Nov. 25, 1952 W. RATH 2,619,170

SWIMMING RACE TIMER

Filed May 22, 1951 5 Sheets-Sheet 1

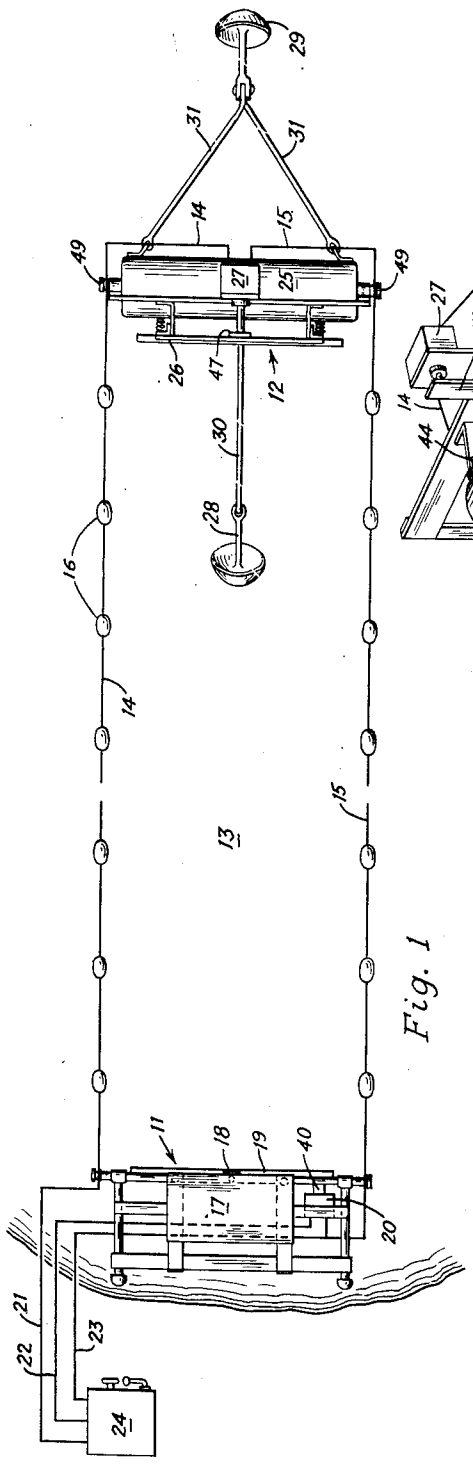


Fig. 1

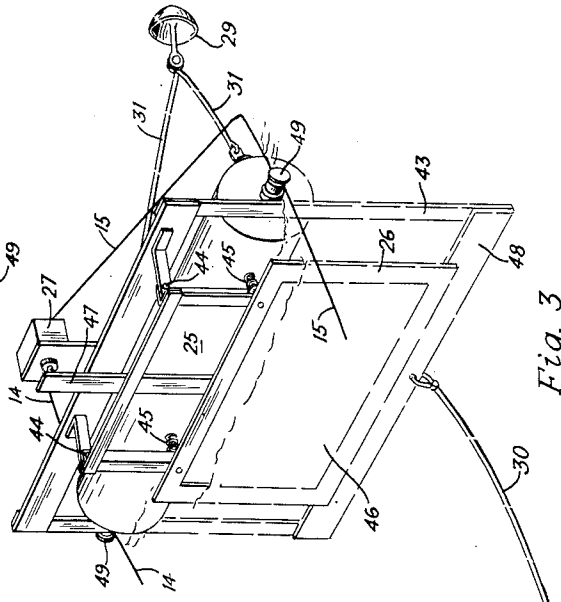


Fig. 3

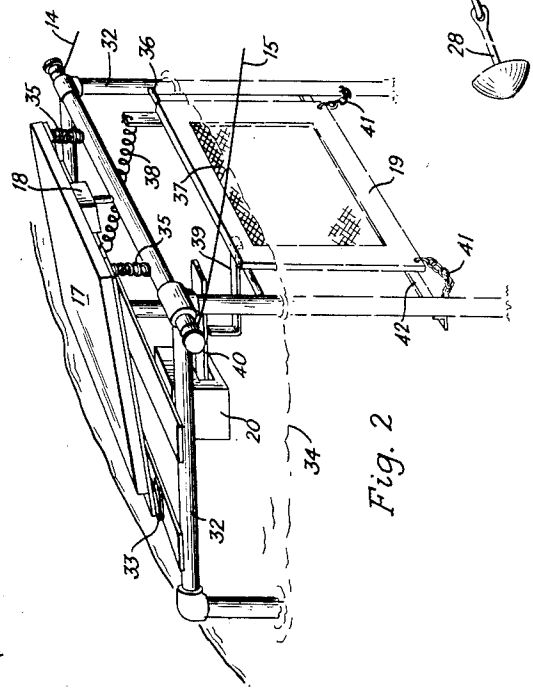


Fig. 2

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SWIMMING RACE TIMER

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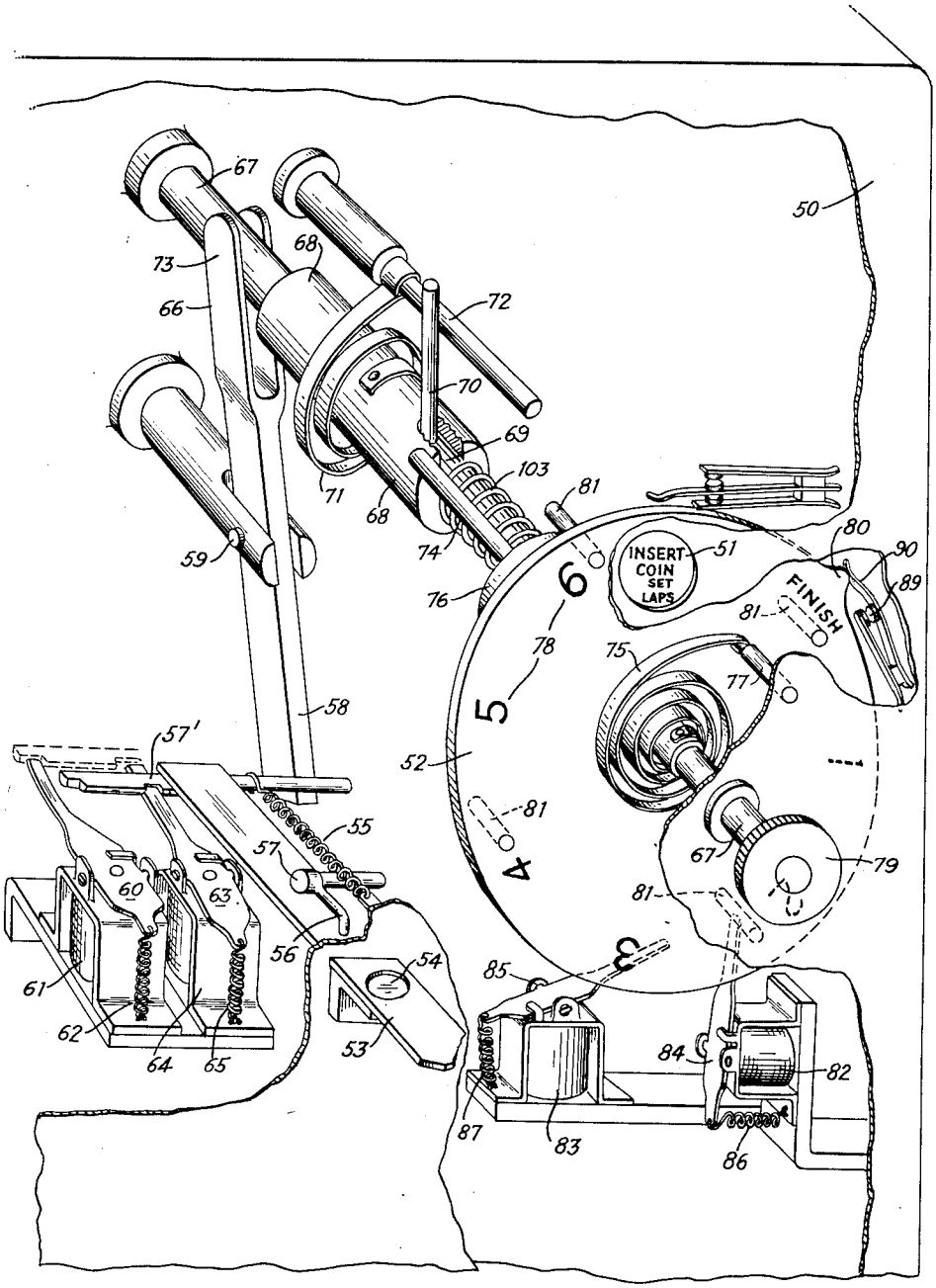



