May 8, 1934. F. S. SMITH 1,957,985

HIGH VOLTAGE TERMINAL CONSTRUCTION

Filed Jan. 23, 1931 2 Sheets-Sheet 1

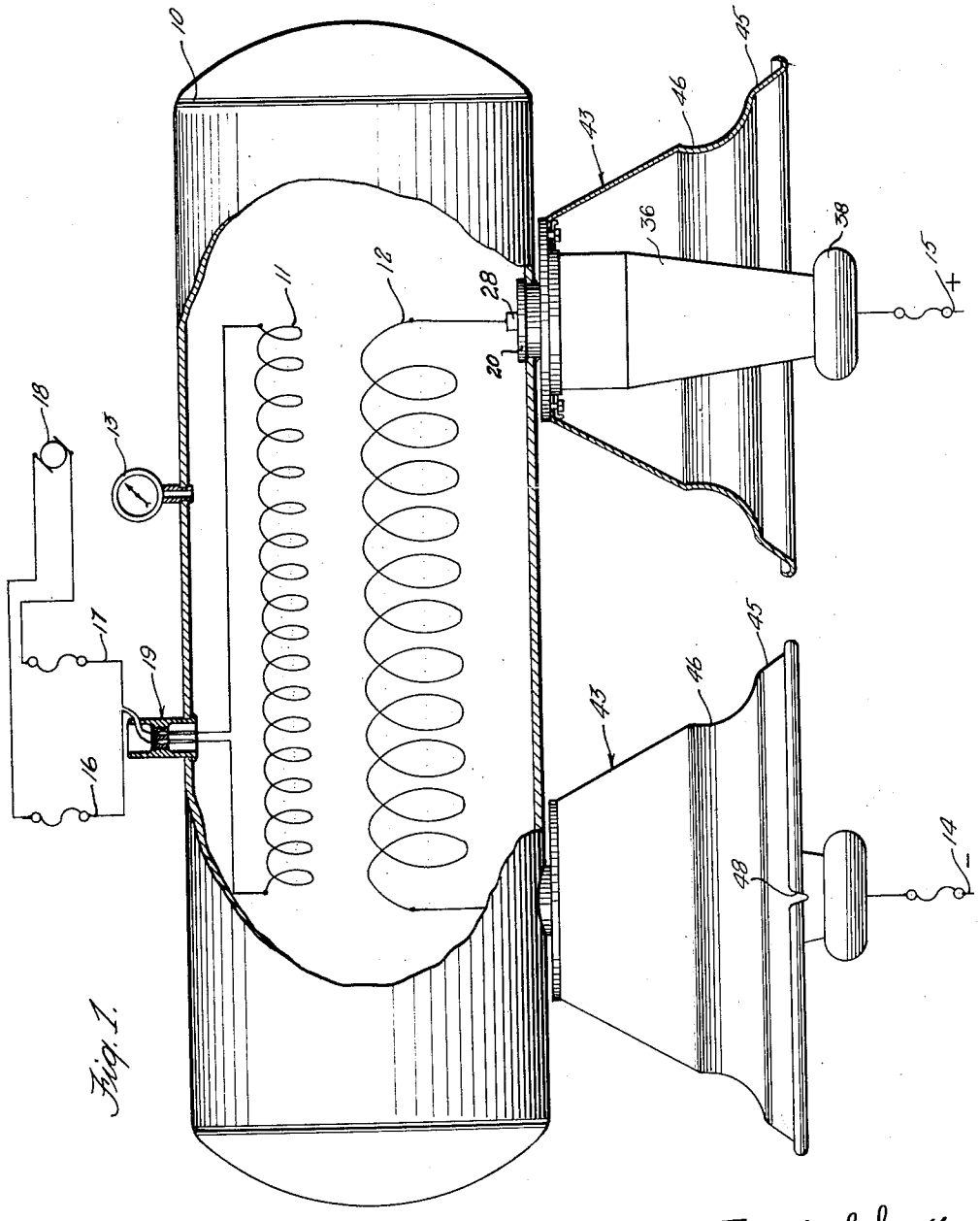


Fig. 1.

