

April 29, 1941.

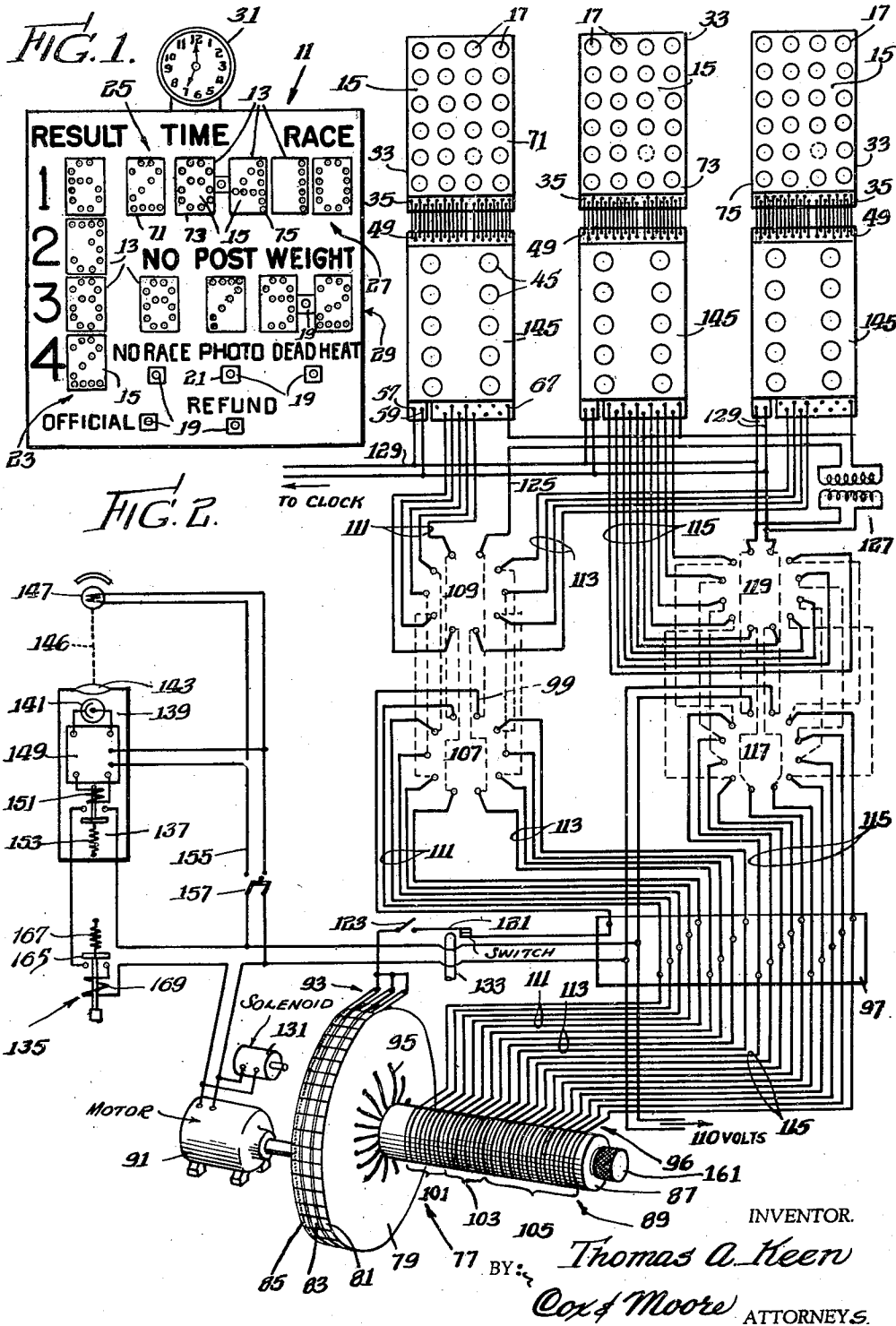
T. A. KEEN

2,239,894

DISPLAY DEVICE

Filed May 3, 1939

4 Sheets-Sheet 1



April 29, 1941.

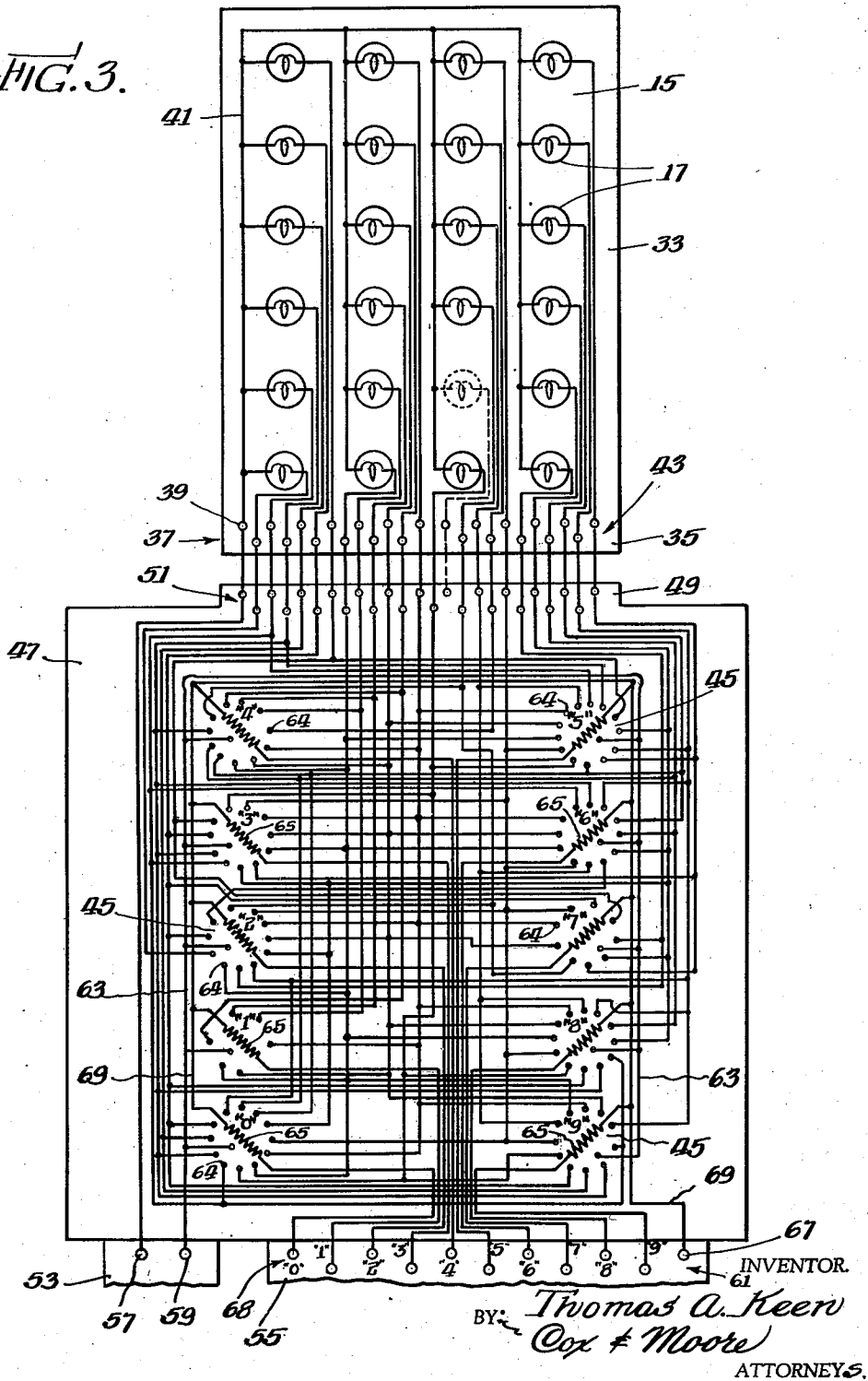
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FIG. 3.



