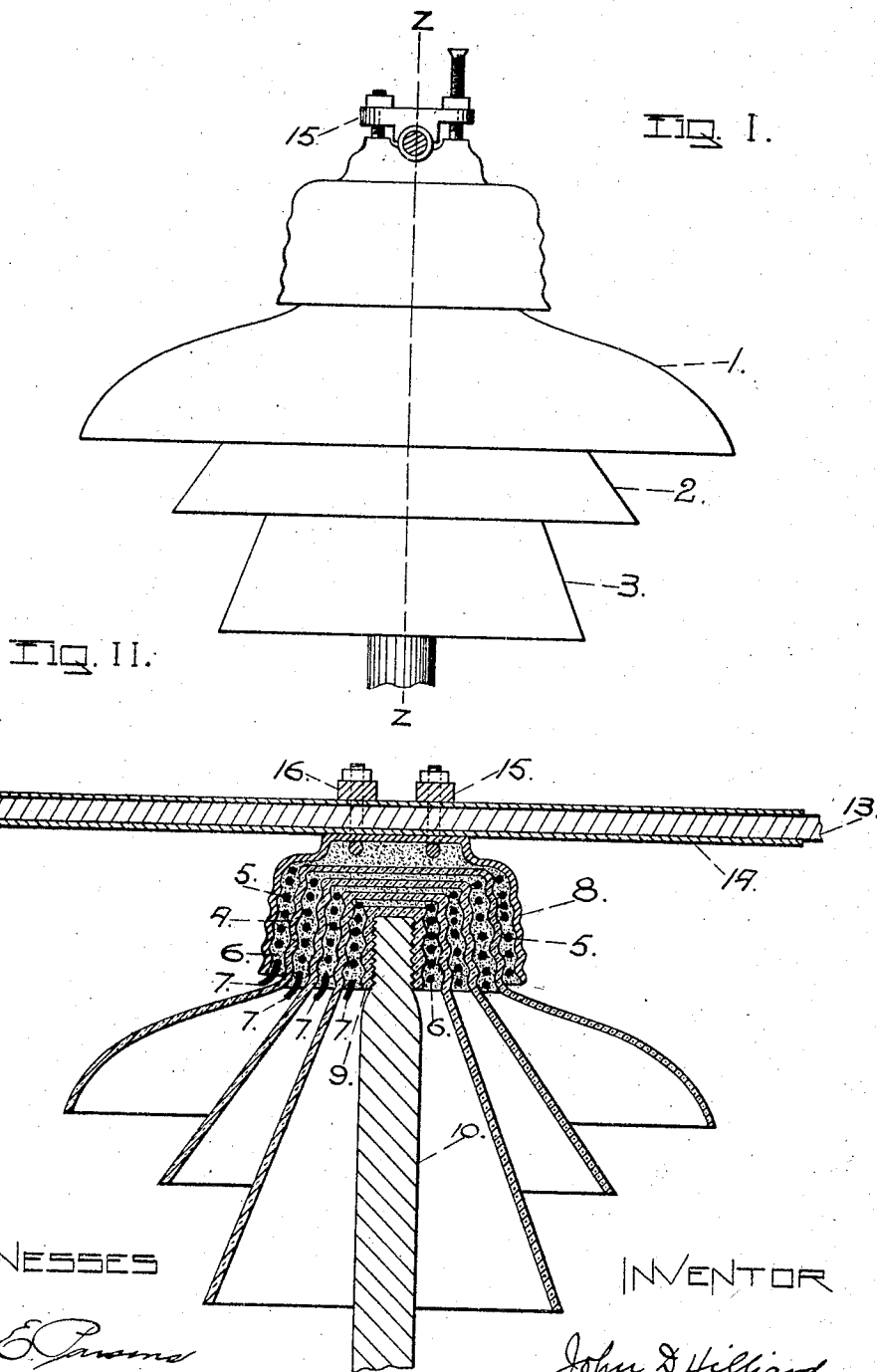


J. D. HILLIARD.
 ELECTRIC INSULATOR.
 APPLICATION FILED AUG. 11, 1908.

1,069,782.

