

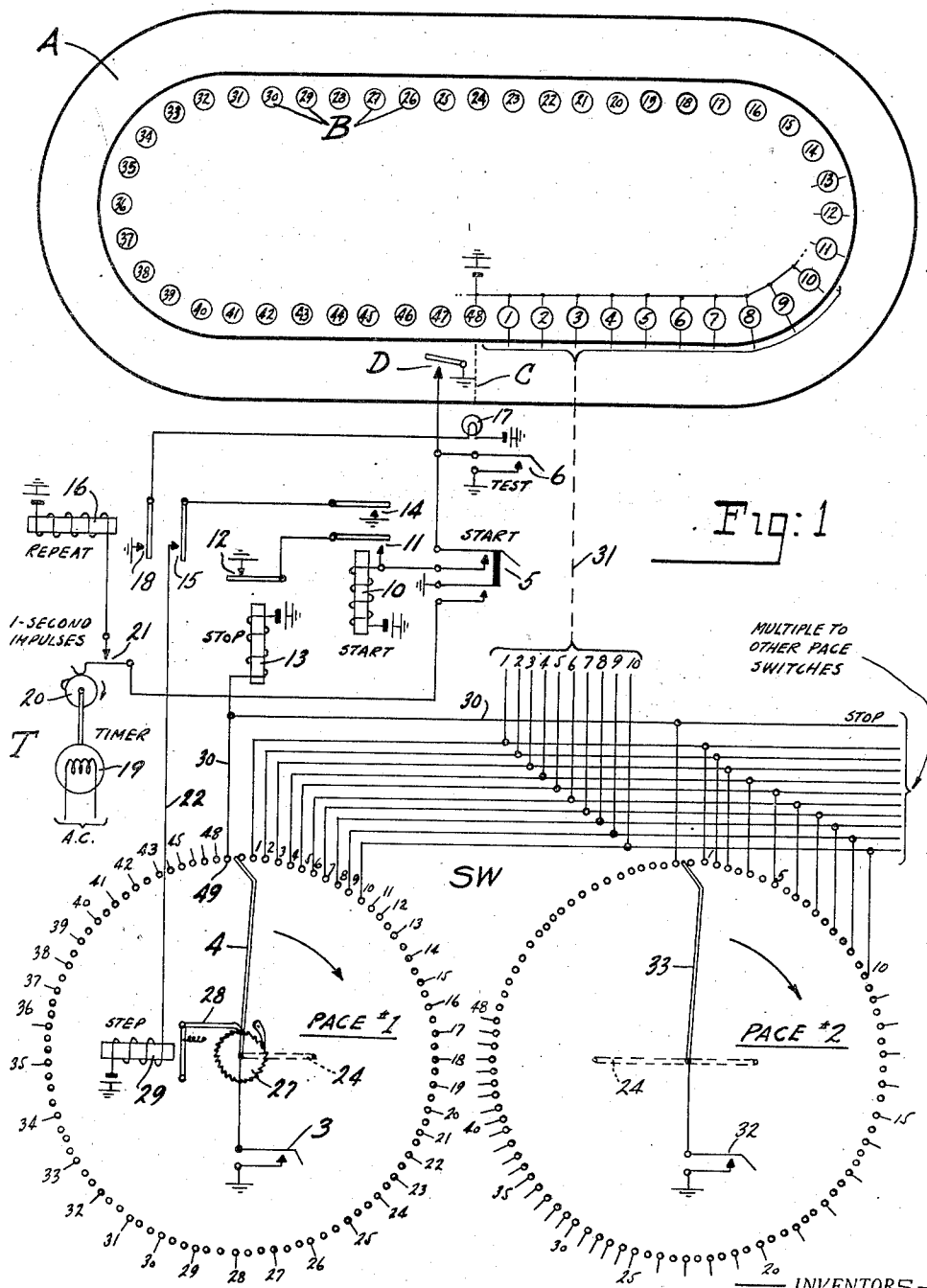
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AUTOMATIC PACING SYSTEM

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AUTOMATIC PACING SYSTEM

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This invention relates in general to automatic pacing systems and more particularly to a pacing system for training racers to progress over a given race course at a predetermined pace.

An object of the invention is to provide an automatic pacing mechanism for enabling racers to gain proficiency in running races by simulating the pace of a recognized good racer or any other predetermined pace desired.

A further object of the invention is to design an automatic pacing system and apparatus in which a series of wayside signals arranged along a race track are progressively operated at a predetermined rate or pace, so that a runner in maintaining pace with the signals will accustom himself to that particular pace and thereby become proficient in attaining his best elapsed time for the course run.

Another object is to design an automatic pacing mechanism in which any particular predetermined pace desired may be selected by a runner and the pacing mechanism operated to produce the desired pace.

