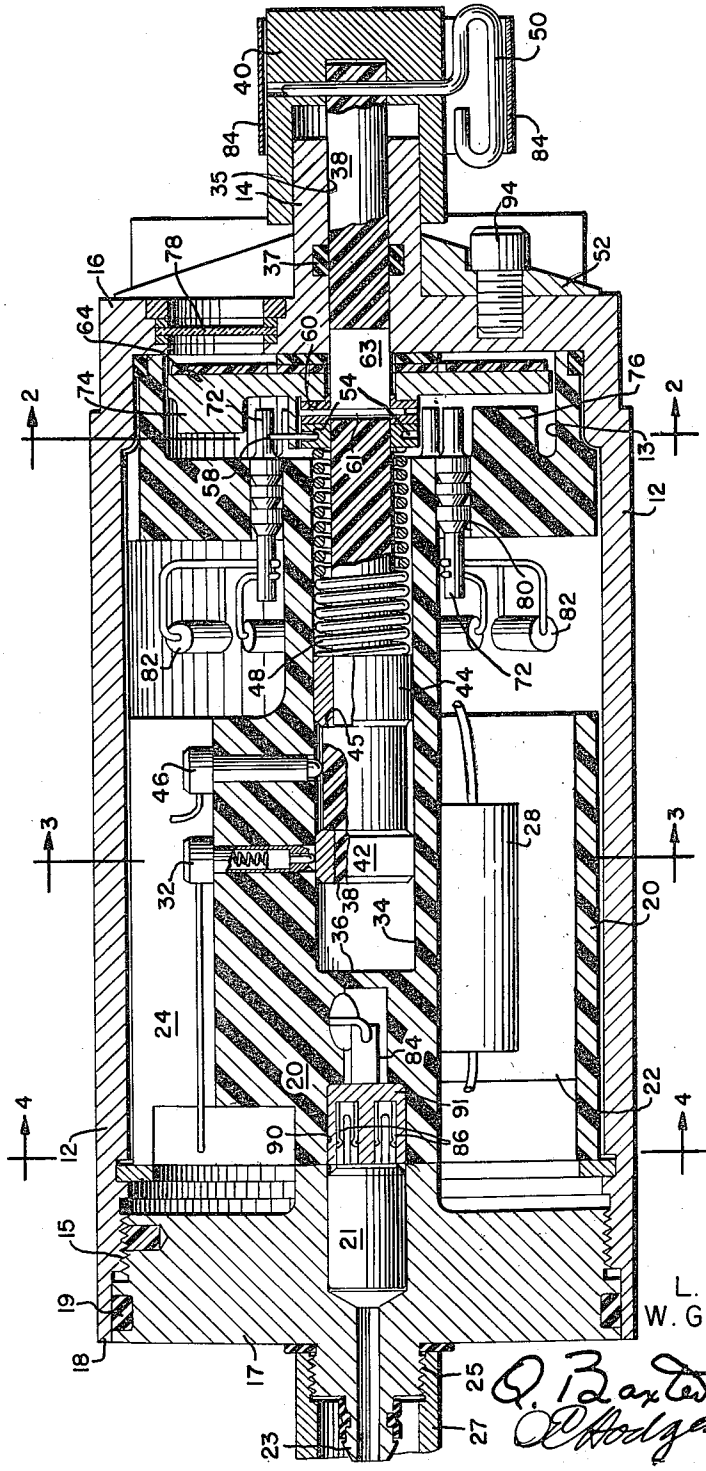
Feb. 26, 1963 L. RZEWINSKI ETAL 3,078,801

DEMOLITION TIMING DEVICE

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FIG. 1.



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DEMOLITION TIMING DEVICE

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FIG.2.

