Oct. 28, 1941. T. F. JOHNSON 2,260,457

HIGH TENSION FUSE

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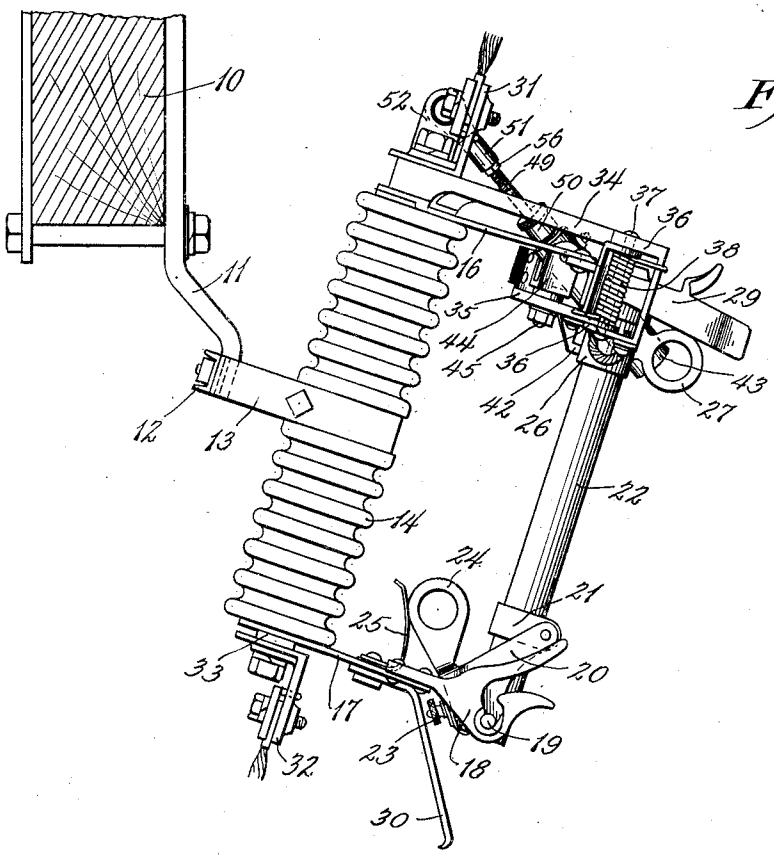


