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MINIATURE MULTIPLE SURGE ARRESTOR

Filed Sept. 14, 1961

2 Sheets-Sheet 1

Fig. 1

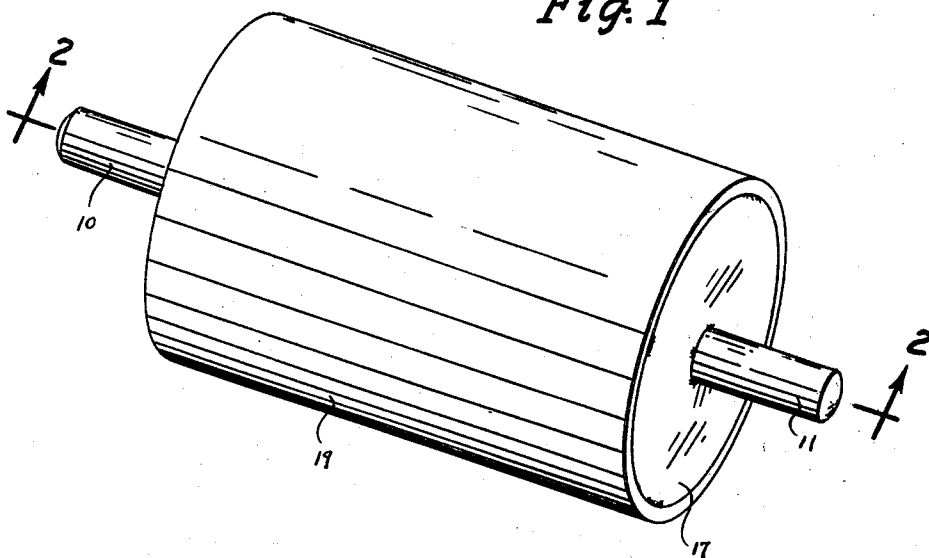
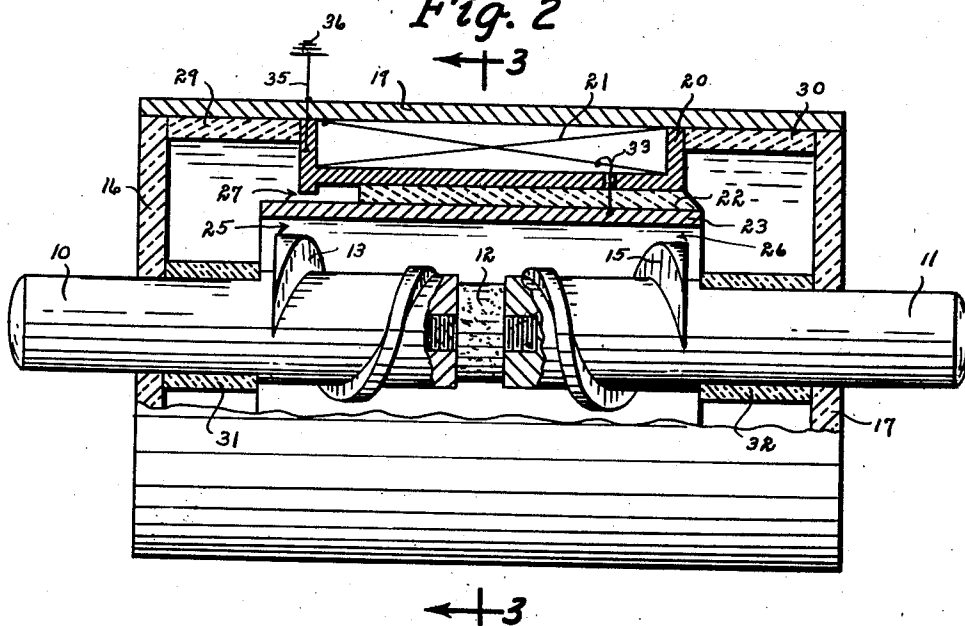