It is a further object to design an automatic pacing system in which the selected pace is automatically started by the runner and is stopped when the predetermined pace selected has terminated.

An additional object is to design a pacing system for a race track in which a runner traverses a track several times in the course of a race and in which the wayside pacing signals are operated each time at a different rate.

A further object is to provide a pacing system in which a runner traverses a track several times to complete a race and the runner's total elapsed time is automatically recorded independent of the pace at which the wayside signals are operated.

Another object of the invention is to provide an automatic pacing system in which any single predetermined pace may have several different elapsed times for that particular pace selectable by a runner. In this manner the pace of a champion runner may be selected by a novice runner and he will train initially at that pace but at a slower elapsed time and then gradually reduce the elapsed time as the runner improves his speed.

Another object is to design an automatic pacing apparatus which is portable and arranged so the principal operating mechanism may be moved to different tracks.

While the invention as disclosed herein is particularly applicable to the pacing of foot races, horse races, bicycle races, swimming races or other races customarily conducted over a track or

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course especially designed for that purpose, it will be obvious to persons skilled in the art that it is equally applicable to many other types of races or speed events, and that many phases of the invention are applicable for still other purposes not specifically mentioned.

Other objects, novel features, and advantages of this invention will be apparent from the following description and the accompanying drawings which illustrate a preferred and modified embodiment of the invention. In the drawings;

Fig. 1 is a diagrammatic illustration of a race track and circuit arrangement therefore including a step-by-step pacing switch mechanism;

Fig. 2 is a diagrammatic illustration and circuit arrangement of a form of the invention designed for a one-quarter mile track applicable to foot races;

Fig. 3 shows a section of a race track and associated apparatus in perspective for pacing foot racers;

Fig. 4 is a perspective view of the portable operating apparatus for pacing runners;

Fig. 5 illustrates a starting block and switch in side elevation;

Fig. 6 is a cross-sectional view of a wayside signal; while

Fig. 7 is a cross-sectional view of the resetting knob for the mechanism of Fig. 4.

In order for distance runners to gain proficiency in foot races it is necessary that they train constantly and diligently to perfect themselves, and one of their objects is to run the race course at a predetermined pace or a speed pattern depending upon their physical characteristics or their choice of pace which they believe will enable them to attain their best elapsed time for the race. Some runners will train at a rate of speed or pace which is greater at the beginning of the race and then gradually taper off till near the end where a final burst of speed is thought necessary. Other runners train at a still different pace varying in rate of speed at different portions of the race course.

When a runner has selected a pace best suited for him he practices that particular pace, but not so initially at his best speed. After he has established his pattern which may be at a slow elapsed time, he gradually increases his speed for that identical pace or pattern until he has attained his best time for the selected pace.

Other runners may elect to train themselves at a running pace in accordance with the pace established or characteristic of some well-known champion foot runner, and while the pace or pat-

tern selected may not be for the same elapsed time of the champion racer, it will gradually be increased as the practicing runner trains himself in that pace and acquires skill and speed.

The foregoing applies particularly to horse races where it is necessary to train young horses to run at a predetermined pace either patterned after a champion race horse or a pace selected by a trainer which he believes is best suited for that horse. At the present time practice races for horses are conducted by the rider or a trainer, and the speed of the horse clocked at intervals around the track as he progresses. A particular pace cannot therefore be predetermined with any degree of accuracy since the human element for predetermining the pace is involved.

The present invention enables a runner to select any desired pace or pattern he wishes to train himself by and the automatic pacing mechanism is arranged to actuate a series of signals progressively around the track with which the runner maintains pace. The mechanism is started automatically by the runner himself as he starts down the track and is terminated automatically by the mechanism according to the elapsed time of the pace selected.

Simultaneously the runner as he starts his run initiates the operation of a timing device arranged to record the runner's actual elapsed time for the full course, independent of the actual time required for the mechanism to operate the wayside signals in accordance with the pace selected. The elapsed time record enables the runner to compare his actual running time for the full course with the elapsed time of the pace he selected and operated the wayside signals with.

Referring now to Fig. 1 of the drawings, which illustrates diagrammatically the invention in one of its generic forms; an oval race track "A" is shown having a series of wayside signals "B" preferably arranged around the inside or post side of the track at short intervals where they are visible to a runner traversing the track. The wayside signals "B" may be in the form of lamps or any other signal, and be embedded in the ground or arranged on elevated posts. The starting line is indicated at "C" and a starting block actuated by the runner when he starts his race is shown at "D." To actuate the signals "B" in the desired manner a step-by-step automatic switch SW is provided having a stepping magnet for rotating a series of wipers over associated sets of bank contacts. This form of stepping switch is well known in the automatic telephone and signalling arts and need not be illustrated or further described in detail. Each wiper and associated set of bank contacts represents a certain pace or pattern; pace #1 and pace #2 are shown in detail although there may be many more additional and different paces or banks all mounted together and the wipers all rotatable on a single shaft. Certain selected contacts of each pace switch bank are multiplied to the other pace switch banks and all in turn are connected to the wayside signals "B" as shown. For brevity the relays and electrical connections are shown diagrammatically with separate ground and battery connections but it will be understood that the source of electrical power may be a common battery or rectifier.