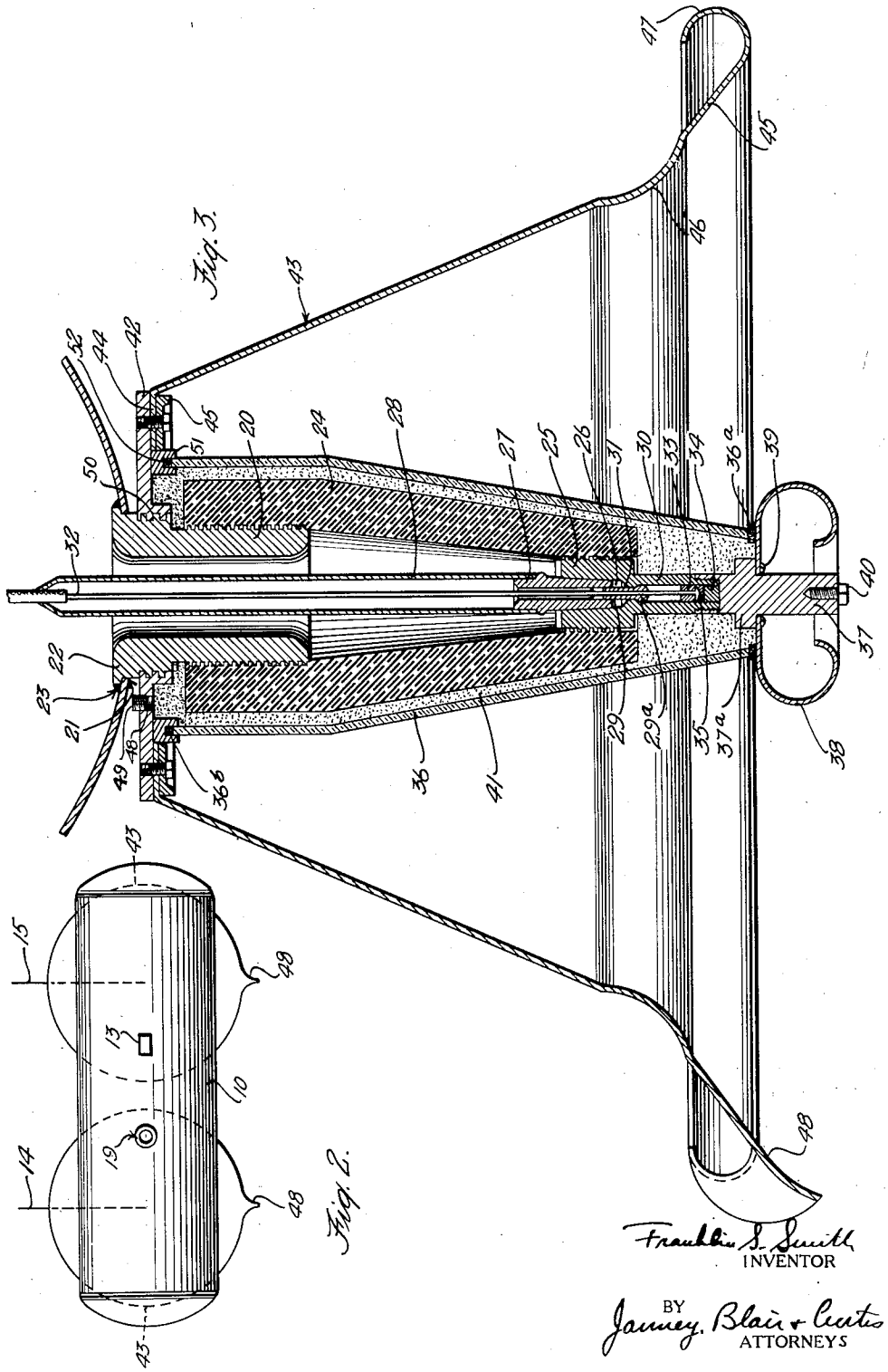
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Patented May 8, 1934 1,957,985

UNITED STATES PATENT OFFICE

1,957,985

HIGH VOLTAGE TERMINAL CONSTRUCTION

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Application January 26, 1931, Serial No. 511,306

27 Claims. (Cl. 173—318)

This invention relates to electric terminal construction and more particularly to the construction of high voltage terminals.

One of the objects of this invention is to provide a simple and thoroughly practical high voltage terminal construction that will be compact, capable of rapid and inexpensive manufacture and well adapted to meet the varying conditions of hard practical use. Another object is to provide a high voltage terminal construction that will be capable of handling relatively high voltages without necessitating unduly cumbersome sizes of certain of the parts. Another object is to provide a high voltage terminal construction in which certain advantages flowing from the use of a molded material, like phenolic condensation product, may be fully realized while achieving a capacity for handling voltages higher than has heretofore been possible without necessitating undue or otherwise relatively large increases in the size of the molded part or parts. Another object of this invention is to make it possible to achieve a high voltage-handling capacity in a terminal but in a simple, dependable and inexpensive manner. Another object is to provide a high voltage terminal construction of the above-mentioned character that will be well adapted to function outdoors where it is exposed to the elements, particularly to rain, snow, soot, or smoke particles, or the like. Another object is to provide a high voltage terminal construction for outdoor service in which the possibility of flash-over or arc-over is greatly minimized. Other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings in which is shown one of various possible embodiments of this invention,

Figure 1 is a side elevation, partly in section, showing the terminal construction of my invention as applied to an outdoor transformer, certain parts being broken away in order to indicate certain other parts diagrammatically;

Figure 2 is a plan view, on a smaller scale, of the apparatus shown in Figure 1, and

Figure 3 is a vertical central sectional view, on an enlarged scale, through one of the high voltage terminals.

Similar reference characters refer to similar parts throughout the several views in the drawings.

Referring now to the drawings and more particularly to Figure 1, I have shown a casing 10 preferably in the form of a tank, hermetically sealed and of sufficient strength to contain therein a gaseous dielectric under pressure, such as nitrogen, for example, under a pressure on the order of fifteen atmospheres, for insulating and/or cooling the parts of a high voltage apparatus contained in the casing and illustratively taking the form of a transformer, the windings of which are diagrammatically indicated at 11 and 12, in Figure 1. The transformer windings 11—12 are appropriately related to any suitable form of transformer core (not shown) the detailed construction of the transformer not being shown or described since per se it does not constitute part of the present invention. A pressure gage 13 is connected to the casing 10 to indicate the pressure of the gaseous dielectric.

