

Aug. 7, 1951

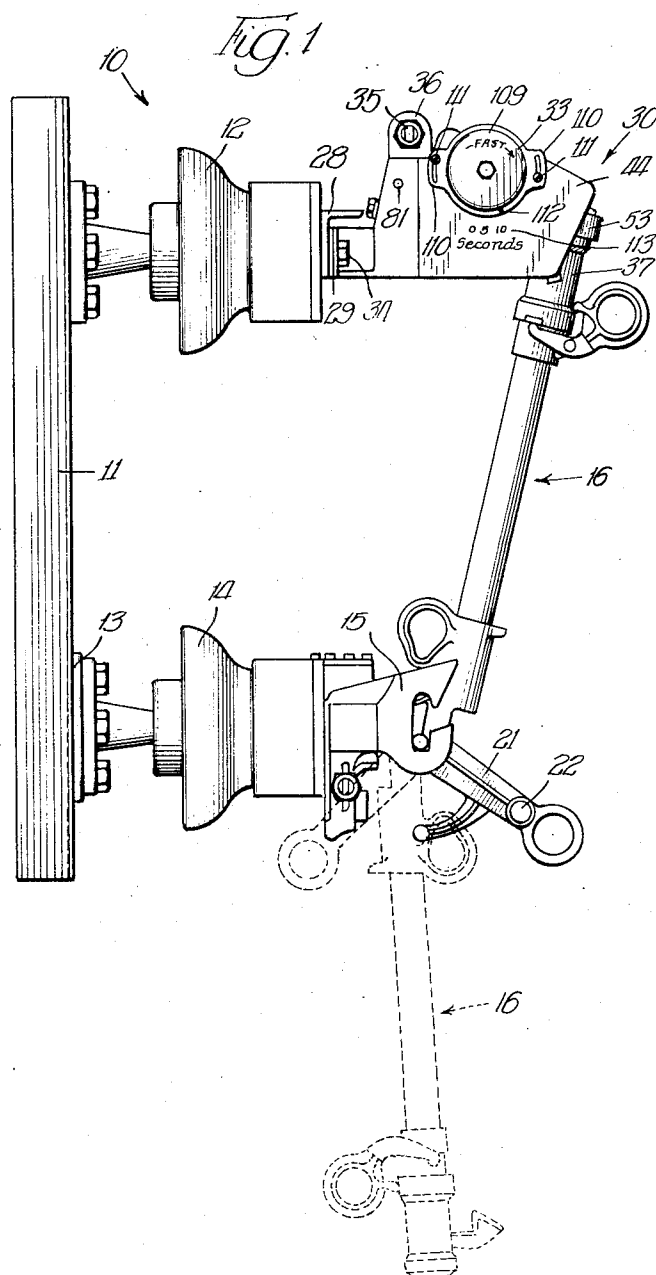
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2,563,558

TIME DELAYED REPEATER FUSE CONSTRUCTION

Filed Feb. 21, 1949

4 Sheets-Sheet 1



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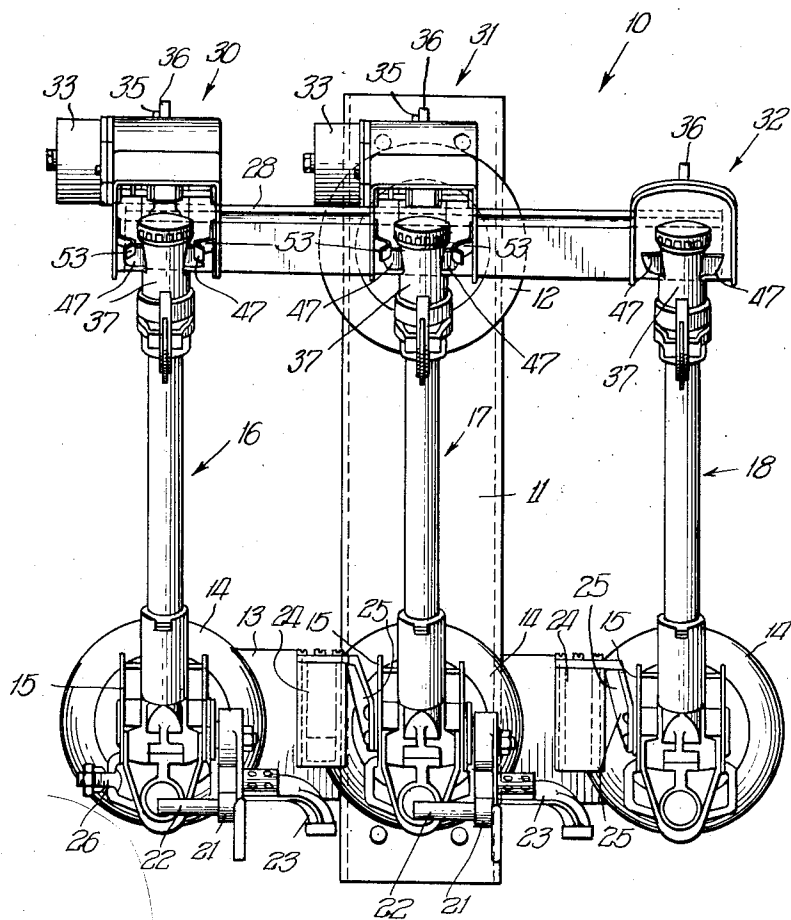
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TIME DELAYED REPEATER FUSE CONSTRUCTION