April 29, 1941.

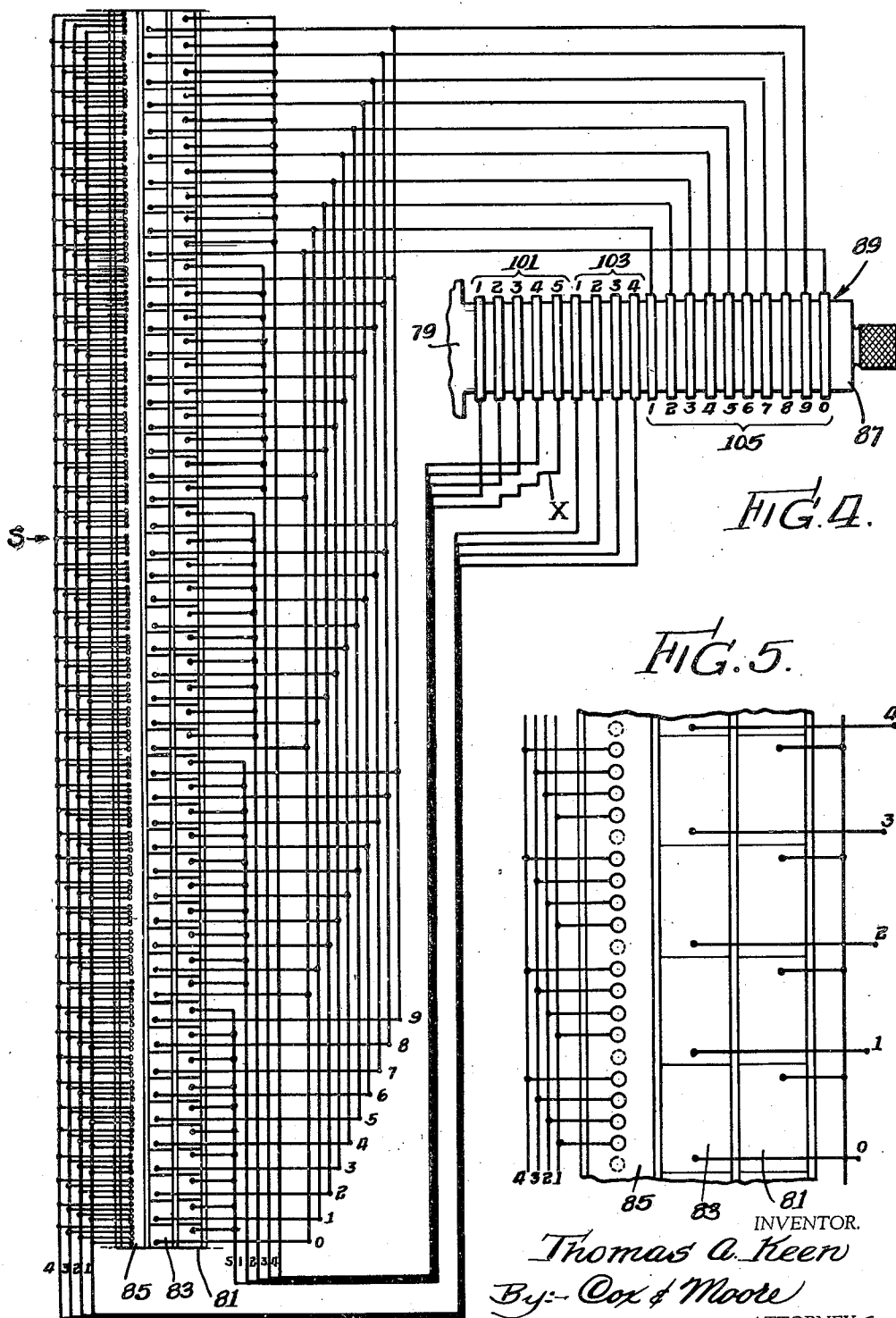
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FIG. 6.