Fig. 4

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SWIMMING RACE TIMER

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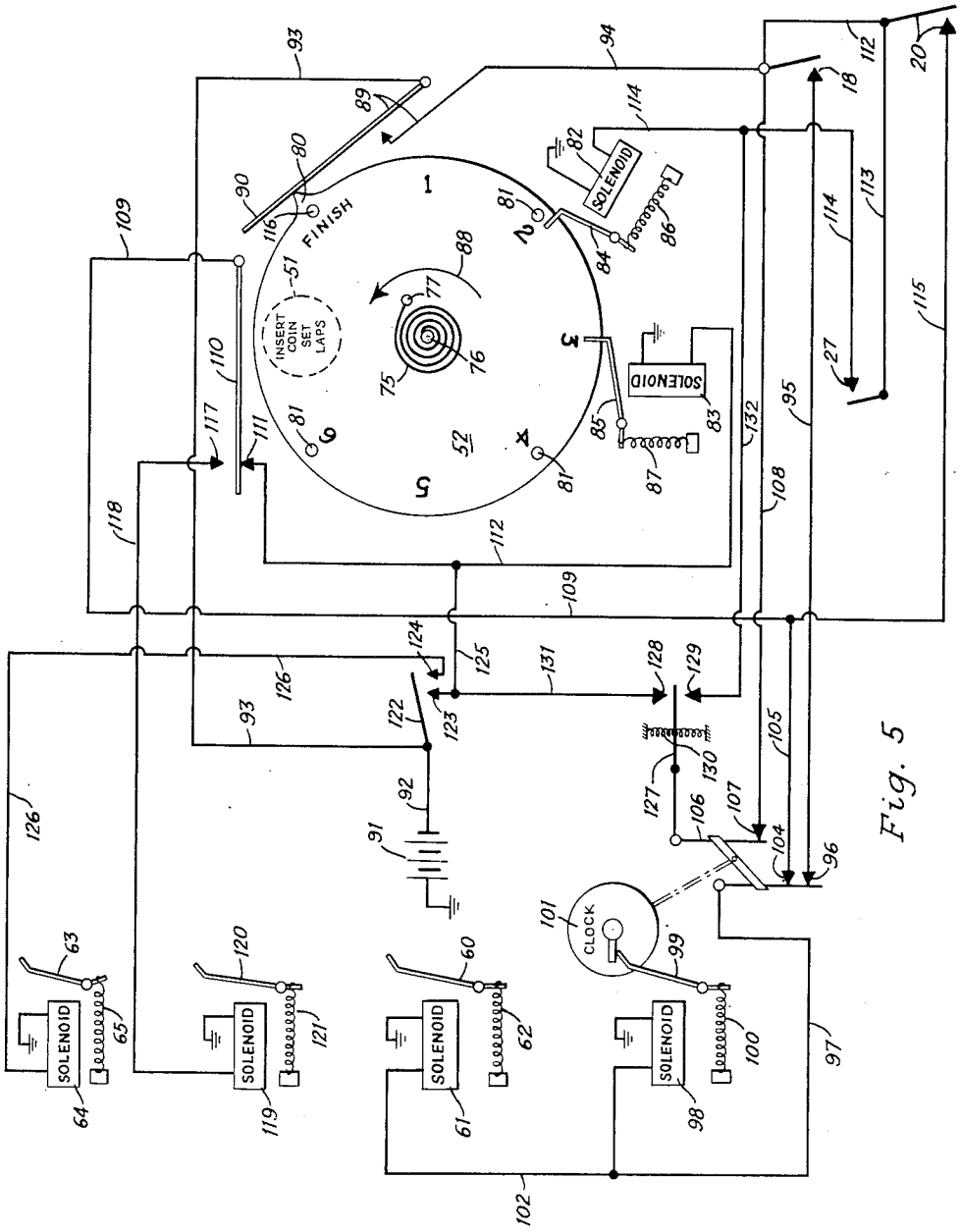



Fig. 5

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SWIMMING RACE TIMER

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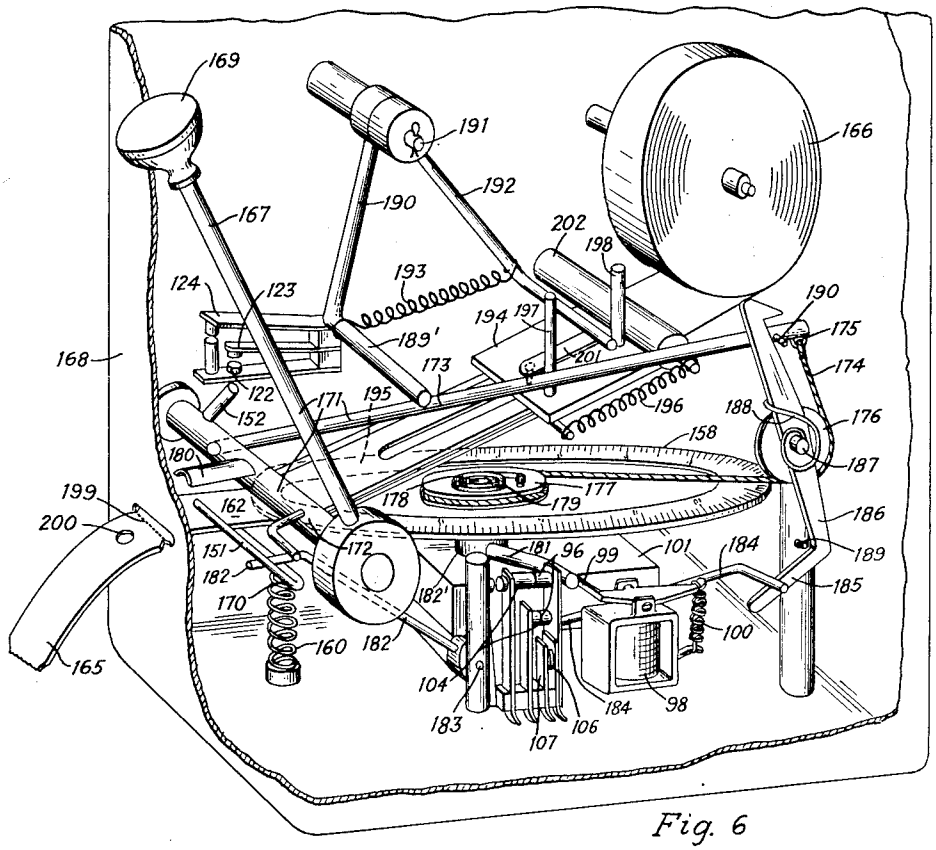