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4 Sheets-Sheet 2

Fig. 2



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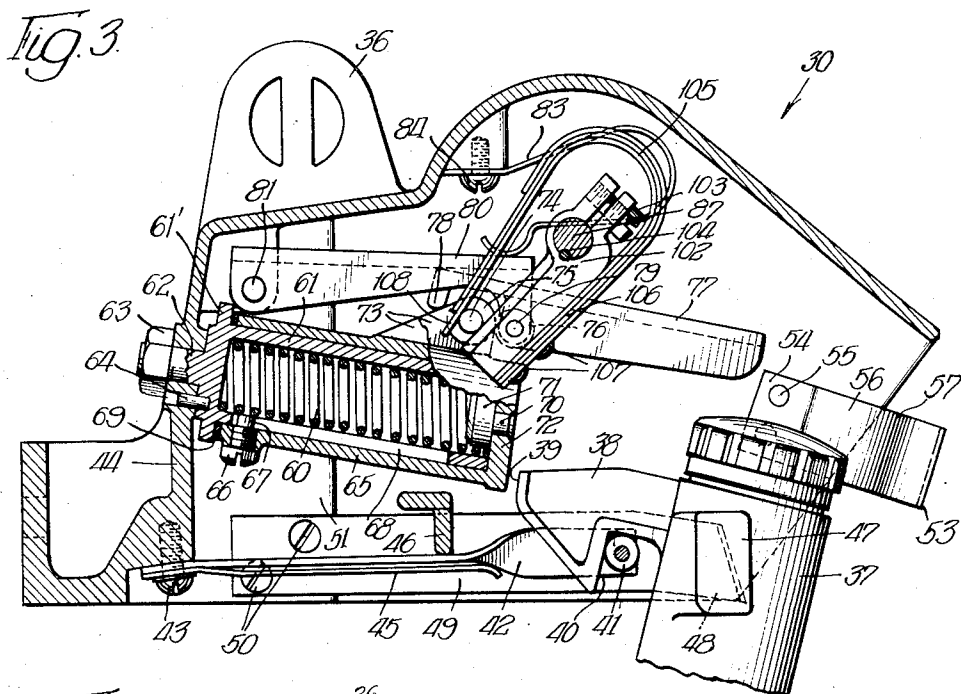
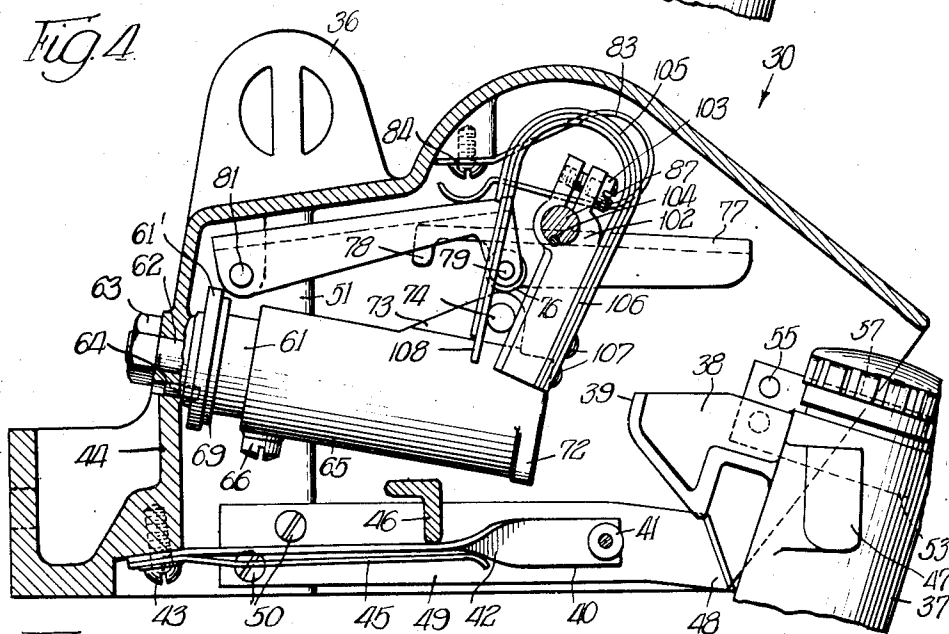
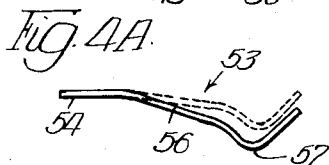
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4 Sheets-Sheet 3



