

Jan. 2, 1951

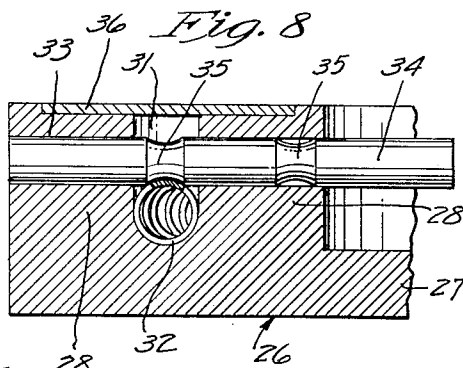
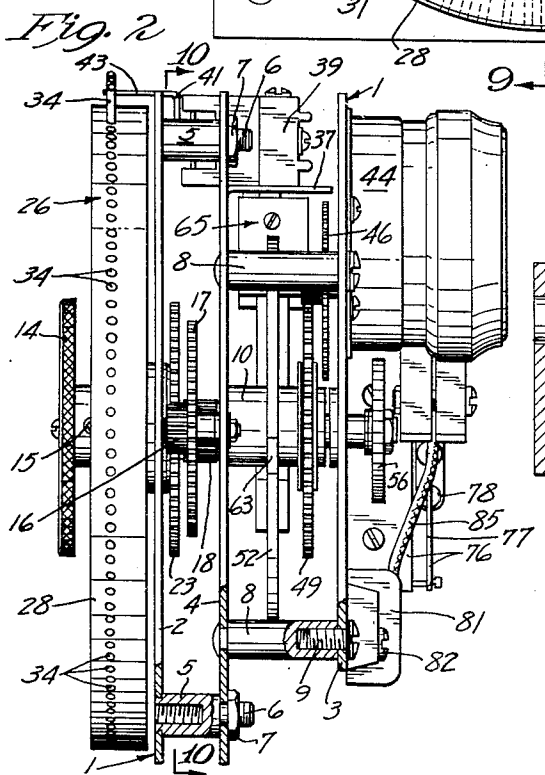
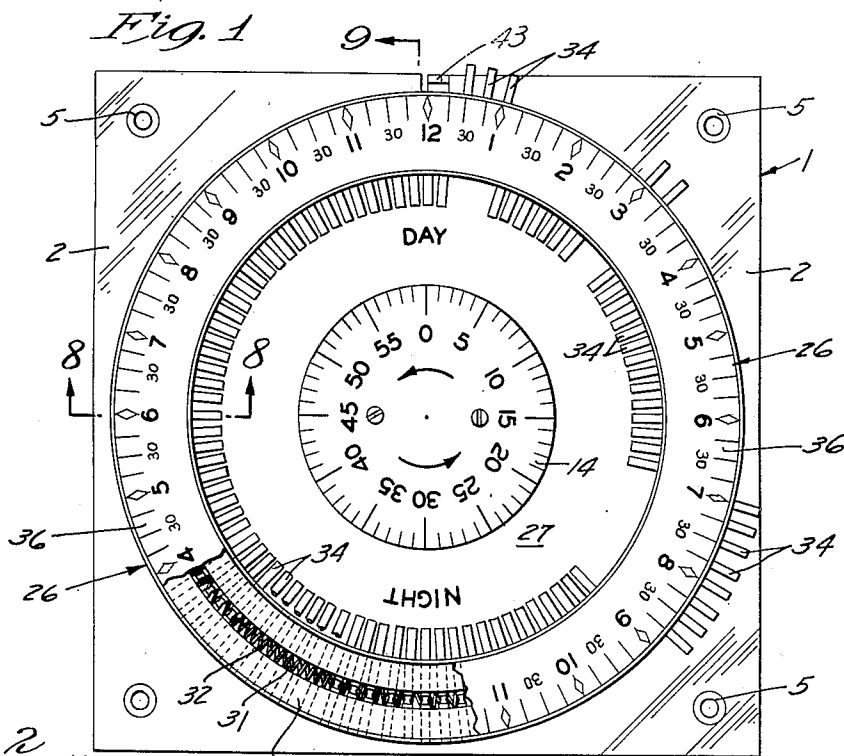
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2,536,133