Fig. 6

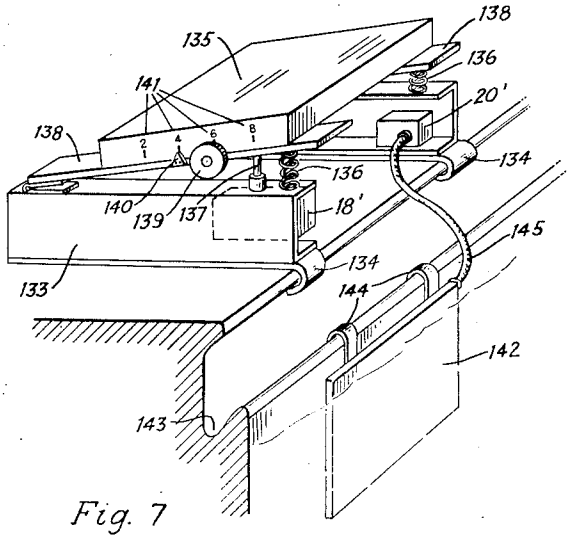



Fig. 7

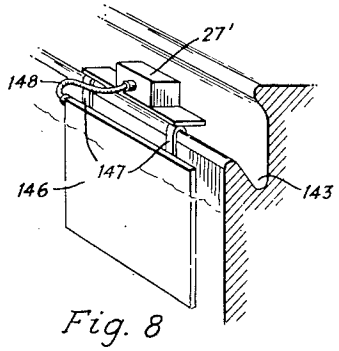



Fig. 8

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SWIMMING RACE TIMER

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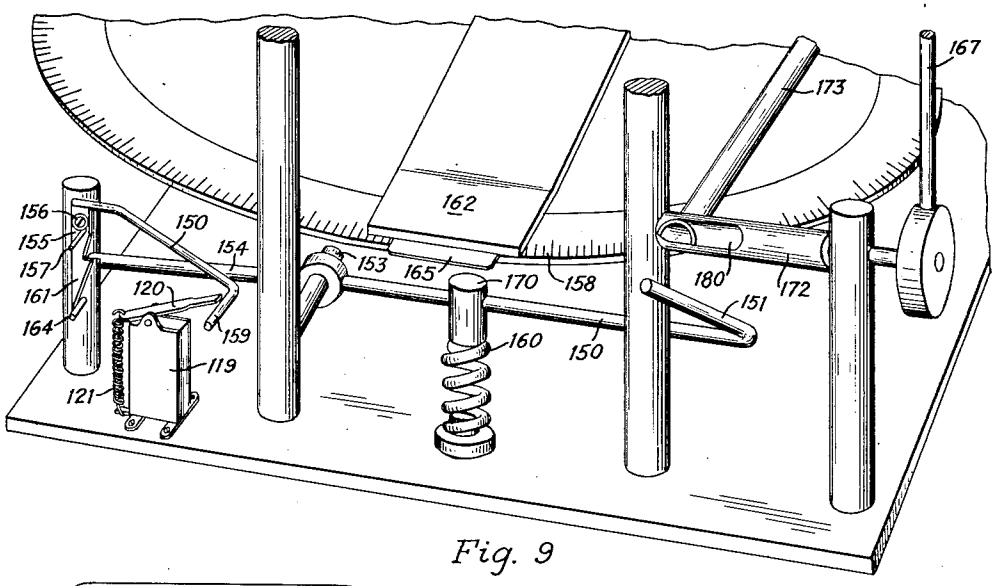



Fig. 9

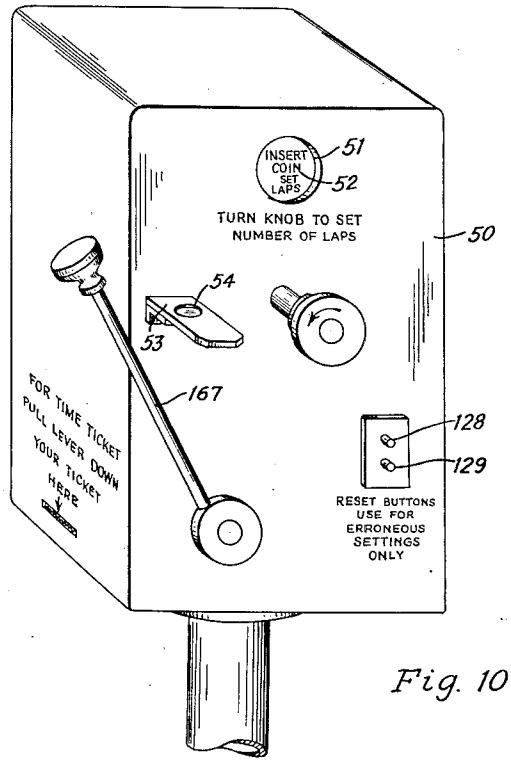



Fig. 10

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Patented Nov. 25, 1952

2,619,170

# UNITED STATES PATENT OFFICE

2,619,170

## SWIMMING RACE TIMER

Walter Rath, Dorset, Vt.

Application May 22, 1951, Serial No. 227,706

7 Claims. (Cl. 161—18)

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This invention relates to automatic timing devices for determining the time required by a person or object to move from a starting point or starting line over a given course past one or a plurality of intermediate or part-way points to a finish point or finish line.

The invention provides an automatic timing apparatus which is particularly suited for the self-timing of runners, skiers, and swimmers and provides in its preferred form an apparatus for the automatic measurement of the time elapsed between the passage by a person of a starting line and his passage of a finish line after completion of a predetermined course. The race course may follow an irregular outline marked by one or a plurality of check points, all of which must be passed by the racer in proper order before obtaining an indication or a record of elapsed time. The course may also be a straight course to be traversed a plurality of times, in which event, the starting point and the finish point also serve as intermediate check points.