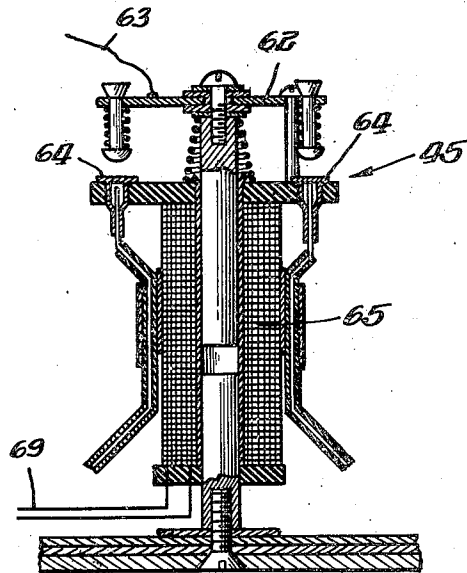
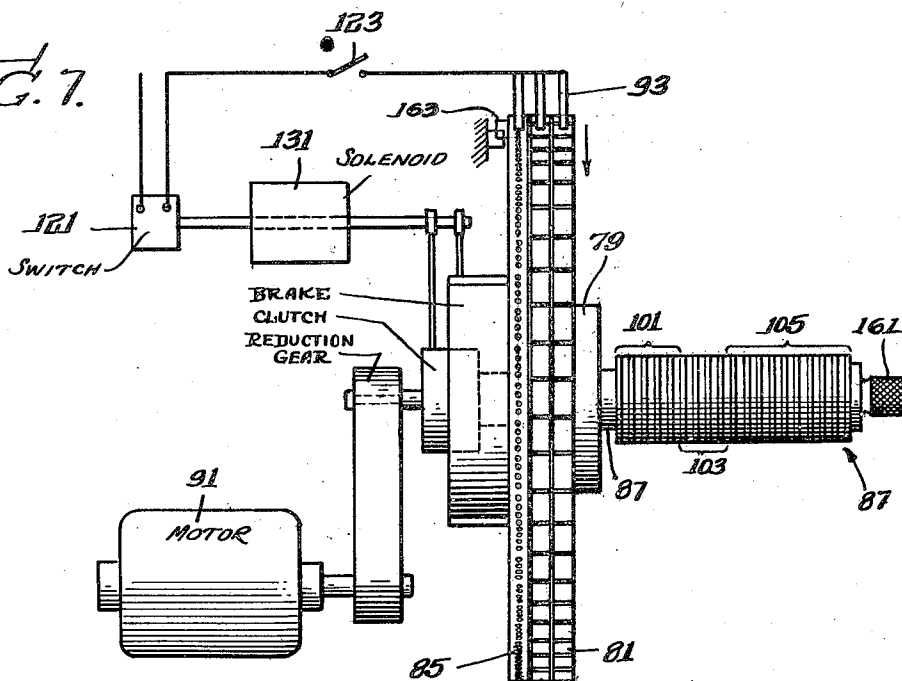


FIG. 7.



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UNITED STATES PATENT OFFICE

2,239,894

DISPLAY DEVICE

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12 Claims. (Cl. 161—18)

My invention relates in general to display devices and has more particular reference to an apparatus for quickly and accurately displaying the results of a race promptly upon the termination thereof, the invention including means for timing the race and for displaying the time, as well as indicia identifying the winning contestants.

An important object of the invention resides in providing a device by means of which the elapsed time of a race may be visually displayed upon the conclusion of the race; a further object being to provide timing mechanism and display means selectively operable by said mechanism to visually display the time of the race as measured by the timing mechanism, whereby the elapsed time of the race may be flashed on the display device immediately at the conclusion of the race; a still further object being to provide timing mechanism adapted to be set in motion as an incident of the race-starting procedure and actuated as the leading contestant finishes the race to register the elapsed time.

Another important object resides in utilizing lamps in the display device and selectively operable to visually display numerals indicative of time, and to provide selective means operable under the control of a timing device for energizing the lamps; a further object being to utilize, for the control of the time display lamps, timing apparatus including means for starting the same in operation at the beginning of the race to be timed, and means to stop the timing apparatus at the end of the race, and simultaneously to selectively energize the time display lamps for indicating the elapse of time as measured by the timing apparatus.

Another important object is to utilize progressively operating switch means, including provision for driving the switch means at a uniform rate of speed as a timing mechanism, whereby the switch means may be utilized to energize selected circuits corresponding with the position of the switch means in order to energize the lamp means to indicate the elapsed time of the race.

Another important object resides in providing means for starting the progressively operable switch means in operation, at the desired uniform speed to be maintained, instantly at the start of the race to be measured, and for stopping said switch mechanism instantly at the end of the race; a further object being to utilize light sensitive means for stopping the timing mechanism at the conclusion of the race; and a still further object being to provide switch means

adapted for operation by the starter that controls the start of the race, for setting the timing mechanism in operation.

Another important object is to provide a time display device of the character mentioned, including a clock mounted adjacent the zone in which the elapsed time of a race is displayed.

Another important object is to provide, in an elapsed time display device, means operable in conjunction with timing mechanism controlling the time display means, and means selectively operable to display indicia identifying the winning contestants in their order of finish; a further object being to provide for displaying indicia representing various data pertaining to the race, including the number of the race, weight of contestants, betting odds, the character of the finish as, for example, photo-finish, or no race, and the like.

Numerous other important objects, advantages and inherent functions of the invention will become apparent as the same is more fully understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment of the invention.

Referring to the drawings,

Figure 1 is a front view of a display device embodying my present invention;

Figure 2 is a diagrammatic representation of apparatus including a timing device used in conjunction with and for the purpose of operating the display device shown in Figure 1, in accordance with my present invention;

Figure 3 is a diagrammatic view illustrating the details of parts of the apparatus shown in Figure 2;

Figure 4 is a developed view of contacts forming a part of the timing device shown in Figure 2;

Figure 5 is an enlarged view of a portion of Figure 4;

Figure 6 is a sectional view through a multi-circuit controlling solenoid switch forming a part of the apparatus shown in Figures 2 and 3; and

Figure 7 is a diagrammatic illustration of the several structural elements of the timing device.

To illustrate my invention, I have shown on the drawings a display device 11, and means selectively operable to actuate the device 11 in order to visually display indicia thereon. The illustrated device comprises a display apparatus particularly arranged for the display of information relating to racing contests, but it will be obvious that the invention is not necessarily restricted to apparatus for displaying race informa-

tion, and many features of the invention may be incorporated to advantage in apparatus other than for the special purpose mentioned.

The display device 11 comprises a panel having openings 13 therein, in each of which is arranged means selectively operable to visually display, forwardly of the panel, any one of a desired number of indicia or characters, said selectively operable means comprising, preferably, lamp banks 15, each comprising, in the illustrated embodiment, four vertical rows of incandescent lamps 17, each row containing six lamps, so that by selectively energizing certain selected lamps in each bank, various characters may be visually displayed.

In addition to the openings 13 and lamp banks 15 disposed therein, the panel has openings 19 in each of which one or two lamps 21 may be mounted. Certain of the said openings 19 are disposed between adjacent lamp banks 15 so that when the lamps 21 therein are energized, a hyphen may be visually displayed between the characters disclosed in said adjacent lamp banks.

In the illustrated embodiment, four of the lamp banks 15 are arranged in a vertical row along one edge of the panel, said vertically arranged banks being adapted to form place indicators 23 operable to indicate the race contestants in the order of finishing the race. Other banks 15 are arranged in adjacent relationship to provide time indicators 25 operable to indicate the elapsed time of a race. A pair of the banks also may be arranged to form a race indicator 27 operable to show the number of the race, of a race program, the results of which are being displayed. Additional lamp banks may be arranged on the board to provide indicators 29 operable to display information or data concerning the race being indicated, for example, the number of contestants in the race, the contestant occupying the post position, and the weight of or carried by the contestants.

