J. N. KELMAN.

INSULATOR FOR HIGH POTENTIAL CIRCUITS.

APPLICATION FILED FEB. 10, 1908.

949,184.

Patented Feb. 15, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

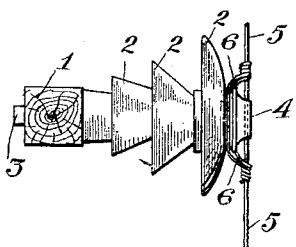


Fig. 2.

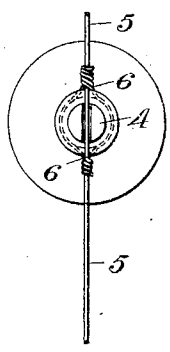
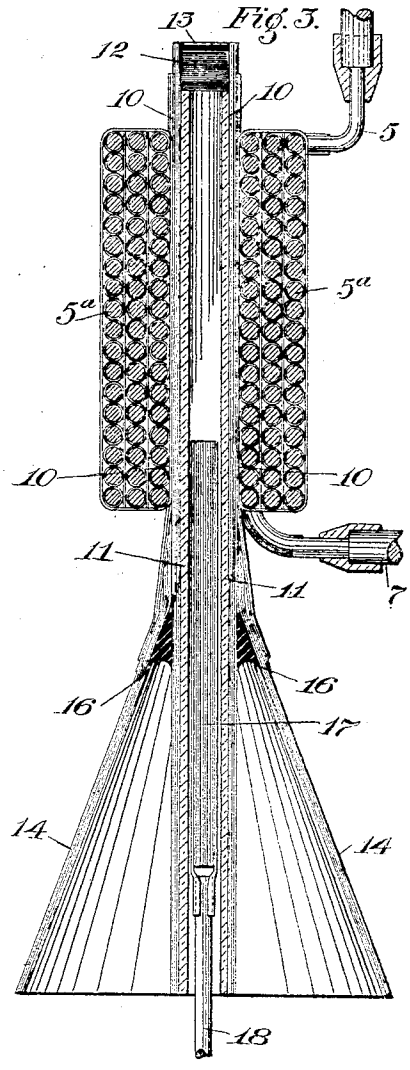


Fig. 3.



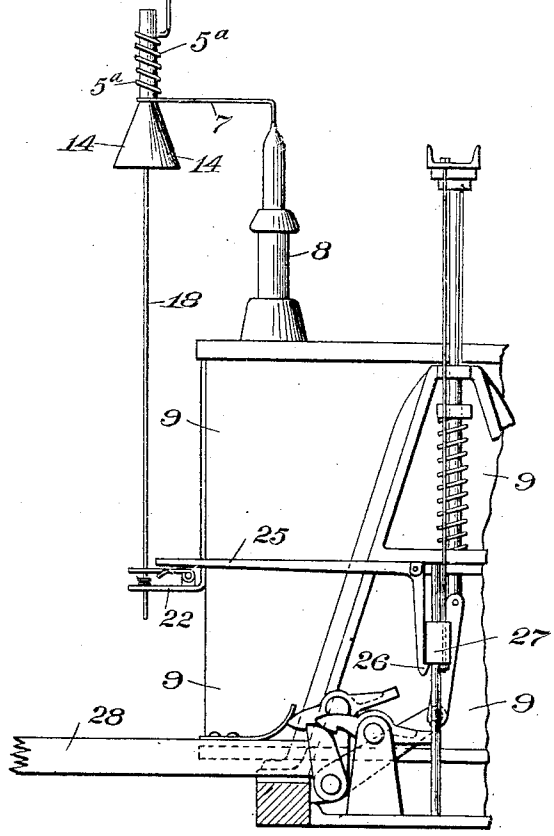
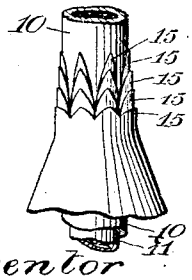


Fig. 5.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 3. bis

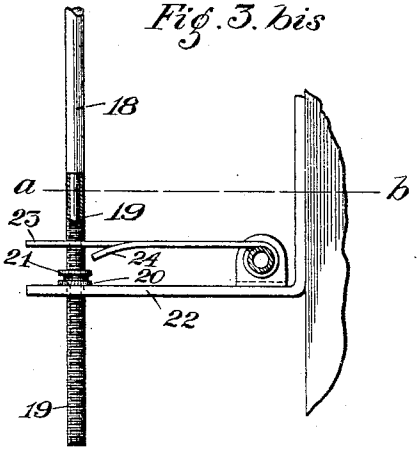


Fig. 4.