Patented Aug. 12, 1913.

3 SHEETS—SHEET 1.



WITNESSES

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Robert S. Walker

INVENTOR

John D. Hilliard

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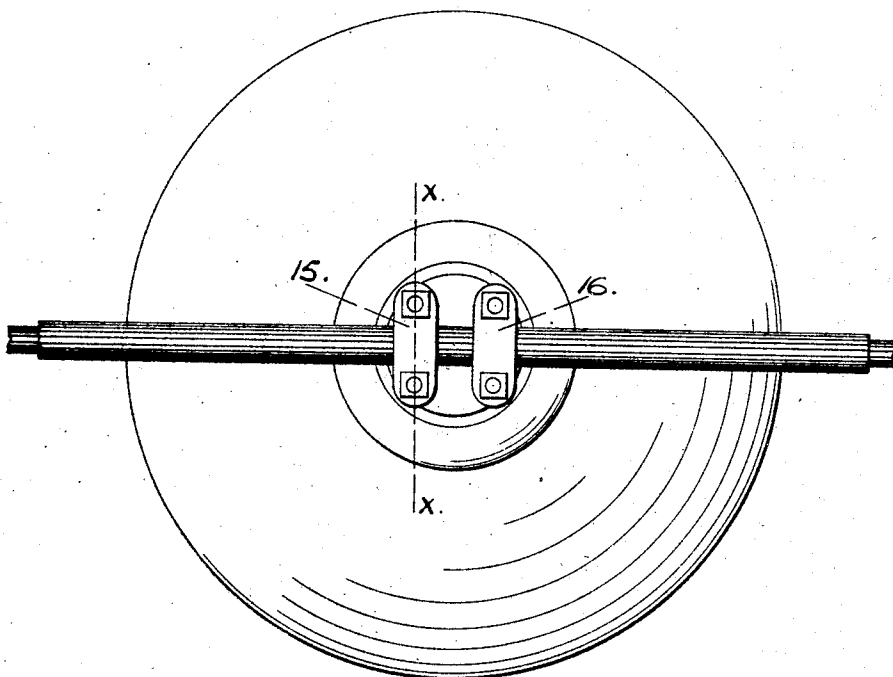


FIG. IV.

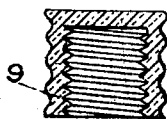


FIG. III.

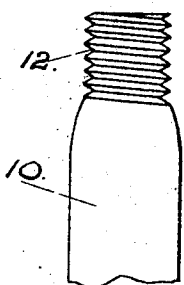


FIG. VI.

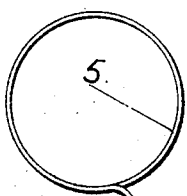


FIG. V.

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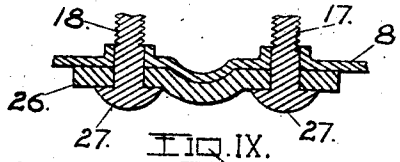
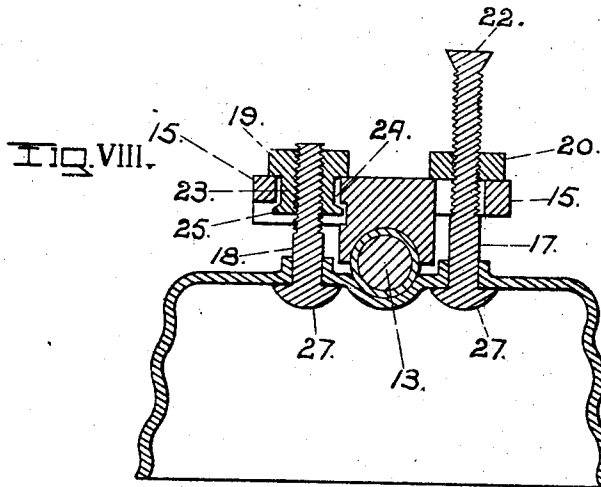
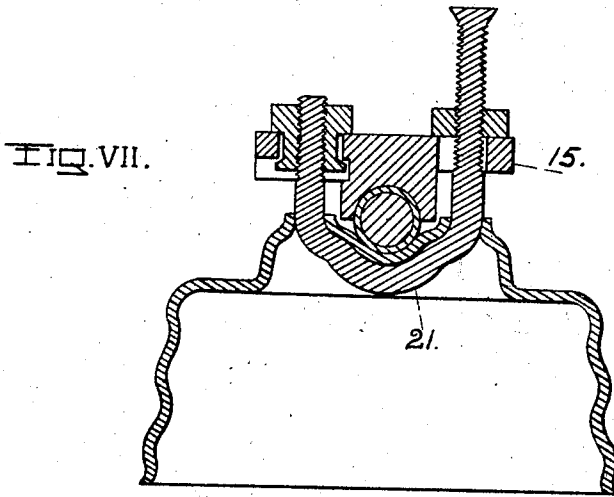
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3 SHEETS-SHEET 3.