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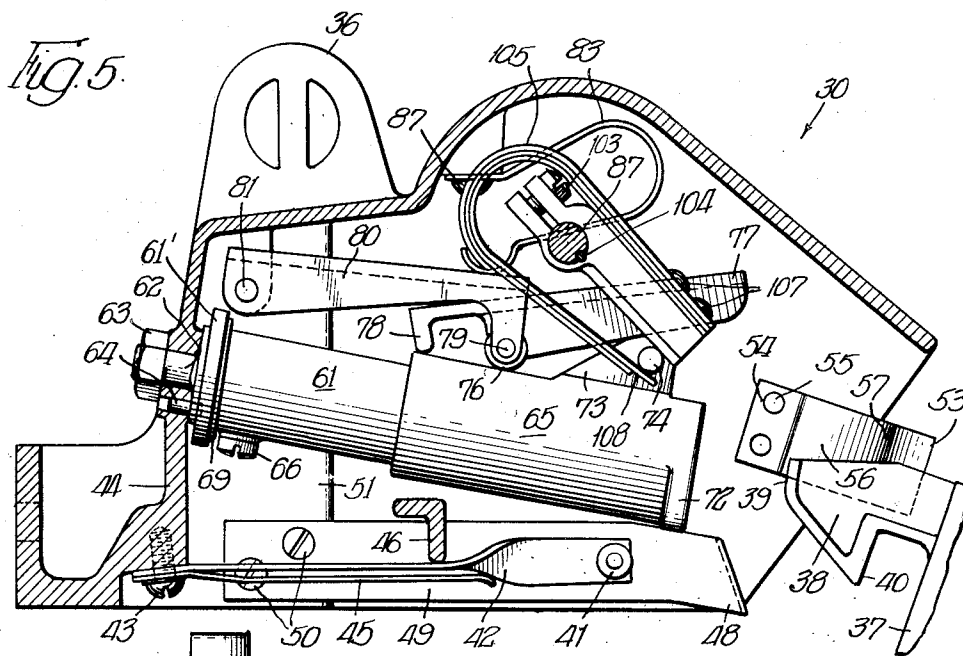
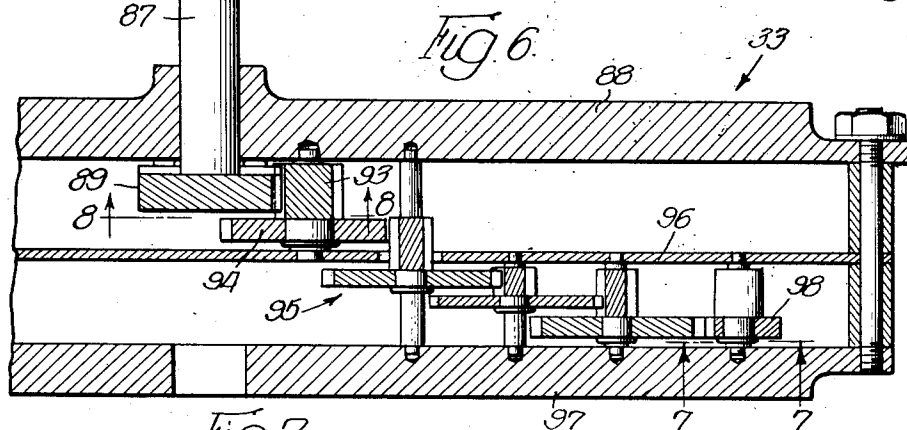
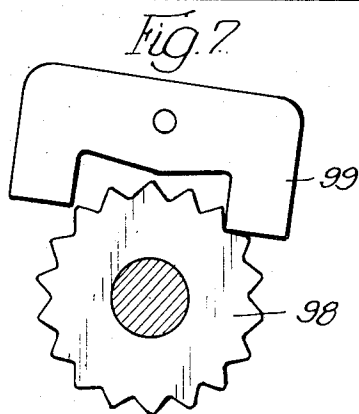
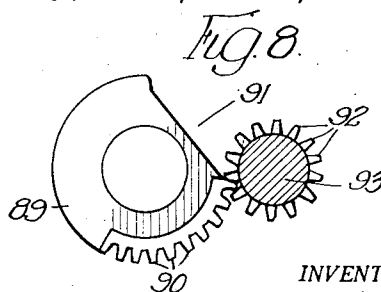
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TIME DELAYED REPEATER FUSE CONSTRUCTION

Filed Feb. 21, 1949

4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,563,558

TIME DELAYED REPEATER FUSE
CONSTRUCTION

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Application February 21, 1949, Serial No. 77,576

14 Claims. (Cl. 200—126)

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This invention relates, generally, to time delayed repeater fuse constructions, and it has particular relation to time delayed devices and operating mechanisms for use with dropout fuses. The present invention is adapted particularly for use with the repeating or reclosing cutout shown in United States Patent No. 2,247,700, issued July 1, 1941, to Allan Ramsey, and assigned to the assignee of this application. It will be understood, however, that its use is not so restricted and that it may be used in conjunction with other cutouts and fuses.

The cutout shown in the patent just referred to comprises a fuse tube which is hinged at its lower end and has a cap at its upper end which is biased upwardly by a spring. The cap carries a hook which is latched over a suitable detent at the upper end of the fuse tube for holding it in a generally upright position. Within the fuse tube there is a fuse link which, in the unblown condition, holds the cap in the retracted position and the hook in the latched position. When the fuse link blows as a result of an overload or a short circuit, the cap is restrained no longer but is moved upwardly to disengage the hook from the detent. This permits the fuse tube to rotate about its lower hinged end to an open position and place an air gap in the circuit.

It often happens that the fault on the circuit is of a momentary nature. It may result from the conductors being bridged by a falling branch, by their being swung together by the wind, by an animal or a bird short circuiting them, or like reason. A fault of this nature usually is self-clearing but it may persist long enough to cause the blowing of the fuse in the circuit. Now, despite the fact that there is no fault on the circuit, the line remains unenergized because of the blowing of the fuse and it is necessary for a lineman to refuse the same.

In order to overcome this difficulty, the repeating or reclosing cutout shown in the Ramsey patent was provided. It comprises a plurality of dropout fuse devices rather than a single fuse device for each circuit. However, only one of the fuse devices is connected in the circuit at any one time. Between successive fuse devices is a transfer switch which is arranged to be operated as a result of one fuse device moving to the dropped out position to transfer the circuit to the next fuse device. Now if the fault still persists, the next fuse device blows, and, if there is a third fuse device, it is connected in the circuit. After the third fuse device blows, assuming there are no others, the circuit is opened permanently and

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the services of a lineman are required to restore service.

When the repeating or reclosing cutout of the Ramsey patent is employed there is an interval between the blowing of one fuse device and the connection of the next fuse device in the circuit. The length of this interval is determined by the time required for the blown fuse device to be unlatched and to fall to the open position and operate the transfer switch. This interval is relatively short and is of the order of one or two seconds. Such a short interval may not be long enough to permit the fault to clear itself if it is of this nature. Accordingly, it is desirable to provide for delaying the connection of the next fuse device into the circuit for a longer interval than that which is provided in the repeating or reclosing cutout just described and shown in the Ramsey patent.

In United States Patent No. 2,268,899, issued January 6, 1942, to Allan Ramsey, and assigned to the assignee of this application, there is illustrated mechanism for increasing the length of this interval by delaying the movement of the blown fuse device from its generally upright position to the dropped out position where it picks up the transfer switch and operates the same. In general this mechanism comprises a holding lever having a portion which was positioned in the path of movement of the fuse device to the open position after blowing. A time delay mechanism, either mechanical or hydraulic is provided for effecting the movement of the holding lever out of the path of the blown fuse device at the end of a predetermined interval. Thereafter the fuse device is free to fall to the dropped out position where it picks up the transfer switch to connect the next fuse device in the circuit. This solution to the problem of providing additional time delay between the blowing of one fuse device and the connection of the next fuse device in the circuit was not entirely satisfactory. One reason for this was that the release of the blown fuse device by the time delay mechanism is solely under the control of gravity and experience showed that, in some instances, the fuse device, after being released by the time delay device, did not drop out. As a result, the transfer switch was not operated, the next fuse device was not connected into the circuit and service was not restored automatically.