Fig. 2



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*Fig. 3*

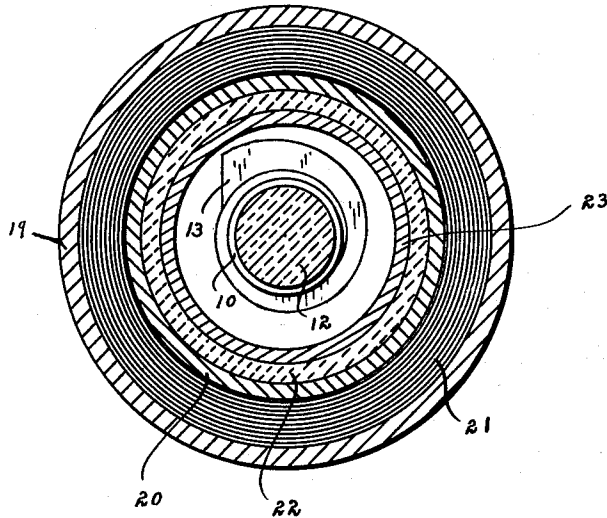
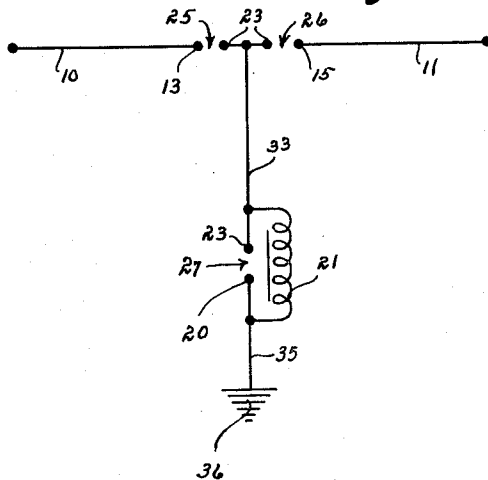


*Fig. 4*



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## MINIATURE MULTIPLE SURGE ARRESTOR

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This invention relates to a miniature multiple surge electricity arrestor and more particularly to a surge arrestor particularly adapted for use as over voltage protector; surge current bypasser; lightning arrestor, rectifier protector; magnetrons protector; high surge current switch to discharge capacitors; surge suppressor on relay circuits; over voltage protection on cables; and like.

Surge arrestors are old in the art and are in general usage. However such devices heretofore are complicated, large, costly; and are not versatile. They are seriously adversely affected by surrounding environments and do not have a constant arc-over voltage. Furthermore, they are of short useful life and do not have the ability to extinguish follow-through current created by the equipment associated with the surge arrestor.

Therefore one of the principal objects of my invention is to provide a reliable small size multiple surge arrestor.

A further object of this invention is to provide a multiple surge arrestor that is most versatile.

A still further object of this invention is to provide a multiple surge arrestor that is completely unaffected by the surrounding environment.

A still further object of this invention is to provide a multiple surge arrestor that has a constant arc-over voltage.

A still further object of this invention is to provide a multiple surge arrestor that has the ability to extinguish follow-through current created by the equipment to which it is attached.

Still further objects of my invention are to provide a multiple surge arrestor that is of long life, economical in manufacture, and durable in use.

These and other objects will be apparent to those skilled in the art.

My invention consists in the construction, arrangements, and combination, of the various parts of the device, whereby the objects contemplated are attained as hereinafter more fully set forth, specifically pointed out in my claims, and illustrated in the accompanying drawing, in which:

FIG. 1 is a perspective view of my device ready for use.

FIG. 2 is a longitudinal sectional view of my multiple surge arrestor with some parts in symbol, is taken on line 2-2 of FIG. 1, and more fully illustrates its construction.

FIG. 3 is a cross-sectional view of the device taken on line 3-3 of FIG. 2, and

FIG. 4 is a schematic diagram of the electrical wiring of the device.

In the drawings I show a device having two spiral gaps. For many uses, only one spiral gap will be used. The one not in use may be used as a "spare" or discarded entirely. However and inasmuch as the twin spiral gaps are necessary for certain uses such as for use on twin lead balance cables, I will describe a unit having the two spiral gaps, it being understood that in many situations, one spiral gap will be employed.