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ELECTRIC INSULATOR.

1,069,782.

Specification of Letters Patent. Patented Aug. 12, 1913.

Application filed August 11, 1908. Serial No. 447,960.

To all whom it may concern:

Be it known that I, JOHN D. HILLIARD, a citizen of the United States, residing at Albany, county of Albany, and State of New York, have invented certain new and useful Improvements in Electric Insulators, of which the following is a specification.

The invention relates to such improvements and consists of the novel construction and combination of parts hereinafter described and subsequently claimed.

Reference may be had to the accompanying drawings, and the reference characters marked thereon, which form a part of this specification. Similar characters refer to similar parts in the several figures therein.

In the transmission of electrical energy the line voltage has been from time to time largely increased until the question of insulation has become of very great importance. To prevent damage to the line or interruption to the supply of current it is important to prevent arcing caused by a jump of the current from the line-wire to the insulator-pin or arm; and in extreme cases where an arc is formed to prevent damage to the conductor.

It is the common practice in the construction of high-tension insulators to make use of a nest of porcelain shells, cemented one within another, which is secured to a supporting metallic pin on one side, and on the opposite side secured to the conductor so that the shells are interposed between the pin and conductor, as many as three or four shells being employed. As frequently happens one of these shells may be broken necessitating its replacement by an unbroken shell. As heretofore constructed, if one of the lower shells was thus broken all the shells above the broken one had to be broken and removed together with the injured shell and the broken shells replaced with new ones. The reason for this was the fact that the shells were so cemented together that they could not be detached one from another without breakage.

The objects of my invention are among others to protect the conductor against damage from arcs; to detachably connect the insulator-shells with each other so that they may be detached one from another without breakage when desired; to provide mechanism for conveniently and detachably securing the conductor to the insulator, the parts of such mechanism being non-detachable

from each other to secure them against loss; detachably securing to a nest of insulator shells an attaching cap and a pin-receiving socket; and to secure a more reliable connection between the insulator and conductor; also to form a series condenser which will tend to equalize the electric stresses applied to the insulator and greatly reduce the liability of puncture.

The invention consists in interposing a metallic shield contacting with the conductor between such conductor and the insulator; in embedding in the cement which connects the neighboring insulator-shells a spiral or coil of wire or other material which can be pulled out from between the shells in such a manner as to break up the cement which binds the shells together without injury to the shells so that the shells can be easily separated one from another; securing by cement to one side of the nest of insulator-shells a pin-receiving socket and to the opposite side an attaching cap, the cement containing similar means for detaching the socket and cap from the shell by breaking up the cement-binding between the shell and socket or cap; and providing clamping mechanism for securing the insulator to the conductor which can be safely used without danger of breaking the shells, the parts of which mechanism are permanently connected with each other so that when the clamp is operated none of the parts of the clamp can be lost or mislaid as will be hereinafter more fully described in this specification and claimed at the end thereof; also in embedding in the cement between the insulating shells masses of metal such as a spiral or coil of wire or other forms of metal so that the alternating insulator-shells and masses of metal will form a series condenser for the purposes above named.