The tank 10, containing the electrical apparatus illustratively in the form of a transformer may be, in so far as certain features of my invention are concerned, mounted or otherwise suitably supported outdoors and as illustrative of a possible outdoor installation to which certain features of my invention are particularly adapted, the transformer 11—12 may take the form of a potential instrument transformer for connecting a potential-indicating instrument to a high voltage circuit or line, the latter being indicated as comprising the line conductors 14 and 15. The high tension winding 12 of the transformer is connected across the high tension circuit 14—15 while the low tension winding 11 is connected by conductors 16—17 to a suitable voltage-indicating instrument diagrammatically shown at 18, the conductors leading from the low tension winding 11 being passed through the wall of the casing 10 by means of any suitable terminal construction, generally indicated at 19.

The high tension leads connecting the high tension winding 12 to the high tension circuit 14—15 are passed through openings in the bottom wall of the casing 10 by a terminal construction shown more clearly in section and on an enlarged scale in Figure 3, to which reference may now be made.

Referring therefore to Figure 3, I have shown a bushing 20, of metal, fitted into a suitable opening 21 in the wall of the casing 10, the bushing 20 being flanged, as at 22, the flange abutting

against the inner face of the wall of the casing. The bushing 20 is connected to the wall of the casing 10 in fluid-tight manner, as by welding the parts together, as indicated at 23. The bushing 20 thus forms an extension of the opening 21 in the casing 10.

A part of the exterior of the bushing 20 is threaded so as to receive the interiorly threaded upper end of a housing 24, substantially tube-like in form, made of a solid dielectric material, being preferably molded of phenolic condensation product or bakelite. A suitable cement is interposed between the interengaged threaded portions of the housing 24 and bushing 20 to form a seal against the escape of the gaseous dielectric under pressure which, as will be more clearly set forth hereinafter, fills the free spaces within the bushing 20 as well as within the housing 24.

The tube-like housing 24 is made of sufficient thickness not only to withstand the high pressure of the gaseous dielectric but also to withstand the potential of the conductor which it is to support and assist in insulating from the wall of the casing 10. Preferably the housing 24 tapers in a downward direction, as is clearly shown in Figure 3, and at its lowermost end it is interiorly threaded to receive a metal plug-like member 25, also threaded, the interengaged threaded portions being sealed with a suitable cement to prevent the escape of the high pressure gaseous dielectric.

The inner or upper end of the metal plug member 25, as viewed in Figure 3, is provided with a tapered recess 26, round in horizontal cross-section, and having its axis coincident with the axis of the cylindrical inside wall of the bushing 20. Into this recess 26 is fitted an exteriorly tapered hollow plug or sleeve-like member 27, forming a portion of the high voltage conductor that is to be passed through the wall of the casing 10. The remaining portion of this high voltage conductor takes the form preferably of a tube 28 suitably secured to the tapered plug 27 so that the axis thereof and the axis of the tapered portion of the plug 27 will be coincident.

When, therefore, the high voltage conductor 27—28 is inserted through the bushing 20 and the tapered plug 27 thereof fitted into the tapered recess 26 of the member 25, the cylindrical portion or tube portion 28 will be positioned and held coaxially with the interior cylindrical wall of the bushing 20.

The outer wall of the cylindrical portion 28 of the high voltage conductor and the inner wall of the bushing 20 will thus be concentric and their radii, moreover, are preferably so proportioned that these two parts form the electrodes of a fast discharge gap, spark-over between which will take place without being preceded by corona and, moreover, at a critical voltage below that at which any part of the apparatus within the casing 10, such as the transformer 11—12, or any parts thereof, will be injured.

The lower end of the tapered plug 27 is threaded to receive a hollow screw 29. The end plug 25 has a tube-like extension 30, the inner passage of which is restricted by a shoulder 31 against which the head 29ª of the hollow screw 29 abuts. As the screw 29 is turned, in the course of the assembly of the parts, as by means of a screw driver passed into the tube-like extension 30, the interfitting tapered parts 27 and 25 are tightly drawn together, thus rigidly holding the cylindrical portion 28 in the above-described concentric or coaxial relation with respect to the bushing 20.

A suitable wire 32 leads from one end of the high tension winding 12 downwardly through the tube 28, thence through the plug 27 and through the hollow screw 29, whence its end is tightly clamped between a threaded plug 33 and a screw plug 34 also threaded into the lowermost end of the tube-like extension 30, a suitable sealing means, such as lead, indicated at 35, being interposed between the plug 33 and the screw plug 34 and tightly compressed therebetween to form a hermetic seal against the escape of the high pressure gaseous dielectric.