TIMING MECHANISM

Filed June 14, 1948

4 Sheets-Sheet 1



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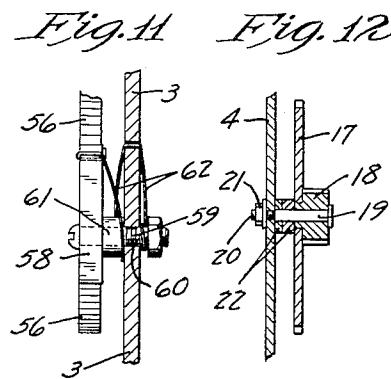
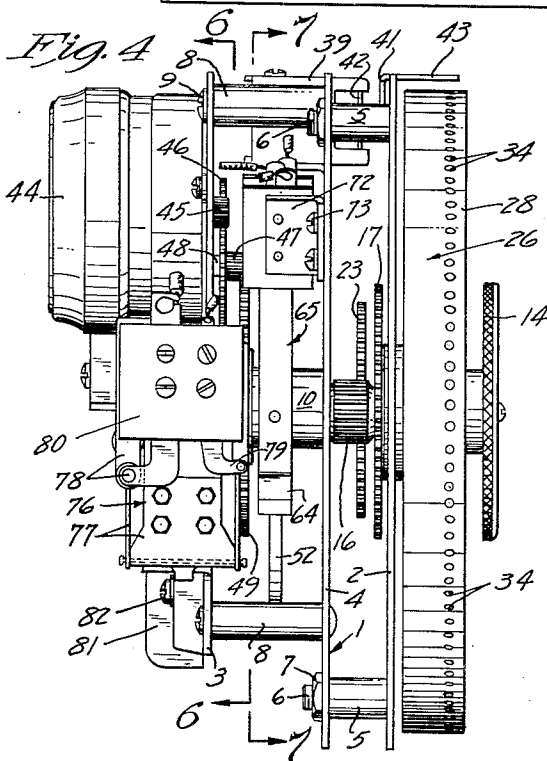
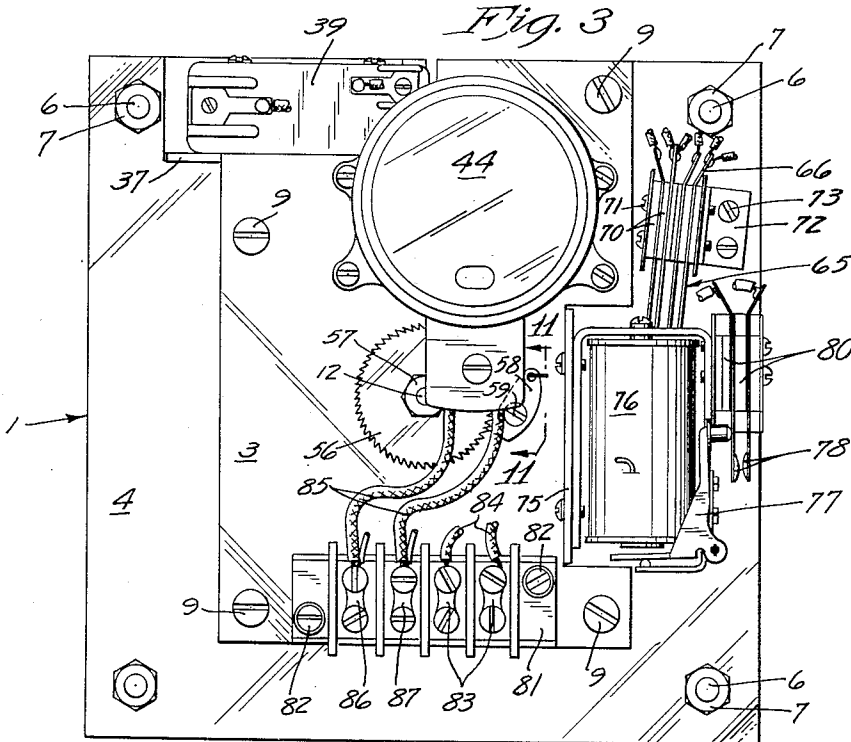
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Filed June 14, 1948