Figure 1 of the drawings is a view in side elevation of the improved insulator secured to a wire-conductor shown in cross-section, the supporting-pin being shown with a part broken away. Fig. 2 is a central, vertical section taken on the broken line $z-z$ in Fig. 1. Fig. 3 is a top plan view of the part shown in Fig. 1. Fig. 4 is a central, vertical section of the pin-socket, or bushing, detached. Fig. 5 is a bottom plan view of a wire coil embedded in the cement which binds together the insulator-shells. Fig. 6 is a side elevation of the upper portion of the insulator-supporting pin. Fig. 7 is a ver-

tical section of the clamping mechanism by which the wire conductor is secured to the insulator taken on the broken line $x-x$ in Fig. 3. Fig. 8 is a view similar to that shown in Fig. 7 showing a modified form of construction. Fig. 9 is a section similar to that shown in Fig. 8 and showing a reinforcing plate between the cap and bolt-heads.

The insulator comprises a plurality of insulator-shells, 1, 2 and 3, preferably made of porcelain inserted one within another as shown in Figs. 1 and 2. Each of the shells is provided with a central shank, 4, graduated in size so that one may be inserted within another, the shank of the shell, 1, being large enough to receive the shank of the shell, 2, and the shank of the shell, 3, being small enough to be inserted within the shank of the shell 2. These shanks are preferably corrugated as seen in cross-section in Fig. 2. By depositing a quantity of plastic cement within the shanks when they are inserted one within another and allowing the cement to harden the shells are firmly secured one to another. The shanks may be given any irregular form, as well as a corrugated form, such as will prevent the withdrawal of one shank from another when the cement has become hardened. As a means for making the connection between the several shells a detachable one a coil of wire is embedded in the plastic cement when the shells are assembled. The relative positions of the coils, 5, shanks, 4, and cement, 6, are shown in Fig. 2, the large black dots representing a cross-sectional view of the coil. One end, 7, of each coil projects from the cement down into the space between the shells where it can be grasped by a pair of tongs and drawn from the cement. Upon withdrawing the wire of the coils from the cement, by means of the tongs, the coil unwinds and breaks the thin layers of cement between the coils and the shanks of the shells so as to loosen one shell from another whereupon an outer shell can be removed from an inner one without breaking either shell. In the same manner the metallic attaching cap, 8, which incloses the nest of shells can be detached from the shells by withdrawing the wire of the coil from between the cap and shells, and the stem-receiving socket, 9, can be detached from the nest of shells by withdrawing the coil between the socket and the inner shell. Both the cap and the socket are corrugated or given an uneven surface which is engaged by the cement between the cap or socket and its neighboring shell. It is obvious that the supporting-pin, 10, provided with the screw-threaded shank, 12, can be easily inserted and withdrawn from the correspondingly-threaded pin-socket 9.

As a means for securing the insulator-

shells to the conducting wire, 13, shown inclosed in the metallic tube, 14, I provide clamping bars, 15 and 16, adapted to fit and embrace the upper surface of the tube, the lower surface of which bears upon the outer surface of the cap; 8, and I connect the bars with the cap by means of the screw-threaded bolts, 17, and 18, which project outwardly through apertures in the cap with their heads bearing upon the inner surface of the cap, and nuts, 19, and 20, adapted to bear upon the upper surface of the clamping bars when turned onto the screw-threaded ends of the bolts, as seen in Fig. 8 of the drawings, the bolts passing up through apertures in the ends of the clamping bars. By having the bolts project outwardly from the cap through apertures therein and connected with the clamping-bars as shown no strain is imposed directly upon the insulator shells as frequently happens when the bolts pass down through the clamping bars and are screwed into a screw-threaded aperture in the cap, in which latter case if the bolts pass too far through the cap they might come in contact with the outer insulator shell and fracture the same. When desired the bolts may be connected, as by a yoke, 21, Fig. 7, located interiorly of the cap. When the bolts are so connected by a yoke the cap-apertures through which the bolts pass may be circular in form, and the shanks of the bolts shaped to fit such circular openings; but when the bolts are not connected but are provided with separate heads, as seen in Fig. 8, the bolt-apertures in the cap should be angular in shape and the shanks of the bolts correspondingly shaped to prevent the bolts from turning therein when the nuts are turned to operate the clamping bars.