Fig. 1

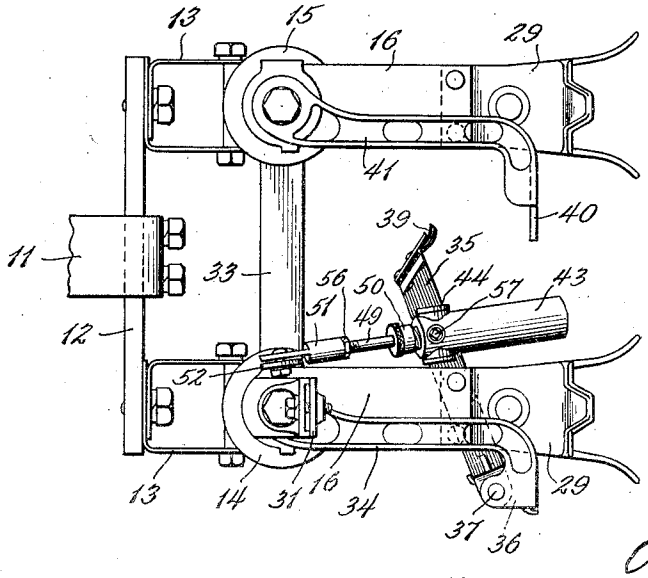


Fig. 2

Inventor
T. F. Johnson
A. D. Adams
By
Attorney

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Fig. 3

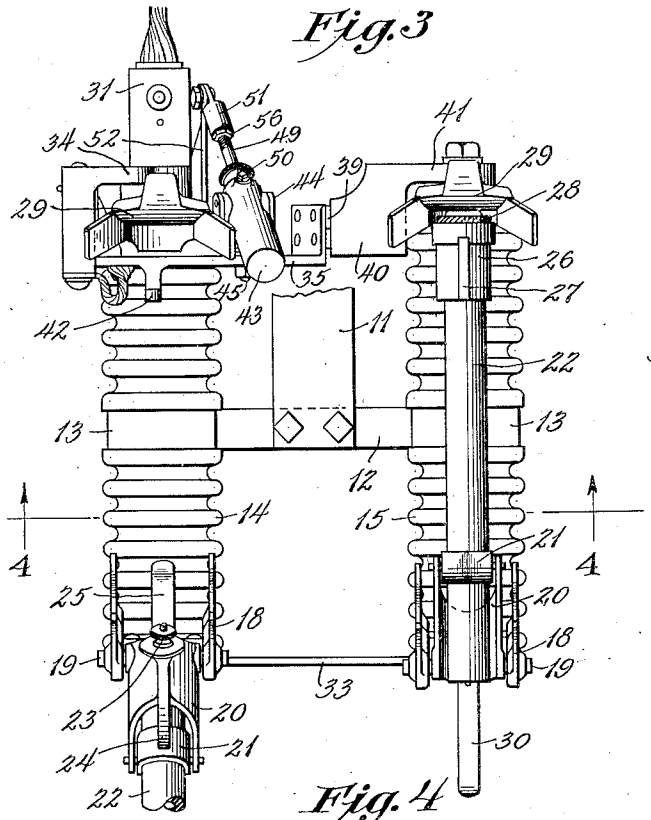


Fig. 4

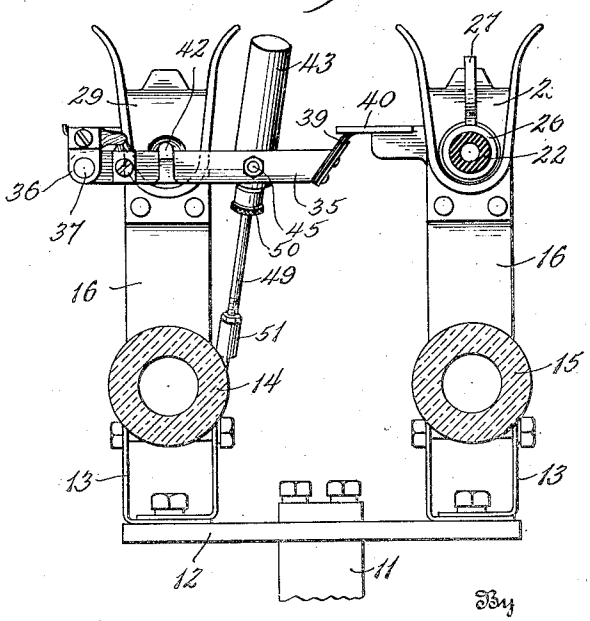


Fig. 5

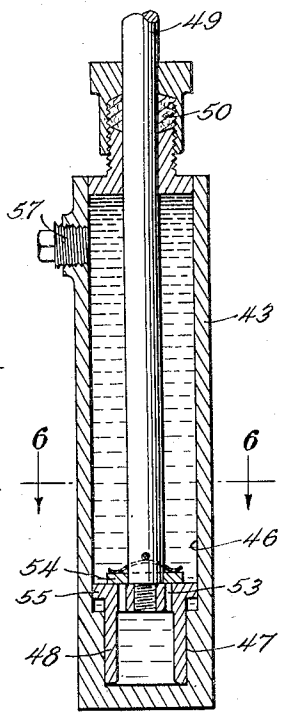
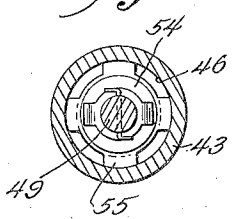


Fig. 6



Inventor

T. F. Johnson

A. S. Adams

By

Attorney

Patented Oct. 28, 1941

2,260,457

UNITED STATES PATENT OFFICE

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HIGH TENSION FUSE

Tomlinson Fort Johnson, Atlanta, Ga.

Application May 14, 1935, Serial No. 21,422

3 Claims. (Cl. 200—126)

This invention relates to high tension fuses, such as are used on pole-type transmission lines and, among other objects, aims to provide a relatively simple, rugged, cheap and durable multiple shot fuse assembly wherein switch type fuses are employed and automatic switch means is provided to connect a new fuse in the circuit incident to the blowing of an active fuse. Another important aim is to provide delayed action switch mechanism automatically operated by the blowing of one of the fuses to provide for a variable time delay between the blowing of one of the fuses and the closing of the circuit through the next fuse.

Other aims and advantages of the invention will appear in the specification, when considered in connection with the accompanying drawings, wherein:

Fig. 1 is a side elevation of a multiple fuse assembly embodying the invention;

Fig. 2 is a top plan view of the same;

Fig. 3 is a front elevation showing one of the fuse units in its tripped and open position;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a longitudinal sectional view on an enlarged scale of a dashpot; and

Fig. 6 is a cross sectional view taken on the line 6—6 of Fig. 5.

Referring particularly to the drawings, the multiple fuse assembly there shown embodies generally a pair of single fuses such as are shown in my copending application, Ser. No. 20,106, filed May 6, 1935, now Patent No. 2,074,913. In the illustrative example, two such fuses are shown as being mounted on a single support, the arrangement being such that both fuses have to be blown in succession due to some transient condition on the transmission line before the service is finally interrupted. Thus, it is a two-shot fuse; but, it is to be understood that any reasonable number of fuses may be connected in like manner to be blown in succession.