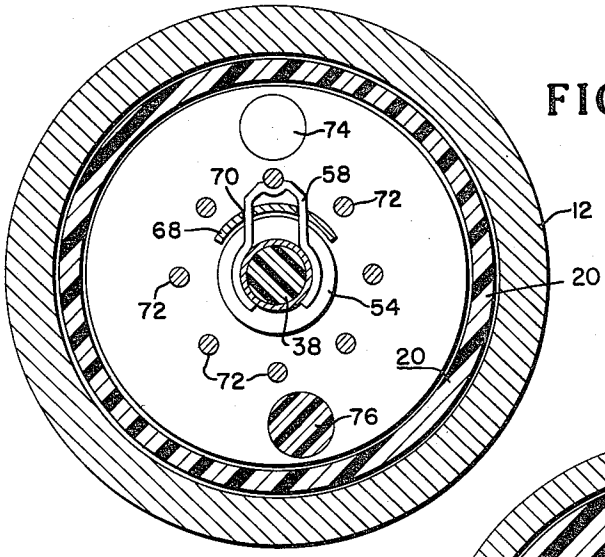


FIG.3.

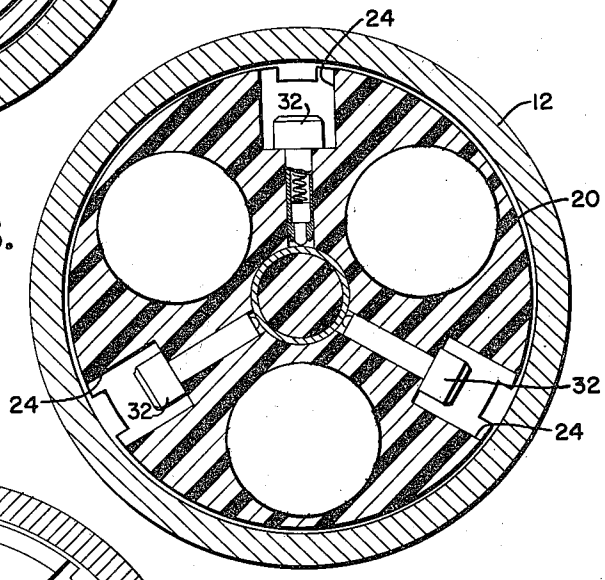
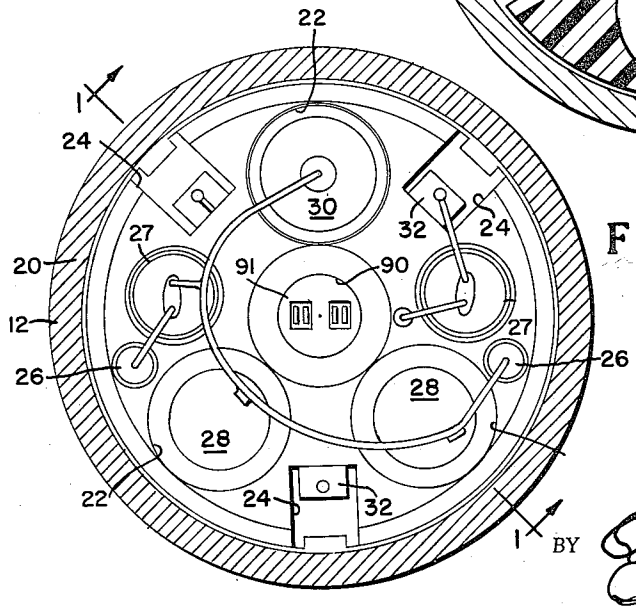


FIG.4.



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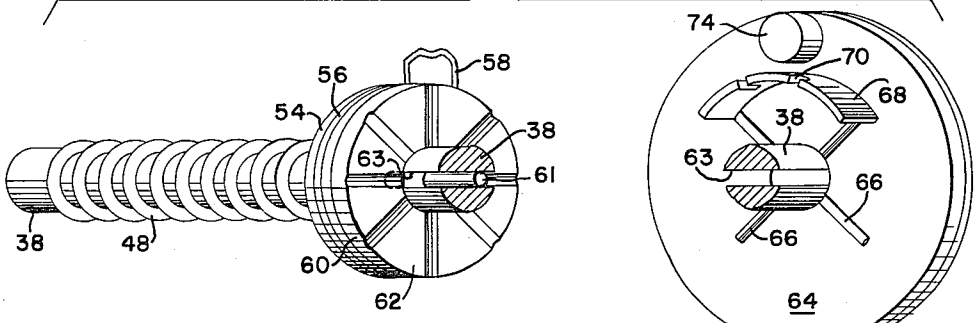
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Feb. 26, 1963 L. RZEWINSKI ETAL 3,078,801

DEMOLITION TIMING DEVICE

Filed March 21, 1960 3 Sheets-Sheet 3

FIG.5.



