

July 11, 1939.

H. H. WHEELER ET AL

2,165,773

INSULATOR FOR COMMUNICATION SYSTEMS

Filed July 8, 1932

FIG. 1

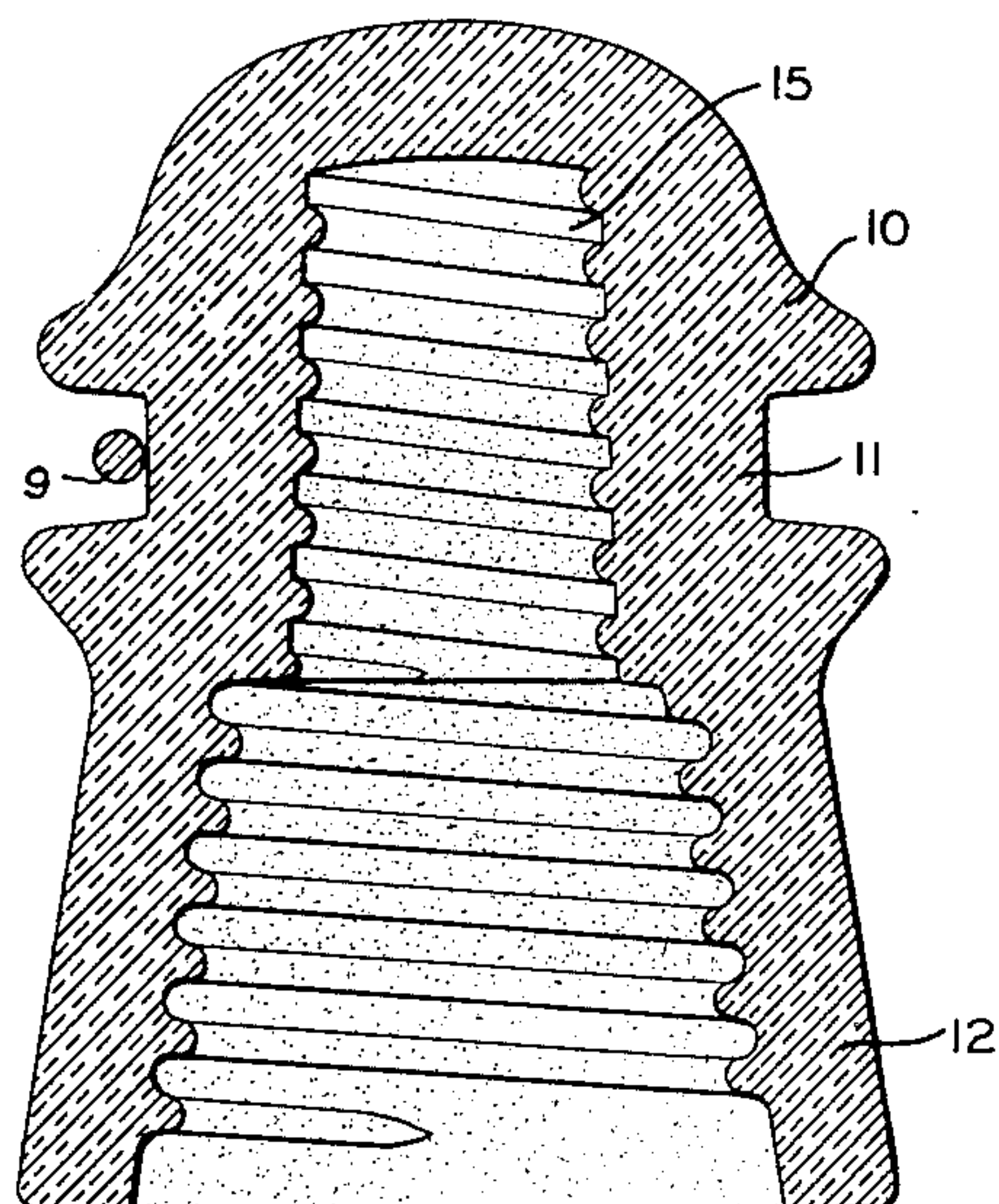
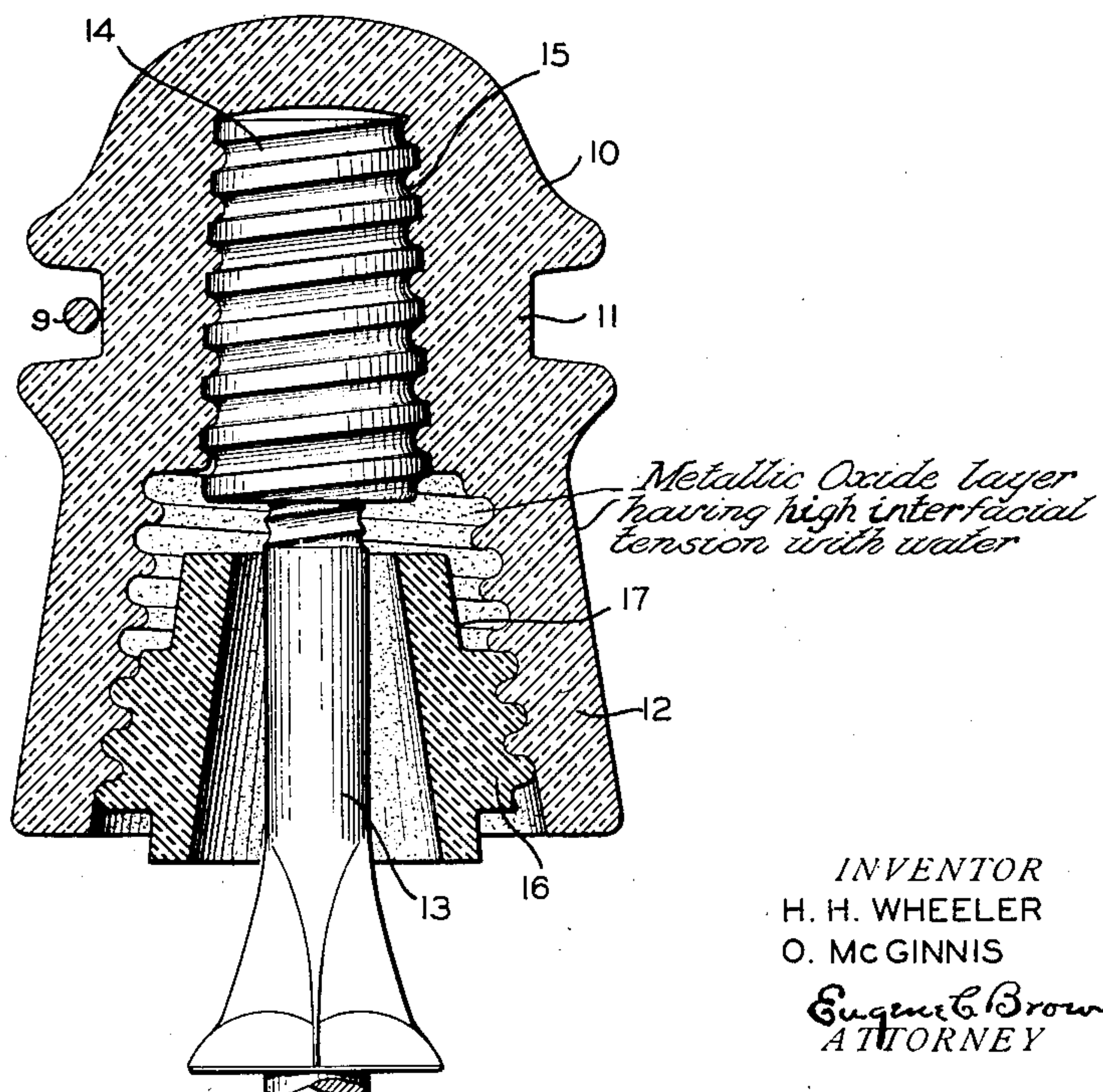