In the operation of the system of Fig. 1, assuming the runner is either a foot racer, swimmer, horse racer, etc., the desired pace is selected for example, by first operating locking key 3 of pace

#1 of the stepping switch SW. This prepares a circuit from the ground side of battery through key 3, the wiper 4 and to the bank contact upon which it is normally resting but which is also dead. The runner now poises himself before the starting line "C" and lightly engages his hands with the starting block "D" in the customary manner of runners. A tape or other starting means may be substituted for the starting block "D." An attendant then operates the locking start key 5 thereby preparing at the upper contacts of the key, a circuit for start relay 10, and at the lower contacts a circuit for repeat relay 16. The test key 6 is provided and connected in parallel with the starting block "D" to enable an attendant to check the operation of the system and the signals if desired when no runner is practicing.

The timer "T" operated continuously by the synchronous motor 19 drives a cam 20 to close cam contacts 21 at one second intervals. This causes repeat relay 16 to be energized every second when start key 5 is closed. As a result starting lamp 17 is intermittently operated over a circuit from ground through contacts 13 and through lamp 17 to battery. The runner watches the flashing of lamp 17 and dashes off at any time when the lamp just flashes on. In his starting lunge he firmly and momentarily presses down starting block "D," thereby closing a circuit extending from ground through the starting block contacts, upper contacts of key 5, winding of start relay 10 to battery. Start relay 10 upon energizing closes a locking circuit for itself through its locking contacts 11 to ground at contacts 12 of relay 13. At contacts 14 relay 10 closes a circuit from ground through contacts 13, (closed and opened every second) of stop relay 16, wire 22, and through the winding of the stepping magnet 29 to battery. Stepping magnet 29 energizes and deenergizes each time contacts 15 open and close, and upon each deenergization steps the wiper 4 upon the next bank contact by means of the ratchet 27 and armature pawl 28. All other wipers such as 33 are also rotated since they are mounted on the common shaft 24. However, these are not effective to actuate the signals since the associated pace keys such as pace key 32 have not been operated.

The stepping of wiper 4 upon the first bank contact establishes an energizing circuit for the first or number one wayside signal B on the race track A as follows: ground through the contacts of key 3 of pace #1 switch, wiper 4, first bank contact and the wire connected thereto, the cable 31 indicated in dotted lines, the wire connected to lamp 1 and through the lamp to battery, lighting the lamp No. 1. If the runner is directly opposite the lamp No. 1 when it lights he will know that he is maintaining the correct pace.

It will be noted that the first 12 contacts of pace #1 switch are all connected to wires leading to the lamps Nos. 1 to 12 and are also one second apart from each other as the wiper 4 steps across them. Since the lamps B are all spaced around the track A the same distance apart it is apparent that the initial pace of the runner as he follows the lamps is fairly fast. Bank contact 13 however is two steps or seconds apart from contact 12 and the pace therefore slows up somewhat for the runner. Lamps 13 to 24 are operated at this same slower (2 second) pace until lamp 24 is reached by wiper 4. The time between contacts 24 and 25 is now slowed down to 3 seconds until contact 33 is reached when it is changed to 4

seconds. The lamps associated with contacts 33 to 35 are now all operated at the same rate or pace and the runner also attempts to maintain his speed and pace accordingly. After bank contact 35 is reached by wiper 4 the pace is again speeded up slightly to 3 seconds until contact 37 is encountered, whereupon it is 2 seconds and finally after bank contact 43 is engaged by wiper 4 the pace is 1 second to the end of the race indicated by lamp 48. This last portion of the pace indicates the final burst of speed prior to the end of the race by the runner.

It will be apparent that the wires leading to the lamps 1 to 48 inclusive, over the cable 31 are not all connected sequentially to consecutive ones of the bank contacts, but some are to alternate ones or alternate groups of contacts and the variation of the pace is produced by the number of "dead" contacts between any sets of the "live" contacts.