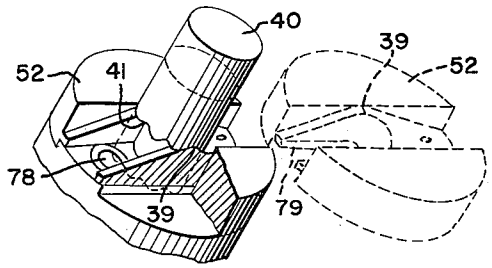


FIG.6.



FIG.8.

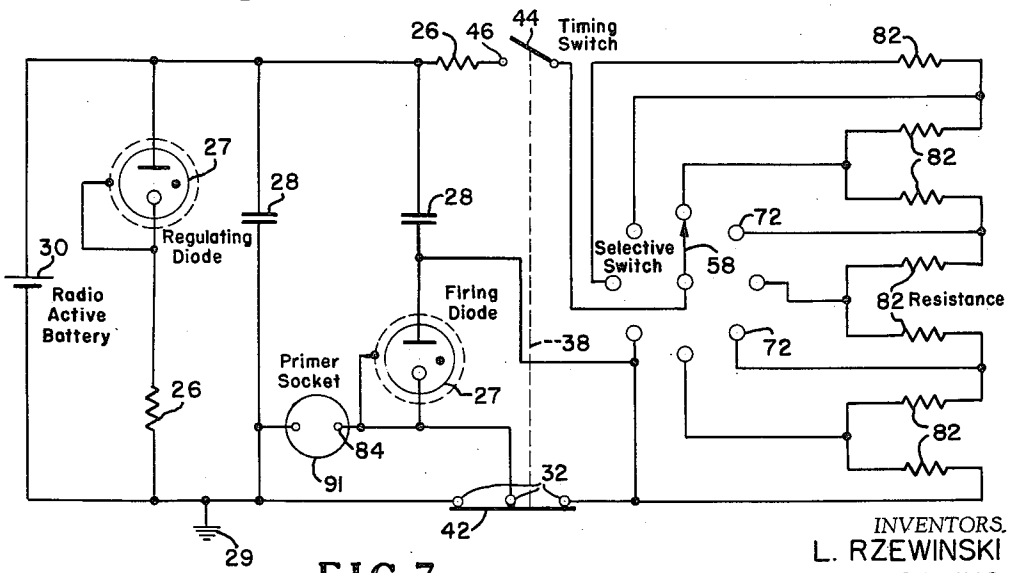


FIG.7.

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United States Patent Office 3,078,801 Patented Feb. 26, 1963

3,078,801
DEMOLITION TIMING DEVICE

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Filed Mar. 21, 1960, Ser. No. 16,615
7 Claims. (Cl. 102—70.2)

This invention relates to a demolition timing device for initiating high order explosives, after a predetermined time interval has elasped, and after the device is manually set to an armed position.

An object of the invention is to provide a demolition timer which may be set to initiate an explosive charge in from fifteen minutes to two hours and by changing resistance units to extend the time interval to twelve hours and to provide a minimum time setting under which the device will be incapable of firing. The timer will be enclosed in a case made sufficiently water tight to permit it to be submerged to a depth of two hundred feet; it should be safe to handle without danger of igniting during ordinary transportation and when once armed, incapable of being reset without the use of special tools. It should be capable of being set visibly or audibly and capable of being handled for setting by an operator wearing gloves of the mitten type. After being armed the device should be substantially inaudible and should produce no visible indication of operation and should operate in any position.

Another object of the invention is to provide a mechanical release to change the demolition timer from unarmed position to armed positioin, and an electrical timing circuit for initiating a primer, the same circuit being used to test for operativeness.

