June 16, 1936. L. E. DODD ET AL 2,044,471

TIME RECORDER

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Fig. 1.

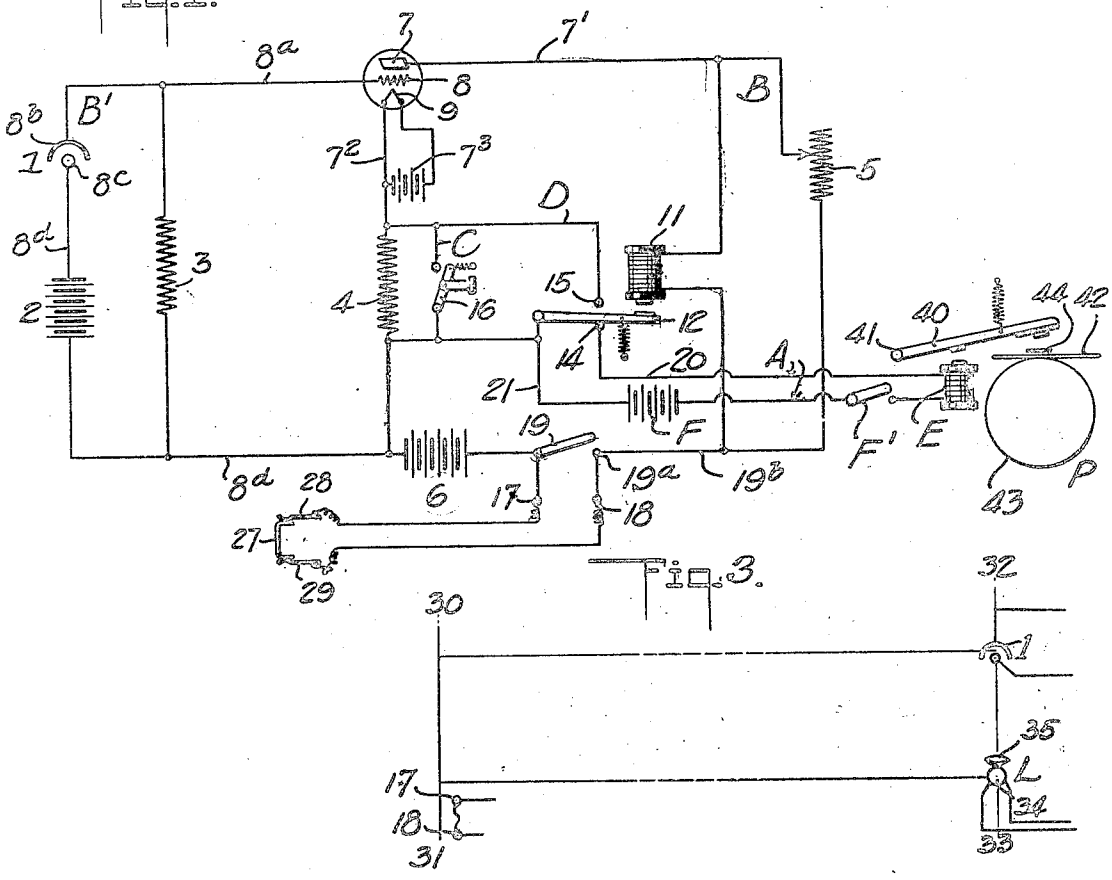
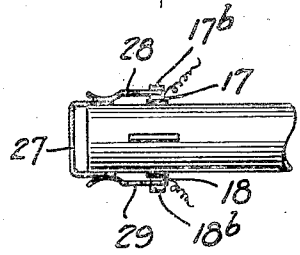


Fig. 3.

Fig. 2.



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TIME RECORDER

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2 Claims. (Cl. 175—320)

This invention relates to time recorders, and has for its primary object the provision of means for utilizing a light beam to actuate an electrical circuit and effect recordation of the time required for the movement of an object from one place to another and for definitely indicating and recording with precision the elapsed time between two successive signals to be measured or for indicating and recording the exact time of a single signal.

The invention is particularly, but not necessarily, designed for use in recording the time required for the passage of a moving object over a race course, say from a starting line to the finishing line of the course, and an important object of the invention resides in the provision of positively and accurately functioning means for timing each individual runner at selected points in the course in such manner that the history of the individual participants will be recorded separately and become a permanent record that will be clearly legible.

A further object of the invention is to provide a recording system employing separate light beams for causing actuation of corresponding circuits and an operation of a printing chronograph in succession, with an actuation of any particular circuit upon the interception of a beam, and means for automatically resetting each of said circuits following the interception of the light beam thereof.