Extending about the housing 24 and spaced therefrom is a tube-like downwardly tapered sleeve 36 made of a suitable vitreous material, such as porcelain fused silica or Pyrex glass. The member 36 has its upper end terminating substantially adjacent the upper end of the housing 24, but its lower end extends for a substantial distance beyond the lower end of the housing 24, as is clearly shown in Figure 3. The vitreous member 36 is held in assembled relation with respect to the housing 24 in part by a terminal extension member 37 threaded onto the lowermost end of the plug member 25 and having a corona cap 38, made of sheet metal and shaped substantially as is indicated in Figure 3, secured thereto as by the screws 39 threaded therethrough and into the flange 37ª of the extension 37. A suitable binding screw or the like 40 serves to connect one of the wires of the high tension circuit to the high voltage conductor construction above described. The lower end of the vitreous member 36 abuts against a gasket 36ª in contact with the corona cap 38. The upper end of member 36 also abuts a gasket 36ᵇ, the relation of which to other parts will be described hereinafter.

The permittivity of the material of which the housing 24 is made is relatively high and where it is made of phenolic condensation molding material it may have a permittivity as high as 6. The vitreous material of which the member 36 is made has a preferably much lower permittivity and if made of fused silica, for example, its permittivity may be as low as 3. Interposed, however, between the housing 24 and the vitreous member 36 is a layer of insulating material 41, made preferably of a permanently plastic material which can be introduced in the space between the members 24 and 36 and related parts by pouring it in a liquid state, the spaces between the parts 24 and 36 having been thoroughly evacuated. A suitable material for this intermediate insulating medium is Halowax, whose permittivity may be in the neighborhood of 4 or 5 and which is liquid when introduced in the manner above described, whereupon, upon cooling, it becomes a plastic.

Fitted about and suitably secured to a portion of the bushing 20, intermediate of the housing 24 and the wall of the casing 10, is a metallic disk-like member 42 which supports an umbrella-like member 43, the latter being made preferably of sheet metal and being flanged at its upper periphery, as at 44, so as to permit the flange 44 to be clamped between a clamping ring 45 and the disk member 42. The member 43 extends downwardly and outwardly away from the above-described terminal construction and conveniently takes the form of a frustum of a cone, flared outwardly at its lower end, as at 45, but having, adjacent the lower end 45, an inwardly convex portion 46. The member 43

will thus be seen to be electrically connected with the bushing 20 and maintained at the potential of the latter. The latter may be at ground potential and preferably is maintained at ground potential by grounding the casing 10. Disk member 42 may be threaded and sealed onto the bushing 20, as at 50, and carries or is formed to provide a ring 51 which has an annular recess 52 in which is seated the gasket 36^b. Gaskets 36^a and 36^b, in coaction with the corona cap 38, the member 36 and the parts 45 and 42, thus seal the space within member 36; the Halowax, above mentioned, is poured into the space between parts 24 and 36 through an opening 48 in disk member 42, this opening being thereafter sealed by a plug 49 threaded thereinto.

The above-described structural features coact in a unique manner to achieve many thoroughly practical advantages and, considering certain of the coactions that take place, it might first be pointed out that the gaseous dielectric under pressure, on the order of 15 atmospheres, as above-noted, is in the field of highest voltage gradient, namely, in the field between the bushing 20, at ground potential, and the high potential conductor 28. The gas under this high pressure has a very high dielectric strength and is excellently suited to withstand this field of highest voltage gradient.

Considering now the coaction of certain other parts of the apparatus, and taking the portion 25 of the high voltage conductor, the three solid dielectric insulating mediums represented by the housing 24, the layer 41 of permanently plastic material, and the layer or coating 36 of vitreous material, and the metal shield 43, were it not for the dielectric field distribution caused by the latter, the voltage gradient at the upper edge of plug 25 would be considerably greater.

The shield 43, however, being at the potential of the part or parts (wall of the casing 10 and connected parts), causes such a redistribution of the flux lines that some are diverted and are made to pass, instead of lengthwise through the solid dielectric media, substantially crosswise or radially therethrough to the sloping walls of the metal shield 43. The maximum voltage gradient lengthwise of the solid dielectric media is thus greatly reduced and the solid dielectric members may be made shorter than would otherwise be the case. Furthermore, the possibility of surface leakage is thereby greatly diminished.

By reason of the graded insulating media, the voltage gradient on the external surface of the member 36 is thereby reduced and the tendency for surface arc-over is also reduced.

Thus the concentration of flux in a direction lengthwise of the solid dielectric media and particularly lengthwise of the outer surface thereof is greatly minimized and I am enabled, for a given high voltage, to make these solid dielectric parts of a lesser over-all length inasmuch as both the voltage gradient which they have to withstand in a direction lengthwise thereof is much diminished and the tendency of surface leakage from the member 38 to the bushing 20 or connected parts is also greatly minimized. There are numerous advantages in using a housing member 24 of molded phenolic condensation product and by reason of certain features of my invention, some of which have been above-described in detail, I am enabled to achieve these advantages without having to use a molded part of undue size and, in fact, while being able to use a smaller size of bakelite housing 24.