After the wiper has stepped from bank contact 48 (lighting lamp 48) it engages bank contact 49 to which stop wire 30 is connected. This establishes a circuit from the ground at pace key contacts 3, wiper 4, bank contact 49, wire 30, winding of stop relay 13 to battery. Stop relay 13 upon energizing opens its grounded contacts 12 thereby opening the locking circuit through contacts 11 for stop relay 10 which immediately deenergizes and opens its grounded contacts 14. This opens the pulsing circuit through contacts 15 of the stepping magnet 29 stopping further operation of the switch SW and bringing the wiper 4 off of bank contact 49 to rest on the dead contact ahead of contact 1. The stop relay 13 deenergizes when wiper 4 steps off of bank contact 49 and at contacts 12 again prepares the locking circuit for starting relay 10 which is now deenergized.

The attendant noting that lamp 17 continues to flash after the runner has completed his race is thereby made aware that the locking start key 5 must be restored. Pace key 3 is also restored to normal and when this is done all of the apparatus is again in normal starting position.

If the runner desires to select a different pace he operates the switch key 32 of pace #2 switch, thereby rendering wiper 33 effective to wipe over its associated bank contacts and light the track lamps 1 to 48 inclusive, but at a pace or elapsed time which may be totally different, or which may be only slightly different from pace #1 switch, as is indicated by the wires connected to bank contacts of pace #2 switch. Since the wiper 33 is connected to the same rotary shaft 24 that wiper 4 is, the stepping magnet 29 will rotate wiper 33 at the same rate or one step per second. Any additional number of sets of pace switches may be stacked together on the shaft 24 with the bank contacts multiplied together and connected to the track lamps, but only the one switch associated with the pace key selected will be effective. It is presumed in the illustration of Fig. 1 that the runner traverses the track A only once for each practice run, that is, he does not lap the track several times for one particular race.

Referring now particularly to the embodiment of the invention illustrated in Fig. 2 this arrangement presupposes a race track H arranged especially for foot runners in the manner of a great majority of the tracks located at universities, schools, etc. and is one-quarter mile or 440 yards in length. For races one mile in length for example, the track must be traversed or lapped by a runner four complete times. In such an arrangement the wayside signals L in the form of lamps 1 to 44 inclusive are preferably arranged

ten yards apart and this distance it has been determined, is approximately that which will be suitable for any desired pace that may be selected and still be within the speed or ability adaptable for a novice runner. The starting line E is usually located in the approximate center of the track stretch as shown and according to the present invention is provided with a starting block S. Also located at the starting line are a photo-electric eye R and associated target lamp P, arranged to provide recorded elapsed time of a runner per se regardless of the elapsed time of the pace making mechanism. The time recording arrangement makes provisions for recording the time of a full mile run and disregards the passage of the runner across the finish line the first three laps of his mile run. This is an important feature of the invention.

The switch bank of pace #3 switch is one of a group of other similar rotary switch banks (not shown) each arranged to provide a different pace or rate of speed to the track signals L the wipers of which are all driven by a synchronous A. C. motor indicated diagrammatically at M. The preferred rate of travel of the wipers over their associated bank contacts by the motor M has been determined as being about 6 R. P. M. since it is assumed that the time for the "perfect" mile run by a foot runner is approximately 4 minutes, the goal sought by all the best mile runners. This rotation of 6 R. P. M. has no relation to a perfect 4 minute mile. Instead it is used here to cover the maximum lapsed time needed for the average novice as he starts to train himself for the mile race.

For the sake of clarity in understanding the invention the bank contacts of this pace switch No. 3 have been arranged in four separate groups as shown corresponding to the four laps of the track H, but it will be understood that all four rows of bank contacts are actually arranged in a continuous circular bank end to end with the wiper 39 connected by the driving shaft to motor M and adapted to rotate across all four sets of bank contacts. A theoretical 4 minute mile pace will now be described and in this arrangement the first row of bank contacts shown represents the first quarter mile or the first lap of the track, and involves an elapsed time of 55 seconds. The second quarter mile or second lap has an elapsed time of 60 seconds; the third quarter or lap a time of 69 seconds, and the final or fourth quarter 56 seconds; the total time being four minutes. Each row of bank contacts (track lap) is connected in multiple by 44 wires with the other three rows of bank contacts, as indicated by the cable W and the cable in turn leads to many other switches similar to the pace #3 but arranged to provide different elapsed time for the same pace #3 or different selectable paces. The cable W is also connected to the track lamps Nos. 1 to 44 inclusive, for operating the same. It will be noted that the 44 bank contacts in each quarter mile row are spaced apart various distances from each other, that those in the first group of contacts in the first quarter mile are spaced progressively further apart from each other, indicating the initial starting burst of speed of a runner and a gradually settling down of a speed or pace for the first lap to conserve the energies of the runner. The lapsed time for the first quarter mile in this example is 55 seconds. In the second quarter the contacts are spaced slightly further apart (60 seconds for this lap), and the third quarter (69 seconds) the spacing of the contacts

indicates a further slacking in the speed or pace. The last portion of the fourth quarter shows an increase of speed indicating a renewed final effort by the runner with his husbanded reserve energies and making the last lap in 56 seconds. The unequal spacing of the contacts in the switch bank to provide the desired pace is readily determined by clocking a skilled runner on a track and plotting his pace or a closely similar one on a chart indicating his time against the distance traversed. In assembling the switch bank contacts the sets of contacts may be first arranged in a template or holder and then clamped together rigidly in any well known manner.