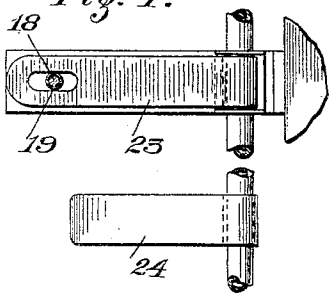


Fig. 6.

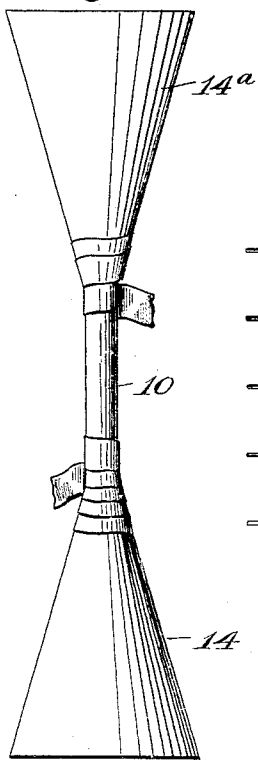


Fig. 9.

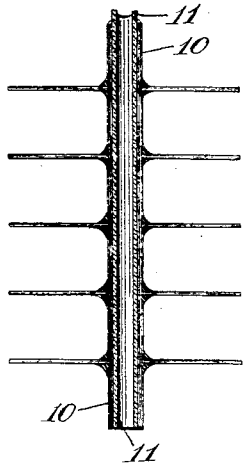


Fig. 7.

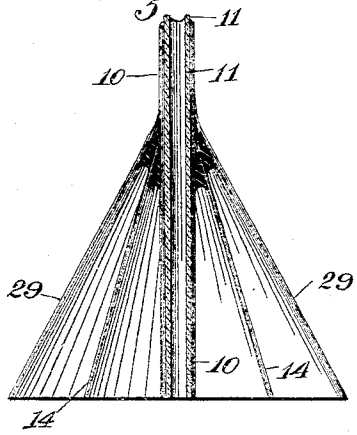
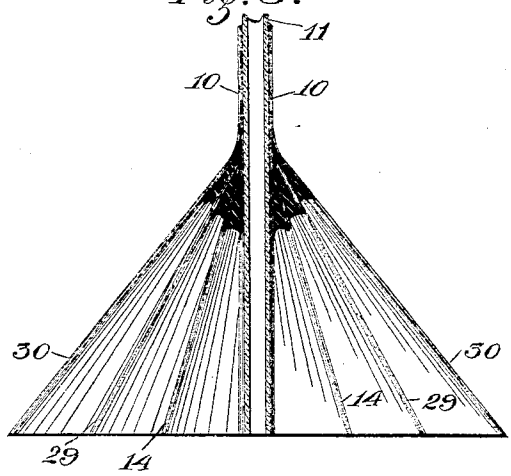


Fig. 8.



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UNITED STATES PATENT OFFICE.

JOSEPH NELSON KELMAN, OF LOS ANGELES, CALIFORNIA.

INSULATOR FOR HIGH-POTENTIAL CIRCUITS.

949,184. Specification of Letters Patent. Patented Feb. 15, 1910.

Application filed February 10, 1908. Serial No. 415,231.

To all whom it may concern:

Be it known that I, JOSEPH NELSON KELMAN, of the city of Los Angeles, in the county of Los Angeles and State of California, have invented certain new and useful Improvements in Insulators for High-Potential Circuits, of which the following is a full, clear, and exact specification, reference being had to the annexed drawings, and to the letters and figures marked thereon.

My invention which relates to certain new and useful improvements in the construction of insulators for high potential circuits, is not only especially applicable to circuits wherein the switch and circuit breakers for high potential circuits described and claimed, and shown in the drawings of my application for Letters Patent, Serial Number 370,091, filed April 22nd, 1907, are used, but it is, or may be used more especially for preventing leakage of high potential current from the main conductor of a high potential circuit to other metallic parts of an electrical plant, and especially to the tank containing the high potential switch and circuit breaker described in the said application for Letters Patent.

My said improved insulators are also adapted for use in many other cases of high potential insulations wherein there is possibility or opportunity for leakage to take place from a conductor to other proximate or nearby metallic parts of apparatus, whether connected or not, in connection with high potential circuits. The high potential circuits which I refer to are such as vary from say, 10,000 to 100,000, or a still higher number of volts under all conditions of operation.