Timing devices incorporating the present invention are highly versatile and may easily be adapted to races of different character. For example, the form of apparatus hereinafter described in greater detail and explained in its application to a swimming race extending over a plurality of laps, may also be used for the timing of a cross-country race over an irregular course having a plurality of check-points, the distances between each two check-points or the distance between a check-point and the starting, or the finishing line being comparable to single laps of a swimming race. The apparatus not only furnishes an indication of elapsed time, or a printed record, if desired, but also operates as a counter of laps or a counter of the completed race course sections, thus permitting spectators or the racer, to observe the progress of the race.

Timing devices incorporating the present invention may be embodied in a wide variety of forms. One preferred form, which will be described hereinafter, comprises a self-contained coin-operated unit including a timing mechanism, hereinafter briefly referred to as a "clock," a counter, a means for presetting the device for a race of predetermined length, a printing device for issuing a printed time record, and various mechanical and electrical elements for actuating the clock, the counter, the printer, and other parts of the mechanism. Electric lines extend from the self-contained unit to the starting station, the finish station and to the part-way check-points.

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The specific forms of the start responsive means of the finish responsive means and of the passage responsive means at the check points naturally varies with the particular nature of each installation.

In a swimming race, for example, it is desirable to use electric contact devices operated by a platform closely resembling the top of a starting block at the starting line, and to use vertical panels in the water or slightly above the water to be touched by the swimmer at the intermediate or turn-around points and at the finishing line.

If the device is used in a skiing race, it is convenient to employ movable barriers extending across a gate. Such a barrier may be a fish-pole type of rod extending across the gate. The rod is struck and swung aside by the racer passing through the gate. There may also be tapes actuating a contact, or a photo-electric device whose beam extends across the gate and is broken by the racer.

For track races, or cross-country races similar passage responsive means may be used. Gates may serve as intermediate check-points for cross-country races. Vertical contact poles to be touched or rounded by the racer are other forms of passage responsive means.

It thus becomes evident that any form of apparatus or device which will make or break an electric contact or generate or send an electric impulse at the moment of passage by a racer will serve as a passage responsive device or as a start or finish responsive means.

Similarly, the timing means, or "clock" proper may assume a variety of forms. It may be a spring-motor-operated clock of conventional construction, it may be an electric clock which, in essence, is a constant speed motor, or it may be any other form of known device for determining lapse of time.

Conventional timing devices generally require at least one operator for attending to the numerous details, such as starting the racer, resetting the clock, removing or reading the time record, and other details which ordinarily are not attended to by the racer.

The present invention provides a timing device which is particularly designed for the self-timing of a racer, all operations being fully automatic, and the device being so designed that it may be used by an untrained person with no greater difficulty than is involved in the use of a conventional coin-operated vending machine.

A particular feature of the present invention is

the arrangement of the timing device such that no indication or record of the time is given unless the predetermined race course is fully traversed. This is accomplished by blocking the timing device in such a way that the passage responsive device at the finish line will not actuate the clock unless the passage devices at all intermediate check points were properly actuated. Thus inadvertent mistakes and deliberate cheating are prevented. This feature makes the automatic timing device suited for competitive racing. The feature is particularly valuable in instances where the location does not permit more than one racer to be on the race course, as for example, where only a single track is available. In the illustrated embodiment of the invention only a single swimming lane is provided, marked by floating lines in a conventional manner. This form of race course is relatively inexpensive to construct and is admirably suited for installation by clubs, hotels, resorts or beaches, yet, as will later be seen, provides a course for competitive races in which the contestants use it in succession.

The timing device is so constructed that its use by a second person is prevented while the first person is still on the course. This arrangement is valuable in instances where a portion of the race course is not visible from the starting or finishing line. It is also advantageous in instances where a certain number of laps must be completed, as in a swimming race, since tampering with the device for the purpose of obtaining a time record before completion of the race is prevented.

For this purpose blocking means are provided which automatically become effective when a racer passes the starting line. The blocking remains effective until the racer passes the finish line. The unblocking operation of the device is preferably combined with the issuance of a printed time record of the race, so that the timing device automatically becomes available for reuse after issuance of a time record.

Indicating or signaling means are provided for advising prospective users of the device of its present state of availability and non-availability. Such signaling means may simply indicate the condition of availability or non-availability, but may also indicate the progress of the current race by indication, for example, of the number of completed laps or the number of laps still to be completed. If the device is specifically constructed for coin operation, the coin collecting device is preferably so constructed that no further coin is accepted until the device is in condition for reuse.

These and various other features and advantages of the invention will appear more fully from the detailed description which follows accompanied by drawings showing, for the purpose of illustration, an application of the principles of the invention to a timing device for swimming races. The invention also consists in certain new and original features of construction and combination of elements having a wider field of use. Such features will hereinafter be set forth and claimed.

Although the characteristic features of the invention which are believed to be novel will be particularly pointed out in the claims appended hereto, the invention itself, its objects and advantages, and the manner in which it may be carried out may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part of it in which:



Figure 1 is a plan view, partly diagrammatic, of an installation embodying the present invention for multi-lap swimming races;

Figure 2 is a perspective view of a starting platform also incorporating a passage responsive panel which may serve either as an intermediate check pointer or as a finishing line;

Figure 3 is a perspective view of a floating installation at the end of the swimming lane including a vertical panel which serves as an intermediate check point;

Figure 4 is a perspective view of certain elements of the coin operated mechanism including a device for presetting and counting the number of laps;

Figure 5 is a diagram illustrating the operation of the device;

Figure 6 is a perspective view of a certain mechanism for printing the time record;

Figure 7 is a perspective view of a modified starting and finishing arrangement for swimming pools;

Figure 8 is a perspective illustration of a turn-around point for swimming pools;

Figure 9 is a perspective view of certain elements of the recording mechanism; and

Figure 10 is a perspective view of the outside of the mechanism housing.

In the following description and in the claims the various details will be identified by specific names for convenience. The names however, are intended to be as generic in their application as the art will permit. Corresponding reference characters refer to corresponding parts in the several figures of the drawings.

In the drawings accompanying, and forming part of this specification, certain specific disclosure of the invention is made for the purpose of explanation of broader aspects of the invention, but it is understood that the details may be modified in various respects without departure from the broad principles of the invention and that the invention may be applied to other structures than the ones shown.

As illustrated in Figure 1, the time device comprises a starting line station 11 and a remote station 12 spaced along a race course or lane 13. The starting line station 11 may serve as a finish line station in the event the race extends over an even number of laps, such as two, four or six, this being the most practical arrangement, since it causes the race to terminate at the location where the time record is issued. The remote station 12 serves as a turn-around point.

The two stations 11 and 12 are connected by conductors 14 and 15 supported by conventional floats 16 of the type commonly used in swimming races for the support of the lines which divide the several lanes from one another. In the illustrated installation the insulated conductors 14 and 15 serve the double purpose of furnishing an electric connection between the two stations 11 and 12 and of marking the width of the lane or course 13.

