his score.

To operate the "Off goal—seconds left" indicator, the control board shown in Fig. 17 is provided with double-throw switches 181. Referring to Fig. 18, assuming that one team gets the ball in its back court and, therefore, under the present rules, has ten seconds to get the ball into the front territory, the operator presses the switch 181 to the right to close a circuit sending current from the battery 184 into the relay 185. This relay will close contacts to send current from the power lines 186 into the solenoid 40 to put the "Off goal—seconds left" clock 14, Fig. 1, into gear. The switch 181 may then be released and will spring back to neutral position cutting off the flow of current to the relay 185, and to the solenoid 40, but the clock will remain in gear. With the clock 14 in gear, the finger 75, Figs. 12, 13 and 18, and the hand 16 will rotate at the rate of one revolution in ten seconds. If the team overruns the ten seconds, the finger 75 will impinge against the block 79 and will assume a position between the block 79 and the end of the dog 87. The contacts 73 and 84 will be brought together and will close the circuit to operate the electric signal. The finger 75, however, will continue to move and the block 79 will be pushed through an additional distance to close another circuit through the contacts 85 and 86 to send current into the solenoid 41. This will move the slide 39 in the opposite direction and will disengage the clutch disks 70 and 71. The contacts 84, 85 and 86 being carried by light springs, will permit finger 75 to continue moving until a slight magnetic lag in the solenoid 41 is overcome. As soon as the clutch disks are disengaged, due to

the influence of the torsion spring 73, the finger 75 will fall back against the end of the dog 87. Although current will stop flowing to the solenoid 41, and the clock is out of gear, the electric signal will continue. The operator may stop the signal and reset the clock by momentarily moving the switch 181 to the left to send current into the magnet 90 and the solenoid 41, but, since the clock is out of gear, energization of the solenoid 41 is without effect. The magnet 90, however, will release the dog 87 from the finger 75, which will rotate back to the initial and starting position through the effort of the torsion spring 73. If the team does not overrun its allotted time, the operator may stop and reset the clock at any time by briefly pushing the switch 181 to the left, and since the clock is now in gear, the solenoid 41 will put it out of gear, allowing the finger 75 and the hand 16 to return to the initial and starting position through the effort of the torsion spring 73.

To operate the "Minutes to play" indicator, the control board shown in Fig. 17 is provided with a double-throw switch 181 bearing the legend "Time." Referring to Fig. 18, and assuming that the clock is stopped and the teams are ready to start a playing period, the switch 181 is pushed to the right to permit current from the battery 184 to flow through the relay 185, which, in turn, causes current from the power line 186 to flow through the solenoid 40 to pull the core of the slide 39 inwardly. As already explained, the movement of the slide 39 rocks the lever 38 to slide the clutch disk 35 into engagement with the clutch disk 33 so that the shaft 26 will turn the shaft 27, Fig. 3. This will cause rotation of the "Seconds" indicating hand 11. The gearing from the shaft 27 will cause the hand 12 to turn to indicate the minutes of play remaining. When the pressure is taken off switch 181, it will assume a neutral position between its two contact positions, so that no current will flow from the battery 184 through either of the relays 185 or 200. The flow of current through the solenoid 40 will cease but the clutch disks 33 and 35 will remain in engagement because power is required to disengage the clutch disks. Thus, the clock will continue to operate until the time-keeper stops it by giving the switch 181 a push to the left. When the switch is moved to the left, current from the battery 184 flows through the relay 200 causing current from the supply line 186 to flow through the solenoid 41. The slide 39 is then pulled to the left or toward the solenoid 41 with the result that the clock is stopped. When the pressure holding the switch 181 to the left is relieved it will assume a neutral position again and the flow of current in the circuit will cease. The clock can be thrown in and out of gear any number of times during the playing period, and the time-indicators will continue on toward the close of the playing period from each stopping point.