Still another object is to provide a demolition timer which may be tested any number of times after assembly and before being placed in armed position, but having been set and placed in armed position it cannot be returned to unarmed position.

A further object of the demolition titmer is the provision of a timing circuit which may be set within limits of from fifteen minutes to twelve hours.

A still further object is the provision of a demolition timer having a variable resistance control to establish a definite internal in an electrical timing circuit operated by a radioactive battery.

A still further object of the invention is the provision of means for setting the timer by visual or audible means.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is a longitudinal cross-section of the demolition timer;

FIG. 2 is a section on line 2—2 of FIG. 1;

FIG. 3 is a cross-section on line 3—3 of FIG. 1;

FIG. 4 is an end view of the demolition timer taken along line 4—4 of FIG. 1;

FIG. 5 is a perspective view showing opposite faces of the clutch;

FIG. 6 is a perspective view of the setting knob showing the position taken (in dashed outline) upon removal of the wedge;

FIG. 7 is a diagrammatic view of the electrical circuitry of the timer;

FIG. 8 is a diagrammatic representation of a testing device.

Referring now to the drawings wherein like numerals designate like parts throughout the several views FIG. 1 illustrates, the demolition timer is housed within a metal

hollow housing 12 of substantially cylindrical shape with an extended cylindrical boss 14 at one end 16, the other end 18 being threaded at 15 to receive a threaded plug 17 which is held in sealing relation to the housing 12 by the O-ring 19. The plug 17 is centrally bored to support a primer 21, the bore continuing in reduced form to terminate in a nipple 23 adapted to receive a blasting cap (not shown). The plug 17 has a threaded boss 25 on which a guard 27 may be threaded. The plug 17 is not ordinarily placed in position until after the timer has been tested by inserting a testing device (FIG. 8) in place of the primer 21. After testing, the testing device is replaced by the primer and the plug 17 is threaded into sealing position.

As shown in FIG. 4 there is carried within the housing 12, a central core 20 formed with numerous cavities 22 and slots 24 housing resistors 26, capacitors 28, battery 30, contact posts 32, diodes 27 and other parts more particularly described hereafter. The core 20, FIG. 1, is formed with a central bore 34 extending from an annular central cavity 13 adjacent the end 16 to a termination 36 within the body of the core. A second central bore 35 extends through the boss 14. Carried within the bores 34 and 35 and capable of both rotation and longitudinal motion relative to the core and to the housing 12, is a shaft 38, projecting beyond the boss 14 and fitted with a knob 40. A pin 50 passes through the knob 40 and shaft 38 preventing relative movement therebetween.

The shaft 38 fits snugly within the boss section of the bore and is sealed to the casing by the O-ring 37. In the enlarged section of the bore 34 the shaft carries metallic collars 42 and 44 which serve as electrical conductors.

The collar 42 is located on the end of the shaft and connects two of the posts 32 to the other post 32 which is grounded to the housing (FIG. 7), while the collar 44 is spaced from the collar 42 and makes contact with the contact post 46 upon longitudinal movement of the shaft from unarmed position to armed position or when the device is being tested. One end of collar 44 abuts the shoulder 45 on the shaft 38 and the other end serves as a stop for coil spring 48 which is coiled about shaft 38 and tends to urge the shaft 38 in the direction of the end 36 of the bore. Longitudinal movement of the shaft 38 is resisted by a pin 50 passing through the knob 40 and shaft 38. The knob 40 engages a slidable wedge 52 which in turn rests on the end 16 of the casing to prevent movement of the shaft from an unarmed to an armed position. With the shaft in the unarmed position the collar 42 by tying together the contacts 32 establishes a ground connection to the housing (FIG. 7).