It frequently happens, in changing a pole-supported insulator, that the clamping nuts or bars are, when detached, dropped which necessitates descending the pole to find the same which is often a difficult matter when the ground is covered with snow. To prevent such accidental loss of any of the parts, I make such parts non-detachable which positively insures against accidental misplacing, or loss, of the parts. As a preferred means for thus permanently connecting the parts together I make one of the bolts as, 17, longer than the other bolt, 18, and after its clamping-nut, 20, has been turned onto the bolt the projecting end, 22, is upset or made larger, as seen in Fig. 8, so that the nut cannot be removed from the bolt, and the nut, 19, is provided with a boss, 23, which is inserted in the enlarged opening, 24, of the clamping-bar and after being so inserted the inserted end, 25, is upset so that it cannot be withdrawn through the aperture, 24, as seen in Fig. 8. The same construction is shown in Fig. 7 where the bolts are connected by a yoke 21.

To release the conductor, which is shown clamped in Figs. 7 and 8 between the cap and clamping-bars, it is only necessary to turn backward the nuts, 20 and 19, until the nut, 19, is wholly detached from the bolt, 18, the nut, 20, passing up to the enlargement on the end, 22, of bolt 17. The clamping-bar can then be swung around upon the bolt, 17, until it is wholly withdrawn from the conductor, 13, which will permit the conductor to be entirely removed from the clamp. To again attach the conductor it is only necessary to place the parts so that the conductor will rest upon the cap and swing the clamping-bar back over the conductor to a position which will permit the nut, 19, to be turned upon the bolt 18. By then turning both clamping nuts the clamping-bars can be made to assume the position shown in Figs. 7 and 8 firmly clamping the conductor between the bars and the cap. Both clamping bars, 15 and 16, are operated in substantially the same manner. It will thus be seen that the clamping-nut, 19, cannot be detached from its clamping-bar, 15, and neither the clamping-nut, 20, nor the clamping-bar, 15, can be detached from the bolt 17.

When desired, a strengthening bar, 26, may be inserted between the heads, 27, of the bolts and the cap, 8, as seen in Fig. 9.

It sometimes happens that the electric tension is sufficient to cause the current to pass from the conductor to the supporting-pin thus forming an arc between the pin and conductor which would not only interfere with the transmission of the current but would damage the conductor by the action of the arc upon it. As a means for protecting the conductor from the effects of such an arc the conductor may be inclosed in a metallic casing or tube, 14, so that if any arc was formed it would be formed between the casing and the pin instead of coming in contact with the conductor itself. It is not absolutely essential that the casing or shield should entirely inclose the conductor. The shield may be a metal plate extending along the undersurface of the conductor. Whatever form of shield is used it should extend a sufficient distance on opposite sides of the insulator to protect the conductor from any arc which might be formed.

When desired, the cap, 8, and bolts, 17 and 18, may be first assembled in the position shown in Figs. 7 and 8 and then galvanized as one piece effectually sealing up all the openings in the cap between the cap and bolts.

When desired, the pin-socket 9 may be dispensed with and the pin 10 detachably cemented into the shank of the inner shell in the same manner that the socket is attached.

It is obvious that any kind of cement may be employed which can be inserted in a plastic state and will afterward harden sufficiently to bind the parts together; also that the spiral embedded in the cement may be of any known material adapted to be unwound and break up the cement between the parts thus cemented together, when a comparatively low-tension current is employed. A suitable cement is preferably Portland cement, although plaster of Paris or heavy calcined magnesia and silicate or other cement having the required capabilities may be used.