To stop the time-indicators 9 and 10 automatically at the end of a playing period and to fire the gun automatically at the end of a playing period, the shafts 52 and 27 of the time mechanism, as already explained, are provided with fingers 56 and 57 respectively. These fingers are adapted to actuate a pair of switches secured to the front wall 1 of the apparatus. At the start, the switch 119 is open, and the finger 56, Fig. 9, is on the upper side of the lever 121 and in position to move away from the projection as the clock begins to run. Within twenty minutes, the

finger 56 will return to the underside of the lever 121 moving in an upward direction, so that it can swing the switch about its pivot 120 and cause the contacts 125 and 128, and 126 and 129 respectively, to close within the last minute of the playing period. Finger 57, Fig. 10, which makes contact with the grounded side of the supply line 186, passes from the left to the right over the top of the bar 130 once every minute. At the point where the finger 57 touches the contacts 134 and 135, it pushes the bar 130 downwardly until the contacts 136 and 139 are touching. The contact between the finger 57 and the contacts points 134 and 135 has no effect unless the switch 119 is closed. Assuming that the clock is running near the end of a playing period, the finger 57 passes over the bar 130 and starts to measure the last minute, while the finger 56 impinges against the underside of the lever 121. Up to this point, all the contacts of both switches are in an open position. The finger 57 then rocks the switch plate 119 to close the contacts 125 and 128, and 126 and 129 respectively, to prepare the circuits for current flow at the close of the last second of the playing period. Referring to Fig. 18, at the end of the last second, the finger 57 returns and bridges the contacts 134 and 135 of the switch 130; current from the supply line 186 will flow from the contact 134 to the points 123 and 126 which are touching, and then through the solenoid 165 which will pull the plunger 167 and fire the gun. Current also will flow from the contact 135 to the points 128 and 125 and through the solenoid 41 which will stop the clock. Current will continue to flow in the solenoids 41 and 165 as long as switch 119 remains closed, as switch 181 has no effect on the operation of the clock when the switch 119 is closed. It can send current into the solenoid 40 but the latter cannot pull the slide 39 because current is still flowing in the solenoid 41. This in a sense, locks the clock in the position at which it was at the end of the playing period until it is desired to start timing the next playing period.

Assuming that it is desired to put things in order for timing the next playing period, the operator depresses the button 122, Fig. 17, to cause current from the battery 184 to flow through the magnet 124, thereby pulling the switch 119 open so that the contacts 126 and 129, and 125 and 128 will no longer touch. This interrupts the flow of current through the solenoid 165 and allows the plunger 167 of the gun to go back to its original position where it will be ready to fire the next shot at the end of the next playing period. Current also stops flowing through the solenoid 41 thereby making it again possible for the switch 181 to start and stop the clock.

If the next playing period should be an extra five minutes period, as after a tie game, it will become necessary to set the time-indicator to read 5 minutes to play before the period is started. The clock has been stopped in such a position that the finger 57 is holding the contacts 136 and 139 together, Fig. 8. To set the clock, the operator pushes the switch 181 to the left, then depresses the button 123 to cause current from the battery 184 to flow through the contacts 136 and 139 to the magnet 65, causing the dog 63 to engage the ratchet wheel 58 to move it one notch backwards for each stroke of the reciprocating bar 59. Five strokes of the reciprocating bar 59 will shift the "Minutes to play" indicator to a

position where it will indicate five minutes remaining to play. The official then releases the pressure on the button 183 to interrupt the flow of current through the magnet 65 to allow the dog 63 to assume its normal position under the influence of the spring 66. By this method, the time-indicator can be set for any playing interval desired within the range of twenty minutes.

This application is a division of application Serial No. 739,822, filed August 14, 1934, now Patent No. 2,190,543.

We claim:

1. Mechanism for intermittently rotating a member through a predetermined angular distance, comprising an axle, a rotatable member adapted to carry indicia mounted on the axle for rotation therewith, means to rotate said axle and member including a continuously rotating shaft, a reciprocable bar, means for translating rotary motion of the shaft into reciprocatory motion of the bar to continuously reciprocate the bar, a ratchet wheel mounted on the axle and means operably connected to the bar and continuously moved thereby to rotate the ratchet wheel so that the reciprocatory motion of the bar will be translated into rotary motion of the axle and said rotatable member, said connecting means comprising a dog pivotally mounted on the reciprocating bar, a spring urging the dog to engage the notches of the ratchet wheel, means to selectively control the engagement of the dog with the notches of the ratchet wheel, said control means including a member movable to either of two positions, in one of which it is interposed between the dog and the ratchet wheel and engaged by the dog to prevent the dog from engaging with the ratchet wheel, and in the other of which it is not engaged by the dog and permits maximum engagement of the dog with the ratchet wheel, means for so actuating said interposable member that it moves only from one extreme position to the other, so that each actuation of the ratchet wheel by the dog will cause the rotatable member associated with the ratchet wheel to be moved through the same angular distance, and means normally to hold the interposable member between the dog and the ratchet wheel.