4 Sheets-Sheet 2



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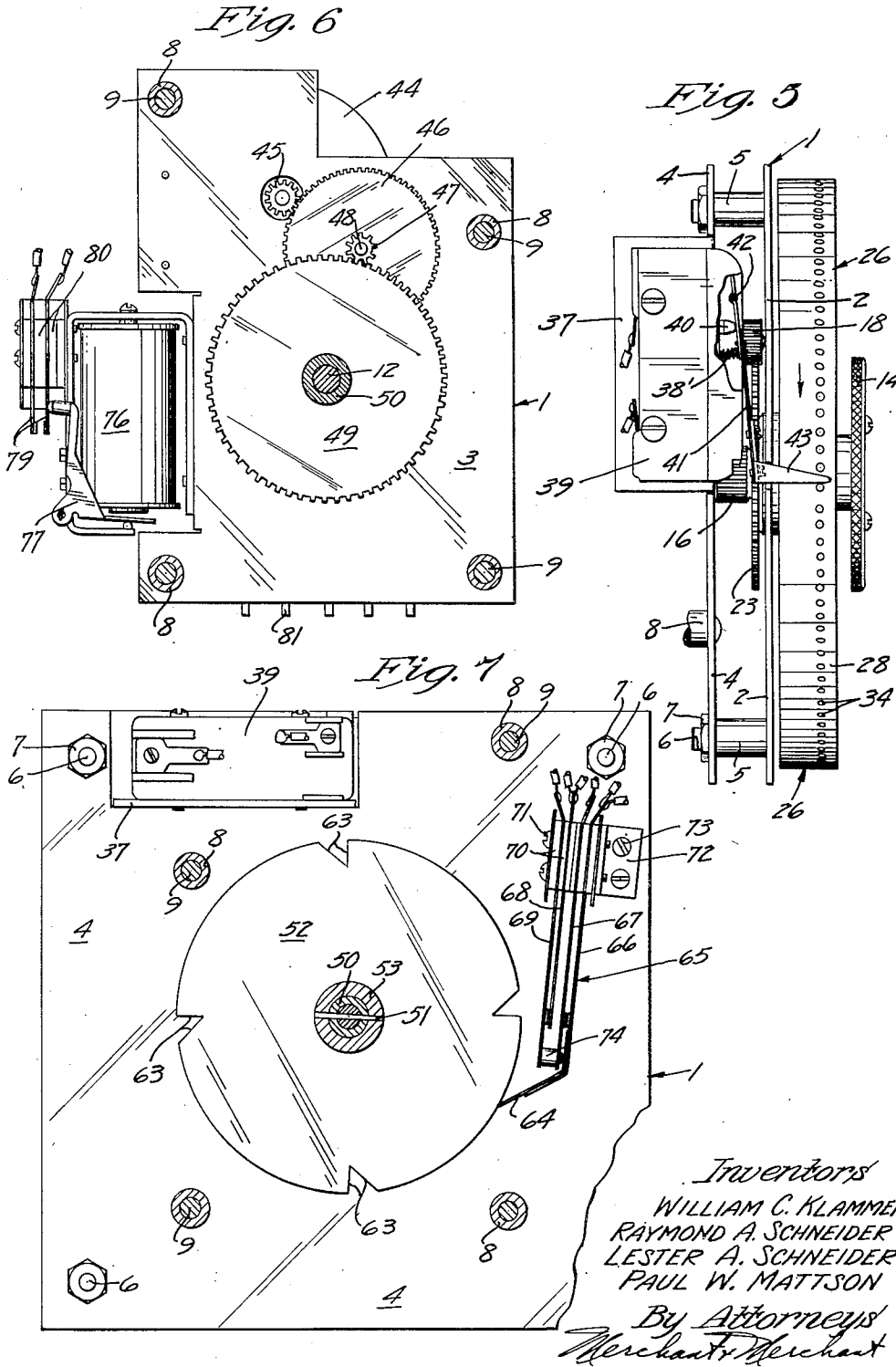
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