Upon the annexed drawings, Figure 1, is an elevation of one application of my improved insulator, namely, the application thereof to a high potential circuit and circuit breaker corresponding to that which is shown at Fig. 4, of the drawings of my aforesaid application for Letters Patent, and described in the specification thereof; the lower part of Fig. 1, corresponding to the lefthand part of Fig. 4, of the aforesaid drawings, also showing the insulated support of the portion of the main circuit wound into a solenoid coil to operate a soft iron core, and attachments. Fig. 2, is an end elevation of the insulating support of a portion of main circuit corresponding to the upper part of Fig. 1. Fig. 3, is a vertical section on a larger scale, showing the main circuit wound as a solenoid coil and insulated from a soft iron core within a rigid tube of glass, porcelain, or other insulating material, said soft iron core being connected by a wooden rod to the trip or releasing mechanism described in my aforesaid specification. The said Fig. 3, also showing in vertical section one form of the main circuit conical insulator constructed in accordance with my present invention. Fig. 3, *bis*, is an elevation upon a larger scale showing the lower part of the insulated rod connecting the soft iron core within the rigid tube of the solenoid device, to the operating lever of the trip or releasing portions of the high potential circuit breaker. Fig. 4, is a plan with parts broken away, corresponding to Fig. 3, *bis*. Fig. 5, is an elevation of the upper part of the conical insulator shown at Fig. 3, and on a smaller scale at Fig. 1, illustrating in part the method whereby the conical portion of the insulator is attached to the insulating tube surrounding the rigid tube of glass or porcelain, or other insulating material inclosing the soft iron core. Fig. 6, is an elevation of a pair of my conical insulators constructed according to my invention to be applied in high potential circuits for the purpose of preventing leakage from any part of said circuit to any adjacent or proximate metallic body. Fig. 7, is a transverse vertical section of my improved conical insulator which instead of being constructed with one insulating petticoat or shield, as is the insulator shown at Fig. 3, the insulator shown at Fig. 7, is constructed with two insulating petticoats or shields, one within the other. Fig. 8, is another vertical section of my improved insulator showing the said insulator as constructed with three conical petticoats or shields. Fig. 9, is another vertical section of my improved insulator, but in this case instead of forming the shields or leakage surfaces of conical form, they are shown as flat disks, the construction of which is hereinafter fully described.

With reference to Figs. 1, and 2, the part marked 1, represents the section of a beam of wood such as is used in the roof or other parts of a building. To this beam 1, the

insulator 2, is attached by a bolt 3, cemented into the insulator, and extending beyond the same. Upon the opposite end of the insulator 2, is formed the wire carrier 4, through which the insulated wire 5, of the main circuit passes, and to which it is bound by the loop 6. The insulator 2, is constructed preferably of porcelain, and is formed of three projecting portions approximately of the shape shown at Fig. 1, the object of so constructing the insulator 2, being to provide an extensive surface over which any leakage which may pass from the main circuit is distributed without breaking the insulation to the nearest body of metal.

The lower part of the insulated wire 5, is wound into a solenoid coil 5^a, as shown at Fig. 1, corresponding to the solenoid coil Q, described in the specification of my aforesaid application for Letters Patent, and shown at Fig. 4, thereof. The lower part 7, Figs. 1, and 3, of the solenoid coil portion of the circuit passes down through the insulator 8, Fig. 1, into the oil tank 9, wherein it is connected to one of the poles of the switch within the tank in the same manner as described in my aforesaid specification and shown at Fig. 5, of the drawings thereof.

The construction of the solenoid coil is shown simply as a single coil in Fig. 1, but shown in its complete construction, and on a much larger scale in Fig. 3, wherein the lower portion 7, of the circuit is wound in successive spirals immediately around the insulating tube 10, to the top of the coil, being then again wound upon the inner layer of the coil, and thence upward again to form the outer layer of the coil, the wire constituting the coil being insulated by an insulating wrapping directly around the wires of the coil itself throughout the entire length of such wires, and also being further insulated by layers of insulation placed between the several layers constituting the coil, and said insulation covering the coil when completely wound, all in such manner that the lower part 7, of the coil passes outward to an oil tank containing the circuit breaker.

The insulation 10, wound upon the rigid tube 11, in Fig. 3, consists of several layers of insulating varnish with which corresponding laminæ or layers of cambric or equivalent woven fabric, or of paper or equivalent non-woven fabric intervenes; these layers of woven or non-woven material impregnated with an adhesive insulating varnish, for example, shellac varnish, or that known as "Stirling varnish," the layers of fabric being wound around and around upon each other with the insulating varnish between them until the requisite thickness and stiffness of tube is attained.