In this latter connection it might at this point be noted that I have safeguarded the member 24 against external surface leakage by the other solid dielectric media which coact with the bakelite member 24, to achieve other advantages, in a manner already above-described. It will be noted that the solid dielectric members 41 and 36 are of greater length than the bakelite member 24 and that the vitreous member 36 is thus made to provide a much longer available or possible surface leakage path than the surface leakage path along the outer surface of the member 24 were the dielectric media 41 and 36 omitted. This longer surface leakage path in coaction with the above-described features which achieve a lessening of the concentration of flux lines lengthwise of the outer surface of the member 36 insures dependably against surface break-down or surface leakage.

Should any surface leakage take place, it takes place along the surface of the vitreous member 36 which is unaffected in air by such break-down and thus the member 24 which, in its preferred form, is made of a molded organic material as above-noted, is protected against possible carbonization that might result upon a surface break-down or leakage taking place thereover.

The resistance of a dielectric surface to surface leakage is, as is well known, greatly diminished by the accumulation on the surface of foreign material, like dirt, dust, soot, and the like, but I am enabled effectively to counteract a possible minimizing of the resistance to surface leakage along the member 36 by reason of the direction of the dielectric field controlled, as above pointed out, by the part 43. This dielectric field dependably repels foreign particles floating in the air and thus effectively prevents their deposition upon the outer surface of the member 36.

This dielectric field in coaction with the umbrella-like effect of the member 43 also protects the terminal construction, particularly the outer surface of the solid dielectric media, against snow, sleet, rain, and the like, and thus these elements are likewise prevented from detrimentally affecting the resistance to break-down of the construction. In this connection, the inwardly convex portion 46 of the shield 43, aside from achieving a substantial concentration of flux lines of the character indicated at E to coact in the manner hereinabove described in detail, functions in a unique manner to prevent break-down in case wind velocities are of such character as to blow rain or sleet into contact with, for example, the lower portions of the member 36. Should the lower portions of the member 36 become wet, they form, in effect, an upward extension of the corona cap 38 and tend to run the right-hand ends of the flux lines E in an upward direction, as viewed in Figure 3. But the convex portion 46, to which the left-hand ends of these flux lines pass, not only achieves a concentration of these redistributed flux lines E, but also insures their retention as thus concentrated. Any tendency to run these flux lines substantially parallel to themselves and in an upward direction is counteracted by the increase in the space which these flux lines must bridge if the left-hand ends are to pass from the convex portion 46 upwardly along the sloping part of the shield 43.

The peripheral portions of the shield 43 are turned upwardly, as at 47, to catch rain, or the like, that runs down the outer surface of the shield 43 and, turning now to Figure 2, in which the high tension conductors 14 and 15 are shown

leading away from the binding posts 40 of the two high voltage terminal constructions, the portions 47 of the shield 43 are each provided with a spout 48 for the discharge of this collected water, but as is clear from Figure 2, the spouts 48 are positioned, preferably by being displaced about 180° from the respective conductors 14 and 15, so that the water dripping therefrom does not drip upon the high tension conductor or conductors and does not, therefore, in effect, achieve a short circuit.

The fast discharge gap provided by the bushing 20 and conductor 28 and interposed self-restoring dielectric functions, moreover, to discharge to ground, where the casing 10 is grounded or to short-circuit through the casing and by means of the two fast gaps, one associated with each of the terminal constructions, as is plain from Figure 1, any potential in excess of that which would injure any part of the apparatus within the casing 10, particularly such high voltages as transients, surges, and the like, of steep wave front.

Thus it will be seen that there has been provided in this invention a terminal construction in which the various objects hereinabove noted, together with many thoroughly practical advantages, are successfully achieved. It will be seen that the construction is thoroughly practical, inexpensive, compact and of high efficiency of action and that it is well adapted to meet the varying conditions of hard practical use.

As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth, or shown in the accompanying drawings, is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In apparatus of the character described, the combination with an outdoor electrical apparatus, of a high voltage terminal construction depending therefrom, said construction including a high voltage conductor extending downwardly from said apparatus and through an opening in the latter, a housing of solid dielectric material secured at its upper end to said apparatus and having said conductor passing through its lower end, said housing having an inside diameter greater than the outside diameter of said conductor and the space between said housing and said conductor being filled with a gaseous dielectric under pressure, vitreous means having a lower permittivity than that of said solid dielectric material surrounding but spaced from said housing, a solid insulating material filling the spaces between said housing and said vitreous means and having a permittivity intermediate of the permittivities of said housing and said vitreous means, and a combined weather and corona shield made of a conductive material and substantially umbrella shaped, said shield having its upper part connected to said apparatus and having its remaining portions extended downwardly and outwardly of said vitreous means.

2. In high voltage terminal construction, in combination, a wall member having an opening therein, a relatively high voltage conductor passing downwardly through but spaced from the walls of said opening, a member related to said wall member and having two exterior threaded portions of different diameters, insulating means threaded onto one of said threaded portions and thus secured to said wall member and extending downwardly therefrom for supporting and insulating said conductor from said wall member, and an umbrella-like member depending from said wall member for shielding said terminal construction against the weather and having a threaded part in threaded engagement with said other threaded portion.