It will be understood that according to the invention a number of sets of bank contacts or pace switches may each represent one and the same particular pace but each will represent a different elapsed time of that same pace. With such an arrangement the novice runner having once determined and selected the pace he wants to train himself by, can select any one of several different elapsed times for that same pace. He will first select one of the slower elapsed times and gradually select and train himself to faster elapsed times as his ability improves. In this manner a number of different selectable paces may each have different selectable elapsed times. Accordingly a runner must first decide what particular pace he is to train himself by and then select a particular elapsed time for that same pace.

In describing the operation of the system shown in Fig. 2 it is assumed that the runner has selected the pace #3 from a group of other paces as the pace or "pattern" which he desires to simulate or practice with in an attempt to run a 4 minute mile. The runner or his attendant first operates the corresponding switch key 38 which locks and connects ground through its contacts directly to wiper 39 thereby rendering the wiper "alive" and effective to operate the lamps 1 to 44 inclusive as shown over cable W as the wiper steps from contact to contact. It is desirable for the end of wiper 39 to be broadened enough to engage the next contact before leaving the last one so that the runner will observe more readily the progress of the pace which he is attempting to simulate.

The runner poises himself at the starting line E with his hand lightly in engagement with starting block S. The start key 40 is then operated by an attendant preparing the circuit for start relay 41.

This start key 40 is for the purpose of preventing the runner from making a false start before he is ready and in the event he accidentally presses down upon the starting block S. A test key 42 serves the dual purpose of providing a means for testing the system independent of any action by the runner, and to enable a starter or attendant to initiate the start of a race as by means of a starting gun. In the latter case one or more runners could be poised at the starting line and sent off by the starter operating the key 42 and firing his starting gun. No starting block S and associated switch would be used in this case since the key 42 serves the same purpose and is connected to starting relay 41 in the same manner. Under the above conditions it will be observed that either the runner or the starter can initiate the operation of the pacing system. The use of the combination test and starting key 42 is also applicable for the pacing of race horses,

swimmers, etc., where it would not be practical to use a starting block such as S.

The runner in taking off touches the starting block S momentarily and closes a circuit from ground through the starting switch S, start key 40, winding of relay 41 to battery, energizing the same and locking it up through its locking contacts 43 to the closed contacts 44 and ground on stop relay 45. At contacts 46 relay 41 closes the energizing circuit for the switch motor M from the source of alternating current supply passing over wires 47 and the winding of the motor. This motor through its shaft drives the wiper 39 and all other wipers on this same shaft across their associated bank contacts; for example, the one shown in the pace #3 switch. The speed at which the motor M rotates has been chosen as 6 R. P. M. in order to include as slow a speed as is desired by a runner to traverse track H, it being presumed that no pace would be desired that would require a time of more than 6 minutes to complete a one-mile stretch of the track. The motor M is preferably of the synchronous type operating at constant speed and through a gear train gives the required speed of rotation to the wipers.

As a further result of the energizing of start relay 41 it closes ground on its contacts 50, through the normally closed contacts 51 of relay 52, and through the time recording mechanism F to battery, thereby in any well known manner operating the recorder and establishing a permanent time record, either tape or clock, of the time actually taken by the runner to traverse the mile track. This is independent of the elapsed time of the pace established by the pace switch. The time recorder F may be of any known construction and is started in operation to measure the time simply by closing of contacts 50. The photo start relay 53 is not energized at this time but its purpose is to energize the photo electric cell R through its contacts 54 when it is energized. The photo electric cell R is rendered operative through the photo electric relay 55 which includes amplifiers and other well known elements associated with the operation of photo electric cells. The photo stop relay 56 is included in the circuit of the photo electric relay 55 and is energized only when the photo electric cell R has its beam broken which beam is projected across the start and finish line E from the source of light P.