At the starting line station a starting platform 17 controls a switch 18 in a manner hereinafter described in greater detail, and a vertical panel 19 which serves as a turn-around point and as a finishing line operates a switch 20. Three conductors 21, 22 and 23 extend to the timing unit 24 which may be of the coin operable type and includes appropriate mechanism for setting the number of laps, a clock for measuring the elapsed time, and an indicator or recorder for furnishing a record of the race-time, preferably in the form

of a printed ticket, not unlike the printed tickets issued by recording scales and similar to the printed tickets of the automatic timer disclosed in my prior Patent Number 2,559,796 (application Serial Number 122,675, filed October 21, 1949).

The remote station 12 is maintained afloat by a float or drum 25 and includes a vertical panel 26 which operates a switch 27. The remote station 12 is maintained in place by ground anchors 28 and 29 attached to the station by lines or cables 30 and 31. It is, however, obvious that the remote station can be secured or anchored by other means, for example by poles driven into the bottom.

Turning now to the details of the construction, the starting line station may comprise a supporting framework 32 upon which the platform 17 is hingedly mounted for slight pivotal movement about a hinge axis 33. The front edge of the platform is at regulation height *h* above the water level 34, and the size of starting blocks used in swimming races.

The platform 17 is resiliently supported on helical springs 35. The springs permit the platform to move slightly in a vertical direction under the weight of a swimmer standing on it. The switch 18 is mounted between the platform 17 and the framework 32, respectively, the adjustment being such that the contacts of the switch are open if the platform is free from load or is under load. The switch 18 closes when the platform rebounds as the swimmer dives off causing the springs 35 to expand slightly beyond the no-load position.

The vertical panel 19 is pivotally mounted on the framework 32 about an axis 36. The center portion 37 of the panel is preferably made of expanded metal or other mesh or grid construction to prevent actuation of the panel by waves. The panel 19 is biased by a spring 38 and actuates the switch 20 through an arm 39 bearing against an arm 40 of the switch 20. Pressure against the panel 19 causes the panel to tilt back about the axis 36 against the action of the spring 38. This raises the arm 39 which, in turn, lifts the switch arm 40, resulting in closing of the switch contacts. Chains 41 prevent lifting of the panel in the opposite direction and a bar 42 limits the movement of the panel and supports it when great force is exerted on the panel, for example, during a racing turn when the swimmer pushes himself off from the panel.

The remote station comprises a frame 43 supported by the float 25. The panel 26 is pivotally mounted on the frame 43 about an axis 44 and is biased by helical springs 45. The panel 26 also includes a center portion 46 of expanded metal or other mesh construction and has an actuating arm 47 for operating the switch 27. The bottom member 48 of the frame 43 serves as a limit stop for the panel 26 during racing turns and the anchor cables 30 and 31 are attached to the bottom member 48 and the float 25, respectively. Studs 49 on the frame 43 permit fastening of the conductors 14 and 15 which also mark the borders of the swimming lane.

The mechanical elements of the lap setting mechanism, the coin collecting mechanism and their electrical components are mounted in the housing 50 as shown in Figure 4. The housing 50 has a window 51 through which a signal disc 52 is visible. The signal disc 52 indicates availability and non-availability of the device and also forms a part of the lap setting and lap counting mechanism, as will later be seen.

A coin slide 53 projects from the housing when the device is not in use. The slide may be depressed into a position in which its coin receiving aperture 54 is covered to prevent further insertion of coins during the period of non-availability of the timing device, that is during the period of use of the device by a racer who is either completing his race or has not yet removed his time record.

The construction and operation of the setting and counting device will become apparent from the perspective illustrations, Figures 4 and 6 taken together with the wiring diagram of Figure 5.

Referring first to Figure 4, the coin slide 53 is biased by a spring 55 towards its projecting position in which a coin may be inserted into the receiving aperture 54. A feeler lever 56 pivoted at 57 rests against the top surface of the slide and engages the aperture 54 in the event no coin is inserted, thus preventing the slide 53 from reaching a position in which the lap setting or counting mechanism becomes operative.

If a coin has been inserted, the feeler lever 56 passes over the coin without arresting the slide and the slide 53 may be depressed to its full extent. The slide 53 is finally locked in its fully depressed position. For this purpose, the slide is equipped with a transverse arm 57'. This arm engages an operating lever 58 which is pivoted at 59 and is movable in the path of an armature 60 of a solenoid 61. When the slide 53 is fully depressed the transverse arm 57' extends beyond the end of the armature 60 which tilts under the action of the biasing spring 62 and locks the transverse arm 57' and the operating lever 58 in deflected position. In this position the transverse arm 57' has also moved beyond the end of an armature 63 of a second solenoid 64. The armature 63 tilts up under the action of a biasing spring 65 and engages the transverse arm 57 locking the slide in depressed position. The arrangement of the two armatures 60 and 63 is such that the transverse arm is first arrested by the armature 60, whereas it is further locked by the armature 63 after the slide has moved a short distance towards the projected position. This arrangement permits release of the operating lever 58 from its deflected position without returning the slide 53 to its projected position, the slide being still locked by the solenoid 64.

The operating lever 58 has a forked upper end 66 straddling a shaft 67 on which a hub 68 is longitudinally slidable. The shaft has a keyway 69 into which a pin or arm 70 extends preventing the hub 68 from turning relatively to the shaft 67.

The hub 68 and shaft 67 are biased in a clockwise direction by a spring 71 attached to the hub 68 and to a pin 72 in the housing, respectively.

In deflected position the operating lever 58 moves the hub 68 with its arm 73 into the path of a pin 74 on the disc 52. The disc is freely rotatable on the shaft 67 and is biased in a clockwise direction by a spring 75, the spring being attached to the hub 76 of the disc with one end, and to a fixed pin 77 with the other end.

The disc 52 bears a dial reading in term of laps, or other suitable units, the numerals of the dial being shown at 78 and being visible through the window 51 when the disc is in the appropriate rotary position.

A manually operable knob 79 is secured to the

end of the shaft 67. Turning of the knob in a counterclockwise direction causes rotation of the disc 52 with its dial, the motion being transmitted to the dial from the knob 79 through the shaft 67 and the hub 68 keyed to the shaft. The arm 70 of the hub engages the pin 74, and the pin 74 rotates the disc, since the pin is fixed in the hub 76 of the disc.

The disc 52 has a cam projection 80 for operating certain contacts later to be described, and also carries a number of stop pins 81, for arresting the disc in various rotary positions.

Turning now to the mechanism for arresting the disc 52, two solenoids 82 and 83 are provided whose armatures 84 and 85 extend into the path of the pins 81. The armatures are biased by springs 86 and 87, and the arrangement is such that the armature of one solenoid arrests the disc 52 at every other indicating position whereas the armature of the other solenoid engages the disc at the intermediate indicating positions. In this connection, it will be noted that for the particular arrangement of the solenoids, pins are set in the disc at every even number of the dial, whereas no pins are present at the odd numbers of the dial.