As shown in FIG. 6 the knob 40 rests against the apex 39 of the wedge 52, the notches 41 of the knob being held against the apex of the wedge by the spring 48. The audible sounds made by the notches riding over the wedge allows the timer to be set by listening and counting the clicks. The wedge is formed with center sections slopping upward to a central apex 39 and is open in one direction from the center 79 to permit insertion and withdrawal from under the knob. As shown in FIG. 1 upon withdrawal of the wedge 52 the shaft 38 with the knob attached moves longitudinally in the bore toward end 36, breaking the connection between the contact posts 32 and the collar 42 and establishing a circuit through the post 46 and the collar 44. This is done so that the testing device, plugged into socket 91, and the timer may be reset to unarmed position by inserting the wedge and removing the testing device.

As shown in FIG. 1, when the pin 50 is withdrawn the shaft is free of the knob 40 and under the influence of the coil spring 48 moves toward the end 36 of the bore bringing the collar 44 into contact with the post 46. Contact

between the spring 48 and the collar 44 continues the circuit to a contact washer 54. As illustrated in FIG. 5 the washer 54 is formed with an annular groove 56 in which a spring contact wire 58 is sealed. This resilient contact wire is free to turn in the annular groove while maintaining electrical contact.

As illustrated in FIGS. 1 and 5 there is carried by the shaft 38 and next to the contact washer 54 a clutch washer 60. The washer 60 is pinned to the shaft 38 by a pin 61 passing through the slot 63 which insures rotation of the clutch washer 60 with the shaft while permitting longitudinal movement of the shaft relative to the washer.

A dial 64, FIG. 5, mounted freely on the shaft 38 has radial bars 66 cooperating with the corrugated face of the clutch 62 to turn the dial with the shaft 38 upon rotation of the shaft by the knob 40 of FIGS. 1 and 6. The dial carries a projection 74 of FIGS. 1 and 5 which engages a similar projection 76, FIG. 1, which is part of the core 20. This engagement stops rotation of the dial and the contact wire 58 but the shaft may be rotated further, the clutch washer 62 riding over the radial bars 66. Integral with the dial, a tab 68, FIG. 5, engages the resilient contact wire 58 to rotate the wire with the dial. The tab is formed with slots 70 which engage the contact wire to turn the wire with the dial and to brace the wire and give it stability.

As illustrated in FIGS. 1 and 2 the contact wire 58 may be selectively engaged with any of a plurality of contact pins 72 arranged concentrically about the shaft 38, and connected to resistances 82, FIGS. 1 and 7.

The forward or front face of the dial carries numerals (not shown) corresponding to the number of contact pins 72, FIGS. 1 and 2, generally from 1–8, and the dial starting from a position with stop 74 in engagement with stop 76, may be rotated step by step to bring the contact wire into engagement with any desired contact pin. A window 78, FIG. 1, located in the casing 12 permits observation of the numerals on the front face of the dial.

The contact pins 72, FIG. 1, are supported by holes 80 in the core 20 and connected to resistance units 82 which permits from one to eight resistances to be included in the circuit shown in FIG. 7.

The power is supplied by a radioactive battery capable of furnishing a useful constant current for twenty-five years. Suitable batteries are described in U.S. Patents 2,517,120, 2,552,050, 2,555,143 and 2,661,431, all issued to E. G. Linder on August 1, 1950, May 8, 1951, May 29, 1951, and December 1, 1953, respectively. This power is stored in high quality Teflon dielectric capacitors having leaking resistances greater than 1×10^{14} ohms. Energy transfer to the primer is controlled by a cold cathode diode having negligible conduction until its breakdown is reached. In storage the switch would be in the position shown with the contact posts 32 in engagement with the collar 42, grounding to the housing, and the two capacitors would be kept charged to a voltage determined by the breakdown potential of the regulating diode and resistor.

For operation the switch is transferred by movement of the shaft 38, the contact 42 unshorting the contact posts 32 and bringing the contact post 46 into contact with the collar 44 and the timing capacitor is connected to the timing resistance, selected by turning the knob 40, and the capacitor discharges until the breakdown of the firing diode is reached, the length of time being determined by the value of the resistance in the circuit. The breakdown of the firing diode and the resulting discharge of the storage capacitor through the primer into the timing capacitor provides the energy for primer initiation. The operation of the timing circuit is more fully disclosed in U.S. Patent 3,011,096 issued to S. Wallack et al., on November 28, 1961.