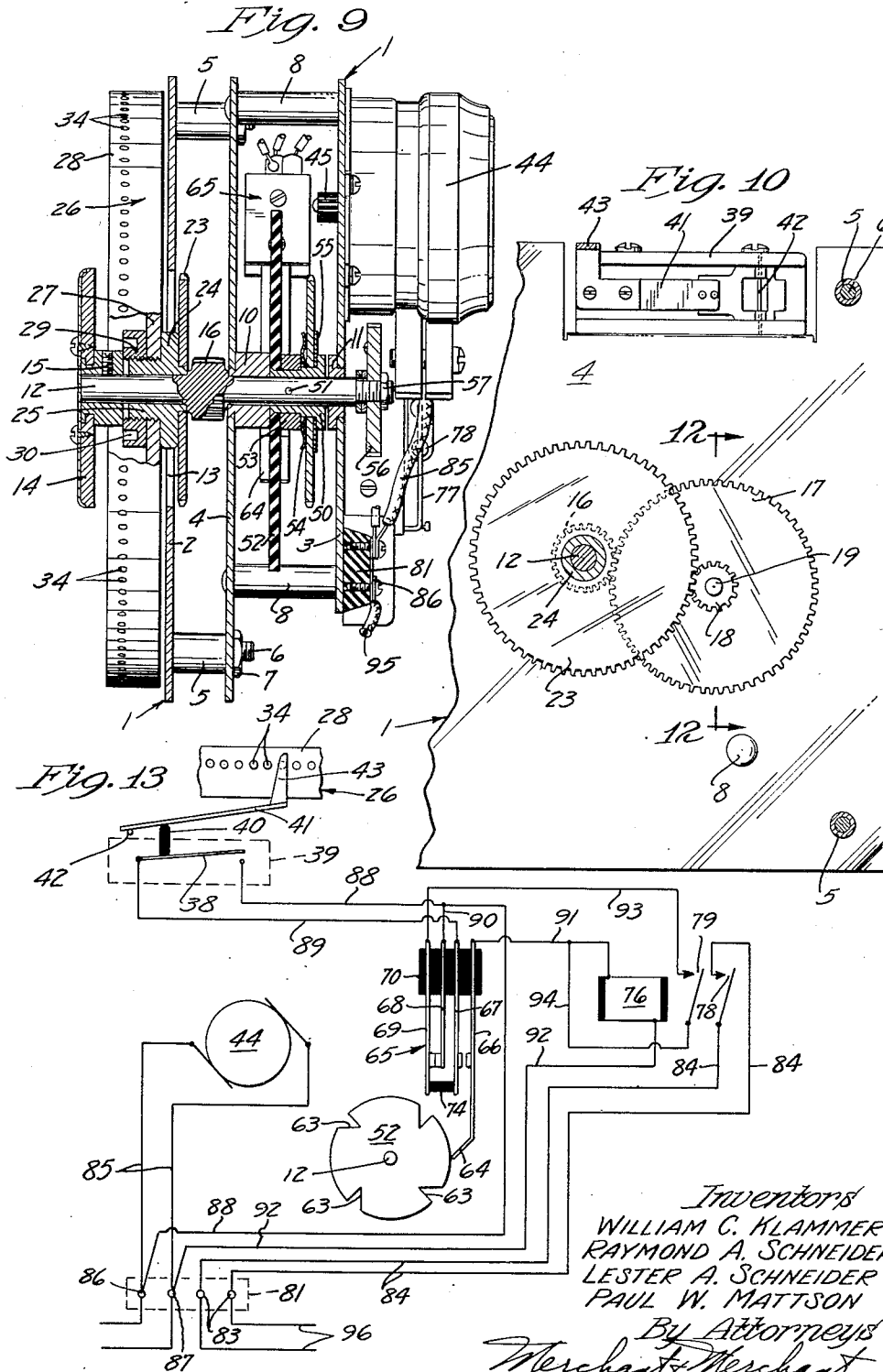
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Filed June 14, 1948