The upper part 12, of the tube formed of cambric or of equivalent material, is filled for a sufficient depth with disks of the insulating varnish with the impregnated varnished cambric, or of equivalent material between them, and these disks fit tightly and adhesively to the interior of the tube. The possibility of any leakage of high voltage current taking place through the disks 12, to the inner portion of the tube 10, being still further prevented by placing a thick layer of insulating varnish 13, over the top of the disks so as to be practically level with the top of the tube 10, which is formed of cambric or equivalent material. The tube 10, of cambric or equivalent material, extends the entire length of the glass tube 11, and therefore completely incloses the glass tube 11, as shown at Fig. 3.

Although I have described the disks 12, as being placed in the upper part of the tube 10, it is to be understood that they may be placed in either end of the tube 10, which is, or may be an open end of the tube 10.

From about the middle downward of the tube 10, of cambric or equivalent material, there extends the conical petticoat or shield 14, as shown at Fig. 3. This conical petticoat or shield 14, is also constructed of laminæ or layers of insulating varnish with laminæ or layers of other woven or non-woven material such as varnished cambric intervening, cut in such shape that the laminæ or layers being wound one upon the other on a conical former so as to produce the petticoat or shield of the shape shown at Figs. 3, and 1.

In order to tightly unite the petticoat or shield 14, with the tube 10, as it is shown to be so united in Fig. 3, the several layers of the cambric or equivalent material constituting the petticoat or shield at the part immediately uniting the petticoat or shield 14, with the tube 10, of cambric or equivalent material, are cut as shown at Fig. 5, with a series of upwardly pointing tongues 15, the innermost of which pointedly cut portions are directly next the outer surface of the tube 10, while the other cut portions 15, overlap these, and in part unite the outer surface of the tube 10.

When the cut portions or tongues 15, of the smaller end of the petticoat or shield are united by adhesive varnish to the tube 10, then these cut pointed portions or tongues are served over with tape of cambric or equivalent material correspondingly impregnated or charged with the insulating varnish, until a sufficiency of such layers of such varnished tape have been wound upon them to securely unite the petticoat or shield 14, with the tube 10, of varnished cambric or equivalent material. After the petticoat or shield 14, has been connected as now last described with the tube 10, then a sufficient quantity of insulating varnish 16, is poured into the conical annulus at the smaller end of the insulator, so as to fill a sufficient depth

of such conical annulus at the part where the petticoat or shield, and the tube 10, are united.

Within the rigid tube 11, of glass, porcelain, or other material, there is contained the movable soft iron core 17, which is operated upward and downward within the tube 11, by the exciting action of the solenoid coil 5^a, when the circuit is in operation as is well understood. To the lower part of the soft iron core 17, the rod 18, is attached, this rod being constructed of wood, or other insulating material. The lower part of the rod 18, shown at Fig. 3, Fig. 3, *bis*, and Fig. 4, is covered with a brass tube 19. The tube 19, has formed upon it a screw thread as shown at Fig. 3, *bis*, and upon this screw thread there are carried the nut 20, and jam-nut 21, by which the position of the soft iron core 17, within the solenoid coil 5^a, is adjusted, and by which also the lever 23, which operates the cam 24, for releasing the lever 25, and hook 26, from supporting the weight 27, is operated. As the other parts shown at Fig. 1, of the lower part of the oil tank 9, and of the circuit breaker and the lever 28, also the detents, shafts, and link connections, also the spring and restorer of the weight 27, to its normal position are reproductions of the same device hereinbefore referred to as in Fig. 4, of the drawings, and corresponding parts of the specification of my aforesaid application for Letters Patent, and as such parts all operate in the same manner as they are described in the specification of my aforesaid application for Letters Patent, and as such parts do not constitute any portion of my present invention, they therefore need not be herein further described.

With reference to Fig. 6, showing two conical petticoats or shields 14, and 14^a, constructed in the same manner as the petticoat or shield 14, hereinbefore described with reference to Fig. 3, as attached to the tube 10; and since the said petticoats and shields 14, and 14^a, have their smaller ends constructed in the manner hereinbefore described as shown at Figs. 3, and 5, and as these parts are wound over by tape of cambric or equivalent material, in the same manner shown at Fig. 3, and hereinbefore described with reference to Figs. 3, and 5, such winding and connection of the said parts need not be herein repeated with reference to Fig. 6; it being explained that at the inner and smaller ends of each of the varnished petticoats or shields 14, and 14^a, the insulation and connection of the parts are made efficient by the pouring in, and hardening of shellac varnish, or other equivalent insulating medium.