The hyphen indicating lamps 21 may be used advantageously in conjunction with lamp banks 15 utilized in displaying elapsed time and weight data. Others of the lamps 21 are preferably arranged in position remote from the banks 15 and may be suitably labeled to disclose, when energized, race information such as the character of the finish, whether photo or dead heat, race cancelled, bets refunded, and that the information displayed is official.

I also prefer to mount a clock 31 in the display device 11 adjacent the elapsed time indicating banks 25 as I find that racing enthusiasts derive considerable advantage through watching a conveniently located clock so mounted near, and preferably immediately above, the elapsed time indicators 25.

The panel on which the lamp banks 15, the indicating lamps 21, and the clock are mounted may be of any suitable or preferred construction, and the display devices may be mounted thereon in any convenient arrangement and fashion. I prefer, however, to form the panel of rigid, self-sustaining, board-like material having the openings 13 and 19 formed therein, and to arrange the labels "Result," "Time," "Race," "N.," "Post," "Weight," "No race," "Photo," "Dead heat," "Official," "Refund," and the place labels "1," "2," "3" and "4," as translucent characters formed in otherwise opaque plates mounted in suitable openings formed in the panel for illumination from behind the panel, in order that the label plates may be clearly visible adjacent

selectively operable information displaying banks 15 and lamps 21.

It will be seen that the foregoing arrangement provides a display device visible not only during the daytime, but also highly visible at night, and therefore particularly well suited for use in displaying information in connection with dog races and other racing contests held at night.

The lamps 21 may be mounted in suitable socketed housings adapted to be secured in the openings 19. The lamps comprising the banks 15 also may be mounted in suitable socketed housings 33 comprising frames carrying the lamp sockets and adapted to be mounted in the openings 13 and secured on the panel. The lamp bank housings 33 may also provide support each for a connection panel 35 on which insulated terminals 37 may be mounted and electrically connected with the lamps 17, whereby said lamps 17 may be each interconnected in selectively operated external circuits.

In the illustrated embodiment, each lamp bank 15 comprises twenty-four lamps arranged in four vertical rows, with six lamps in each row. This arrangement permits all of the characters of the Arabic numeral system and, of course, many other characters, to be outlined by energizing selected lamps in the bank. The terminal set 37 includes a common terminal 39 which is connected, through common conductor means 41, with each of the lamps 17. The remaining terminals 43 of the set are connected each with but one of the lamps 17. The twenty-four lamps of a bank, therefore, may be selectively energized to produce any desired Arabic numeral by applying an electrical potential between the common terminal 39 and selected terminals of the group 43.

In order thus to selectively apply potential to energize desired lamps in a bank, I have provided separate switching means for each bank adapted to be electrically connected with the terminals 37, for the purpose of selectively connecting the lamps with a suitable source of electrical power for energizing the same. Of course, any suitable switching arrangement may be employed, but I have shown on the drawings switching means 145 comprising a plurality of individual circuit controlling switches 45, a separate switch being provided for each desired character to be displayed, each switch controlling the energization of a selected group of lamps in a bank to display the desired character.

In the illustrated embodiment, the switching means 145 comprises ten switches 45, the same being the number required in reproducing the ten Arabic numerals, "1," "2," "3," "4," "5," "6," "7," "8," "9," "0," as noted in Figure 3 of the drawings.

The switches 45 are mounted in a suitable housing or container 47 which may be secured on the back of the display panel 11 preferably adjacent the lamp bank which the switches control. The container 47 provides support for a terminal mounting 49 carrying terminals 51 corresponding with and adapted for electrical connection with the terminals 37. The switch housing 47 also provides terminal mountings 53 and 55 thereon, the mounting 53 carrying a pair of terminals 57 and 59, while the panel 55 is provided with a plurality of terminals 61.

The switches 45 each comprise a common conductor plate 62 (Figure 6) connected with the terminal 59 (Figure 3) by the common conductor means 63. Each switch 45 likewise has

a switch plate carrying a plurality of relatively insulated switch elements 64 which are electrically connected by means of suitable conductors, as shown in Figure 3 of the drawings, with the terminals of the set 51 which are adapted for connection with the terminals 43 of the lamp bank. The terminal 57 is connected directly with the terminal of the set 51 which is adapted for connection with the common terminal 39 of the lamp bank terminals.

Each of the switches 45 includes an operating solenoid 65, one end of which is connected with a common terminal 67 of the set 61, through common conductor means 69. The other ends of the solenoids are each connected with one of the remaining terminals 58 of the set 61, so that any selected one of the ten switches 45 may be operated by applying electrical potential between the terminal 67 and the terminal of the group 68 with which such solenoid is connected. When the solenoid of a switch 45 is thus energized, contact members carried by the conductor plate 62 of the switch engage the several switch elements 64 so that electrical circuits are completed from the terminal 59 through the common conductor 63, thence in parallel through each of the several circuits, including the lamps 17, controlled by said switch elements, thence through the common conductor 41, to the terminal 57.

By connecting the terminals 57 and 59 with a source of electrical power suitable for energizing the lamps 17, it will be seen that, by energizing the solenoid of a desired one of the switches 45, the lamps 17 required in producing a desired character will be energized and display the desired character in the lamp bank.

The switch sets 145 used in controlling the lamp banks forming the indicators 23, 27 and 29 are controlled preferably by circuits including a suitable power source and manually operable switches electrically connected with the terminals 61 and located at a control station usually remotely situated from the display device 11. Suitable manually operated switches at the control station and electrically connected with the power source and the lamps 21 may also be provided for controlling the "No race," "Photo" and "Dead heat" finish, "Official" and "Refund" indicators.

In the illustrated embodiment, the elapsed time indicating means 25 comprises three lamp banks 71, 73 and 75, and a hyphen lamp 21 between two of the lamp banks, so that any elapsed time up to and including 99.9% seconds may be expressed in seconds and tenths of seconds, by means of display apparatus shown on the drawings.

The operation of the elapsed time indicator means 25 also may be controlled by manually operable switches at the control station, but I prefer to provide automatic timing means for controlling the actuation of the elapsed time indicator 25 in order to eliminate the delay of manual control. As shown, the timing device is arranged to register and display elapsed time, at intervals of one-fifth of a second, up to 59.9% seconds, and is therefore particularly adapted for timing dog races. The invention, however, may, of course, be embodied in equipment to cover any desired elapsed time range; and the invention, of course, visualizes the possibility of expressing elapsed time in minutes, seconds and fractional parts of a second other than fifths or tenths, and the changes necessary to accom-

plish the same will be readily appreciated and become apparent as the description progresses.