Referring to Figs. 1 and 2, the fuse assembly is shown as being supported on a cross arm 10 by means of a single bent strap metal bracket 11 connected to a horizontal structural supporting member in the form of a channel 12 which, in turn, carries at its opposite ends a pair of clamps 13 supporting identical bushing type insulators 14 and 15 preferably like those shown in my aforesaid application. These clamps are connected to the insulators midway between their ends and the insulators are supported at an acute angle to the vertical, the bracket 11 being bent to provide this inclination.

For a full understanding of the two switch type fuses, reference is here made to my aforesaid copending application. It is sufficient here to state that each insulator carries at its opposite ends spring arms 16 and 17, conveniently made of phosphor-bronze. The fuse holder is carried by the outer ends of the spring arms, being pivotally mounted with respect to the lower one and adapted to make contact with the upper one, and is arranged to drop out initially and to swing downwardly, as clearly explained in said application. The lower arm carries a hinge or bearing bracket 18 for the trunnions 19 on a lever or arm 20 pivotally mounted on a collar 21, carried by the fuse holder or insulating tube 22. The fuse holder carries an ordinary fuse element or wire which is connected to a binding post or terminal 23 on the lever 20, the arrangement being such that the lever transmits spring tension to the fuse element. Also, the lever carries a hook eye 24 adapted to be used for taking out and replacing the fuse unit in the slotted bearing member 18 and this hook eye is adapted to contact with a leaf spring contact member 25 on the lower spring arm 17 to insure better electrical contact and to exert some spring pressure against the lever. The upper end of the fuse tube is shown as having a metal ferrule 26 and another hook eye 27 adapted to be engaged by an ordinary switch hook to swing the fuse unit to its closed position. The upper end of this ferrule is closed by a removable screw cap 28 with a dome-shaped end adapted to engage in a recess in a hood shaped contact 29 on the upper spring arm 16. The construction and arrangement is such that both of the spring arms 16 and 17 exert endwise pressure on the fuse unit when it is in closed position, as clearly shown in Fig. 1. The lever or arm 20 is held in its stiff leg position by means of the fuse wire, being connected to it and, when the fuse is blown, the spring pressure forces the lever outwardly, thereby permitting the fuse to swing initially downwardly about the joint between the collar 21 and the lever 20, and drop out of engagement with the upper contact 29. The fuse unit is then free to swing downwardly to its open position where it strikes a spring shock absorber 30 secured to the lower spring arm 17. When the fuse unit is in this position, it is adapted to be lifted out by an ordinary switch hook engaging the eye 24 so that the fuse element can be replaced or a properly fused unit inserted in its stead. The circuit may again be closed

by means of a switch hook engaging the eye 27, the parts being again placed under tension as described.

The construction of the first fuse, as thus far disclosed, is identical with that of the second fuse. In this example, one phase of the transmission line is connected to the first fuse by means of terminal lugs 31 and 32 conveniently in the form of L-shaped castings. The lower lug is shown as being clamped in contact with a bus bar 33 which extends from one fuse to the other and connects the lower spring arms 17 together. This bar also serves as a mechanical brace for the fuses. The upper terminal lug is shown as being clamped against a rigid bracket 34 which provides a bearing for a switch arm 35. In this instance, the bracket has a pair of lateral ears 36 to receive a shaft or pivot pin 37 for the switch arm and the switch arm is normally biased to swing toward its circuit closing position by a coil spring 38 conveniently wound about the pivot pin. The switch arm is shown as having a laminated flexible terminal 39 adapted to make good electrical contact with a contact face 40 on a somewhat similar bracket 41 which is secured to the upper end of the insulator 15 in contact with its upper spring arm 16. The arrangement is such that when the switch is open, as shown in Figs. 1 and 2, the circuit is closed through the first or normally active fuse unit and, when the switch is closed, as shown in Figs. 3 and 4, the circuit is restored through the second fuse unit and this circuit includes the bus bar 33.

Referring to the switch, the arm 35 is shown as being arranged in the path of the upper ferrule 26 of the first fuse unit so that, when the fuse unit is swung to its closed position, it will force the arm to the position shown in Fig. 2 and maintain the switch in open position. For this purpose, the arm is shown as having a lateral lug or finger 42 adapted to be engaged by the lower portion of the metal ferrule on the fuse unit.