The second or outer petticoat or shield 29, shown in Fig. 7, is attached to the tube 10, above the inner petticoat or shield 14, in the same manner as hereinbefore described with reference to the attachment of the petticoats or shields 14, and 14^a, in the preceding figures of drawing, while with reference to Fig. 8, wherein there are two petticoats or shields 29, and 30, respectively, outside the inner petticoat or shield 14, it is explained that these outer petticoats or shields are formed in the same manner of laminæ or layers of insulating varnish, with laminæ or layers of cambric, or of equivalent material impregnated with insulating varnish intervening, and fastened to the tube 10, in the same manner as the inner petticoat or shield 14, has been hereinbefore described as fastened to the tube 10. The smaller ends connecting the parts of each of the petticoats or shields 14, 29, and 30, are insulated and securely fastened to each other and to the tube 10, by the insulating varnish as shown, and hereinbefore described with reference to Fig. 8.

While the conical form of insulators hereinbefore described, and shown upon the annexed drawings, is found to give excellent results in operation, yet I desire it to be understood that my invention is not limited to the construction of the conical petticoat or shield in the forms of hollow cones, and that instead of forming insulators in the shape of a single hollow cone, or as of several hollow cones inclosing one another, the laminæ or layers of insulating varnish with impregnated cambric, or equivalent material constituting the said insulators may be cut into the form of flat disks, and several such flat laminæ or layers of such insulating varnish with cambric or equivalent material intervening are, or may be united to form each insulating projecting surface around the tube 10, of cambric or equivalent material.

One advantage of constructing the insulators in the form of hollow cones, is that they are not liable to get out of shape under exposure to the atmosphere, while flat disks, such as are shown in Fig. 9, are liable to become distorted from their flat shape or form.

It is to be understood that while I have by the references in this specification, and by a portion of the drawings of my aforesaid application for Letters Patent having been inserted in the drawings forming part of this application, as illustrating an exemplary application of the insulator constituting my present invention, yet I explain that the said insulators are not applicable only to the parts of high potential circuits referred to in my aforesaid application for Letters Patent, but that the said insulators are generally applicable to every part of high potential circuits wherein any part of such circuits are in sufficient proximity to metallic bodies to tend to cause leakage from the nearest parts of said circuits, to metallic bodies so located, which leakage it is the ob-

ject of the insulators constituting my present invention to obviate the occurrence of, by providing very extensive insulating surfaces over which such leakage of high potential current must pass or travel, before coming into sufficient proximity to the metallic surfaces so as to electrically excite the said metallic bodies.

I desire it to be understood that while I have in the preceding parts of this specification described the laminæ or layers of fabric which support the layers of insulating varnish in, or of my insulator as cambric, that instead of employing cambric as constituting the textile fabric for carrying the insulating varnish, I also use instead of cambric, other textile fabrics, such as silk, linen, muslin, or calico, or other non-conducting textile fabrics, and instead of using a textile fabric, I also use laminæ or layers of paper, cardboard, felt, or equivalent non-woven insulating material as the support for carrying the adhesive insulating varnish between the layers of such paper or textile fabrics.

In cases where I can employ the improved insulator constituting my present invention on any portion of a high potential circuit which is not in proximity to a high potential circuit breaker, and in parts of high potential circuits where winding of a portion of the circuit as a solenoid coil is not necessary, and wherein it is not necessary to place a movable soft iron core within the tube of my insulator; then I carry a straight portion of a high potential circuit through the tube of my insulator, in which case it becomes necessary to remove the plugs 12, and 13, shown in Fig. 3, from the end of the tube 10, thence allowing the high potential conductor to pass through the tube.

I claim as my invention.

1. An insulator consisting of a spreading member and tube composed of laminæ or layers of flexible fabric, said layers of fabric being separated by insulating varnish with which said fabric is covered and impregnated.

2. An insulator consisting of a spreading member and tube composed of laminæ or layers of flexible fabric, said layers of fabric being separated by insulating varnish with which said fabric is covered and impregnated, said insulator having a rigid central insulating tube.

3. An insulator consisting of a plurality of spreading members and a tube, said spreading members and said tube being constituted of laminæ or layers of flexible fabric covered and impregnated with insulating varnish.

4. An insulator consisting of a plurality of spreading members and a tube, said spreading members and said tube being constituted of laminæ or layers of flexible fabric covered and impregnated with insulating varnish, said insulator having a rigid central insulating tube.

In testimony whereof, I have hereunto set my hand and seal at the city of Los Angeles aforesaid, in the presence of two subscribing witnesses.

JOSEPH NELSON KELMAN. [L. S.]

Witnesses:
ST. JOHN DAY,
J. D. CORY.