The circuits remain in the foregoing condition, with start relay 41 locked energized, the time recorder F measuring the time, and the motor M rotating all of the wipers, including wiper 39, at the fixed constant speed of 6 R. P. M. across the bank contacts. Wiper 39 rotating across its bank contacts for the first quarter section of the bank, or as shown diagrammatically, the first quarter mile, will energize the wayside lamps or signals L1 to 44 successively in a varying predetermined manner or rate depending upon the spacing of the bank contacts to which the lamp wires extending over the cable W are connected. In the hypothetical 4-minute mile, the first quarter mile, is presumed to be traversed in 55 seconds and the runner follows the blinking or flashing of the lamps around the track at the fixed pace or pattern at which the signals are flashing on and off. He attempts to always be in a position opposite or slightly beyond a wayside signal just at the moment it flashes on. In other words he "chases" the signals around the track.

After the finish line E is reached and the track lapped by the runner, the No. 1 lamp is energized

for the second quarter mile operation of the track pace this time, however, with the wiper 39 positioned on the first one of the second row of bank contacts shown on the drawings. With the spacing now shown between the bank contacts the wiper 39 will require 60 seconds to complete its movement across this second set of bank contacts and the runner will follow the lamps but at a slower pace than the first quarter mile. The third time around the track the No. 1 lamp will be again energized, but from the third section of the bank contacts to simulate the pace of the 3rd quarter mile, this, as shown on the drawings will require a time interval of 69 seconds, further slowing the pace or pattern that the runner is to follow. The fourth time around the track or the final quarter of the mile run, the fourth section of the bank contacts shown in the drawings is effective and the wiper traverses these bank contacts at the same speed as the previous three quarter mile sections. In this last quarter mile, however, as the finish line is approached by the runner his pace quickens since he is pressing himself as the finish line gets closer.

Toward the latter part of the 4th quarter mile section or at about the time the runner is passing opposite lamp 40, for example, the wiper 39 reaches bank contact 61, to which lamp 40 is connected. Another branch of this circuit extends over photo lead 62 and a circuit is established from ground through the pace key 38, wiper 39 now resting on bank contact 40, lead 62, through the winding of photo start relay 53 and battery. Relay 53 upon energizing closes a locking circuit for itself through its contacts 59 to ground at contacts 60 of stop relay 45. As a further result of the photo start relay 53 energizing it closes its contacts 54 thereby closing the energizing circuit for the photo electric cell R from photo electric relay mechanism 55. This photo electric cell R, it will be observed, is not activated the first three times the runner passes over the finish line E but is only energized to check the runner at about the time he is opposite wayside signal 40. The photo electric relay 55 will, however, have its amplifier always energized to function and light P for the photo electric cell R is also illuminated at all times.

As the runner now crosses the finish line for the final time he breaks the light beam for the photo electric cell R causing the latter to momentarily deenergize which in turn causes the photoelectric relay 55 to function in a manner to momentarily deenergize the photo stop relay 56. At its contacts 57 relay 56 momentarily closes a circuit through the winding of time cut-off relay 52 to battery. Relay 52 closes a locking circuit for itself at its contact 58 independent of contacts 57 which are immediately opened by the operation of relay 56 after the runner has passed the photo electric cell beam. At contacts 51 relay 52 disconnects the time recorder F from its running circuit at contacts 50 and the time recorder F stops its operation thereby making a record, either printed or with other suitable means, of the total lapsed time that the runner has taken to traverse the track H four complete times, or one full mile. This time recording means is entirely separate and independent of any time interval required for the pace switch No. 3 to successively energize the wayside signals L, there being no relationship between the stepping of the wiper across the contacts and the timing required by the runner. This is a desirable feature since the runner will want to know how long it has taken him to run the mile as

he may or may not be able to maintain the exact pace which has been patterned for him by the pace switch No. 3, or any other pace selected.

After the wiper 39 has encountered the last bank contact 63 which is connected to lamp 44, the wayside signals are not again operated and the next bank contact 64 following bank contact 63 is engaged by the wiper 39. This closes a circuit from ground through the pace key 38, wiper 39, bank contact 64, stop wire 65 through the winding of stop relay 45 to battery. Stop relay 45 at its contacts 60 disconnects ground from the locking contacts 59 of the photo start relay 53 thereby causing deenergization of relay 53 which in turn opens its locking contacts 59 and at contacts 54 opens the energizing circuit of the photo electric cell R.

As a further result of the energization of relay 45 it disconnects ground at its contacts 44 through locking contacts 43 of relay 41, thereby causing the deenergization of start relay 41 which opens its locking contacts 43 and at contacts 50 disconnects the ground extending through the locking contacts 58 of the time cut-off relay 52 which likewise is deenergized. At contacts 58 relay 52 opens its locking circuit and again prepares the circuit for the time recorder F at its contacts 51. Returning again to relay 41, when it deenergized it also opened its contacts 46 thereby disconnecting the current source over wires 47 for the switch motor M causing the same to deaccelerate. However, due to the momentum caused by the operation of the gearing connecting the motor with the wiper shaft and the momentum acquired by the wipers, these wipers may continue to rotate across the extra set of bank contacts 66 which are provided in the switch and the wipers may stop on any one of them. The last bank contact 67 of this group, is the contact in the circular bank which is immediately preceding the No. 1 bank contact adjacent to which the wiper 39 is normally positioned in the first quarter section of the bank. This bank contact 67 is connected by a wire with the bank contact 63, which is in turn connected to the last lamp 44 located at the starting line E. The purpose of this is to reset the wipers manually to their proper position ahead of bank contact No. 1 after each race, as will be hereinafter pointed out more specifically. After this is accomplished the mechanism is in position to be again operated.