4 Sheets-Sheet 4



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2,536,133

TIMING MECHANISM

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Application June 14, 1948, Serial No. 32,756

2 Claims. (Cl. 161-1)

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Our present invention relates generally to timing mechanisms and, more specifically, to a mechanically-operated mechanism for closing and opening electrical circuits at predetermined time intervals.

The primary object of our invention is the provision of a timing mechanism which can be quickly and easily set to close and open electrical circuits at specified intervals during a given time cycle.

Another object of our invention is the provision of means whereby the time interval settings of our improved timing mechanism may be manually changed at will.

Another object of our invention is the provision of a plurality of trip fingers movable into and out of engagement with switch means for closing an electrical circuit and means for maintaining said trip fingers in set positions.

Still another object of our invention is the provision of a timing mechanism as set forth which is relatively inexpensive to manufacture and install, which is rugged in construction, and which is accurate and durable in use.

Generally stated, the invention consists of the novel devices, combination of devices, and arrangement of parts hereinafter described and defined in the claims.

In the attached drawings, like characters indicate like parts throughout the several views.

Referring to the drawings:

Fig. 1 is a front elevation of my improved timing device, some parts being broken away;

Fig. 2 is a side elevation as seen from the right to the left with respect to Fig. 1, some parts being broken away and some parts being shown in sections;

Fig. 3 is a rear elevation of the mechanism of Fig. 1;

Fig. 4 is a side elevation as seen from the left to the right with respect to Fig. 1;

Fig. 5 is a plan of our improved timing mechanism, some parts being broken away;

Fig. 6 is a view partly in elevation and partly in section, taken on the line 6-6 of Fig. 4;

Fig. 7 is a view partly in elevation and partly in section, taken on the line 7-7 of Fig. 4;

Fig. 8 is an enlarged fragmentary detail in section, taken substantially on the line 8-8 of Fig. 1;

Fig. 9 is a view partly in side elevation and partly in section, taken substantially on the line 9-9 of Fig. 1;

Fig. 10 is a fragmentary view partly in elevation and partly in section, taken on the line 10-10 of Fig. 2;

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Fig. 11 is an enlarged fragmentary detail taken substantially on the line 11-11 of Fig. 3;

Fig. 12 is a fragmentary section, taken on the line 12-12 of Fig. 10; and

Fig. 13 is an electrical wiring diagram of our invention.

Referring with greater particularity to the drawings, the numeral 1 indicates, in its entirety, a frame comprising front and rear mounting plates 2 and 3 respectively, and an intermediate plate 4. Plates 2 and 4 are maintained in spaced parallel relation by spacers 5 secured at one of their ends to the plate 2 and having studs 6 on their other ends extending through the plate 4 and equipped with nuts or burrs 7. A plurality of posts 8 are mounted fast at one of their ends to the plate 4 and are internally threaded at their other ends to receive threaded screws or the like 9 which pass through apertures in the rear mounting plate 5 (see particularly Fig. 2). It will be observed, by reference to Figs. 1 and 2, that the spacers 5 are internally threaded for the reception of mounting screws or the like for securing the timing device to a panel, housing, or the like, not shown.

The plates 3 and 4 are provided with axially-aligned bearing bosses 10 and 11 respectively in which is journaled a shaft 12. The shaft 12 projects forwardly through an enlarged opening 13 in the front plate 2 and at its forward end is provided with a turning knob 14 rigidly secured thereto by means of a set screw or the like 15. Integrally formed with the shaft 12 between the plates 2 and 4 is a toothed pinion 16, which has meshing engagement with a gear 17. The gear 17 is coaxial with and rigidly secured to a pinion 18 which is journaled on a stub shaft 19. The stub shaft 19 has a reduced threaded end 20 which passes through the intermediate plate 4 and is secured thereto by means of a washer-equipped nut 21. The gear 17 is maintained in spaced relation from the plate 4 by means of spacing sleeves 22. A relatively large gear 23 is rigidly secured to a hub 24 journaled on the shaft 12 and has meshing engagement with the pinion 18. The hub 24 has an axially-projecting threaded portion 25 on which is mounted a timing dial 26 which comprises a flat plate-like back 27 and an axially-extended circumferential flange 28. The dial 26 is clamped over the axially-projecting threaded portion 25 of the hub 24 by means of a clamping nut 29 which is provided with circumferentially-spaced openings 30 for the reception of a pin wrench or the like not shown.

The flange 28 is formed to provide a circumferentially-extended axially-opening channel

31 in the bottom of which is contained a coil spring 32. A plurality of circumferentially-spaced holes 33 extend radially through the flange 28. The holes 33 lie in a plane transversely of the shaft 12 and intersect a portion of the channel 31 a distance from the bottom thereof whereby a portion of the spring 32 projects into the intersection there-between. Slidably mounted in each of the holes 33 is a trip finger 34 which is provided with longitudinally-spaced detent-forming notches 35 intermediate its ends. The trip fingers 34 are of such a length and the notches 35 are so spaced that when the radially outer end of each finger 34 is even with the outer periphery of the flange 28, the coil spring 32 is seated in one of the notches 35. The trip fingers 34 may be manually moved to a radially outer extreme position with the inner end of each trip finger 34 even with the inner periphery of the flange 28. In this position, the spring 32 is seated in the other notch 35 of each trip finger 34; and the outer end of the trip finger 34 projects radially outwardly of each flange 28. During shifting movements of the trip fingers 34, the convolutions of the spring 32 spread apart to allow the fingers 34 to slide therebetween. However, sufficient lateral bias is applied to the trip fingers 34 during radial movement thereof in the holes 33 by the convolutions of the spring 32 to provide a relatively light frictional resistance against such radial movements. The open end of the channel 31 is closed by an annular plate 36 which may be rigidly secured to the flange 28 by any suitable means and which is provided with indicia designating time intervals determined by the circumferential spacing of the trip fingers 34.