Assuming, for example, that the dial is arrested in the position in which the numeral 5 on the dial is visible, a stop pin will be engaged by the armature 84. Actuation of the solenoid 82 releases the dial which under action of the biasing spring 75 turns until the previously arrested pin strikes the armature 85 of the solenoid 83. In this position, the numeral 4 is visible through the window 51. If then the solenoid 83 is energized, its armature 85 releases the stop pin it last engaged and the next stop pin comes to rest against the armature 84 of the solenoid 82 after rotation of the disc 52 to the next position in which the numeral 3 is visible through the window 51.

This particular arrangement of stop pins and solenoids is chosen to insure step-by-step movement of the disc in response to alternate actuation from two spaced check points, as will later become apparent.

Thus the lap counting device remains unaffected by repeated actuation of one and the same passage responsive means. For example, repeated actuation of the vertical panel 26 will not result in advance of the disc by more than one single step. This is important, since the panel 26 is likely to be deflected more than once during a racing turn, first when the swimmer strikes it with his hand and then when he pushes off. This causes the contacts of the switch 27 to be closed at least twice. However, only the first actuation is effective to advance the disc 52 of the lap counter or indicator, whereas the second or a possible third actuation remains ineffective. The same considerations apply to repeated actuation of the panel 19.

Returning now to Figure 4, it is seen that actuation of the solenoids 82 and 83 causes the disc 52 to be advanced in a step-by-step fashion. The solenoids, together with the stop pins 81 and the biasing spring 75 constitute a step-by-step advance mechanism, and it is evident that other known forms of step-by-step mechanisms could be used, such mechanisms being well known units in the art of automatic switching.

The automatic operation of the device, and further details of its mechanism may best be described by reference to the diagrammatic illustration of Figure 5.

Summarizing, the previously described operations, it may be assumed that a person who intends using the device has inserted a coin into the slide 53, as hereinbefore explained and that the slide was depressed and locked in depressed position. Also, the operation lever 58 was deflected and locked, permitting the lap setting mechanism to be operated. Turning of the knob 79 in a counter-clockwise direction causes the disc 52 to turn in the direction indicated by the arrow 88 in Figure 5. The disc is rotated until the number of laps to be swum, for example, six, appears at the window, or at the top of the disc. A main switch 89 is closed as the cam 80 moves out of engagement with the switch arm 90. Closing of the switch 89 prepares an electric circuit from a battery or other suitable source of electric energy 91 through leads 92, 93, main switch 89 to a lead 94. When the swimmer steps on the starting platform 17 (Figure 1), the starting switch 18 remains unaffected. The moment the swimmer leaves the platform, however, the switch 18 is momentarily closed as the platform 17 rebounds, as hereinbefore described. Closing of the starting switch 18 completes the circuit which was just traced to lead 94, the completed circuit now extending through closed switch 18, lead 95, break contacts 96 presently in closed position, a further lead 97 to a solenoid 98. The solenoid 98 pulls up its armature 99 against the action of a biasing spring 100 and starts the clock 101. A further lead 102 extends to the solenoid 61 which is likewise energized since it lies parallel with the solenoid 98. Solenoid 61 pulls up its armature and frees the operating lever 58 (Figure 4), thereby disengaging the lap setting or lap counting disc 52 from the setting shafts 67. The disengagement is aided by a helical spring 103 tending to push the hubs 68 and 76 apart.

Starting of the clock 101 causes the clock-controlled switch 96 to open. The switch 96 includes a further break contact 104 at the end of a lead 105. The lead 105 is disconnected by opening of the switch 96. A further switch arm 106 is mechanically coupled with the arm of the switch 96. Starting of the clock 101 therefore also causes the switch arm 106 to be separated from its break contact 107 at the end of a lead 108. Opening of the clock-operated switches, particularly of switch 96 disconnects the solenoid 61 and also the solenoid 98, and prevents their further actuation.

Closing of the starting switch 18 causes a further circuit to be completed, continuing from lead 94 through contacts 18, leads 95, switch 96, break contact 104, lead 105, a further lead 109, contact arm 110, contact 111, lead 112 to the solenoid 83. Solenoid 83 pulls up its armature 85 and permits the disc 52 to rotate under the action of its biasing spring 75 until the next stop pin 81 strikes the extended armature 84 of the solenoid 82. The armature 84 arrests the disc 52 in a position indicating one lap less than the number originally set.

When the swimmer reaches the remote station 12 (Figure 1) he touches the panel 46, turns, and pushes himself off, thereby actuating the switch 27. Closing of the switch 27 completes a circuit from the battery 91 through leads 92, 93, main switch 89, lead 94, further leads 112, 113, switch 27, lead 114 to the solenoid 82. This solenoid pulls up its armature 84, freeing the disc 52, which now advances a further step until the previously engaged pin 81 comes to rest against the extended armature 85 of the solenoid 83. Rota-

tion of the disc by this additional step brings the next number on the dial in line with the window 51. This number, in the specific example, is four and indicates the number of laps to be completed.

When the swimmer arrives at the panel 19 it causes the switch 20 to close thereby completing a circuit from the battery 91 through leads 92, 93, main switch 89, leads 94, 112, switch 20, leads 115, 109, contacts 110, 111, lead 112 to the solenoid 83. The solenoid 83 pulls up its armature 85 and causes the disc 52 to advance a further step.

In this manner, the disc 52 continues to advance as the swimmer completes his laps until a position is reached in which the signal "Finish" shown at 116 on the disc, appears at the window 51. In this position, the cam surface 89 of the disc engages the switch arm 110 and the connection 110 and 111 is broken while a new path is established from contact arm 110 through a make contact 117, a lead 118 to a solenoid 119. This solenoid controls the clock 101 and stops it when its armature 120 is pulled up against the action of the biasing spring 121. In doing so the armature 120 strikes an arm 159 of a time record printing assembly shown in Fig. 9.

It is now evident that the next current impulse will be directed to the clock stopping solenoid 119 instead of to the solenoid 83. When the swimmer touches the panel 19, actuating the switch 20, the solenoid 119 pulls up its armature 120 and stops the clock, by operating the printing mechanism shown, in part, in Fig. 9 which will presently be described.

A hammer 170 is mounted on a lever 150 having an angular end 151. The lever 150 is under tension of a spring 160 and is pivoted at 153. The other end 154 of the lever 150 is detained by a catch assembly 155. This catch assembly 155 consists of a catch 161 pivoted at 156 and is biased by a spring 157 towards a pin 164. The catch assembly includes the angular lever 150 extending into the pathway of the armature 120 of the solenoid 119. When the armature 120 strikes the arm 150 at 159, the end 154 of the lever 150 is released and a hammer 170 loaded by the spring 160 strikes the underside of the clock disc 158 and forces it towards a platen 162.

Record blanks 165 are fed from a magazine or roll 166 along the underside of the platen 162. The disc 158 of the time clock is arrested by the hammer 170 which causes an impression to be made on the blank 165 at the moment the swimmer operates the finish line switch 20. Thus a permanent record is made of the time elapsed between the start of the race and passage of the finish line. The printed record is then dispensed to the racer who for this purpose actuates a dispensing and resetting mechanism.