Other objects and advantages of the invention will appear from the following description taken in connection with the accompanying drawing, in which

Figure 1 is a diagrammatic view of the recorder;

Figure 2 is a view in side elevation of a portion of a mechanically controlled circuit breaker adapted to be employed in the circuit of the recorder;

Figure 3 is a diagrammatic view showing the recorder installed for use upon a race course.

In carrying the invention into practice, use is made of a printing chronograph P which is partly characterized by a motor-actuated type wheel 43, a recording tape 42, a transfer ribbon 44 and an oscillatory printing hammer 40. Said hammer 40 is pivotally supported at 41 so that it may operatively coact with the ribbon 44 to cause an impression to be formed on the tape 42 at a time and under conditions hereinafter to be referred to.

In Figure 1 is illustrated an actuating circuit A for said printing chronograph P; a control circuit B for the actuating circuit; a direct current relay 11 in said control circuit, the same having an armature 12 urged to one position in which the actuating circuit is closed and adapted to be moved by field energization of the aforementioned relay so as to assume another position in which the actuating circuit is opened. In order that the current flow through the relay can be normally reduced sufficiently to prevent movement of the armature 12 to open the actuating circuit, we provide a resistance 4 in said control circuit and the functioning thereof will be fully appreciated as the description proceeds.

A branch circuit C of said control circuit is provided with a normally open, manually controlled switch 16 for shunting current flow around said resistance 4 to thereby sufficiently increase energization of the relay 11 to cause it to operate the armature 12 and thus open the actuating circuit.

A second branch circuit D in said control circuit is so controllable by said armature 12 that when the relay 11 is fully energized and the switch 16 is opened, said resistance 4 will remain shunted to thereby maintain the relay fully energized.

The lead 21 of the actuating circuit A connects at one end with the armature 12 and at its other end with an electro-magnet E. The other lead 20 of the actuating circuit, which is arranged in a source of potential F, connects at one end with a contact device 14 which is spaced apart from a similar contact device 15 of the secondary branch circuit D, and it will be observed that the armature 12 is interposed between said contact devices and that same is in normal engagement with the contact device 14. The other end of the lead 20 passes to said electro-magnet E, as shown.

The relay 11 connects with the plate 7 of a three element vacuum tube through the lead $7'$ of the control circuit B, and the lead 7^2 of the control circuit passes to the filament 9 of said tube, the said filament being supplied with current through the battery 7^3.

The grid 8 of the vacuum tube connects through the lead $8a$ of a second control circuit B' with the electrode $8b$ of a light sensitive tube 1, which latter constitutes means for reducing the current flow through the aforementioned control circuit B. The electrode $8c$ of the device 1 connects through the lead $8d$ with a source of potential 2 in said circuit B', and said lead connects with the primary control circuit B, as shown. Extending across from the lead $8a$ to the lead $8d$ is a resistance 3.

In the control circuit B is a battery 6 for supplying current to the plate 7 through a rheostat 5. A manually actuated switch 19 in the control circuit B coacts with a contact device 19a in said circuit, and, as illustrated, said switch connects with a contact member 17 and the contact member 19a connects with a contact member 18 and between the latter and said contact member 17 is a bridge strip 27 of conducting material, which is adapted to be removed from the control circuit, preferably by percussion when the pistol shown in Figure 2 is fired at the starting of a race. It will be noted that the contact devices 17 and 18 which are shunted across the switch 19 are adapted to be connected with the metallic clips 28 and 29 at the muzzle of said pistol. Said clips 28 and 29 are suitably connected with the muzzle by binding posts 17b and 18b and the free extremities thereof normally engage the bridge strip 27 as shown in Figure 2. It is understood that contact members 17 and 18 are insulated from the muzzle of the pistol and that the spring clips 28 and 29 do not contact the muzzle when the strip 27 is disengaged, thereby enabling the circuit B to be disrupted as intended. When the pistol is fired the said bridge strip is disengaged from the clips 28 and 29 so as to disrupt the control circuit B. This causes de-energization of the magnet 11 so that the armature 12 will return against said contact device 14, at which time, the actuating circuit will be closed and the magnet E energized to cause the hammer 40 to strike against the ribbon 46 and thereby effect recordation of a signal.

As previously stated, the switch 19 is manually controlled in the form of the invention as herein illustrated, but it should be clearly understood that same may be automatically actuated in any suitable well known manner without departing from the scope of the hereto appended claims.