Adjacent its upper edge, a portion of the intermediate plate 4 is bent to form a bracket 37 on which is mounted a switch 38 contained within a housing 39. The switch 38 is operated by a push button 40 and an actuator lever 41 hinged to the housing 39, as indicated at 42. At its free end, the actuator lever 41 is provided with a cam portion 43 which extends laterally therefrom into the path of travel of the trip fingers 34 when said trip fingers are in their radially outwardly-projected positions (see particularly Figs. 1, 2, 4, 5, and 13). It will be observed, by reference to the above figures, that the cam portion 43 is located above the periphery of the flange 28, whereby it is out of the path of travel of the trip fingers 34 when said trip fingers are in their radially retracted positions. Yielding bias is imparted to the cam portion 43 in a direction away from the switch 38 and toward the trip fingers 34 by a coil compression spring 38' working between the switch housing 39 and the actuator lever 41.

Rotation, in a clockwise direction with respect to Fig. 1, is imparted to the turning knob 14 and the timing dial 26 by an electric motor 44 to the shaft of which is secured a driving pinion 45. The pinion 45 has meshing engagement with a speed reduction gear 46 to which is rigidly secured a pinion 47. The gear 46 and pinion 47 are journaled on a stub shaft 48 which is secured to the frame plate 3. The pinion 47 meshes with a relatively large gear 49 that is journaled for rotation on a flanged bushing 50 rigidly secured to the shaft 12 by a pin or the like 51 intermediate the bearing bosses 10 and 11 of the frame 1. A circular plate-like cam element 52 and an annular spacer 53 are mounted fast on the flanged bushing 50, and a pair of friction

elements 54 and 55 are interposed between opposite sides of the gear 49 and the spacer 53 and the flange of the bushing 50 respectively. The friction elements 54 and 55 are in the nature of spring washers of the type commonly used in clock mechanisms and provide friction driving means between the gear 49 and the flanged bushing 50. Obviously the purpose of the friction drive is to allow manual setting of the timing dial 26 and cam element 52 independently of the rotation of the motor 44.

The particular construction of the cam portion 43 permits engagement therewith by the trip fingers 34 to actuate the switch 38 under rotary movements of the turning dial 26 in one direction only. To prevent manual setting rotation of the turning knob 14 in the opposite direction, we provide a ratchet 56 mounted on the rear end of the shaft 12 and held securely in place by means of a nut 57. A pawl 58 is mounted for pivotal movements on a threaded bolt 59 which is screw-threaded into the rear frame plate 3 as indicated at 60. The pawl 58 is maintained in spaced relation from the plate 3 and in the plane of the ratchet 56 by means of a spacer 61; and the pawl 58 is biased toward engagement with the ratchet 56 by a torsion spring 62. The ratchet teeth are inclined in a direction to permit rotary movements of the turning knob 14 and timing dial 26 in a counter-clockwise direction with respect to Fig. 1, but prevent counter-clockwise movements of either the turning knob 14 or the dial 26.

The length of the desired complete time cycle and the particular use to which our timing mechanism is to be applied are factors which determine the speed of rotation of the timing dial 26 and the cam element 52. In the structure shown, the shaft 12 and cam element 52 carried thereby are arranged to rotate at the speed of one revolution per hour. The speed reduction connections comprising the pinions 16 and 18 and the gears 17 and 23 cause the timing dial 26 to be rotated at a speed of one revolution every twenty-four hours. With this arrangement, the timing device is particularly adapted for use with radio receiving sets and the like inasmuch as most of the broadcast programs have durations of multiples of quarter hours. The quarter-hour increments are determined by circumferentially-spaced notches 63 in the cam element 52 which are adapted to successively receive, upon rotation of the cam 52, the cam follower 64 of switch 65. As seen, by reference to Figs. 7 and 13, the notches 63 are four in number, so that the follower 64 will be received into the notches 63 at quarter-hour intervals, assuming that the rate of rotation of the cam element 52 is one revolution per hour.