Accordingly, among the objects of this invention are: To hold a dropout fuse device substantially in its operative position after it blows and then, after a pre-determined interval, strike

it so as to impart sufficient energy thereto for releasing it to fall to the open or dropout position; to provide resilient detent means for holding the dropout fuse device during said interval; to employ a power spring which is released at the end of said interval to strike the fuse device a blow to cause it to disengage said resilient detent means; to restore the power spring to its initial stressed position by movement of the fuse device back to operative position and connection in the circuit; to latch the power spring in its stressed position and to unlatch the same when the fuse device blows; to employ a time delay device to provide said interval; to connect the time delay device to the power spring in such manner that it controls its operation after the latch is released; to disconnect the time delay device from the power spring at the end of said interval so that this spring is free to dislodge the fuse device from the resilient detent means; and to reset the time delay device on restoration of the power spring to its initial stressed position at a speed which is independent of the speed at which the same is accomplished.

Other objects of this invention will, in part, be obvious and in part appear hereinafter.

This invention is disclosed in the embodiment thereof shown in the accompanying drawings, and it comprises the features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the appended claims.

For a more complete understanding of the nature and scope of this invention reference can be had to the following detailed description, taken together with the accompanying drawings, in which:

Figure 1 is a view, in side elevation, of a repeating or reclosing cutout in which this invention is incorporated;

Figure 2 is a view, in front elevation, of the cutout shown in Figure 1;

Figure 3 is a view, partly in side elevation and partly in section, showing a portion of the operating mechanism which is controlled by a time delay device and employed in conjunction with the cutout shown in Figures 1 and 2, the fuse tube being illustrated in the unblown and latched position;

Figure 4 is a view, similar to Figure 3, showing certain parts in elevation and the cap of the fuse tube in the position which it occupies immediately after the fuse device blows and before it is struck by the impact producing means to dislodge it from the resilient detents which hold it temporarily in this position;

Figure 4A is a top plan view of one of the resilient detents used to hold the fuse device temporarily;

Figure 5 is a view, similar to Figure 4, but showing the impact producing means at the end of its stroke and the fuse tube moving toward the drop out position;

Figure 6 is a detail sectional view, somewhat diagrammatic in character, illustrating the gear train which can be employed in the time delay device to provide the desired interval;

Figure 7 is a view, at an enlarged scale, taken along the line 7—7 of Figure 6 and showing the relationship between the scape wheel and the anchor; and

Figure 8 is a view, at an enlarged scale, taken along the line 8—8 of Figure 6 and showing the

relationship between the sector gear wheel and the first pinion of the gear train.

Referring now to Figures 1 and 2 of the drawings, it will be observed that the reference character 10 designates, generally, a repeating or reclosing cutout in which the present invention is embodied. The cutout 10 includes a suitable channel base 11 which carries a single upper insulator 12 near its upper end and a cross plate 13 near its lower end on which three lower insulators 14 are mounted. Each of the lower insulators 14 carries a lower contact 15 for rockably mounting its respective fuse device 16, 17, or 18. The present invention is illustrated in conjunction with a repeating or reclosing cutout in which three fuse devices are employed. Obviously it may be employed where only two fuse devices are used or where more than three are used. The usual practice is to use either two or three fuse devices in a cutout of this character. Since the details of construction of each of the fuse devices 16 are set forth in Patent No. 2,247,700, referred to above, no further description will be set forth herein of any of the fuse devices except as may be required in order to provide an understanding of the nature and construction and operation of the present invention.

The lower contact 15 associated with each of the fuse devices 16 and 17 has a transfer switch arm 21 rockably mounted thereon. Each switch arm carries a transversely extending pin 22 which, as shown in Figure 2, is positioned in the path of movement of the respective fuse device 16 or 17 when it swings to the dropped out position shown by the broken lines in Figure 1. When this occurs the transfer switch arm is rocked from its position shown by full lines in Figure 1 to its position shown by broken lines therein. The switch arm 21 in each case carries a contact arm 23 on the side away from the pin 22 and it is arranged to engage a stationary contact 24 that is carried at the end of an arm 25 which is supported, as shown, on each of the lower contacts 15 which carry the fuse devices 17 and 18. A split bolt connector 26 is mounted on the lower contact 15 which carries the fuse device 16 to permit connection of one of the line conductors thereto.

Normally the fuse device 16 is connected in the circuit and the fuse devices 17 and 18, while in the position shown in Figure 2 of the drawings, are not connected in the circuit. Now, when the fuse link in the fuse device 16 blows, this device is released, in a manner to be described, and swings downwardly to pick up the pin 22 and rock the transfer switch arm 21 so as to cause the contact arm 23 to engage the stationary contact 24. The circuit from the split bolt connector 26 to which the line is connected now is extended from the lower contact 15 of the fuse device 16 to the corresponding lower contact of the fuse device 17. This fuse device now is connected in the circuit and carries the load. If the fuse link therein blows, it drops out to connect the last fuse device 18 into the circuit in a similar manner. After the fuse device 18 blows, the circuit is permanently opened and must be inspected by a lineman before it is restored.

After any of the fuse devices has blown, it is removed from its lower contact 15 and refused by insertion of an unblown fuse link therein. Thereafter the refused fuse device is replaced on its lower contact 15 and is swung to the upright position. The transfer switch arm 21 associated

therewith is returned to the position shown by the full lines in Figure 1.

It will be observed that the fuse devices 16, 17 and 18 are commonly supported and are commonly connected at their upper ends on the upper insulator 12. For this purpose a transverse angle 28 is carried by this upper insulator 12 and a copper connector strap 29 extends therealong to provide good electrical connection. Upper terminal assemblies 30, 31 and 32 are associated, respectively, with the fuse devices 16, 17, and 18.