In the diagrammatic illustration (Figure 3) numerals 30 and 31 indicate the starting line of a race course and numerals 32 and 33 the finishing line, along which latter a beam of light is directed toward the light responsive device or means 1 from a light projecting system L. Said system L includes a lamp 34 and a lens 35 by means of which parallel light rays will be made to impinge on said device 1 so that actuation will be set up in the secondary control circuit B' and finally in the actuating circuit A to operate the printing chronograph P and thereby record the elapsed time between the starting signal and the interval which marks the interruption of the respective circuits the moment the light beam is intercepted by the movement of an object across same. The sound actuated means in the control circuit B is intended to occupy a position in close proximity to the starting line 30—31, and while we have described that the aforementioned light beam is positioned at the line 32—33, it obviously follows that said beam can be projected across any selected intermediate portion of said course.

Having described the essential features of construction of the apparatus, the operation thereof is as follows:

Upon reference to Figure 1 of the drawing, it will be assumed that a steady light beam is being projected onto the cell 1. The armature 12 of the relay 11 is normally closed against the contact device 14, and it follows that when the switch 16 is momentarily closed a shorting of the resistance 4 is effected to thereby increase the flow of plate current through said relay 11 sufficiently to attract the armature 12 away from the contact device 14 and draw same against the contact device 15. Subsequent release of the switch 16 will now have no effect on the relay because the resistance 4 is shorted through the contact device 15 and the armature 12. A steady condition now exists in the primary and secondary control circuits to constitute a set condition of the apparatus. For the purpose of recording time signals, the just referred to steady condition of said circuits may be disturbed, first by opening the primary control circuit between the terminals 17 and 18 in the manner aforestated, and secondly, by interrupting the steady beam of light falling upon the cell 1. When the condition is disturbed by opening the primary control circuit as just stated, current flow in the primary control circuit is interrupted and the electro-magnet 11 is de-energized and the armature 12 is drawn back against the contact device 14, thus closing the actuating circuit and effecting an operation of the printing chronograph to record the "first" time signal, as indicative of the starting time of a race. The circuits are restored to their normal condition by closing the switches 16 and 19, providing, of course, there exists an open condition between the contact devices 17 and 18.

With the circuits re-set after an initial operation of the apparatus, to record said "first" signal, a "second" signal will be recorded the instant the light beam is intercepted by an object, in this case the runner or contestant. This changes the potential of the grid 8 to a relatively high negative value, causing a corresponding drop in the plate current, and likewise in the current flow through the relay 11, at which time the armature 12 is returned against the contact device 14. Obviously, subsequent restoration of the light beam and a closing of the switch 16 prepares the apparatus for recordation of another time signal when the light beam is next interrupted or intercepted. A switch F' in the circuit A is provided in order that said circuit may be broken when the apparatus is not in use.

What we claim as our invention is:

1. In an electrical system for controlling an instrument actuating circuit, a control circuit having a relay whose armature is adapted to be connected in an actuating circuit to respectively open and close same and said armature being biased to a closed position; a resistance in said control circuit for normally reducing current flow through the relay and thus maintain said normal biased position of said armature; a branch circuit in the control circuit having a switch normally open but manually operable to shunt current flow around said resistance and sufficiently to increase energization of the relay to cause it to move the armature from said normal biased position; a second branch circuit in the control circuit so controllable by said armature that when the relay is fully energized and the switch is open, said resistance will remain shunted to maintain the relay fully energized; and means for disrupting the control circuit at such point therein as to de-energize the relay.

2. In an electrical system for controlling an instrument actuating circuit, a primary control circuit having a relay whose armature is biased to a closed position and movable by full energization of the relay to an open position; a resistance in the primary control circuit normally reducing current flow through the relay sufficiently to prevent movement of the armature from said biased position; a branch circuit in the primary control circuit having a switch biased to open

position but manually movable to shunt current flow around the resistance and thereby increase energization of the relay sufficiently to cause it to operate the armature; a second branch circuit so controllable by said armature that when the relay is fully energized and the switch is open, said resistance will remain shunted to maintain the relay fully energized; means for disrupting the primary control circuit at such point therein as to de-energize the relay; a second control circuit including a part of said primary control circuit and having a separate source of current; a current control device in the two control circuits and connected with said separate source of current; and means for reducing current flow in the secondary control circuit, to thus cause operation of the current control device to reduce current flow in the primary control circuit sufficiently to effect deenergization of said relay.

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