The switch 65 comprises a plurality of laterally-spaced leaf springs 66, 67, 68, and 69, maintained in spaced parallel relationship by blocks 70 which are made from any suitable insulating material. A pair of machine screws 71 rigidly secure the leaf springs and insulating blocks to a bracket 72 which is secured fast to the intermediate plate 4 by screws or the like 73. It will be seen, by reference to Figs. 2, 4, 7, 9, and 13, that the leaf springs 66 to 69 inclusive and the cam follower 64 lie in the plane of the cam element 52 and that the leaves 67 and 69 are tied together at their free ends by an insulating member 74. The leaves 66 and 67 are each provided with opposed contact buttons which are spaced apart when the cam follower 64 rides on the

outer periphery of the cam element 52 but which come into contact when the cam follower 64 is received within any one of the notches 63. The leaves 68 and 69 are also provided with opposed contact buttons which engage one another when the cam follower 64 rides on the periphery of the cam element 52 but which are in spaced apart relationship when the follower 64 is received within any one of the notches 63. The leaf spring 66 is yieldably biased in the direction of the cam element 52 so that the cam follower 64 will be received into the full depth of any one of the notches 63 when said notches move into alignment with the follower 64. The rear plate 3 is formed at one side to provide a rearwardly-projecting bracket 75 to which is rigidly secured a relay 76. The armature 77 of the relay 76 is adapted to close a pair of normally open switches 78 and 79, the purpose of which will hereinafter become apparent. The switches 78 and 79 are made up of leaf springs held apart in spaced relationship by means of insulating blocks 80 and are mounted on the frame of the relay 76. A terminal block 81 is secured fast to the rear plate 3 by means of screws 82 and is provided with a pair of terminals 83 to one each of which is connected one of a pair of leads 84 which are connected at their other ends to the relay-operated switch 78. The motor 44 is provided with a pair of leads 85 which are connected one each to one of a pair of terminals 86 and 87 on the terminal block 81.

Referring to Fig. 13, it will be seen that a lead 88 extends from the terminal 85 to one side of the switch 38. The other side of the switch 38 is connected to the leaf spring 67 by a lead 89. A short lead 90 connects the lead 88 to the leaf spring 68 of the switch 65. The leaf spring 66 is connected to one end of the coil of the relay 76 by a lead 91 while a lead 92 connects the other end of the coil of the relay 76 to the terminal 87. One side of the relay-operated switch 79 is connected to the leaf spring 69 by a lead 93 and the other side of the relay switch 79 is connected to the leaf spring 66 by a lead 94 connected at one end to the lead 91. A pair of leads 95 are shown as extending from the terminals 86 and 87 and may be assumed to be connected to a source of electrical power not shown. A pair of leads 96 are also shown in Fig. 13 as extending from the terminals 83 and may be assumed to be connected in a radio receiver circuit also not shown, whereby closing of the switch 78 by the relay 76 will cause the radio receiver circuit to be closed. It will be noted that when the cam portion 43 is not engaged by an outwardly-projected trip finger 34 the switch 38 is open, when the follower 64 rides on the periphery of the cam element 52 connections between the leaf springs 66 and 67 are closed and connections between the leaf springs 68 and 69 are open, and that when the relay 76 is inoperative the switches 78 and 79 are open.

When it is desired to operate our improved timing device, the timing dial 26 is turned by manual rotation of the turning knob 14 in a counter-clockwise direction until the timing dial 26 is moved to the correct chronological setting. This setting is determined by a pointer not shown but located adjacent the cam portion 43 so that, by reference to Fig. 1, the timing dial is set at twelve o'clock noon, assuming, of course, that the setting is made at noon. Rotation of the timing dial 26 will bring successive radially outwardly-projecting tripping fingers 34 into engagement with the cam portion 43 of the actu-