The timing device comprises a movable support 77 preferably formed of insulating material and comprising preferably a rotatable wheel 79 upon which is mounted a plurality of preferably circularly arranged rows of contacts, there being, in the illustrated embodiment, three rows of contacts 81, 83 and 85, peripherally arranged on the wheel.

Means, preferably an electric motor 91, is provided for moving the support 77 at a uniform speed to progressively engage the contacts of the rows 81, 83 and 85 with stationary contact means comprising wiping blades 93, whereby to provide a progressively operable multiple circuit switch adapted to control circuits operable to actuate the switch means 145 of the lamp banks 71, 73 and 75.

Since the illustrated embodiment contemplates a range of elapsed time indication up to 59.9% seconds, the contacts in row 81 are arranged to control five circuits, each capable of flashing one of the numbers from "one" to "five," inclusive, in the lamp bank 71, the contacts of the row 83 are arranged to control ten circuits, each capable of flashing one of the ten numerals of the decimal system in the lamp bank 73, while the contacts of the row 85 are arranged to control four circuits, each capable of flashing one of the numbers from "one" to "four," inclusive, in the lamp banks 75. If it is desired to indicate time at one-tenth second intervals, the contacts in the row 85 may be arranged in sets of nine to display the numbers from "one" to "nine" in the lamp bank 75. To indicate elapsed time in minutes, additional banks and corresponding rows of contacts on the support 77 may be supplied for the purpose.

As shown more particularly in Figure 4, there are fifty relatively insulated contacts in the rows 81 and 83. The contacts are separated by a small gap at their meeting edges.

The contacts in the row 81 are electrically interconnected to form five separate and successive sets for controlling the lamp bank 71. If desired, the row 81 may comprise but five contacts, each extending throughout the area occupied by ten interconnected terminals in the illustrated embodiment. I find it more expedient, however, to provide contacts in the row 81 of the same size and shape as used in the row 83. If it be desired to register more than the numerals "one" to "five" in the bank 71, an additional set of contacts may be provided in the row 81 for each additional numeral required. For example, a total of nine sets of contacts may be used if the display of numerals "one" to "nine" is desired in the lamp bank 71, ten sets if zero is to be displayed also.

The contacts in row 83 also are divided in sets corresponding in number with the sets in row 81. Each contact set in row 83 comprises ten successive contacts, and the corresponding contacts of each set are connected to provide ten circuits, as shown in Figure 4, for controlling the operation of the lamp bank 73.

The contacts in the row 85 preferably comprise buttons arranged in sets of four, to control the lamp bank 75 which indicates one-fifth second intervals. There are four contacts in the row 85 for each contact in the row 83, or a total of two hundred contacts in row 85. If one-tenth second intervals are to be displayed in the bank 75, then nine contacts in row 85 may be employed for each

contact in row 83, or a total of four hundred and fifty contacts in the row 85.

Since it is ordinarily unnecessary to display zero in the fractional second lamp bank 75, the first or zero contact of each set may be omitted, as indicated in dotted lines in Figure 5, so that in the illustrated embodiment only four active contacts in each set, or a total of two hundred contacts, are shown.

It will be noted that the leading edge of the first or zero button of the contact sets in row 85 is in line with the leading edge of the corresponding contact in row 83, the remaining buttons being spaced with the leading edges thereof opposite one-fifth intervals along the length of said corresponding terminal in row 83.

The timing member 77 comprises an axle portion 87 on the wheel 79, said axle portion carrying a plurality of relatively insulated circular conductors 89, preferably in the form of slip rings.

The rotatable timing element 77 may be mounted or supported for rotation in any suitable or convenient manner, and I provide preferably an electric motor 91 drivingly connected with the member 77, preferably through suitable reduction gearing and a clutch. The motor 91, when energized, is adapted to rotate the member 77 at a uniform speed with respect to the blades 93 which are supported in position to bear each upon one of the rows of contacts 81, 83 and 85 at the periphery of the wheel 79. As the wheel is turned at uniform speed by the motor, the stationary contact blades 93 will successively engage the successive contacts comprising the rows 81, 83 and 85.

The wheel 79 is turned by the motor 91 at a speed such that the switch means 93 progresses from the leading edge of one contact in the row 85 to the leading edge of the next adjacent contact in an elapsed time of one-fifth of a second, progresses from the leading edge of one contact to the leading edge of the next adjacent contact in the row 83 in an elapsed time of one second, and from the leading edge of one interconnected contact set in the row 81 to the leading edge of the next contact set in an elapsed time of ten seconds.

A plurality of stationary slip contact fingers 96 are provided and mounted in position, each bearing upon a corresponding one of the slip rings 89, and these slip fingers are connected with the terminals 61 of the switch sets 145 controlling the lamp banks 71, 73 and 75 forming the elapsed time indicator, whereby the wheel, as it rotates from a starting position, may successively form circuits adapted to actuate the switch units 45 to display elapsed time indicia on the indicator 25.

If desired, the device may be used to flash elapsed time on the indicator 25 at intervals as the race progresses, but I prefer not to energize the indicator 25 until after the race has ended.

Since ordinarily it is not necessary to show elapsed times of less than ten seconds, I may utilize the five contact sets commencing from the zero or starting position, in the illustrated device, to control circuits adapted to flash numerals "five," "one," "two," "three" and "four," respectively, thereby affording a range up to 59 1/2 seconds, by allowing the times greater than 49 1/2 seconds to be flashed after the wheel has turned more than one complete revolution from the zero or starting position. I thus can obtain maximum space efficiency. If, however, times of less than ten seconds are required to be flashed, the first

contact set in row 81 will have to be blanked out as by inserting at X (Figure 4) a switch adapted to open the circuit while the blade means 93 is passing over the contact set from starting position, means being provided for holding the switch closed thereafter during the remainder of its operating cycle, including the period of travel of the wheel beyond one revolution.

Suitable means, of course, is provided for starting the motor and the wheel in operation contemporaneously with the start of the race, and means is provided also for stopping the motor and wheel at the conclusion of the race, so that the elapsed time may be displayed immediately on the device 11.

The rings 89 are arranged in sets 101, 103 and 105, respectively, comprising, five, four and ten rings for connection, respectively, with the five, four and ten circuits connected with the contacts in rows 81, 85 and 83, respectively. Connections between the contacts and the rings is accomplished by means of conductors extending within the wheel 79 and the axle 87, portions of which conductors are shown at 95.

The slip rings 89 are connected with the terminals 61 of the switch sets 145 by suitable conductors arranged in sets 111, 113 and 115, the set 111 comprising five conductors engaging each a ring of the ring set 101, the conductor set 113 comprising four conductors engaging corresponding rings of the ring set 103, and the conductor set 115 comprising ten conductors engaging corresponding rings of the ring set 105.