The upper terminal assemblies 31 and 32 are identical in construction and each is provided with a time delay device 33 the details of which will be set forth hereinafter. The mechanism, to be described, associated with each time delay device 33 is somewhat bulky and this accounts for the difference between the size of the terminal assemblies 30 and 31 and that of the terminal assembly 32 which is not provided with a time delay device since the fuse device 18 with which it is associated is the last device to operate.

The terminal assemblies 30, 31, and 32 may be secured by bolts, one of which is shown at 34, to the transverse angle 28. These terminal assemblies are interconnected by the copper connector strap 29 which is clamped between them and the transverse angle 28. A split bolt connector 35 is secured to a lug 36 which is formed integrally with a housing casting to be identified later. The split bolt connector 35 permits connection of the other line conductor and only one is required since, as previously described, all of the terminal assemblies 30, 31, and 32 are interconnected by the copper connector strap 29.

The upper end of each of the fuse devices 16, 17, and 18 is provided with a sleeve or cap 37 that is biased upwardly by a spring, not shown, and is held down by a fuse link, not shown, within the respective fuse tube. The sleeve or cap 37, as shown in Figure 3, is provided with a hook 38 having a nose 39 and a notch 40. The notch 40 interfits with a latch roller 41 that is carried by a pair of fingers one of which is shown at 42. The fingers 42 may be secured by screws 43 to a housing casting 44 which preferably is formed of brass. A leaf spring 45, also secured by the screws 43 to the housing casting 44, cooperates with the fingers 42 to urge them upwardly against the underside of a web 46 which is formed integrally with the housing casting 44 and extends transversely across the same. It will be understood that, when the fuse device is swung to the closed position, the inclined forward surface of the hook 38 rides up over the roller 41 and depresses the same together with the fingers 42 and leaf spring 45 until the roller 41 enters the notch 40 whereupon it is moved to the position shown in Figure 3 of the drawings.

Each sleeve or cap 37 is provided with a pair of contact ears 47 which project radially outwardly therefrom and are generally wedge-shaped for engaging the out-turned ends 48 of a pair of contact fingers one of which is shown at 49 in Figure 3. It will be observed that the contact fingers 49 are secured near their rear ends to the housing casting 44 by screws 50.

It will be understood that, except for the slightly larger housing casting 44 for each of the contact assemblies 30 and 31, all of the contact assemblies 30, 31, and 32 are identical insofar as the portions thereof which have been described thus far are concerned. It remains to describe the impact producing means and associated mechanism located in each of the housing cast-

ings 44 of the terminal assemblies 30 and 31 together with the mechanism which prevents a blown fuse device from falling to the open position until the expiration of a predetermined interval.

Each of the housing castings 44 is provided with a pair of resilient detents 53 the shape of which is shown more clearly in Figure 4A of the drawings. Each resilient detent 53 is formed preferably of phosphor bronze and has a flat end portion 54 for placing against the inner flat surface of the vertical wall of the casting 44 near the forward edge. Rivets 55 may be employed for holding each resilient detent 53 in position. It will be observed that the intermediate section 56 of each detent 53 is shaped so that it extends inwardly toward the other detent and terminates in a reversely curved end portion 57 which, as shown in Figure 4, is arranged to receive the rear surfaces of the contact ears 47 when the sleeve or cap 37 is moved upwardly on blowing of the fuse link and the hook 38 is moved out of engagement with the latch roller 41. The resilient detents 53 thus serve to hold temporarily the sleeve or cap 37 and the associated fuse device in the upright position after it has blown. However, each of the resilient detents 53 can be deformed to the position shown by the broken lines in Figure 4A so as to permit the contact ears 47 to move therebetween either into or out of the closed position.

In order to dislodge the sleeve or cap 37 from the resilient detents 53 after the fuse device associated therewith has blown and it is being held temporarily thereby, provision is made for striking a blow on the nose 39 of the hook 38. For this purpose a coil compression power spring 60 is employed. As illustrated in Figure 3 the spring 60 is located within an inner cylinder 61 which may be a bronze casting. The cylinder 61 has a threaded extension 62 which projects through the wall of the housing casting 44 and a nut 63 is threaded thereon to hold the same in position. A pin 64 extends through the wall of the housing casting 44 into the end wall of the inner cylinder 61, as shown, for preventing relative rotation therebetween. An outer cylinder 65, preferably a bronze casting, is telescoped over the inner cylinder 61 and it is guided with respect thereto by means of a screw 66 having a reduced diameter inner end 67 which projects into a slot 68 extending lengthwise of the wall of the inner cylinder 61. While only one screw 67 has been illustrated together with a single slot 68 it will be understood that two screws 66 may be provided on opposite sides of the outer cylinder 65 and that they may project into longitudinally extending slots on diametrically opposite sides of the inner cylinder 61. Where two screws 66 are employed, they would be located on opposite sides of the outer cylinder 65 rather than on the underside as illustrated in Figure 3.

A washer 69 of felt is provided around the inner cylinder 61 in front of a flange 61' formed integrally therewith. The washer 69 serves as a seal to prevent entrance of grit and dust between the inner cylinder 61 and the outer cylinder 65 when the power spring 60 is compressed.

It will be understood that the forward movement of the outer cylinder 65 is limited by the screw 66 when its reduced diameter end 67 engages the outer end of the slot 68 in the inner cylinder 61. The spring 60 is centered by a rivet 70 having a cylindrical head 71 around which the end convolutions of the spring are placed. It will

be observed that the rivet 70 extends through a base 72, formed integrally with the outer cylinder 65 and that the face of the base 72 is large enough and so positioned that it will engage the nose 39 of the hook 38 in either of the positions of the sleeve or cap 37 shown in Figure 3 or Figure 4.