2. Mechanism for intermittently rotating a member through a predetermined angular distance, comprising an axle, a rotatable member adapted to carry indicia mounted on the axle for rotation therewith, means to rotate said axle and member including a continuously rotating shaft, a reciprocable bar, means for translating rotary motion of the shaft into reciprocatory motion of the bar to continuously reciprocate the bar, a ratchet wheel mounted on the axle and means operably connected to the bar and continuously moved thereby to rotate the ratchet wheel so that the reciprocatory motion of the bar will be translated into rotary motion of the axle and said rotatable member, said connecting means comprising a dog pivotally mounted on the reciprocating bar, a spring urging the dog to engage the notches of the ratchet wheel, means to selectively control the engagement of the dog with the notches of the ratchet wheel, said control means including a member movable to either of two positions, in one of which it is interposed between the dog and the ratchet wheel and engaged by the dog to prevent the dog from engaging with the ratchet wheel, and in the other of which it is not engaged by the dog and permits maximum engagement of the dog with the ratchet wheel,

means for so actuating said interposable member that it moves only from one extreme position to the other, so that each actuation of the ratchet wheel by the dog will cause the rotatable member associated with the ratchet wheel to be moved through the same angular distance, a spring adapted normally to hold the interposed member between the dog and the ratchet wheel, and a detent resiliently urged into engagement with the notches of the ratchet wheel to retain the rotatable member in a set position when the ratchet wheel is not engaged by the dog.

3. Mechanism for intermittently rotating a member through a predetermined angular distance, comprising an axle, a rotatable member adapted to carry indicia mounted on the axle for rotation therewith, means to rotate said axle and member including a continuously rotating shaft, a reciprocable bar, means for translating rotary motion of the shaft into reciprocatory motion of the bar to continuously reciprocate the bar, a ratchet wheel mounted on the axle and means operably connected to the bar and continuously moved thereby to rotate the ratchet wheel so that the reciprocatory motion of the bar will be translated into rotary motion of the axle and said rotatable member, said connecting means comprising a dog pivotally mounted on the reciprocating bar, a spring urging the dog to engage the notches of the ratchet wheel, means to selectively control the engagement of the dog with the notches of the ratchet wheel, said control means including a member movable to either of two positions, in one of which it is interposed between the dog and the ratchet wheel and engaged by the dog to prevent the dog from engaging with the ratchet wheel, and in the other of which it is not engaged by the dog and permits maximum engagement of the dog with the ratchet wheel, means for so actuating said interposable member that it moves only from one extreme position to the other, so that each actuation of the ratchet wheel by the dog will cause the rotatable member associated with the ratchet wheel to be moved through the same angular distance, a spring adapted normally to hold the interposed member between the dog and the ratchet wheel, said actuating means being normally inoperative and adapted when operative to move the interposed member out of engagement with the dog against the effort of the spring to release the dog into engagement with the notches of the ratchet wheel.

4. Mechanism for intermittently rotating a member through a predetermined angular distance, comprising an axle, a rotatable member adapted to carry indicia mounted on the axle for rotation therewith, means to rotate said axle and member including a continuously rotating shaft, a reciprocable bar, means for translating rotary motion of the shaft into reciprocatory motion of the bar to continuously reciprocate the bar, a ratchet wheel mounted on the axle and means operably connected to the bar and continuously moved thereby to rotate the ratchet wheel so that the reciprocatory motion of the bar will be translated into rotary motion of the axle and said rotatable member, said connecting means comprising a dog pivotally mounted on the reciprocating bar, a spring urging the dog to engage the notches of the ratchet wheel, means to selectively control the engagement of the dog with the notches of the ratchet wheel, said control means including a member movable to either of two positions, in one of which it is interposed between the dog and

the ratchet wheel and engaged by the dog to prevent the dog from engaging with the ratchet wheel, and in the other of which it is not engaged by the dog and permits a maximum engagement of the dog with the ratchet means, electromagnetic means for so actuating said interposable member that it moves only from one extreme position to the other, so that each actuation of the ratchet wheel by the dog will cause the rotatable member associated with the ratchet wheel to be moved through the same angular distance, a

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spring adapted normally to hold the interposed member between the dog and the ratchet wheel and said electromagnetic means being normally deenergized and adapted when energized to pull the interposed member out of engagement with the dog against the effort of the spring to release the dog into engagement with the notches of the ratchet wheel.

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