When the first or normally active fuse blows and the dome-shaped contact terminal 28 drops out of its recess in the contact member 29, the switch arm is free to swing toward its circuit closing position by the action of the spring 38. In some instances, this action may be practically instantaneous, and, in that case, the spring pressure exerted by the switch arm will impart initial swinging movement to the fuse unit as soon as it drops out of contact with the contact member. However, it is desirable in most cases to delay the action of the switch to give a transient condition an opportunity to subside before the circuit is attempted to be restored through the second fuse. In this instance, the closure of the switch is delayed by a dashpot which has a cylinder 43 closed at one end and pivoted near the other end in a fork 44 which, in turn, is pivoted as at 45 to the switch arm 35 on the opposite side of the fuse unit from the hinge connection of the switch.

The dashpot cylinder is shown as having an elongated cylindrical bore 46 and a relatively short counterbore 47 at its closed end to receive a hollow cup-shaped piston 48 to which is connected a piston rod 49 passing through a stuffing box 50 and the end of the piston rod is screw threaded for adjustable connection to an extension 51 which, in turn is pivotally connected to a fixed ear 52 on the bracket member 34. The piston is shown as having a series of holes or ports 53 normally closed by a check valve 54 and an enlarged notched guiding flange 55 fitted in the cylindrical bore, the arrangement being such that when the cylinder is filled with liquid, such as glycerin or oil and the arm is released, the liquid will leak from the enlarged bore past the piston into the counterbore until the end of the piston passes the open end of the counterbore; then, the piston is free to move rapidly in the enlarged bore by virtue of the fact that oil or liquid by-passes rapidly around the piston through the notches in the guiding flange 55. The check valve permits the piston to be moved rapidly on its inward stroke. The time delay may be regulated or adjusted by changing the effective length of the piston rod and thereby changing the distance through which the piston has to travel in the counterbore. This is easily done by releasing a jamb nut 56 on the screw threaded end of the piston rod and turning the piston rod in the desired direction. In the position shown in Fig. 5, the dashpot is set for a maximum time delay, since the piston has to travel through its maximum distance before it clears the counterbore. It will be observed that the dashpot cylinder is normally inclined upwardly and this prevents possible leakage of the liquid. However, the liquid is adapted to be replenished or the cylinder initially filled through a filling opening near the upper end closed by an ordinary screw plug 57.

In the operation of the fuses, it will be understood that both fuse units are initially closed. The act of closing the first one opens the switch so that the second one is normally disconnected. If the first fuse blows, it will swing out of its circuit closing position to the open position shown in Fig. 3, in which position it signifies to a lineman that it has been blown. If the circuit is restored, after the switch closes the circuit through the second fuse, the second fuse unit will remain in its closed position. Incidentally, the circuit will be restored if the transient condition does not persist any longer than is due to ordinary lightning flashes. When the lineman finds the fuses in this condition, he can easily replace the fuse element in the first fuse and restore it to its circuit closing position without interrupting the service, thereby cocking the fuses for multiple shot operation again. The construction and arrangement of the switch is such that the first fuse does not begin to swing the switch arm to the switch opening position until it makes good electrical contact with the contact 29. It will thus be seen that the apparatus is extremely simple in its construction and can be manufactured at a relatively low cost. It can be used very effectively on transmission lines of relatively low voltages to displace the far more expensive and complex multiple fuses.

Obviously, the present invention is not restricted to the particular embodiment thereof herein shown and described. Moreover, it is not indispensable that all the features of the invention be used conjointly, since they may be employed advantageously in various combinations and subcombinations.

What is claimed is:

1. In combination with a multiple shot fuse assembly for high tension transmission lines, adjacent fuse units adapted to be connected in the circuit in succession; a switch having an arm normally biased to close the circuit through another fuse automatically when an adjacent fuse is blown; and an adjustable dash pot connected to said arm to delay the closing action of the switch.

2. A multiple fuse assembly for high tension

transmission lines comprising, in combination, a pair of pivoted switch type drop out fuses each mounted on an insulator and arranged parallel and adjacent to each other; terminals carried by one of the insulators to connect the first fuse in circuit; a bracket mounted on the first insulator; a switch arm pivotally mounted on the bracket and arranged in the path of the upper end portion of the first drop out fuse unit; spring means normally biasing said switch arm toward its closed position and said arm being adapted to be held in open position by said first drop out fuse unit; a switch contact member carried by the insulator of the second drop out fuse unit; and a bus bar connecting a terminal of each fuse unit with a corresponding terminal of the other, whereby the switch will automatically close the circuit through the second fuse when the first fuse blows and the fuse unit drops out.

3. A fuse assembly for high tension transmission lines comprising, in combination, a plurality of drop out fuse units each supported on a single insulator and said insulators being arranged adjacent to and parallel with each other; a single bracket connected to support all of said fuse units; means normally connecting the first of said fuse units in circuit with a transmission conductor; a time delayed automatic switch connected to close the circuit through an adjoining fuse automatically when a fuse blows and drops out; and adjustable means to regulate the time interval required for the switch means to close the circuit.

TOMLINSON FORT JOHNSON.