It will be observed that the outer cylinder 65 has a pair of ears 73 formed integrally therewith and that they extend upwardly therefrom. A pin 74 extends through these ears 73 and projects to one side thereof for a purpose to be set forth presently. A roller 75 is mounted on the pin 74 between the ears 73 and it is arranged to be engaged by a latch roller 76 that is carried by a channel-shaped pry out lever 77 which may be in the form of a bronze casting. The lever 77 has a nose 78 which, as shown in Figure 3, is arranged to engage the upper surfaces of the ears 73 for prying the latch roller 76 out of the path of the roller 75. The pry out lever 77 is secured by a pin 79 to a channel-shaped latch lever 80 which may be a bronze casting. It will be understood that the pry out lever 77 is rockable about the pin 79 with respect to the latch lever 80. The latch lever 80, in turn, is pivoted on a pin 81 which extends through the housing casting 44 from side to side. It will be observed that a line drawn through the centers of pins 79 and 81 in their positions shown in Figure 3 is slightly below the center of pin 74. This overcenter relationship serves to lock securely the outer cylinder 65 and the power spring 60 in the cocked or loaded position. At the same time, because of the provision of the rollers 75 and 76, only very little force need be applied to the pry out lever 77 to break the joint and to free the outer cylinder 65 for movement under the influence of the power spring 60.

With a view to insuring that the latch mechanism just described will not be released as a result of vibration or will not be released accidentally, a hold down hairpin shaped leaf spring 83 may be provided as shown. It is held by a screw 84 to the housing casting 44 at one end while its other end bears against the outer end of the latch lever 80 and urges the same downwardly to hold the latch roller 76 in latching engagement with the roller 75.

It will be noted that the outer end of the pry out lever 77 is located in the path of upward movement of the sleeve or cap 37. When it is released as a result of the blowing of the fuse link, it engages the pry out lever 77 and this is rocked in a counterclockwise direction to lift the latch roller 76 out of latching engagement with the roller 75. This is accomplished by the nose 78 engaging the upper surfaces of the ears 73 and the latch lever 80 rocking about the pin 81. The outer cylinder 65 then is free to move forwardly under the influence of the power spring 60 to bring the base 72 into engagement with the nose 39 and dislodge the contact ears 47 from the resilient detents 53.

The time delay device 33, referred to hereinbefore, is provided for delaying this forward movement of the outer cylinder 65 until the expiration of the predetermined interval which can be varied, within limits, in a manner now to be described.

The details of construction of the time delay device 33 are shown more clearly in Figures 6, 7, and 8 of the drawings. It will be observed that it includes a shaft 87 which extends through a housing plate 88. The shaft 87 carries a sec-

tor gear wheel 89 which is shown in more detail in Figure 8. The gear wheel 89 is provided with teeth 90 only over a limited extent of its periphery and it has a portion 91 entirely removed so that when the teeth 90 rotate out of engagement with teeth 92 on a cooperating pinion 93, the gear wheel 89 and shaft 87 are free to rotate unhindered by the pinion 93 and the gear train in driving engagement therewith. The purpose of this will be apparent presently.

A suitable mechanism, such as a Geneva gear mechanism, can be provided between the shaft 87 and the pinion 93 to insure that the teeth 90 and 93 will engage properly on reverse operation thereof in resetting the time delay device now to be described.

As shown in Figure 6, the pinion 93 is mounted for conjoint rotation with a gear wheel 94 that is arranged to drive a gear train which is indicated, generally, at 95. It will be noted that the gear train 95 is mounted on suitable staffs which extend between an inner plate 96 and an outer plate 97. The gear train 95 terminates in a scape wheel 98, Figure 7, with which a pawl 99 cooperates. By this means the speed of rotation of the pinion 93 is retarded and a corresponding retarding effect is provided for the sector gear wheel 89 as long as its teeth 90 are in engagement with the teeth 92 of the pinion 93.

Referring now to Figure 3 it will be observed that the shaft 87 has an arm 102 clamped thereto by a clamp screw 103. A locking pin 104 serves further to maintain the desired relationship between the shaft 87 and the arm 102.

Now it will be recalled that the pin 74 extending through the ears 73 on the outer cylinder 65 extends therebeyond. The pin 74 extends sufficiently far so that the arm 102 is located in its path. As a result when the latch roller 76 is moved out of engagement with the roller 75 and the power spring 60 is no longer restrained by this latch mechanism, the arm 102, since it is positioned in the path of the pin 74, serves to delay the forward movement of the outer cylinder 65 as long as this engagement remains. The spring 60 moves the outer cylinder 65 forwardly at a speed which is determined by the rate at which the pawl 99 permits the scape wheel 98 of the time delay device 33 to rotate. This delaying action takes place only so long as the teeth 90 of the sector gear wheel 89 are in engagement with the teeth 92 of the pinion 93. As soon as the power spring 60 has driven the arm 102 to such position that none of the teeth 90 engage the teeth 92, then because of the cut away portion 91 of the sector gear wheel 89, it and the shaft 87 are freed from further restraint and they can be rocked forwardly quickly with a corresponding rapid movement of the outer cylinder 65.

Since the outer cylinder 65 no longer is restrained, its speed of movement is increased rapidly by the coil compression power spring 60 and it strikes the nose 39 of the hook 38 a sharp blow so that sufficient energy is imparted to the sleeve or cap 37 to dislodge its contact ears 47 from the resilient detents 53. Thereafter the fuse device falls to the open position under the influence of gravity and whatever remains of the energy imparted thereto by the spring 60.

As previously set forth, when the blown fuse device is restored to the normal upright position, the nose 39 engages the base 72 of the outer cylinder 65 and moves the same backwardly and compresses the power spring 60. At the same time it causes the pin 74 to be moved in the same direc-

tion. Now it is necessary to reset the arm 102 to the initial position shown in Figure 3 so that it will become operative on release of the latch to delay the forward movement of the outer cylinder 65 until the predetermined interval has expired. However, the reverse movement of the outer cylinder 65 and of the pin 74 takes place at a relatively high speed. It is not feasible to provide a direct connection between the arm 102 and the pin 74 so that the former is moved positively when the latter is retracted and the spring 60 is compressed. The shaft 87 and the sector gear wheel 89 mounted thereon must be reset to the initial position thereof so as to provide the same interval for the next operation. This retrograde movement of the shaft 87 and the arm 102 is delayed by the pawl 99 acting through the scape wheel 98 and the gear train 95.