The issuance of the ticket is coupled in a suitable manner with a reset switch 122. This switch includes two make contacts 123 and 124. When the reset switch is closed, a circuit is formed from the battery 91, through lead 92, switch 122, contact 123, lead 125, lead 112 to the solenoid 83. The solenoid pulls up its armature 85 and permits the disc 52 to rotate to its initial position in which the indication reads "Insert coin."

Closing of the switch 122 completes a further circuit from the battery 91 through lead 92, contact 124, lead 126 to the solenoid 64. The solenoid 64 pulls up its armature 63 (see also Figure 4) and frees the coin slide 53 which returns to its projecting position.

The clock is preferably coupled with the issue mechanism for the time record, and assuming the clock being of the spring motor type, the clock is automatically rewound. Also the clock operated switches 96, 104 and 106 are closed for the new cycle of operations.

Means are provided for correcting erroneous settings of the laps setting disc 52. From the foregoing description it is seen that prior to closing of the starting switch 18 the disc 52 may be advanced to a higher setting, for example, it may be advanced from four to six laps by turning of the knob 79. It is therefore not difficult to correct too low a setting. Assuming, however, that the disc was set for six laps, whereas the race is to extend over four laps only, it is evidently not possible to turn the disc 52 back since the armatures 84 and 85 block it. Electrical means are provided for correcting oversetting. These means comprise a manually operable switch arm 127 normally maintained in a neutral and inactive position between make contacts 128 and 129 by a biasing spring 130. Closing of the switch 127, 128 completes the circuit from the battery 91 through leads 92, 93, main switch 89, leads 94, 108, switch 107, lead 106, switch 127, 128, leads 131, 125, 112 to solenoid 83. The solenoid 83 is thus energized and permits the respective disc stop 81 to move past its armature 85. If the switch 127 is moved in the opposite sense to close the switch 127, 129, the circuit extends through a lead 132, lead 114 to the solenoid 82. The solenoid 82 is energized and causes the disc 52 to turn under the action of its biasing spring 75. A pair of push buttons are shown in Fig. 10 for moving the switch arm 127 in one direction or the other.

The timing and ticket release mechanism proper is shown in Fig. 6.

An actuating lever 167 projects from the housing of the mechanism housing 163 and carries a knob 169. The lever 167 forms a part of a bell crank assembly 171 secured to a lever shaft 172. The bell crank assembly includes a further arm 173 to which a cord 174 is attached at 175. The cord 174 runs over a pulley 176 and is trained around a clock winding disc 177. The disc 177 is loosely mounted on a winding stem 178 which serves to rewind the clockwork and to reset the clock disc 158. The rewinding disc 177 is connected to the winding stem 178 by a spring 179 which takes up the slack of the cord 174 and also permits the disc 158 to turn when the arm 173 and cord 174 are in the position shown in Figure 6.

When the actuating lever 167 is pulled down the arm 173 moves in a counter-clockwise sense and the cord 174 is unreeled from the winding disc 177 until the spring 179 tightens whereafter the clockwork is rewound and the disc 158 is reset towards and beyond its zero position for a reason which will presently appear.

Actuation of the lever 167 causes a stub arm 180 on the lever shaft 172 to strike the angular end 151 of the lever 150 thereby tilting the lever 150 in a clockwise sense, tensioning the spring 160 and re-engaging the arm 154 (Fig. 9) with the catch assembly 155.

The clock carries a control arm 181 on its disc stem 182' which is normally engaged by the armature 99 of the starter solenoid 98. This control arm rests against the contact assembly and keeps 106, 107 and 96, 104 closed as long as the clock is at rest. When the clock is started the

arm 181 permits the contacts to open as was previously explained.

It was previously described that actuation of the solenoid 119 trips the catch assembly 155 causing the lever 154 to tilt counter-clockwisely (Fig. 9) under action of the spring 160.

Referring now to Figure 6 it will be seen that a rod 182 extends into the path of the lever 150. The rod 182 is pivoted at 183 and forms a part of a double armed lever whose other end 184 is adapted to engage the lower inclined end 185 of a release lever 186 pivoted at 187.

The release lever 186 is urged by a spring 188 against a stop pin 189. In the position in which the release lever rests against the stop pin 189, it engages a lock pin 190 on the arm 173 and prevents the operating arm 167 from moving. Rotation of the release lever 186 causes the lock pin 190 to be freed thus permitting a ticket to be issued and the apparatus to be reset.

Referring now to the ticket dispensing mechanism proper, it was previously described that actuation of the operating lever 167 causes the arm 173 to use. In doing so it strikes the horizontal arm 189' of a lever 190 pivoted at 191. The lever 190 swings about its pivot 191 in a clockwise sense and causes a second lever 192 also pivoted at 191 to move in the same direction through a coupling spring 193 connecting the two levers 190 and 192. The lever 192 actuates a blank transport of conventional construction which comprises a carriage 194 slidable on a guideway 195 through which the blanks are fed. The carriage is biased towards its end position by a biasing spring 196. The carriage 194 carries two upright pins 197 and 198 between which the end of the lever 192 moves.

The unmarked blanks are connected along interrupted cut lines 199 to permit convenient separation. Each blank has a hole 200 adapted to be engaged by a resilient feed finger 201 on the carriage 194. The finger 201 normally engages the hole in one of the blanks and upon actuation of the carriage 194 by the lever 192 pushes the strip of blanks towards the platen 162, the length of the stroke of the carriage 194 being equal to the length of one blank. When the actuating lever 167 is released the carriage 194 is pulled back to its end position by its spring 196. During this movement the feed finger 201 rises slightly and slides over the blank next to the one previously engaged until its end drops into the next hole. The carriage 194 then comes to rest against a stop 202 secured to the housing wall.

Operation of the hand lever 167 further causes actuation of the reset contacts 122, 123 and 124 by a cam element 152 on the shaft 172. This, as previously described, causes solenoid 83 to be energized releasing the disc 52 to the action of the spring 75 which turns the disc back towards its initial position (Fig. 4).

The start and finish responsive means shown in Figures 7 and 8 is particularly suited for use in swimming pools having end walls spaced apart by a standardized distance. The illustrated device comprises a base 133 having hook shaped members 134 to be placed over the edge of the pool. A platform 135 is resiliently supported on the base 133 by springs 136 in a similar manner as shown in the device of Figure 2. A rebound-responsive switch 18' has an actuating stem 137 bearing against one of the two rails 138 on which the platform proper 135 is longitudinally adjustable by a hand wheel. A marker 140 is fixed on one of the rails 138 and reads against a graduation on the platform 141 calibrated in terms of laps.

The passage and finish responsive element has the form of a liquid filled capsule or container 142 having an easily deflectable thin front wall. The container 142 is hooked over the edge of the overflow trough 143 of the pool at 144, and a liquid duct 145 extends to the switch 29' which is of the fluid-pressure-actuated type.