The five conductors of the set 111 are, respectively, connected with the solenoid supply terminals 61 of the switching means 145 that actuates the lamp bank 71 to display numbers from 1 to 5, inclusive. The four conductors of the set 113 are connected with the solenoid supply terminals 61 of the switching means 145 that controls the lamp bank 75 to display the numbers 1 to 4, inclusive. The ten conductors of the set 115 are connected with the solenoid supply terminals of the switching means 145 that controls the lamp bank 73 for the display of numbers 0 to 9, inclusive.

For convenience, the conductors 111, 113 and 115 are brought from the slip rings 89 to terminals on a connection panel 97, whence the nine conductors comprising the sets 111 and 113 extend to a ten-terminal connector 107, the tenth terminal of which is connected, by means of a conductor 99 through a terminal on the panel 97 and through a circuit control switch 121 and a manually operated toggle switch 123, with the contact blades 93.

The mating connector 109 for the ten-circuit connector 107 has five of its ten terminals connected with the appropriate terminals 61 of the switching means that controls the lamp bank 71. Four of the remaining five terminals of the connector 109 are connected with the appropriate solenoid supply terminals of the switching means 145 controlling the lamp bank 75. The tenth terminal is connected in a circuit 125, including a source of preferably low voltage electrical power, and the common solenoid supply terminal 67 of each of the switching means 145.

As shown on the drawings, the power source comprises a transformer 127, the secondary winding of which is interconnected in series with the tenth contact of the coupler 109 and the terminals 67 of the switching means 145. The primary winding of the transformer 127 may be energized

from a suitable commercial power source, as shown.

The ten conductors 115 extend from the connection panel 97 to a twelve-terminal connector 117, the additional two terminals of the connector being attached to the commercial power source.

The mating connector 119 has ten of its twelve terminals connected with the appropriate terminals of the switching means 145 that controls the lamp bank 73. The remaining two terminals of the connector 119 are connected by means of conductors 129 with the terminals 57 and 59 of all of the switching means 145, and also with the clock 31. The conductors 129 also, if desired, may be connected to energize the primary winding of the transformer 127.

It will be seen from the foregoing that all of the equipment, including the lamp banks 71, 73 and 75, the corresponding switching means 145, the connectors 109 and 119, the transformer 127, and the conductors forming connections between the aforesaid apparatus, may all be mounted on the panel 11 in permanent fashion, preferably completely housed from the weather, connection with the timing apparatus being made by means of multi-conductor cables between the panel 11 and the connectors 107 and 117.

A brake, preferably comprising a drum on the wheel 79 and a band cooperatively associated with the drum, is provided for stopping rotation of the wheel instantly at the end of a race being timed. This brake is preferably arranged adjacent the clutch through which the wheel is drivingly connected with the motor 91, and suitable mechanism is provided for interconnecting the brake and clutch so that the brake may be released as and when the clutch is engaged and vice versa.

The brake and clutch actuating mechanism preferably includes biasing means normally urging the brake toward engaged, and the clutch toward disengaged, position, and a manually-operable handle may be provided to disengage the brake to permit the timing device to be initially set to a starting position. A solenoid motor 131 is also provided which, when energized, serves to hold the brake in the released position and the clutch in engagement.

The circuit control switch 121 is of a type normally closed by suitable switch biasing means, and means 133, drivingly connected with the clutch operating mechanism, is provided for holding the switch 121 open against the urge of said switch biasing means, the switch being open as long as the clutch is engaged, and closing as soon as the clutch disengages and the brake is applied at the end of the race being timed. It will thus be seen that the switch 121, in the illustrated embodiment, since it is in the common or return circuit of the operating solenoids 65 of all of the switching means 145, serves to hold the solenoids and the lamp banks controlled thereby in inactive condition, so that the time indicators 71, 73 and 75 will remain dark and inactive so long as the timing wheel 79 is being turned. As soon, however, as the clutch is disengaged and the brake applied to stop the wheel 79 at the conclusion of the race being timed, the switch 121 will close and energize the lamp banks 71, 73 and 75 through their respective switching means 145 in order to indicate time on the lamp banks corresponding to the position to which the wheel has turned.

Of course, if desired, the switch 121 may be eliminated and the lamp control circuits con-

trolled manually by the switch 123, particularly if the lamp banks are used to display the elapsed time during the progress of the period being measured; and, of course, various other arrangements may be employed for controlling the circuits in order to render the same active and inactive at desired periods.

The motor 91 and the clutch and brake operating solenoid 131 may be interconnected in parallel for operation from any suitable power source, usually a commercial power outlet, as shown. The motor and solenoid may be energized by manually operable switching means to permit the motor circuit to be energized instantly at the start and deenergized at the conclusion of the race. I prefer, however, to control the motor and solenoid by connecting them in a circuit including a switch 135 adapted to be closed to energize the circuit and start the motor in operation at the start of the race, and another switch 137, adapted to be normally closed at the start of the race and to open at the end of the race.

The switch 135 is preferably positioned at or near the location of the start of the race, and where the device is used for timing dog, horse or other races employing starting chutes, the switch 135 preferably is mounted on the chute in position to cooperate with the starting handle which is pulled to open the doors of the chute. When so mounted, the switch 135 may be closed by the movement of said starting handle, thus insuring switch closure at the instant the race starts. As shown in Figure 2, the switch 135 includes a switch blade 165, a spring 167 biasing the blade to open position, and a holding coil 169. The switch blade is, of course, as previously noted, moved to closed position upon the starting of the race. The holding coil 169 is controlled by the blade 165 and the switch 137, for when the blade is in closed position, the coil is in series with the blade 165 and the switch 137. Therefore, if the blade 165 is moved to closed position when the switch 137 is closed, the coil 169 will be energized and hold the blade 165 in closed position, but when the switch 137 is opened, the coil 169 will be deenergized, the spring 167 will move the blade 165 to open position, and the blade will remain in open position until subsequently mechanically actuated to closed position as by manipulation of the starting handle to initiate a race.

The switch 137 preferably is located opposite the finish line of the race and may comprise a part of photoelectric equipment 139. The equipment 139 may be of any suitable or preferred form adapted, when energized, to close the switch 137 and retain the same in closed position until the race participant first to finish deenergizes the apparatus 139, as by interrupting a light beam. To this end the equipment 139 may comprise a light-sensitive cell 141 suitably housed in a casing disposed on one side of the track and provided with a windowed aperture 143 to receive therethrough a light beam 146 projected across the track in alignment with the finish line by a light source 147.

