

March 21, 1933.

H. D. GARRETSON

1,902,228

IMPULSE TIMER

Filed July 24, 1930

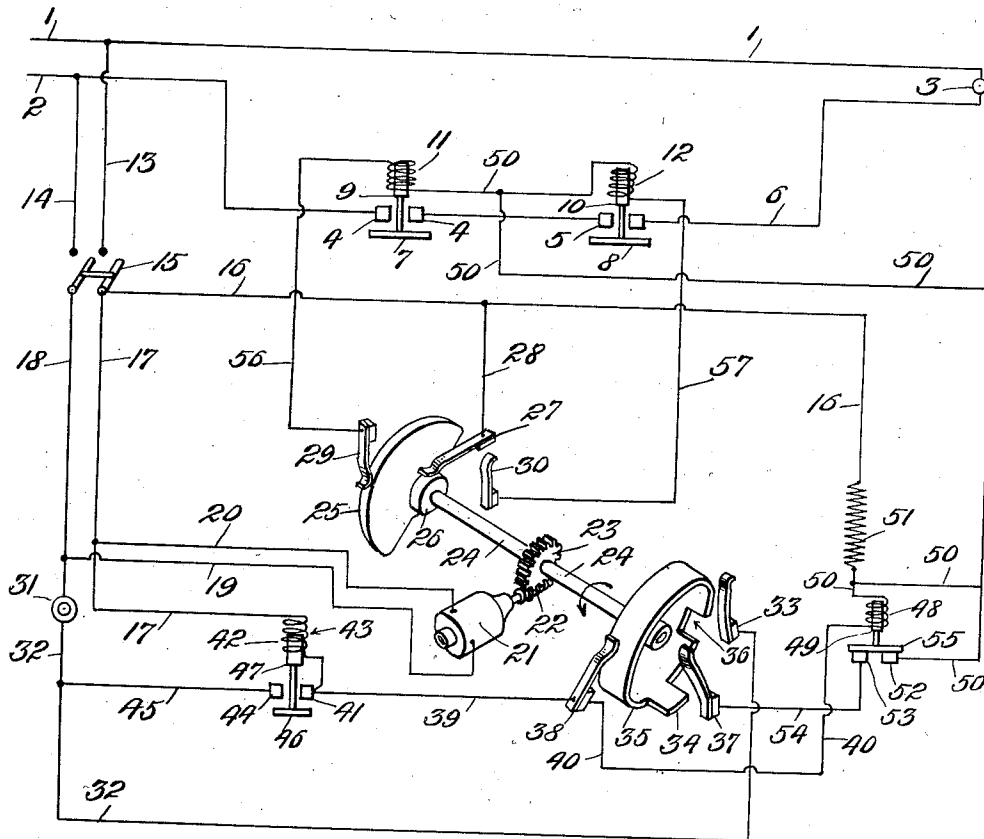


Fig. 1.

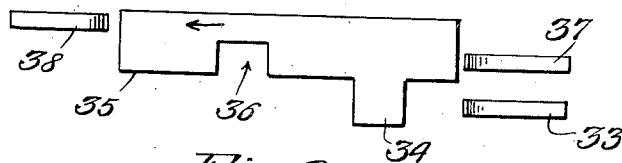


Fig. 2.

INVENTOR
HARRY D. GARRETSON
BY
O. Edwards
ATTORNEY

UNITED STATES PATENT OFFICE

HARRY D. GARRETSON, OF NEW YORK, N. Y., ASSIGNOR TO HARRY F. WAITE, OF NEW YORK, N. Y.

IMPULSE TIMER

Application filed July 24, 1930. Serial No. 470,314.

The object of my invention is to provide a means for accurately controlling the time of very short electrical contacts, so that a fraction of one alternation, one alternation, or more than one alternation, to any extent desired, may be sent through a circuit, or so that a direct current may be accurately timed to any short interval. This object is accomplished by having two switches which are relay controlled and in a series circuit with the circuit to be energized for a short time, as an X-ray apparatus, and the relays have timing mechanism and connections so that they will function concurrently or successively with an overlap. Both have to be closed to enable the system to be energized. The overlap is subject to manual adjustment.