3. In high voltage terminal construction, in combination, a wall member having an opening therein, a relatively high voltage conductor passing downwardly through but spaced from the walls of said opening, insulating means secured to said wall member and extending downwardly therefrom for supporting and insulating said conductor from said wall member, conductive means of relatively large radius of curvature positioned at the outermost end of said insulating means and in electrical connection with said conductor and hence subjected to the potential of the latter, and a downwardly and laterally extending member of conductive material in electrical connection with said wall member and coacting with said conductive member and forming a combined weather shield and dielectric-field-controlling means, said downwardly extending member flaring outwardly away from said insulating means at a rate to materially reduce the flux concentration lengthwise of said insulating means.

4. In high voltage terminal construction, in combination, a wall member having an opening therein, a bushing secured in said opening and forming an extension of the latter, a relatively high voltage conductor passing downwardly through said bushing and spaced from the walls of the latter, insulating tubular means secured to said bushing and extending downwardly therefrom for supporting and insulating said conductor from said wall member, said tubular means extending about and spaced from said conductor, a rain shield of umbrella-like form for protecting said terminal construction against rain and the like, said shield being made of sheet metal, a ring-like member projecting laterally about said bushing and having an upper portion of said rain shield resting thereagainst, a ring-like member resting against said portion of said rain shield, and means for forcing said two ring-like members towards each other, thereby to clamp said rain shield portion therebetween.

5. In high voltage terminal construction, in combination, a wall member having an opening therein, a relatively high voltage conductor passing downwardly through but spaced from the walls of said opening, insulating means secured to said wall member and extending downwardly therefrom for supporting and insulating said conductor from said wall member, a line wire connected to the outer end of said conductor and extending substantially laterally away from the latter in a general vertical plane, and a metallic member in connection with said wall member and extending downwardly and laterally away from said terminal construction for protecting the latter against rain and the like and for lessening the concentration of flux lines lengthwise of the outer surface of said insulating means, said metallic member having peripheral means for preventing collected rain from dripping onto said line wire and having a discharge spout positioned so that the normal vertical line of discharge from said peripheral means does not intersect said wire.

6. In high voltage terminal construction, in combination, a wall member having an opening therein, a relatively high voltage conductor pass-

ing downwardly through but spaced from the walls of said opening, insulating means secured to said wall member and extending downwardly therefrom for supporting and insulating said conductor from said wall member, a line wire connected to the outer end of said conductor and extending away from the latter in a general lateral direction, and a metallic member in connection with said wall member and extending downwardly and laterally away from said terminal construction for protecting the latter against rain and the like and for lessening the concentration of flux lines lengthwise of the outer surface of said insulating means, said metallic member having a peripheral portion shaped to catch water running down its outer surface, and a discharge spout in said periphery positioned so that water discharged therefrom clears said wire.

7. In high voltage terminal construction, in combination, a wall member having an opening therein, a relatively high voltage conductor passing downwardly through but spaced from the walls of said opening, insulating means secured to said wall member and extending downwardly therefrom for supporting and insulating said conductor from said wall member, means for shielding said terminal construction against the weather and for lessening the flux concentration along the outer surface of said insulating means to lessen any tendency for surface arc-over, said insulating means being generally tapered so that its effective outside dimensions progressively diminish in a downward direction and said shielding means being tapered in reverse direction so that the dimensions of its effective flux-controlling surface progressively increase in said downward direction, and conductive means at the lower end of said insulating means and in electrical connection with said high voltage conductor and having a relatively large radius of curvature for coacting with said shielding means.

8. In high voltage terminal construction, in combination, a wall member having an opening therein, a relatively high voltage conductor passing through but spaced from the walls of said opening, a tube-like housing of solid dielectric material secured at one end to said wall member and having said conductor passing through its other end, said housing having an inside diameter greater than the outside diameter of said conductor, a gaseous dielectric under pressure filling the space between said housing and said conductor, and a plurality of layers of solid dielectric material related exteriorly of said housing, said layers being made of material having a lower permittivity than the material of said housing and the materials of the individual layers having such permittivities that the permittivities diminish in a direction from said housing to the outermost layer.

9. In high voltage terminal construction, in combination, a wall member having an opening therein, a relatively high voltage conductor passing through but spaced from the walls of said opening, a tube-like housing of solid dielectric material secured at one end to said wall member and having said conductor passing through its other end, said housing having an inside diameter greater than the outside diameter of said conductor, a gaseous dielectric under pressure filling the space between said housing and said conductor, the material of said housing being a phenolic condensation product, and a plurality of layers of solid insulating material about said housing, the outermost layer being made of vitreous material having a permittivity less than that of the material of said housing and an intermediate layer having a permittivity intermediate of the permittivities of said vitreous material and of said phenolic condensation product.

10. In high voltage terminal construction, in combination, a wall member having an opening therein, a relatively high voltage conductor passing through but spaced from the walls of said opening, a tube-like housing of solid dielectric material secured at one end to said wall member and having said conductor passing through its other end, said housing having an inside diameter greater than the outside diameter of said conductor, a gaseous dielectric under pressure filling the space between said housing and said conductor, the material of said housing being a phenolic condensation product, and a plurality of layers of solid insulating material about said housing, the outermost layer being made of vitreous material having a permittivity less than that of the material of said housing and an intermediate layer of wax having a permittivity intermediate of the permittivities of said vitreous material and of said phenolic condensation product.