Turning, briefly, to Figure 8, the passage responsive element at the turn-around point is a similar deformable liquid filled capsule of container 146 hooked over the edge of the overflow trough 143 with hooks 147. A passage responsive switch 27' is actuated through a liquid duct 148. Inasmuch as the passage responsive capsules 142 and 146 have a certain thickness, which is of the order of one half inch, it is necessary to compensate for the corresponding reduction in the distance between the ends of the pool by a corresponding set back of the starting platform. This is easily accomplished by turning the hand wheel 139 causing the platform 135 to assume its proper position with respect to the edge of the pool, the front edge of the platform 135 being set back a distance which is equal to the total of the thicknesses of the capsules 142, 146 touched by the swimmer. Assuming, for example, that the race extends over six laps, it is evident that the platform must be set back three inches to compensate for the shortening of the race course by one half of an inch for each lap.

The invention thus provides a simple, reliable and compact timing mechanism which can be used by untrained persons without the assistance of a skilled operator. The mechanism by effective automatic blocking and checking means ingeniously prevents improper use, or double use or incorrect timing in the event of shortcuts taken by the racer. More particularly, the apparatus is blocked against reuse during the time a race is in progress. Also, no time record is obtainable if the proper check points are not passed and actuated by the racer.

The device can easily be installed at permanent or temporary race trails. It can readily be moved to new locations and is powered by dry cell batteries or an automobile storage battery.

Obviously numerous additions, omissions, substitutions or other changes can be made in the illustrated structure without departure from the spirit of the invention.

What is claimed is:

1. An automatic timing device for measuring the time elapsed between the passage of a starting line, traverse of a predetermined number of laps of a course, and passage of a finish line, the device comprising, in combination, two spaced timing stations, each station including a passage responsive means; a lap setting device including a settable member manually displaceable from a zero position by a displacement corresponding to the number of laps to be traversed; step-by-step means for restoring said member towards its zero position; means operable by both said passage responsive means, in alternating sequence, for actuating said step-by-step means upon actuation of said two passage responsive means; a clock startable by actuation of one of said passage responsive means; means operable by at least one of said passage responsive means for stopping said clock; and means for rendering effective and ineffective said stopping means when said settable member is in displaced position, and in zero position, respectively, whereby stopping of the

clock prior to completion of a predetermined number of laps is prevented.

2. An automatic timing device for measuring the time elapsed between the passage of a starting line, traverse of a predetermined number of laps of a course, and passage of a finish line, the device comprising, in combination, two spaced timing stations; each station including a passage responsive means, one station, in addition including a start responsive means; a lap setting device including a settable member manually displaceable from a zero position by a displacement corresponding to the number of laps to be traversed; step-by-step means for restoring said member towards its zero position; means operable by both said passage responsive means, in alternating sequence, for actuating said step-by-step means upon actuation of said two passage responsive means; a clock startable by actuation of said responsive means; means operable by at least one of said passage responsive means for stopping said clock; said means for rendering effective and ineffective said stopping means when said settable member is in displaced position, and in zero position, respectively, whereby stopping of the clock prior to completion of a predetermined number of laps is prevented.

3. An automatic timing device for measuring the time elapsed between the passage of a starting line, traverse of a predetermined number of laps of a course, and passage of a finish line, the device comprising, in combination, two spaced timing stations, each station including a passage responsive means; a lap setting device including a rotatable member manually displaceable from a zero position by a rotation corresponding to the number of laps to be traversed; means for biasing said rotatable member towards its zero position; means for releasably arresting said rotatable member in set position including two solenoids for arresting said rotatable member in predetermined positions of rotation, one of said solenoids being operable by the passage responsive means at one of said timing stations, and the other of said solenoids being operable by the passage responsive means at the other of said timing stations; a clock startable by actuation of one of said passage responsive means; means operable by at least one of said responsive means for stopping said clock; and means operable by said rotatable member for rendering ineffective said stopping means when said rotatable member is displaced from its zero position, whereby stopping of the clock prior to completion of a predetermined number of laps is prevented.

4. An automatic timing device for measuring the time elapsed between the passage of a starting line, traverse of a predetermined course including at least one part-way point, and passage of a finish line, the device comprising, in combination, a start responsive means at the starting line; a finish responsive means at the finish line; a passage responsive means at each part-way point; a rotatable member manually displaceable from a zero position by a rotation corresponding to the number of part-way points to be passed; means for biasing said rotatable member towards its zero position; means for releasably arresting said rotatable member in set position and in intermediate positions, one intermediate position being provided for each part-way point, said arresting means including two solenoids operable by said responsive means in alternating sequence; a clock startable by said responsive means; means operable by said finish responsive means for stopping said clock; and means operable by said rotatable member for rendering ineffective said stopping means when said rotatable member is displaced from its zero position, whereby stopping of the clock prior to completion of the predetermined course is prevented.

5. An automatic timing device for measuring the time elapsed between the passage of a starting line, traverse of a predetermined course including at least one part-way point, and passage of a finish line, the device comprising, in combination, a start responsive means at the starting line; a finish responsive means at the finish line; a passage responsive means at each part-way point; a rotatable member manually displaceable from a zero position by a rotation corresponding to the number of part-way points to be passed; step-by-step means for restoring said rotatable member towards its zero position; means operable by said responsive means, in alternating sequence, for actuating said step-by-step means; a clock startable by said start responsive means; means operable by said finish responsive means for stopping said clock; and means operable by said rotatable member for rendering ineffective said stopping means when said rotatable member is displaced from its zero position, whereby stopping of the clock prior to completion of the predetermined course is prevented.

6. An automatic timing device for measuring the time elapsed between passage of a starting line, traverse of a predetermined number of laps of a course, and passage of a finish line, the device comprising in combination, two spaced timing stations, each station including a passage responsive means, a counter of laps actuable by said passage responsive means; manually operable setting means for setting said counter for a predetermined number of laps; a clock; means actuable by one of said passage responsive means for starting said clock; means actuable by one of said passage responsive means for stopping said clock; and means operable by said counter and said setting means for rendering ineffective said stopping means except on coincidence of said counter with said setting means, whereby stopping of the clock prior to completion of a predetermined number of laps is prevented.

7. An automatic timing device for measuring the time elapsed between the passage of a starting line, traverse of a predetermined course including at least one part-way-point, and passage of a finish line, the device comprising, in combination, a start responsive means at the starting line a finish responsive means at the finish line, a passage responsive means at each part-way point; a coin operable element actuable by the racer for rendering the device operative, said coin operable element being movable from an inactive rest position into an active position; means for biasing said element towards its rest position; means for locking said element in its active position; a clock; an electric circuit connecting said responsive means and said clock, said clock being startable by said start responsive means; means associated with said clock and means actuable by said finish responsive means for providing an indication of lapsed time; a rotatable member displaceable from a zero position by a rotation corresponding to the number of part-way points to be passed; means for biasing said rotatable member towards its zero position; means for release-

ably arresting said rotatable member in set position and in intermediate positions, one intermediate position being provided for each part-way point, said arresting means including two solenoids operable by said responsive means in alternating sequence; means operable by said rotatable member for rendering ineffective said lapsed time indicating means when said rotatable member is displaced from its zero position; and means for unlocking said coin operable element, said unlocking means being actuable after actuation of said finish responsive means.

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