Accordingly, in order to reset the time delay device 33 as a result of the restoration of the fuse device to its initial or closed position, a lost motion connection in the form of a generally U-shaped compound leaf spring 105 may be employed. The spring 105 has one arm 106 which may be secured by screws 107 to the arm 102. The other arm 108 engages the pin 74 on the side opposite the arm 102. Now, when the outer cylinder 65 is restored from the position shown in Figure 5 to the position shown in Figure 3, the pin 74 of course is moved therewith. This merely causes the branch or other arm 108 of the U-shaped leaf spring 105 to move away from the arm 102 and the branch 106 of the spring secured thereto. This stresses the spring 105 sufficiently to return the arm 102 automatically to the position shown in Figure 3 by operating the time delay device 33 in the reverse direction.

The length of the interval during which the time delay device 33 is effective to delay the forward movement of the outer cylinder 65 depends upon the number of teeth 90 that are required to disengage the teeth 92 before the cut away portion of the sector gear wheel 89 is reached. This may be varied by shifting the position of the casing 109, Figure 1, which encloses the time delay mechanism shown in Figure 6. As indicated in Figure 1, the casing 109 has integrally formed slotted ears 110 through which screws 111 project into the housing casting 44. The slots in the ears 110 permit limited adjustment of the casing 109 to effect a corresponding variation in the number of teeth 90 which have driving engagement with the teeth 92. It will be noted that the casing 109 is provided with a pointer 112 which is movable with respect to a scale 113 on the adjacent face of the housing casting 44, the scale being calibrated, as indicated, in seconds.

Since certain further changes can be made in the foregoing construction and different embodiments of the invention can be made without departing from the spirit and scope thereof, it is intended that all matter shown in the accompanying drawings and described hereinbefore shall be interpreted as illustrative and not in a limiting sense.

What is claimed as new is:

1. In combination with a pair of dropout fuse devices and a transfer switch operated as a result of one fuse device connected in a circuit dropping out to connect the other fuse device into the circuit, detent means engageable by said one fuse device on its release to move to the dropped out position for temporarily preventing further movement thereof, impact producing means for engaging said one fuse device to impart energy thereto

and disengage it from said detent means to subsequently operate said transfer switch, and time delay means initiated in operation on said release of said one fuse device cooperating with said impact producing means to release the same a predetermined interval after said one fuse device is released.

2. In combination with a pair of dropout fuse devices and a transfer switch operated as a result of one fuse device connected in a circuit dropping out to connect the other fuse device into the circuit, detent means engageable by said one fuse device on its release to move to the dropped out position for temporarily preventing further movement thereof, impact producing means including a power spring for striking said one fuse device and imparting energy thereto to disengage it from said detent means to subsequently operate said transfer switch, and time delay means initiated in operation on said release of said one fuse device cooperating with said impact producing means to restrain the same for a predetermined interval, said power spring being stressed on movement of said one fuse device back to operative position and connection in the circuit.

3. In combination with a pair of dropout fuse devices and a transfer switch operated as a result of one fuse device connected in a circuit dropping out to connect the other fuse device into the circuit, detent means engageable by said one fuse device on its release to move to the dropped out position for temporarily preventing further movement thereof, impact producing means including a power spring for striking said one fuse device and imparting energy thereto to disengage it from said detent means to subsequently operate said transfer switch, resettable time delay means initiated in operation on said release of said one fuse device cooperating with said impact producing means to restrain the same for a predetermined interval, said power spring being stressed on movement of said one fuse device back to operative position and connection in the circuit, and resilient means operatively connected to said time delay means and arranged to be stressed on said movement of said one fuse device to operative position for resetting said time delay means.

4. In combination with a pair of dropout fuse devices biased by gravity to the dropped out position and a transfer switch operated by energy imparted thereto by one fuse device connected in a circuit dropping out to connect the other fuse device into the circuit, resilient detent means engageable by said one fuse device on release thereof to move to the dropped out position for temporarily preventing further movement thereof under the influence of gravity, impact producing means for engaging said one fuse device to impart energy thereto and thereby disengage it from said resilient detent means to subsequently operate said transfer switch, and time delay means initiated in operation on said release of said one fuse device cooperating with said impact producing means to release the same a predetermined interval after said release of said one fuse device.

5. In combination with a pair of dropout fuse devices biased by gravity to the dropped out position and a transfer switch operated by energy imparted thereto by one fuse device connected in a circuit dropping out to connect the other fuse device into the circuit, resilient detent means engageable by said one fuse device on release thereof to move to the dropped out position for

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temporarily preventing further movement thereof under the influence of gravity, impact producing means including a coil compression power spring for striking said one fuse device to impart energy thereto and disengage it from said resilient detent means to subsequently operate said transfer switch, and time delay means initiated in operation on said release of said one fuse device cooperating with said impact producing means to release the same a predetermined interval after said release of said one fuse device, said power spring being compressed on movement of said one fuse device to operative position and connection in the circuit.

6. In combination with a pair of dropout fuse devices biased by gravity to the dropped out position and a transfer switch operated by energy imparted thereto by one fuse device connected in a circuit dropping out to connect the other fuse device into the circuit, resilient detent means engageable by said one fuse device on release thereof to move to the dropped out position for temporarily preventing further movement thereof under the influence of gravity, impact producing means including a coil compression power spring for striking said one fuse device to impart energy thereto and disengage it from said resilient detent means to subsequently operate said transfer switch, resettable time delay means initiated in operation on said release of said one fuse device cooperating with said impact producing means to release the same a predetermined interval after said release of said one fuse device, said power spring being compressed on movement of said one fuse device to operative position and connection in the circuit, and spring means operatively connected to said time delay means and arranged to be stressed on said movement of said one fuse device back to operative position for resetting said time delay means to its initial operative position.