11. In high voltage terminal construction, in combination, a wall member having an opening therein, a hollow cylindrical conductor passing through but spaced from the walls of said opening, and means for holding said conductor coaxially with said opening, said means including a tube-like housing of solid dielectric material secured at one end to said wall member and having an interiorly channeled metallic means in its outer end, said metallic means having a tapered recess facing toward the interior of said housing, said conductor having a tapered portion adapted to seat into said tapered recess, a wire threaded through said hollow cylindrical conductor and through said channeled metallic means, and means for sealing the latter.

12. In high voltage terminal construction, in combination, a wall member having an opening therein, a hollow cylindrical conductor passing through but spaced from the walls of said opening, means for holding said conductor coaxially with said opening, said means including a tube-like housing of solid dielectric material secured at one end to said wall member and having an interiorly channeled metallic means in its outer end, said metallic means having a tapered recess facing toward the interior of said housing, said conductor having a tapered portion adapted to seat into said tapered recess, and means for drawing the tapered portion of said conductor into said tapered recess, a wire threaded through said hollow cylindrical conductor and through said channeled metallic means, and means for sealing the latter.

13. In high voltage terminal construction, in combination, a wall member having an opening therein, a relatively high voltage conductor means having a passage therethrough and having a tapered portion, said conductor means passing through but spaced from the walls of said opening, and a tube-like housing of solid dielectric material secured at one end to said wall member and having metallic means in its outer end, said metallic means having a tapered recess facing toward the interior of said housing, the axis of said recess being coincident with the axis of the opening in said wall member and said conductor having said tapered portion coaxial therewith and seated in said tapered recess, means coacting with said metallic means for holding said tapered portion of said conductor means

seated in said tapered recess and having a passage therethrough, and a wire-like conductor passing through said passages.

14. In high voltage terminal construction, in combination, a wall member of a conductive material having an opening in which is secured a metallic bushing, a housing of solid dielectric material secured at one end to said wall member and having metallic means at its other end, said metallic means having a tapered recess whose axis is coincident with the axis of the opening in said bushing, a rigid conductor means having a passage therethrough and having a cylindrical portion adapted to pass through but be spaced from said bushing and having a tapered portion whose axis is coincident with the axis of said cylindrical portion, said tapered portion being seated in said tapered recess, means coacting with said metallic means for holding said tapered portion of said conductor means seated in said tapered recess and having a passage therethrough, and a wire-like conductor passing through said passages.

15. In high voltage terminal construction, in combination, a wall member having an opening therein, a relatively high voltage conductor passing through but spaced from the walls of said opening, insulating means for insulating and supporting said conductor from said wall member and extending away from the latter, said conductor passing through an end portion of said insulating means remote from said wall member, and a substantially dished flux-controlling member about said terminal construction, said dished member having a bulge convex portion intermediate its ends, for coaction with that portion of the conductor exposed beyond the end portion of said insulating means.

16. In high voltage terminal construction, in combination, a metallic bushing adapted to be secured in an opening in a wall, tubular insulating means connected at one end to said bushing and having at its other end interiorly channeled metallic means, a hollow rigid conductor rigidly connected to said metallic means and supported by the latter in spaced relation to the interior walls of said bushing, a wire threaded through said hollow conductor and said metallic means, a metallic packing sealing the channel of said metallic means and engaging said wire, and a plug threaded into the end of said metallic means for compressing said metallic packing means.

17. In high voltage terminal construction, in combination, a metallic bushing adapted to be secured in an opening in a wall, tubular insulating means connected at one end to said bushing and having at its other end metallic means, said metallic means having a passage therethrough, a hollow rigid conductor rigidly connected to said metallic means and supported by the latter in spaced relation to the interior walls of said bushing, a wire threaded through said hollow conductor and said metallic means, and means sealing the outer end of said metallic means.

18. In high voltage terminal construction, in combination, a wall having an opening through which a conductor is to be passed, tubular insulating means connected at one end to said wall and related to the opening in the latter and having at its other end interiorly channeled metallic means, said channeled metallic means being interiorly threaded and having an interior shoulder, a hollow rigid conductor extending from said metallic means and thence interiorly of said tubular insulating means, a hollow screw threaded into the end of said hollow conductor and having its head abutting against said shoulder for securing said conductor to said metallic means, a wire conductor threaded through said hollow conductor, said hollow screw, and into the channel of said metallic means, and means for sealing the channel in the latter.

19. In high voltage terminal construction, in combination, a wall having an opening through which a conductor is to be passed, tubular insulating means connected at one end to said wall and related to the opening in the latter and having at its other end interiorly channeled metallic means, said channeled metallic means being interiorly threaded and having an interior shoulder, a hollow rigid conductor extending from said metallic means and thence interiorly of said tubular insulating means, a hollow screw threaded into the end of said hollow conductor and having its head abutting against said shoulder for securing said conductor to said metallic means, and means for sealing the channel in said metallic means.