The light-sensitive cell 141 may be connected with suitable power amplifier, relay device 149 connected with a coil 151 which serves to close the switch 137 and retain the same in closed position against the influence of a spring 153. The light source 147 and the switch operating mechanism 149 may be energized from a suitable power source by conductor means 155, preferably including a control switch 157. Suitable

tell-tale circuits also may be utilized in conjunction with the light-sensitive equipment and the switch 137 to advise the officials in charge of the contest that the timing mechanism is in operative condition immediately before the start of a race.

The device illustrated herein may be conditioned for operation at the start of a race by closing the switch 157, to thereby place the photosensitive apparatus 139 and 147 in operation. This results in the closure of the switch 137 which remains closed until the light beam 146 is interrupted at the conclusion of an elapsed time interval to be measured.

The switch means 77 may then be set to the zero or starting position by manual operation of the resetting handle or knob 161 (Figure 7), suitable means being provided for releasing the brake during the resetting operation. The resetting operation terminates when engagement occurs between a pair of cooperating stops 163 on the wheel 79 and on any suitable stationary frame member as, for example, a part of a supporting frame on which the wheel and associated driving means is mounted.

I prefer to arrange said cooperating stop means 163 to prevent rotation of the wheel in one direction only. This arrangement is particularly desirable where the wheel is required to drive more than one complete revolution in measuring an elapsed time interval.

After the wheel is set to the starting position, as aforesaid, the switch 135 may be closed at the start of the time period to be measured. As heretofore mentioned, this switch 135 may form a part of a race track starting box, whereby the blade 165 of this switch is mechanically actuated to closed position as a part of the operation of starting the race. Since the switch 137 is already closed, the blade 165 of the switch 135 now completes the circuits to the solenoid 131 and the motor 91 through the holding coil 169. The solenoid 131 releases the brake and moves the clutch into engaged position and the motor now drives the wheel 79 at a uniform, relatively slow rate through the reduction gearing. As the wheel is thus turned, the switches 93 progressively engage the contact elements in the rows 81, 83 and 85, to thus progressively select a plurality of the lamp bank controlling circuits 111, 113 and 115.

In the illustrated embodiment, the selected circuits will not be energized due to the fact that the switch 121 remains open because of its mechanical connection with the clutch. As previously explained, however, this switch 121 may be eliminated, in which case, the switch 123 being closed, the selected circuits will become immediately energized as soon as the switch blades 93 engage with the corresponding circuit contacts in the rows 81, 83 and 85.

At the conclusion of the elapsed time period to be measured, the circuit which energizes the motor 91 and solenoid 131 opens. This is accomplished in the illustrated embodiment as a result of the interruption of the light beam 146, although, of course, the same effect may be accomplished in any other suitable fashion. Upon interruption of the beam 146, the switch 137 will be caused to open by the operation of the relay of the power amplifier, relay device 149, thus breaking the circuits of the motor 91, the solenoid 131 and the holding coil 169 of the switch 135. As soon as the motor 91 and solenoid 131 thus become deenergized, the motor stops, the

clutch releases, and the brake becomes set, thus stopping rotation of the wheel 79 substantially instantly. At the same moment, if the switch 121 is used in the system, said switch closes because of its mechanical interconnection with the clutch, thus energizing those of the circuits 95 which correspond with the contacts engaged by the switch blades 93. Deenergization of the holding coil 169 permits the blade 165 to move to open position under the action of the spring 167. The motor and solenoid circuits are accordingly held open until the blade 165 of the switch 135 is again moved to closed position at the commencement of a succeeding race or at the beginning of a later period to be timed.

If the elapsed time between the closure of the switch 135 and the opening of the switch 137 be $28\frac{1}{2}$ seconds, the wheel will have turned to a position such that the blades 93 engage the contacts indicated by "S," in Figure 4. These contacts are connected, respectively, with the second ring of the set 101, the fourth ring of the set 103, and the eighth ring of the set 105, said rings, respectively, being connected in the circuits adapted to control those solenoid switches 45 which in turn actuate the lamp banks 71, 73 and 75, respectively, to show the numerals 2, 8 and 4, so that when said circuits are energized, said solenoid switches will be energized to close, thereby completing the necessary lamp energizing circuits, as shown in Figure 3 of the drawings, in order to display the numerals, as aforesaid, in the lamp banks 71, 73 and 75.

It is thought that the invention and numerous of its attendant advantages will be understood from the foregoing description, and it is obvious that numerous changes may be made in the form, construction and arrangement of the several parts without departing from the spirit or scope of the invention, or sacrificing any of its attendant advantages, the form herein described being a preferred embodiment for the purpose of illustrating the invention.

The invention is hereby claimed as follows:

1. In display apparatus comprising selectively operable indicia display means, the combination, with said display means, of a cyclically operable timing device, control means under the control of said timing device for actuating said display means in accordance with the position occupied by said timing device at any predetermined position thereof within its operating cycle, means for setting and holding said timing device in a predetermined initial or starting position, means to release said timing device for operation at the beginning of a time interval to be measured, and means operating at the conclusion of said interval, as measured by the timing device, for actuating the display means to indicate the extent of said interval.

2. In display apparatus comprising selectively operable indicia display means, the combination, with said display means, of a cyclically operable timing device, and control means under the control of said timing device for actuating said display means in accordance with the position occupied by said timing device at any instant during its operating cycle, said timing device comprising progressively operable switch means driven at uniform speed, electrical circuits interconnected with said switch means and said control means whereby said timing device is adapted to progressively select and condition said circuits for energization and apply the same to the control of said display means whereby to

actuate said display means for the purpose of indicating elapsed time, means for initiating operation of said timing device at the beginning of a time interval to be measured, means for automatically terminating the operation of said timing device at any instant during its operating cycle upon ending of the time interval being measured, and means for energizing the circuit then selected and conditioned by said timing device.

3. In display apparatus comprising selectively operable indicia display means, the combination, with said display means, of a cyclically operable timing device, and control means under the control of said timing device for actuating said display means in accordance with the position occupied by said timing device at any predetermined position thereof within its operating cycle, said control means comprising a plurality of actuating elements operatively associated with said display means and each adapted to operate the display means for the display of indicia of a predetermined character, separate electric circuits for actuating the actuating elements, each of said circuits being interconnected with switch means progressively operated by said timing device whereby said circuits, during the operation of the timing device, are successively selected and conditioned for energization, and means operating to energize the circuit so selected and conditioned when the timing device stops.