7. In combination with a pair of dropout fuse devices and a transfer switch operated as a result of one fuse device connected in a circuit dropping out to connect the other fuse device into the circuit, detent means engageable by said one fuse device on its release to move to the dropped out position for temporarily preventing further movement thereof, impact producing means including stationary and movable telescoped cylindrical members and a coil compression power spring therein biasing them apart to cause said movable member to strike said one fuse device and impart energy thereto to disengage it from said detent means to subsequently operate said transfer switch, and time delay means initiated in operation on said release of said one fuse device cooperating with said movable member to restrain the same for a predetermined interval, said power spring being stressed on movement of said one fuse device back to operative position and connection in the circuit by engagement and movement of said movable cylindrical member by said one fuse device.

8. In combination with a pair of dropout fuse devices and a transfer switch operated as a result of one fuse device connected in a circuit dropping out to connect the other fuse device into the circuit, detent means engageable by said one fuse device on its release to move to the dropped out position for temporarily preventing further movement thereof, impact producing means for engaging said one fuse device to impart energy thereto and disengage it from said detent means to subsequently operate said

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transfer switch, latch means cooperating with said impact producing means to restrain movement thereof and arranged to be unlatched therefrom on release of said one fuse device, and time delay means cooperating with said impact producing means on unlatching of said latch means to release said impact producing means to strike said one fuse device after a predetermined interval.

9. In combination with a pair of dropout fuse devices and a transfer switch operated as a result of one fuse device connected in a circuit dropping out to connect the other fuse device into the circuit, detent means engageable by said one fuse device on its release to move to the dropped out position for temporarily preventing further movement thereof, impact producing means including a power spring for striking said one fuse device and imparting energy thereto to disengage it from said detent means to subsequently operate said transfer switch, latch means cooperating with said impact producing means to restrain movement thereof and arranged to be unlatched therefrom on release of said one fuse device, time delay means cooperating with said impact producing means on unlatching of said latch means to release said impact producing means to strike said one fuse device after a predetermined interval, said power spring being stressed on movement of said one fuse device back to operative position and connection in the circuit and said latch means being operated to the latched position, and a lost motion connection between said impact producing means and said time delay means including a rigid member in the path of said impact producing means in moving toward said one fuse device and a resilient member in the path of said impact producing means in moving in the opposite direction on restoration of said one fuse device to its operative position to reset said time delay means at a speed independent of the speed of movement of said impact producing means in said opposite direction.

10. In combination with a pair of dropout fuse devices and a transfer switch operated as a result of one fuse device connected in a circuit dropping out to connect the other fuse device into the circuit, detent means engageable by said one fuse device on its release to move to the dropped out position for temporarily preventing further movement thereof, impact producing means including stationary and movable telescoped cylindrical members and a coil compression power spring therein biasing them apart to cause said movable member to strike said one fuse device and impart energy thereto to disengage it from said detent means to subsequently operate said transfer switch, latch means cooperating with said movable cylindrical member to restrain movement thereof and arranged to be unlatched therefrom on release of said one fuse device, and time delay means cooperating with said movable cylindrical member on unlatching of said latch means to release said movable cylindrical member to strike said one fuse device after a predetermined interval, said power spring being stressed on movement of said one fuse device back to operative position and connection in the circuit by engagement and movement of said movable cylindrical member by said one fuse device and held in stressed position by the latching of said latch means.

11. In combination with a pair of dropout fuse devices and a transfer switch operated as a re-

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sult of one fuse device connected in a circuit dropping out to connect the other fuse device into the circuit, detent means engageable by said one fuse device on its release to move to the dropped out position for temporarily preventing further movement thereof, impact producing means including stationary and movable telescoped cylindrical members and a coil compression power spring therein biasing them apart to cause said movable member to strike said one fuse device and impart energy thereto to disengage it from said detent means to subsequently operate said transfer switch, latch means cooperating with said movable cylindrical member to restrain movement thereof and arranged to be unlatched therefrom on release of said one fuse device, resettable time delay means cooperating with said movable cylindrical member on unlatching of said latch means to release said movable cylindrical member to strike said one fuse device after a predetermined interval, said power spring being stressed on movement of said one fuse device back to operative position and connection in the circuit by engagement and movement of said movable cylindrical member by said one fuse device and held in stressed position by the latching of said latch means, and resilient means operatively interconnecting said movable cylindrical member and said time delay means and arranged to be stressed by movement of the former by said one fuse device.

12. In combination with a pair of dropout fuse devices and a transfer switch operated as a result of one fuse device connected in a circuit dropping out to connect the other fuse device into the circuit, detent means engageable by said one fuse device on its release to move to the dropped out position for temporarily preventing further movement thereof, impact producing means including stationary and movable telescoped cylindrical members and a coil compression power spring therein biasing them apart to cause said movable member to strike said one fuse device and impart energy thereto to disengage it from said detent means to subsequently operate said transfer switch, latch means cooperating with said movable cylindrical member to prevent its movement

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and arranged to be unlatched therefrom on release of said one fuse device, a rockable shaft, a time delay device operatively connected to said shaft to retard rotation thereof, and an arm fast on said shaft and cooperating with said movable cylindrical member on unlatching of said latch means to retard the movement of the former for a predetermined interval after which it is freed of restraint by said time delay device and is freely movable under the influence of said power spring to strike said one fuse device.

13. The invention, as set forth in claim 12, wherein the time delay device includes a gear train controlled by an escapement mechanism and the shaft is connected to said gear train by a gear wheel having a section cut away whereby said gear train is disengaged from said shaft at the end of the interval for which said device is set and thereafter said shaft is freely rockable.

14. The invention, as set forth in claim 12, wherein the power spring is stressed on movement of the one fuse device back to its operative position and connection in the circuit by engagement and movement of the movable cylindrical member by said one fuse device and is held in stressed position by the latching of the latch means, and a generally U-shaped leaf spring is provided having one branch connected to the rockable shaft and the other branch cooperating with said movable cylindrical member on restoration thereof to its initial position by said one fuse device to reset the time delay device at a speed independent of the speed at which said movable cylindrical member is restored.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,940,203	Bowie -----	Dec. 19, 1933
2,247,700	Ramsey -----	July 1, 1941
2,268,899	Ramsey -----	Jan. 6, 1942
2,269,372	Johnson -----	Jan. 6, 1942