20. In high voltage terminal construction, in combination, a wall having an opening through which a conductor is to be passed, tubular insulating means connected at one end to said wall and related to the opening in the latter and having at its other end interiorly channeled metallic means, said channeled metallic means being interiorly threaded and having an interior shoulder, a hollow rigid conductor extending from said metallic means and thence interiorly of said tubular insulating means, a hollow screw threaded into the end of said hollow conductor and having its head abutting against said shoulder for securing said conductor to said metallic means, a hollow plug in the outer end of said channeled metallic means, a wire threaded through said hollow conductor, said hollow screw, and said hollow plug, and means for clamping said wire against the outer end of said hollow plug.

21. In high voltage terminal construction, in combination, a wall having an opening through which a conductor is to be passed, tubular insulating means connected at one end to said wall and related to the opening in the latter and having at its other end interiorly channeled metallic means, said channeled metallic means being interiorly threaded and having an interior shoulder, a hollow rigid conductor extending from said metallic means and thence interiorly of said tubular insulating means, a hollow screw threaded into the end of said hollow conductor and having its head abutting against said shoulder for securing said conductor to said metallic means, a hollow plug in the outer end of said channeled metallic means, a wire threaded through said hollow conductor, said hollow screw, and said hollow plug, and a plug in threaded engagement with said metallic means for clamping said wire against said hollow plug.

22. In high voltage terminal construction, in combination, a wall having an opening through which a conductor is to be passed, tubular insulating means connected at one end to said wall and related to the opening in the latter and having at its other end interiorly channeled metallic means, said channeled metallic means being interiorly threaded and having an interior shoulder, a hollow rigid conductor extending from said metallic means and thence interiorly

of said tubular insulating means, a hollow screw threaded into the end of said hollow conductor and having its head abutting against said shoulder for securing said conductor to said metallic means, a hollow plug in the outer end of said channeled metallic means, a wire threaded through said hollow conductor, said hollow screw, and said hollow plug, compressible sealing means abutting against said hollow plug in said channeled metallic means, and means in threaded engagement with said metallic means for closing the channel therein.

23. In high voltage terminal construction, in combination, a wall having an opening through which a conductor is to be passed, tubular insulating means connected at one end to said bushing and having at its other end interiorly channeled metallic means, said channeled metallic means being interiorly threaded and having an interior shoulder, a hollow rigid conductor extending from said metallic means and thence interiorly of said tubular insulating means, a hollow screw threaded into the end of said hollow conductor and having its head abutting against said shoulder for securing said conductor to said metallic means, a hollow plug in the outer end of said channeled metallic means, a wire threaded through said hollow conductor, said hollow screw, and said hollow plug, said wire being bent over the outer face of said hollow plug, a relatively soft metal packing against said outer face, and means in threaded engagement with said metallic means for holding said packing under substantial pressure.

24. In high voltage terminal construction, in combination, a metallic bushing, a tube-like housing of organic dielectric material secured at one end to said bushing, conductive means extending through but spaced from the walls of said bushing and extending through and beyond and secured to the outer end of said tube-like housing, a tube-like member of vitreous material of greater diameter and length than said tube-like housing and extending about the latter, means mounting the inner end of said vitreous member to said bushing, and means mounting the outer end of said vitreous member to said conductive means.

25. In high voltage terminal construction, in combination, a metallic bushing, a tube-like housing of organic dielectric material secured at one end to said bushing, conductive means extending through but spaced from the walls of said bushing and extending through and beyond and secured to the outer end of said tube-like housing, a tube-like member of vitreous material of greater diameter and length than said tube-like housing and extending about the latter, means mounting the inner end of said vitreous member to said bushing, means mounting the outer end of said vitreous member to said conductive means, and a solid dielectric material filling the space between said two tube-like members.

26. In high voltage terminal construction, in combination, a metallic bushing, a tube-like housing of organic dielectric material secured at one end to said bushing, conductive means extending through but spaced from the walls of said bushing and extending through and beyond and secured to the outer end of said tube-like housing, a tube-like member of vitreous material of greater diameter and length than said tube-like housing and extending about the latter, means mounting the inner end of said vitreous member to said bushing, means mounting the outer end of said vitreous member to said conductive means, and a moldable dielectric material, solid at ordinary temperatures, filling the space between said two tube-like members, one of said mounting means having an aperture through which said last-mentioned dielectric is injected into the said space.

27. In high voltage terminal construction, in combination, a metallic bushing, a tube-like housing of solid dielectric material secured at one end to said bushing, conductive means extending through but spaced from the walls of said bushing and extending through and beyond and secured to the outer end of said tube-like housing, a tube-like member of vitreous material of greater diameter and length than said tube-like housing and extending about the latter, means mounting the inner end of said vitreous member to said bushing, means mounting the outer end of said vitreous member to said conductive means, and an intervening solid dielectric material filling the space between said two tube-like members, the permittivity of said intervening material being less than that of said inner housing and greater than the permittivity of said vitreous member.

FRANKLIN S. SMITH.

CERTIFICATE OF CORRECTION.

Patent No. 1,957,985. **May 8, 1934.**

FRANKLIN S. SMITH.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 6, line 35, claim 15, strike out the word "convex"; page 7, lines 16-17, claim 23, strike out the word "bushing" and insert the words wall and related to the opening in the latter; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 11th day of September, A. D. 1934.

Leslie Frazer

(Seal) **Acting Commissioner of Patents.**