ator lever 41 and depress the same, whereby to close the switch 38. While the switch 38 is in a closed position, the cam element 52 rotates until one of the notches 63 thereof reaches a point adjacent the cam follower 64. The cam follower 64 is under yielding bias of the leaf spring 66 to enter notch 63, whereby to close a circuit comprising lead 88, switch 38, lead 89, leaf springs 66 and 67, lead 91, the coil of the relay 76, and lead 92, whereby to cause energization of the relay 76. The relay 76 thus energized closes the switch 78 and causes a circuit to the radio receiver, not shown, through the leads 84 and 96, to be completed, thus turning on said receiver. Relay switch 79 is also closed by energization of the relay 76. Continued rotation of the cam element 52 causes the follower 64 to leave the notch 63 and ride upon the peripheral edge of the cam element 52. When this occurs, the circuit closed by leaf springs 66 and 67 is broken but a new circuit is closed, said circuit comprising the lead 88; a short lead 90, leaf springs 68 and 69, lead 93, switch 79, lead 94, part of the lead 91 leading therefrom to the coil of the relay 76, and lead 92. The switch formed by the leaf springs 68 and 69 closes prior to the opening of the switch formed by the leaf springs 66 and 67 so that there is no de-energization of the relay 76 at this point. Subsequent to the closing of the switch formed by the leaf springs 68 and 69, the switch 38 may be opened without affecting the circuit through the relay 76. In fact, the switch 38 opens during the passage of one of the radially outwardly-projected trip fingers 34 beyond the cam element 43 and its engagement by a subsequent radially outwardly-projected trip finger. However, the mechanism is so arranged that connection is always made between leaf springs 68 and 69 before the switch 38 is opened. It will be noted that, in the event of radially outward projection of but a single tripping finger 34, the switch 38 will open after passage of the outwardly-projected trip fingers 34 and remain open. Continued rotation of the cam element 52 brings a subsequent notch 63 into position to receive the cam follower 64 whereby to sever the connection between the leaf springs 68 and 69 and de-energize the relay 76, thus allowing the switches 78 and 79 to open and causing the radio receiver to be shut off. At this point, it will be observed that closing of the connections between leaf springs 66 and 67 have no effect on the relay 76 for the reason that the switch 38, being connected in series with the leaf springs 66 and 67, is open. It will be further noted that the switch 38 is merely a temporary circuit closer and that the actual timing for each quarter-hour interval is determined by the switch 65 and the operation thereof by the cam element 52. In other words, engagement of the cam portion 43 by a radially outwardly-projected tripping finger 34 and its closing of the switch 38 permits the relay 76 to be energized when the cam element 52 rotates to a point where the cam follower 64 is received within one of the notches 63. The relay is then energized until the cam follower 64 is received into a subsequent notch 63. The time interval, therefore, is determined by the speed of rotation of the cam element 52 and the spacing of the notches 63 therein.

From the foregoing, it will be seen that, if but one tripping finger 34 is projected radially outwardly of the flange 28, the relay 76 will be energized for a quarter-hour period. It will be seen, by reference to Fig. 1, that there is a trip-

ping finger 34 for each quarter-hour period in a twenty-four hour cycle, so that, if a group of consecutive tripping fingers 34 are radially outwardly projected, the relay 76 will be energized for the duration of time necessary for the entire group of outwardly-projected tripping fingers to engage and operate the cam portion 43 of the actuator lever 41. Thus, a device such as a radio receiver may be put into and out of operation for a quarter-hour period or any multiple thereof at different times during a twenty-four hour cycle. To set the tripping fingers 34 for any particular time of operation, it is but necessary to manually move the required number of proper fingers to radially outwardly projected positions.

Our invention has been thoroughly tested and found to be entirely adequate for the accomplishment of the objectives set forth; and, while we have shown a single embodiment of our improved timing device, it will be understood that the same is capable of modification without departure from the scope and spirit of the invention as defined in the claims.

What we claim is:

1. In a device of the class described, a frame, a shaft journaled for rotation with said frame, a manual turning knob rigidly secured to the outer end of said shaft, a rotary timing dial mounted for rotation on said shaft adjacent said turning knob, reduction gearing connecting said shaft to said dial, a motor coupled to said shaft, said dial including an annular forwardly projected peripheral flange and a recessed central portion, a plurality of circumferentially spaced radially extending trip fingers slidably mounted in said flange for movements in a vertical plane forwardly of said recessed portion, said trip fingers having a greater length than the radial depth of said flange whereby the opposite ends of said trip fingers may be projected radially inwardly or outwardly of said flange, an electric circuit including a pair of serially connected switches, a switch actuator on one of said switches

having a cam portion adapted to be engaged by said trip fingers when said fingers are projected radially outwardly of said flange, whereby to close said switch when camming engagement is made between said cam portion and one of said fingers, a cam element on said shaft, a switch actuator arm on said other of said switches engageable with the cam element on said shaft to operate said other switch to close said circuit subsequent to the closing of said first-mentioned switch and open said circuit after a predetermined time interval from the closing thereof.

2. The structure defined in claim 1, in further combination with means tending to retain said trip fingers in either of their extreme set positions, said means comprising a circumferentially extended forwardly opening channel in said flange, said trip fingers extending through the intermediate portion of said channels forwardly of the bottom portion thereof, longitudinally spaced annular detents on said trip fingers alignable with said channel when said trip fingers are moved to one or the other of their projected positions, and a coiled spring interposed between the bottom portions of said channels and said trip fingers, said spring exerting yielding bias against said trip fingers in all positions and being of a diameter to be seated in the said detents when said detents are aligned with said channel, whereby to lock said trip fingers against accidental displacement.

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The following references are of record in the file of this patent:

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