As shown in FIG. 1 at the end 18 of the casing, the core has a central cavity 90 which houses a connecting socket 91. The wires of the firing circuit terminate in a pair

of spring connectors 86 within the socket 91. A primer 21 may be connected to this socket and housed in the plug 17. A testing device (FIG. 8) may be plugged into the socket 91 previous to the insertion of the plug 17 and by removing the wedge 52 the circuit may be energized and tested. After testing, the wedge 52 is replaced and secured by bolt 94, the testing device removed and the primer 21 inserted in the socket. The plug 17 is then screwed into position by a spanner wrench fitting holes in its base and the timer is ready for use.

The demolition timer may be used to set off any desired explosion such as an underwater blast to clear a harbor of wreckage or may be used in ordinary blasting where a controlled time interval between the setting and the exposion is desired. The timer may and is usually tested before it is carried to the place it is to be used. However, as shown in FIG. 1, if necessary it may be quickly and easily tested by connecting a testing device to the socket 91 and slipping the wedge from under the knob 40. This permits the shaft to move, under the influence of the spring 48 to bring the resistance units into the timing circuit. The dial is set and after the interval selected, the battery, two capacitors, the diodes and the circuit actuates the testing device. After the test the wedge is slipped again under the knob and the timer is ready for actual use, with the replacement of the testing connection to the socket 91 with a primer 21.

To set the timer the knob may be turned until the desired number appears in the window or the knob may be rotated counter-clockwise until the stop on the dial contacts the stop on the core. The knob may be rotated further but the dial remains stationary, the clutch 60 slipping. The setting may then be made by rotating the knob clockwise, counting the clicks as the notches in the knob ride over the ridge of the wedge. As the initial position of the dial is the number one position, counting the clicks will give the proper setting without seeing the dial. After setting, the safety covering 84 wrapped around the cap 40, covering the pin 50 and providing a safety device, is removed, the pin 50 is pulled and the shaft 38 moves inward. The end of the shaft moves past the end of the boss 14 so that once set to an armed position the timer cannot be reset or stopped from functioning. The movement of shaft inward of the casing brings the collar 44 into contact with contact post 46 and through the coil spring, the washer 54, the spring wire 58 brings the selected resistance 82 into circuit. After the selected time interval the diode fires and the capacitor charge passes through the primer which is ignited, exploding whatever charge it has been attached to.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A demolition timer comprising a cylindrical casing, a core of insulating material within said casing, an electrically energized timing delay circuit including a plurality of resistances and a primer within said casing, said core being formed with a longitudinal bore, a shaft mounted for longitudinal and rotative movement in said bore, a pair of spaced metallic bands on said shaft, one of said bands normally shorting the primer portion of said circuit, means connected to said shaft to rotate the shaft, means carried by the shaft contacting said resistance elements whereby the degree of rotation of said shaft will select any number of resistance elements for the timing circuit, the other of said shaft carried bands upon longitudinal movement of said shaft connecting said resistance elements into said circuit and simultaneously unshorting the primer portion of the circuit to cause said circuit to fire said primer at the end of a

delay period dependent upon the number of resistance elements included in said circuit.

2. A timer according to claim 1 including spring means normally urging said shaft longitudinally to a primer unshorting position, and retaining means for holding said shaft initially in a spring biased position, the removal of said retaining means permitting longitudinal movement of the shaft to a primer unshorting position.

3. A timer according to claim 2 in which the primer is replaced by a testing device.

4. A timer according to claim 3 including a removable wedge encircling said shaft between said spring means and said retaining means, said wedge upon removal permitting longitudinal movement of the shaft to energize the testing means without removing said retaining means.

5. A timer according to claim 1 including a visual indicator attached to the shaft carried resistance elements contacting means to indicate the number of resistance elements selected.

6. A timer according to claim 1 including means attached to the shaft carried resistance elements contacting means to audibly indicate each degree of rotation of said shaft necessary to change from one number of resistance elements to another number of resistance elements.

7. A timer according to claim 1 including a safety covering for said retaining means.

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