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Referring to the drawings I have used the numerals 10 and 11 to designate two longitudinally in line metallic shafts. The two adjacent but space apart ends of those two shafts are secured together by an insulating connector 12. The shafts 10 and 11 are electrodes and are to be considered as equipment terminals. On and around the inner end portion of the shaft 10 and near the connector 12 is a metallic spiral rib electrode 13, decreasing in diameter as it extends toward the connector 12. On and around the inner end portion of the shaft 11 and near the connector 12 is a metallic spiral rib electrode 15 decreasing in diameter as it extends toward the connector 12. Each of these spiral electrodes ribs may be an integral part of the shaft it embraces. Embracing and near the outer end of the terminal shaft pin in a non-electrode conductive disc 16. A like disc 17 embraces the terminal shaft 11 toward its outer end as shown in FIG. 2. Preferably these discs 16 and 17 are of glass so that visual inspection may be made as to the condition of the spiral electrodes 13 and 15. Secured to and embracing the side discs 16 and 17 is a cylinder housing 19. On the inner central side of the cylinder 19 is a housing 20. This housing extends completely around the inner side of the cylinder 19 and contains the wire coil 21. On the inner side of the housing 20 is a cylinder 22 of non-electrode conductive material such as a potting compound. Secured to the inner side of the cylinder 22 is a metallic cylinder electrode 23. This cylindrical electrode 23 is spaced apart from but embraces the two spiral electrodes 13 and 15, thus producing a spark gap designated by the numeral 25 and a second spark gap designated by the numeral 26. The first spark gap 25 exists between the spiral electrode 13 and the cylindrical electrode 23 and the spark gap 26 exists between the spiral electrode 15 and the cylinder electrode 23. One side of the wire coil housing 20 extends inwardly but is spaced apart from the cylindrical electrode 23 thus producing a third spark gap designated by the numeral 27. The cylindrical wire coil housing 20 is of electrode conductive material and is centrally held within the unit by the two insulating collar rings 29 and 30. The numerals 31 and 32 designate the two non-conductive collars embracing the terminals 10 and 11 respectively for holding and centering the spiral electrodes 13 and 15 in proper position within the cylindrical electrode 23.

FIG. 4 illustrates the working diagram of the unit. A conductor 33 connects one end of the coil 21 to the cylindrical electrode 23 and the conductor 35 electrically connects the other end of the coil to the ground 36. This lead 35 and ground 36 are electrically connected to the housing 20 and therefore extends electrically to one side of the gap 27.

If a single spiral electrode is to be used either the spiral electrode 13 or the spiral electrode 15 may be removed and the terminals 10 and 11 electrically connected. Still another system would be to merely use one of the terminals such as the shaft terminal 10 and which the associated equipment would be electrically connected at both the outer and inner ends of the terminal 10. If desired, the terminal 11 could be used. When only one spiral electrode is employed, only two spark gaps would be used, i.e., the spark gap between one of the spiral electrodes and the cylinder 23 and the spark gap 27 between the cylinder 23 and housing 20.

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As herebefore indicated my miniature multiple surge arrestor may be used for many different purposes and variations. By one hook up, a constant current flowing in the coil 21 will cause a magnetic field to pass through the spark gaps, thereby causing the arcs at the spiral gaps to rotate in the same direction regardless of the direction of the current flow. The spiral gap at 25 and the spiral gap at 26 will cause a resultant arc to rotate down and away from the initiating point thereby minimizing the damage that could occur to the initiating point at gaps 25 and 26. The arc will continue to rotate near the lower points of the spirals until the current ceases or until the voltage across the unit drops below a critical value. This critical value of voltage increases as the arc is lengthened by rotating down the spiral gaps. Obviously the arc in the gap 27 rotates due to the fact that the end of the housing 20 which acts as an electrode is spaced apart from but embraces the cylindrical electrode 23, however, the arc does not spiral. Rotating the arcs in the various gaps does not allow the arcs to significantly erode the various electrodes. Moving the arc in the gap 25 and in the gap 26 away from the ignition point allows a spark gap breakdown voltage to remain essentially constant. The gap at 27 however does not have any effect on the initial breakdown voltage because it is shunted by the coil 21. As the arc in either gap 25 or 26 is rotated and lengthened, it requires more energy from the power source to continue arcing. This condition will allow the unit to extinguish the arc that might continue due to the normal voltage from the equipment connected to the unit after the peak voltage has passed.

If desired, my unit can be used in conjunction with an impedance to limit the surge current flow through the equipment that is being protected. The unit may be used with a capacitor or an inductance, or a resistor or a combination of any of these circuit elements could be employed. The impedance could be added externally or the outside housing of the unit could be lengthened and the impedance contained inside the unit.

From the above it will be seen that when the current surge enters the input side of the spiral electrode it causes an arc to take place between that part of the spiral electrode that is close to the cylinder electrode and the cylinder electrode. At the same time an arc takes place between the cylinder electrode, and the fixed metal electrode which is electrically connected to the ground or some type of a return path. The voltage dropped across the fixed gap 27 causes a constant flow of current in the coil because the natural characteristics of such a spark gap is to have a constant voltage across it during the time the arc is occurring.