Referring now more specifically to the drawings in Fig. 3, this shows a section of the track and mechanism adaptable for controlling the circuit arrangement shown in Fig. 2. A runner is shown positioned at the starting line E in preparation for beginning his pace with his hand lightly resting on the starting block S. This starting block S, as shown in Fig. 5, may comprise two flat blades 70 and 71 lying in the track and pivoted at one end at 72, but normally held apart by the spring 73. A set of contacts 74 suitably insulated are arranged opposite each other in the blades 70 and 71 and are adapted to be contacted against the pressure of spring 73 by the runner in taking off. The photo electric cell R is usually encased in a box at about the height of the waist of the runner so that he can break the beam projected across the track from the light source P. The wayside signals L may be arranged as shown in Fig. 6 and are preferably embedded at an inclined angle at the side of the track but in position to be best viewed by a runner following the flashing signals around the track and without any particular eye strain

or without any inconvenience or interference with his running form. The signals may be suitably arranged in a waterproof container 75 provided with a bull's-eye type glass top 76 which may be suitably inscribed with the number of the signal if desired. Under certain conditions numbers on the signals may be entirely dispensed with. Within the enclosure 75 there is mounted a signal 77 in the form of a lamp which is connected in circuit by means of the cable W extending through suitable conduit connections between all the wayside signals L as shown, and embedded in the track side.

In Fig. 4 there is illustrated diagrammatically the operating mechanism arranged in a rectangular container 80 provided with suitable handles to render the same portable so that it may be carried to different tracks where needed. On the cover of the portable box 80 there is arranged the time recorder F, the test key 42, start key 40, and a series of pace keys such as 39, of any number desired. In the illustration, Fig. 4, six of the pace switches are shown. These may be each for a different pace or different elapsed times for any one pace. The interior of the box, as shown in dotted lines, contains the motor M for driving the switch wipers all of which are arranged on a common shaft 81 suitably geared to the motor M. The pace switch No. 3, for example, is shown with its wiper 39 adapted to rotate under the action of the motor M across its associated bank contacts. The bank contacts are suitably supported as by the common supporting bracket 82 in the bottom of the box 80. One end of the wiper shaft 81 is supported by the bracket 83 and an extension on the wiper shaft 81 passes through to the outside of the box where a manual rotatable knob 84 is attached. As shown in cross-section in Fig. 7, the knob 84 is provided with a slotted sleeve member 85 which is adopted to engage a slot in the end of shaft 81 whenever the knob 84 is pressed inward against the spring 86. Rotating the knob 84 thereby rotates the entire shaft 81 including all of the wipers mounted on it. The purpose of this knob 84 is to position the wipers after the mechanism has operated a particular pace so that when wiper 39, for example, is rotated to bank contact 67 a circuit is established from ground through pace key 38, wiper 39, bank contact 67, the wire connected to bank contact 73, to the lamp 44, thereby indicating to the attendant by the lighting of this lamp that wiper 39 should be set forward one more step and in position ready to start the operation of another pace. An indicator 87 on knob 84 shows the proper position for the wipers to be rotated to.

Because the driving shaft 81 is geared to the motor M it is not feasible to rotate the shaft manually with the knob 84 against the gearing. A ratchet clutch arrangement consisting of two discs 88 is therefore provided between the motor gearing and the shaft 81. The teeth of the ratchet are so arranged that when the knob 84 is rotated the teeth on one disc 88 disengage from the other disc, while when the motor rotates the shaft 81 the teeth of each disc firmly engage each other. While the mechanism within portable box 80 is shown more or less diagrammatic it is understood that this type of equipment is well known in the art and it therefore need not further be described.

As has been pointed out, the cable W extends in multiple to all of the pace switches and it also passes out from the side of the box 80 and

is connected to one side of a multiple female jack 90, as shown. The individual wires from the cable W are connected to individual jack blades 91 which extend through the jack block 90. This jack block 90 is adapted to be forced in arrangement with a male jack 92, the individual blades 93 of which connect to the cable W extending to all the wayside signals L.