When a high-tension current is employed the cement breaking spirals or coils are preferably made of metal which masses of metal, together with the insulator-shells, form a series condenser, as before explained.

What I claim as new and desire to secure by Letters Patent is—

1. In a high-tension insulator, a nest of insulator-shells detachably held one within another by means of cement, the parts being removably mounted together and the cement between contiguous shells, being divided into a plurality of relatively small fragile portions proportioned to the shells to have a capacity of being disintegrated with relation to the shells without rupturing the shells.

2. In a high-tension insulator, a nest of insulator-shells detachably held one within another by means of cement, divided into a plurality of relatively small portions proportioned to the shells to have a capacity of being disintegrated with relation to the shells without rupturing the shells, one shell having on its inner surface an inwardly extending projection and the contained shell having on its outer surface an adjacent outwardly extending projection sufficiently near to said inwardly extending projection to cooperate therewith in providing the intervening cement with a thin readily rupturable region of weakness to aid in said disintegration of the cement.

3. In a high-tension insulator, the combination with an attaching cap, of an insulator-shell held rigidly therein and separated therefrom by an interposed layer of cement, said cap and shell on their adjacent surfaces having narrow portions projecting toward each other, but out of contact for providing thin places in the cement and readily rupturable regions of weakness in said cement and the cement layer having such proportion to the adjacent cap and shell, in combination with said regions of weakness as to insure the disrupting of the cement without rupturing the shell.

4. In a high-tension insulator, the combination with an attaching cap, of an insulator-shell held rigidly therein and separated therefrom by an interposed layer of cement,

- said cap and shell on their adjacent surfaces having narrow portions projecting toward each other, and an accessible cement breaker embedded in the cement adjacent said projections for facilitating the breaking of the cement.
5. A built-up insulator, consisting of a series of separated layers, the outer of which layers is of metal to constitute an attaching cap and others of which layers are of insulating material, and cement interposed between all of said layers in readily rupturable deposits, holding them in spaced apart relation.
6. In an insulator, the combination with an attaching cap; of an insulator-shell cemented to the cap; and means operating on the cement for detaching the cap and shell.
7. The combination with an attaching cap; and an accessible coil inserted therein; of an insulator-shell having its supporting shank cemented within the cap and coil.
8. The combination with an insulator-shell having a supporting shank; and a coil encircling the shank; of an attaching cap containing cement and united thereby to said coil and shank.
9. The combination with an attaching cap, and an accessible disrupting coil inserted therein, of an insulator shell having its shank cemented within the cap and coil, the cap and shank having cooperating means for retaining a portion of the cement and the cap and shank together while and until the coil is removed.
10. In an insulator, the combination with a plurality of insulator-shells the center portions of which are insertible, one within another; of binding cement deposited between each neighboring pair of shells; and an accessible cement-breaker embedded in each cement deposit.
11. In an insulator, the combination with a plurality of insulator-shells insertible, one within another; of a deposit of binding cement between the neighboring pairs of shells; and accessible cement-breakers consisting of wire coils severally embedded in the cement deposits.
12. The combination with a plurality of insulator-shells severally provided with supporting shanks insertible one within another; of an accessible coil embedded in cement located between each neighboring pair of shanks.
13. The combination with an insulator having a shank; of a cap adapted to receive such shank; a deposit of cement between such cap and shank; and an accessible cement-breaker embedded in such cement.
14. In an insulator, the combination with a shell-cap having a chamber above the shell-inclosure and bolt-holes leading from the chamber through the cap wall; of screw-threaded bolts inserted in such bolt-holes with their heads in the cap-chamber; a clamp, apertured to receive the bolts, inserted therethrough; and a screw-threaded nut on each bolt adapted to bear upon the clamp.
15. In an insulator, the combination with a chambered shell-cap provided with bolt-holes; of screw-threaded bolts inserted in and closely fitting such bolt-holes with their screw-threaded ends projecting exteriorly of the cap; and a metallic coating applied to the cap and inserted bolts which makes tight joints between the cap and bolts.
16. In an insulator, the combination with a chambered shell-cap provided with bolt-holes; of a strengthening plate having bolt-holes registering with the bolt-holes in the cap and bearing upon the inner side of the chamber-wall; screw-threaded bolts inserted in and fitting the bolt-holes of both cap and plate with their heads in the chamber; a clamp-plate and screw-threaded nuts on the projecting ends of the bolts; and means for preventing the bolts from rotating.
17. In an insulator, the combination with a stationary support for a line-conductor; of screw-threaded bolts unequal in length projecting from said support; a clamp-plate cooperative with said support, and provided with bolt-holes for the respective bolts; a nut permanently and movably secured on the longer bolt; and a nut permanently and movably interlocked with said clamp-plate, said shorter bolt being adapted to detachably receive said clamp-plate and the nut interlocked therewith, and said clamp-plate being adapted to rotate on said longer bolt when detached from the shorter bolt.
18. In an insulator, the combination with a chambered shell-cap provided with bolt-holes; screw-threaded bolts, unequal in length and connected by a yoke, inserted in the bolt-holes with their connecting yoke in the chamber; a bolt-apertured clamp-plate on said bolts; a nut on the longer bolt; a stop on the end of the longer bolt; a nut on the shorter bolt; a loose connection between the short-bolt-nut and the clamp-plate.
19. The combination with an insulator, of an electric conductor, a conductor shield of conducting material extended beyond the insulator, and means for clamping the insulator upon the shielded conductor, said insulator being constructed to receive a support.
20. The combination with an electric conductor; an insulator-shell; a metallic cap secured to the shell; of a metallic shield extending beyond the shell; means for clamping the shield, and cap to the conductor; and means for supporting the parts.
21. The combination with an electric insulator; and a metallic cover on the insulator; of an electric conductor supported by the