For a more detailed description of my invention, reference is to be had to the accompanying drawing, forming a part hereof, in which

Figure 1 is a diagrammatic view of my improved timer; and

Figure 2 shows a feature of the same.

Throughout the various views of the drawing, similar reference characters designate similar parts.

Power is derived for this timer and all connected parts through bus bars 1 and 2 and this power may be applied to an X-ray apparatus or any other kind of apparatus designated generically by the character 3. One bus bar 1 runs directly to this device 3 and the other bar 2 is connected therewith by means of switches 4 and 5, which are relay controlled, and a wire 6. Obviously, the device 3 can receive power only when both the switches 4 and 5 are closed. The apparatus functions through the control of these switches and provides for their common closing only during the desired interval of time. These switches are both electrically controlled with two contacts connected by blades 7 and 8 respectively and these blades are operated in any suitable way as by means of the cores 9 and 10 of solenoids 11 and 12 so that electric impulses through these respective solenoids determine when the switches 4 and 5 will be open or closed. The appa-

ratus for causing this opening and closing will now be described.

The wire 13 is connected to the bus bar 1 and a wire 14 to the bus bar 2, and these wires run to a conventional double-blade switch 15 so that when this switch is closed, the wire 13 will be connected with two wires 16 and 17 and the wire 14 will be connected with the wire 18. The wires 18 and 17 are connected to wires 19 and 20 which run to a motor 21 and power through these wires drives this motor whenever the switch 15 is closed and power is on the bus bars. This motor has an armature with a worm 22 geared to a suitable worm gear 23 on a shaft 24 which is driven anti-clockwise, as indicated, and at any desired speed, say one revolution a second, and at one end of this shaft 24 is a contact disc 25 which has a collar 26 integral therewith, and both the parts 25 and 26 are insulated from the shaft 24. The part 25 is about 180° and the part 26 is 360° so as to be in constant contact with a brush 27, which is connected to a wire 28 that runs to the wire 16. One brush 29 is on one side of the disc 25 and another brush 30 is opposite so that these two brushes engage the disc 25 for a predetermined interval of time, depending upon where the brushes 29 and 30 are placed, these brushes being adjustably mounted so as to move with an angular movement towards or away from each other. If these brushes be 180° apart, they will be on the disc 25 at the same time for substantially a threehundredth of a second, and if they be brought closer together, they will be on the disc 25 a longer period of time, as is obvious. Therefore, the position of these brushes, relatively one to the other, determines the time the switches 4 and 5 are closed simultaneously and on this simultaneous closing will depend the length of impulse allowed to reach the apparatus 3.

It is all important that this impulse should begin and end properly. When an alternating current is employed, this beginning should be on the same part of the revolution. Where an alternating current is employed, the motor 21 is synchronous and so keeps step with the alternations. The means for

timing the opening and closing with regard to the current will now be described.

The wire 18 runs to a push button switch 31, or any other convenient form of switch which may be readily opened and closed, and this joins a wire 32, which, through this switch 31, may be connected to the wire 18. The wire 32 also runs to a brush 33, which once every revolution engages a lug 34 and forms an electrical contact therewith, this lug 34 projecting from an annulus 35 fixed to the shaft 24 but insulated therefrom. At a convenient location, as indicated, this annulus 35 has a gap 36, the purpose of which will appear below. There are two other brushes that rest on the annulus 35. One is the brush 37 which rests on this annulus at all times except when the gap 36 is opposite the brush. The other is a brush 38 which rests on the annulus at all times. The brush 38 has two wires 39 and 40 connected therewith. The wire 39 runs to a pole 41 of a relay 42 and the relay 42 has a magnet 43 connected to this pole 41 and also to the wire 17. The other pole 44 of the relay 42 is connected by a wire 45 to the wire 32. The blade 46 of this relay 42 is connected to a core 47, in the conventional manner, of this relay which passes into the winding 43 and is drawn upwardly when this winding is energized so as to have the blade connect the parts 41 and 44. When the magnet 43 is not energized, gravity causes the core 47 to fall and so the blade 46 opens the circuits at the contacts 41 and 44. The brush 38 also has a wire 40 which runs to a magnet 48 of a relay 49 and this magnet is connected by a wire 50 to a resistance 51 which runs to the wire 16. The wire 50 also runs to a pole 52 of the relay 49, the other pole 53 being connected by a wire 54 to a brush 37. A blade 55 connects the poles 53 and 52 when the coil 48 is not energized. When this coil is energized, the blade 55 is raised because it is connected to a core in this coil 48. The wire 50 is also connected to the windings 11 and 12 of the relays 4 and 5 respectively, so that when a current passes through this wire 50, these coils may be energized and will be energized whenever either or both, depending upon the positions of the brushes 29 and 30 with regard to the disc 25, are on the disc 25, because these coils are connected with these brushes through wires 56 and 57 respectively.