It is preferable that the male jack 92 be permanently located within the box or casing 94 which is sunk in the ground alongside the starting position of the track H and provided with a cover 95 to protect it from the weather. All other electrical connections from the track extend into this sunken box 94 which is also of sufficient capacity so that the pacing equipment contained within box 80 of Fig. 4 may be placed in position within the box when the equipment is used with this track. When this is done the female jack 90 is merely forced in position on male jack 92 so that the individual blades 91 and 93 are firmly contacted, thereby establishing the electrical connections between the portable box 80 and the wayside signals and associated equipment. The box 80 of Fig. 4 may also be of sufficient size to carry an alternating current rectifier or battery to supply direct current to the signals and relay equipment while the source of A. C. supply may be connected to the box to furnish operating current for the motor M and the rectifier.

While only a preferred and modified embodiment of the invention has been shown and described it will be readily apparent that many other similar arrangements may be made by those skilled in the art without departing from the spirit of the invention and it is therefore desired that the invention be not limited by the exact disclosure but only to the extent of the appended claims.

What we claim is:

1. In an automatic pacing system for pacing racers or the like on a race course, signals spaced along said race course, means for operating said signals in successive order, and at a rate that is variable at different portions of said race course, means at the starting line for initiating the operation of said signals when the racer starts the race, and means for stopping the operation of said signals after the last signal is operated independent of the position of racer on the race course.

2. In an automatic pacing system for pacing racers or the like on race courses, a plurality of wayside signals arranged in progressive order along the race course from the starting line, a progressively operated switch connected to said wayside signals and effective to operate said wayside signals in accordance with a predetermined pace for the racers to run, and means actuated by the racers at the controlling line for starting the operation of said switch.

3. In an automatic pacing system for pacing racers on race courses, a plurality of wayside signals arranged at spaced intervals along the course from the starting line, a switch connected to said wayside signals, means in said switch for operating said wayside signals in a predetermined progressive manner to simulate a particular running pace, means operated by a racer at the starting line for starting the operation of said switch, and means for stopping the operation of said switch after said wayside signals have all been actuated.

4. In an automatic pacing system for pacing runners or the like on race courses, a plurality

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of wayside signals arranged at equal spaced intervals along the course, a switch having a set of bank contacts and a wiper adapted to pass across said bank contacts at a constant uniform speed of rotation, certain of said bank contacts being connected to said wayside signals to provide a progressive operation of said wayside signals in accordance with a predetermined pace that a runner is to traverse said course, and means controlled by the runner for initiating the operation of said switch.

5. In an automatic pacing system for race courses, a plurality of wayside signals arranged along said race course at intervals, a switch having a plurality of sets of bank contacts, each set being connected to said wayside signals in a different manner, means for preselecting any of one of said sets of bank contacts to render it effective to actuate said wayside signals in accordance with a predetermined pace for a runner, and means controlled by a runner at the starting line for starting the operation of said switch.

6. In an automatic pacing system for race courses, a plurality of wayside signals arranged in progressive order along said race course in a position to be viewed by a runner or the like as he traverses the race course, a starting line having a starting switch thereat actuated by a runner as he starts a race, a rotary switch connected to said wayside signals for operating said signals in a predetermined rate of progression, a starting key for said rotary switch, and means for operating said rotary switch only when said starting key is operated and the runner actuates the starting switch.

7. In an automatic pacing system for a race course, said race course adapted to be traversed a plurality of laps by a racer to complete a race, a plurality of wayside signals arranged around said race course, means for operating said wayside signals in progressive order in accordance with a predetermined pace the racer is to simulate, means for operating said wayside signals at a different progressive rate for each lap the racer traverses the race course, and selective means for operating said wayside signals in accordance with any one of a plurality of different paces.

8. In an automatic pacing system for race

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courses, said race course adapted to be traversed several laps by a racer to complete a race, a plurality of wayside signals arranged around said race course, means for operating said wayside signals in progressive order for each lap of the race and in accordance with a particular pace the racer is to simulate, elapsed time recording means, means controlled by the racer for simultaneously starting the operation of the wayside signal operating means and said recording means when the racer starts the race, means for stopping the operation of said wayside signals when the racer's pace is terminated independent of the position of the racer on the race course, and means controlled by the racer only after he has traversed the last lap for stopping said recording means and recording the total elapsed time of the racer on the race course.

9. In an elapsed time recording system for race courses in which the race course is traversed by a racer a plurality of laps to complete a race, means for automatically recording the total elapsed time of the racer over the race course for all of the laps traversed, means controlled by the racer for starting the operation of said recording means when the racer starts the race at the beginning of the first lap, means controlled by the racer for stopping the operation of the recording means when the race is terminated at the end of the last lap, and means for preventing control of said recording means by the racer at any intermediate lap.

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