insulator; and a metallic sheath permanently secured on the conductor as a part thereof reaching beyond the insulator cover.

22. The combination with an electric insulator-shell having an exteriorly-corrugated shank and of approximately uniform diameter, of a metallic cap interiorly-corrugated and of approximately uniform internal diameter in which the shank is inserted, said shank and cap having their corrugations separated and united by cement in disrup-
5 turable deposits of unequal thickness adjacent said corrugations, and an accessible cement breaker contained in said cement.

23. In an electric insulator comprising a plurality of non-conducting shells secured together by cement, the combination with the shells; and cement; of a body of electrically conductive metal embedded in the cement between neighboring shells and consti-
20 tuting with said shells a condenser.

24. The combination with a plurality of electric insulating shells; and a deposit of cement between neighboring shells by which
25 the shells are held together; of a spiral metallic member embedded in such cement.

25. The combination with an electric insulator-shell; and a supporting pin; of a metallic bushing adapted interiorly to re-
30 ceive and fit the pin; cement between the shell and bushing; and an accessible spiral metallic member embedded in the cement.

26. Means for distributing the electric stresses applied to the shells of a multi-shell

insulator, said means comprising a mass of
35 electrically conductive metal incorporated in the cementing substance between the shells.

27. An electrical insulator composed of a plurality of insulating shells with cement
40 interposed between them to hold them in spaced apart relation, and a metal spiral embedded in the cement between adjacent shells of the insulator.

28. In combination, an electrical insulator,
45 a metal bushing to support the insulator, a pin fitted in the bushing, cement between insulator and bushing, and a spiral metal member or members incorporated in the cement as a means of separating the insulator
50 and bushing.

29. Means to protect a line wire from being burned off, said means comprising a metal sheath over the wire at the insulator and extending a short distance each side
55 thereof.

30. Means for preventing a line wire being burned off at an insulator, said means comprising a metal cap on the insulator and a metal sheath on the line wire at the in-
60 sulator and projecting beyond the maximum diameter of the cap.

In testimony whereof, I have hereunto set my hand this 16th day of July, 1908.

JOHN D. HILLIARD.

Witnesses:

CHARLES E. PARSONS,
R. S. WALKER.