Operation

In view of the foregoing, the operation of my apparatus will be readily understood.

1. Set one of the brushes 29 or 30 according to the length of time of energizing the apparatus 3.

2. Close the switch 15 so as to energize wires 17 and 18 and start the motor 21, so as to cause the shaft 24 to revolve with the disc 25 and the annulus 35. It is assumed

that this shaft rotates with an angular velocity of substantially one revolution a second. This has been found a convenient velocity although it may be departed from if desired.

3. Press the push button 31 and thereby close the switch at this point. Before this push button is pressed, it will be noted that the circuit is open at the relay 42 and brush 33. The wire 32, which is connected to the button 31, will remain inactive until the lug 34 engages the brush 33, as it does once every revolution of the shaft 24 and then a circuit is closed through this brush, the disc 35, brush 38, wire 39, contact 41, winding 43 of relay 42, and wire 17, so that the relay 42 is energized and closes a switch between the contacts 44 and 41, so that a current may flow through the wire 45, contact 44, armature 46, contact 41, and winding 43 to the wire 17. This current is sufficient to keep the relay 42 closed, so that a current may flow through the wire 39, brush 38, disc 35, brush 37, wire 54, contact 53, armature 55, contact 52, and wire 50, so that as long as the brush 37 is on the disc 35, the magnet 48 is short circuited, and off this disc, the circuit through the wire 54 is open and then a circuit is complete through the wire 40 and magnet 48 which is then energized and raises the armature 55 thereby opening the circuit between the contacts 53 and 52. Once this relay is opened, it stays open until closed in a manner which will be described below. During the normal functioning of the apparatus it is closed, and it is closed at all times except as hereinafter mentioned.

When the apparatus is in the condition indicated in Figure 1, except for the changes incidental to closing the switches 15 and 31, a circuit is complete through the resistance 51 to the wire 16 from the wire 50. The resistance 51 is a high resistance so that the leakage is small and sufficient to permit the relay magnet 48 to be energized sufficiently to keep up its armature if the armature is up but not sufficient to raise the armature if it be down. The wire 50 is also connected to the magnets of the relays 4 and 5 as indicated, i. e. to the magnets 11 and 12 and these are connected by wires 56 and 57 to the brushes 29 and 30. In Figure 1, the brush 29 is shown resting on the disc 25. In such a position, under the normal functioning of the apparatus, the armature 7 rests on the contacts at 4 so as to close the circuit at this point, because a circuit is closed between the brush 29 and disc 25 and through the brush 27, the wire 28 and wire 16, as is obvious. As the shaft 24 rotates, the disc 25 moves and comes in contact with the brush 30. When such is the case, the armature 8 is brought against the contacts at the relay 5 and closes the circuit at a second point in the wire 6 so that the apparatus 3 may be energized, and this apparatus will be energized just as long