4. In display apparatus comprising selectively operable indicia display means, the combination, with said display means, of a cyclically operable timing device, and control means under the control of said timing device for actuating said display means in accordance with the position occupied by said timing device at any instant during its operating cycle, said control means comprising a plurality of actuating elements operatively associated with said display means and each adapted to operate the display means for the display of indicia of a predetermined character, separate electric circuits for actuating the actuating elements, each of said circuits being interconnected with switch means progressively operated by said timing device whereby said circuits, during the operation of the timing device, are successively selected and conditioned for energization to actuate the circuit connected actuating elements whereby said display means may function as an elapsed time indicator, means operating when the timing device stops for energizing the circuit then selected and conditioned by said timing device, and light-sensitive means for stopping said timing device at any instant during its operating cycle.

5. In display apparatus comprising selectively operable indicia display means, the combination, with said display means, of a cyclically operable timing device, and control means under the control of said timing device for actuating said display means in accordance with the position occupied by said timing device at any predetermined position thereof within its operating cycle, said timing device comprising a rotary member carrying a plurality of spaced, circularly-arranged switch contact elements, a motor, clutch means for drivingly connecting the motor with said rotary member, a brake operatively associated with said rotary member, brake and clutch operating means for applying the brake and releasing said clutch substantially instantaneously and vice versa, and means to actuate said oper-

ating means and said motor substantially simultaneously.

6. A timing device comprising a rotary member carrying a plurality of spaced, circularly-arranged switch contact elements, a motor, clutch means for drivingly connecting the motor with said rotary member, a brake operatively associated with said rotary member, brake and clutch operating means for actuating the brake and releasing said clutch substantially simultaneously and vice versa, and means, including electrical circuits, under the control of said switch contact elements and operatively associated with a time indicator.

7. A timing device comprising a wheel and an axle, the wheel carrying a plurality of spaced, circularly-arranged switch contact elements on the periphery thereof, and said axle carrying a plurality of slip rings, means interconnecting each of said slip rings with certain of said contact elements, means for rotating said wheel, switch blade means in position to progressively engage said contact elements, and brush members in position engaging said slip rings whereby electrical circuits connected between said brush members and the blade means may be progressively selected, as a result of the rotation of said wheel, in accordance with the engagement of the blade means on said contact elements.

8. A timing device comprising a wheel and an axle, the wheel carrying a plurality of spaced, circularly-arranged switch contact elements on the periphery thereof, and said axle carrying a plurality of slip rings, means interconnecting each of said slip rings with certain of said contact elements, means for rotating said wheel, switch blade means in position to progressively engage said contact elements, and brush members in position engaging said slip rings whereby electrical circuits connected between said brush members and the blade means may be progressively selected, as a result of the rotation of said wheel, in accordance with the engagement of the blade means on said contact elements, and indicator means adapted to provide time indication corresponding with the circuits so selected, said indicator means being operatively associated with and under the control of said circuits.

9. In display apparatus comprising selectively operable indicia display means, the combination, with said display means, of a cyclically operable timing device, and control means under the control of said timing device for actuating said display means in accordance with the position occupied by said timing device at any instant during its operating cycle, said control means comprising a plurality of actuating elements operatively associated with said display means and each adapted to operate the display means for the display of indicia of a predetermined character, separate electric circuits for actuating the actuating elements, each of said circuits being interconnected with switch means progressively operated by said timing device whereby said circuits, during the operation of the timing device, are successively selected and conditioned to actuate the circuit connected actuating elements whereby said display means may function as an elapsed time indicator, photo-sensitive means operating at the conclusion of the elapsed time interval to be measured to stop said timing device and means to energize the circuit then selected and conditioned by said timing device.

10. In display apparatus comprising selectively operable indicia display means, the combination, with said display means, of a cyclically operable timing device, control means under the control of said timing device progressively actuated by said timing device during its operation to successively condition said control means to actuate said display means in accordance with the position occupied by said timing device at any instant during its operating cycle, means for setting and holding said timing device in a predetermined initial or starting position, means for releasing and starting said timing device at the beginning of a time interval to be measured, means operating at the conclusion of said time interval to be measured to stop and hold said timing device, and means cooperating therewith to actuate the display means in accordance with the position occupied by said timing device at the end of the time interval to be measured.

11. In an indicating timer, a group of electric lamps arranged so that any digit can be formed by lighting the proper lamps in the group, a supply circuit, and means for selectively controlling the connection of the lamps to said supply circuit to cause the lamps to be lighted in the proper combinations to form any digit, said controlling means comprising a contact unit and a cooperating contact member, said contact unit including a plurality of spaced contacts engageable with said cooperating contact member in succession, means for setting and holding said contact unit and cooperating member in a predetermined initial or starting position relative to each other, means for moving said contact unit and cooperating contact member relatively at a uniform speed to cause the contacts of said unit successively to engage said contact member, means for releasing and initiating relative movement of said contact unit and said contact member at the beginning of an event to be timed, means for automatically stopping and holding said contact unit and cooperating contact member against relative movement at the conclusion of the event being timed, and means cooperating with said contact unit and said contact member to energize a group of lamps from said supply circuit in accordance with the se-

lected contact in engagement with the contact member at the termination of the event being timed.

12. In an indicating timer, a group of electric lamps arranged so that any desired digit can be formed by lighting the proper lamps in the group, a supply circuit, a plurality of selector relays for selectively controlling the connections of the lamps to said supply circuit to cause the lamps to be lighted in the proper combinations to form any desired digit, a plurality of selector circuits for energizing said selector relays, a shaft, a plurality of selector contacts mounted on said shaft for rotation therewith, a cooperating contact member adapted to engage said contacts, synchronous motor drive means for rotating said shaft and moving said contacts at a uniform speed to cause said contacts successively to engage said contact member in a predetermined timed sequence, electrically operable clutch means for connecting and disconnecting said drive means to and from said shaft, a control circuit for said electrically operable clutch means, said control circuit comprising a light-sensitive relay means operable upon the termination of an event being timed to break the control circuit for said electrically operable clutch means, a relay operable upon the initiation of the event to be timed and in series with said light-sensitive relay means for completing the control circuit to said electrically operable means upon initiation of an event to be timed, said electrically operable clutch means when energized, connecting said shaft to said drive means and when deenergized, disconnecting said shaft from said drive means, whereby movement of said shaft and said contacts is initiated upon the initiation of the event to be timed and is terminated upon conclusion of the event being timed, and means for preventing energization of said selector circuit through said selector contacts during rotation of said shaft and operable when the shaft has been disconnected from the drive means for completing the selector circuit that includes the selector contact then engaged by said contact member.

THOMAS A. KEEN.

CERTIFICATE OF CORRECTION.

Patent No. 2,239,894.

April 29, 1941.

THOMAS A. KEEN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 69, for "'N.," read --"No.,"--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 22nd day of July, A. D. 1941.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.