Some changes may be made in the construction and arrangement of my miniature multiple surge arrestor without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims, any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

I claim:

1. In a multiple surge arrestor, an equipment terminal having a spiral electrode decreasing in diameter as it extends in one direction, a cylindrical electrode spaced apart from and embracing the spiral electrode of said terminal, an electrode spaced apart from the outer side of said cylindrical electrode, and a wire coil around said cylindrical electrode having one end electrically connected to said cylindrical electrode and its other end operatively electrically connected to said third mentioned electrode, said third mentioned electrode adapted to be operatively electrically connected to a ground.

2. In a multiple surge arrestor, an equipment terminal having a spiral electrode decreasing in diameter as it extends in one direction, a cylindrical electrode spaced apart from and embracing the spiral electrode of said terminal, an electrode spaced apart from the outer side of said

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cylindrical electrode, and a wire coil around said cylindrical electrode having one end electrically connected to said cylindrical electrode and its other end operatively electrically connected to said third mentioned electrode, said third mentioned electrode being in the form of a spaced apart ring loosely embracing said cylindrical electrode and adapted to be operatively electrically connected to a ground.

3. In a multiple surge arrestor, an equipment terminal having a spiral electrode decreasing in diameter as it extends in one direction, a cylindrical electrode spaced apart from and embracing the spiral electrode of said terminal, an electrode spaced apart from the outer side of said cylindrical electrode, a wire coil around said cylindrical electrode having one end electrically connected to said cylindrical electrode and its other end operatively electrically connected to said third mentioned electrode, said third mentioned electrode adapted to be operatively electrically connected to a ground, and a grounded cylindrical housing embracing said coil of wire and embracing and spaced apart from said cylindrical electrode.

4. In a multiple surge arrestor, an equipment terminal having a spiral electrode decreasing in diameter as it extends in one direction, a cylindrical electrode spaced apart from and embracing the spiral electrode of said terminal, an electrode spaced apart from the outer side of said cylindrical electrode, a wire coil around said cylindrical electrode having one end electrically connected to said cylindrical electrode and its other end operatively electrically connected to said third mentioned electrode, said third mentioned electrode adapted to be operatively electrically connected to a ground, a grounded cylindrical housing embracing said coil of wire and embracing and spaced apart from said cylindrical electrode, and a housing embracing said spiral electrode, said wire coil, said cylindrical electrode and said third mentioned electrode.

5. In a multiple surge arrestor, an equipment terminal having a spiral electrode decreasing in diameter as it extends in one direction, a cylindrical electrode spaced apart from and embracing the spiral electrode of said terminal, an electrode spaced apart from the outer side of said cylindrical electrode, a wire coil around said cylindrical electrode having one end electrically connected to said cylindrical electrode and its other end operatively electrically connected to said third mentioned electrode, said third mentioned electrode adapted to be operatively electrically connected to a ground, a grounded cylindrical housing embracing said coil of wire and embracing and spaced apart from said cylindrical electrode, and a housing embracing said spiral electrode, said wire coil, said cylindrical electrode and said third mentioned electrode; said housing having at least a portion of its area of a transparent material.

6. In a multiple surge arrestor, an equipment terminal having a spiral electrode decreasing in diameter as it extends in one direction, a second equipment terminal having a spiral electrode decreasing in diameter as it extends in one direction; said first and second mentioned spiral electrodes extending longitudinally toward each other and decreasing in diameter as they extend toward each other, a cylindrical electrode spaced apart from and embracing both of said spiral electrodes, an electrode spaced apart from the outer side of said cylindrical electrode, and a wire coil around said cylindrical electrode having one end electrically connected to said cylindrical electrode and its other end operatively electrically connected to said third mentioned electrode, said third mentioned electrode adapted to be operatively electrically connected to a ground.

7. In a multiple surge arrestor, an equipment terminal having a spiral electrode decreasing in diameter as it extends in one direction, a second equipment terminal having a spiral electrode decreasing in diameter as it extends in one direction; said first and second mentioned spiral electrodes extending longitudinally toward each

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other and decreasing in diameter as they extend toward each other, an electro-insulating member connecting said first equipment terminal with said second mentioned equipment terminal, a cylindrical electrode spaced apart from and embracing both of said spiral electrodes, an electrode spaced apart from the outer side of said cylindrical electrode, and a wire coil around said cylindrical electrode having one end electrically connected to said cylindrical electrode and its other end operatively electrically connected to said third mentioned electrode, said

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third mentioned electrode adapted to be operatively electrically connected to a ground.

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