as both of the brushes 29 and 30 are simultaneously on the part 25 and no longer. One of these brushes is adjustable and may be brought close to the other, and in this event, they will be simultaneously in contact with the disc 25 throughout substantially one-half of a revolution of the shaft 24, or if separated a little less than 180°, they will both be in contact only a small fraction of a second. It will be noted that while these two brushes have a simultaneous contact, that is, an overlapping contact with the disc 25, the apparatus 3 is energized but no longer, but these two brushes 29 and 30 each remain in contact with the disc 25 throughout half a revolution regardless of their relative positions. This is important because the armatures 7 and 8 are raised for half a revolution in any event during the normal functioning of the apparatus, and so have plenty of time to make a firm contact. It is the overlap of the brushes 29 and 30, which gives the apparatus its true and accurate functioning for minute periods of time. It has been found that where a practically instantaneous contact is had between two parts, which enable an electric current to flow, there are inductive effects and other effects due to the elasticity of materials at the contacts, so that irregular results are produced at the apparatus having a short period of energizing, and it is difficult to get two identical results in the old manner. With the apparatus of this invention, it is possible to get exact and identical results at each exposure and regardless of the length of the exposure at the apparatus 3.

In view of what has just been said, it is apparent that the exposures will be had when the brushes 29 and 30 are in simultaneous contact with the disc 25 and no longer, although one or the other of the contacts 7 or 8 may remain elevated and the relay closed to which it is connected. The apparatus for causing only one exposure to be had at the apparatus 3, by pressing the button 31, will now be set forth.

As above stated, once a revolution the brush 37 enters the gap 36 thereby opening the circuit at the armature 55, because the magnet 48 raised its armature, and thereafter this armature will remain raised because of the leakage through the resistance 51 even though neither of the magnets 11 or 12 be energized as may happen once a revolution when both brushes 29 and 30 are off the disc 25. The resistance of the magnet 48 is so high that when a current passes through it, it is too weak to energize the magnets 11 and 12 and cause them to raise their armatures, so that once the armature 55 is raised, the armatures 7 and 8 remain down, and with these armatures down there can be no exposure at the apparatus 3. However, the relay 42 will remain closed as long as the

push button 31 is pressed, and this will short circuit any circuit closed by the lug 34 coming in contact with the brush 33, so that the functioning of these parts will not affect the apparatus 3. Immediately upon the opening of the switch 31, the relay 42 will open and remain open until there is another cycle of operations as above set forth. When this occurs the magnet 48 is de-energized and then the armature 55 is lowered and rests on its contacts and the apparatus is in the condition shown in Figure 1, except that the switch 15 is closed, and it is ready for another operation.

While I have shown and described one embodiment of my invention, it is obvious that it is not restricted thereto, but that it is broad enough to cover all structures that come within the scope of the annexed claims.

Having thus described my invention, what I claim is:

1. In a system of the class described, two separate electro-magnetic switches provided with suitable circuits, one circuit being closed through the contacts of said switches when both switches are closed but not otherwise, other circuits through the magnets of said switches and means for controlling the magnet circuits for causing one of said circuits to open and close and the other of said circuits to open and close with a lag behind the first both as to opening and closing, and each to function with regard to the other so that both are closed for a common period of time.

2. In a system of the class described, two separate electro-magnetic switches provided with suitable circuits, one circuit being closed through the contacts of said switches when both switches are closed but not otherwise, other circuits through the magnets of said switches, and adjustable means for controlling the magnet circuits for causing one of said circuits to open and close and the other of said circuits to open and close with a lag behind the first both as to opening and closing and each to function with regard to the other so that both are closed for a common period of time.

3. In a system of the class described, two separate electro-magnetic switches provided with suitable circuits, one circuit being closed through the contacts of said switches when both switches are closed but not otherwise, other circuits through the magnets of said switches, means for controlling the magnet circuits for causing one of said circuits to open and close and the other of said circuits to open and close with a lag behind the first both as to opening and closing and each to function with regard to the other so that both are closed for a common period of time, and means for preventing more than one cycle of operations after the cycle starts.

4. In a system of the class described, two

separate electro-magnetic switches provided
with suitable circuits, one circuit being closed
through the contacts of said switches when
both switches are closed but not otherwise,
5 other circuits through the magnets of said
switches, means for controlling the magnet
circuits for causing one of said circuits to
open and close and the other of said circuits
to open and close with a lag behind the first
10 both as to opening and closing and each to
function with regard to the other so that both
are closed for a common period of time, and
means for starting this cycle of operations
and means for preventing more than one
15 cycle, once a cycle has started.

In testimony whereof, I have hereunto set
my hand this 30 day of June 1930.

HARRY D. GARRETSON.

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