FIG. 2



INVENTOR
H. H. WHEELER
O. McGINNIS
Eugene C. Brown
ATTORNEY

UNITED STATES PATENT OFFICE

2,165,773

INSULATOR FOR COMMUNICATION
SYSTEMS

Herbert H. Wheeler, Millburn, N. J., and Orris
McGinnis, Brooklyn, N. Y., assignors to The
Western Union Telegraph Company, New York,
N. Y., a corporation of New York

Application July 8, 1932, Serial No. 621,478

5 Claims. (Cl. 174—209)

This invention relates to electrical insulators and more particularly to pole line insulators for telegraph and other communication circuits.

In communication circuits the signaling currents are usually of small amplitude and a definite and considerable part of each impulse is required to effect the operation of the receiving relays. Repeaters are disposed at convenient locations, of course, but in some instances the repeater points are widely separated and the signals reaching the receiving apparatus may become highly attenuated. Consequently the margin on a telegraph line under the most favorable conditions is relatively small, and any loss in signaling current due to leakage may seriously interfere with the normal operation of the system. Such lines, furthermore, are often disposed along highways and railroad right of ways in common with other signaling and power lines, and are subject to interference therefrom. A considerable portion of the signaling current is required to override these interfering currents thereby further reducing the margin.

It is highly essential, therefore, that pole line insulators in addition to providing adequate support, should interpose a very high resistance to leakage of current from the conductor to earth or to adjacent wires. To perform this function properly the insulator must have this high insulating resistance even under most adverse weather conditions. The materials found most suitable for insulators are vitreous materials, such as glass and porcelain. All of these materials when dry and clean provide a negligible leakage path for the signaling current, but when exposed to moisture they are subject to considerable surface leakage. It is possible to construct the insulators of such shape that even during heavy rains there will be a certain amount of substantially dry surface in the leakage path from the conductor to the pole. This is usually obtained by providing the insulator with concentric petticoats having an annular re-entrant recess therebetween, and in some cases by providing a splash guard between the insulator and the supporting pin so as to prevent entrance of water into the interior of the insulator. Due to such construction, leakage occurring across clean insulators due to rain alone has been materially reduced.

The most severe condition of surface leakage, in insulators as heretofore made, occurs not as might be supposed during heavy rain, but in extremely humid weather, at which time the moisture condenses on both the interior and exterior surfaces of the insulator and forms a substan-

tially continuous leakage path between the conductor and supporting pole, and thence either to ground or to the adjacent conductors.

The surface resistance of insulators of vitreous material of the type heretofore used decreases many fold after the insulators have been subjected to weathering conditions. This leakage varies within wide limits in individual insulators and may be very appreciable.

One of the objects of the present invention is to increase the resistance to leakage of pole line insulators of the vitreous type.

Another object is to render the insulators less susceptible to increased leakage due to accumulations of dirt, that is, under actual weathering conditions.

Another object is to maintain the resistance of pole line insulators at a high value in both rainy and humid weather and throughout a long commercial life.

A still further object is to increase the uniformity of the surface resistance of individual insulators of a pole line under various conditions of usage.

Other objects and advantages of the invention will hereinafter appear.

The present invention is based upon the discovery that insulators, the surface of which have been treated while hot by certain metallic compounds offer a much greater resistance to the passage of leakage currents in rainy or humid weather than insulators which are not so treated.

This is true not only when the insulators are new and clean, but also and in a greater proportion when the insulators have been subject to weathering conditions for substantial periods. This last characteristic of the insulators so treated is of extreme importance since ordinary telegraph pole line insulators are subject to severe conditions of weather and dirt accumulation. Due to their location along railroad right of ways, they are subject to smoke and soot of passing locomotives and along highways they are subject to the dust raised by passing vehicles. Consequently, they quickly accumulate a surface coating which, as stated, with untreated glass or porcelain insulators, decreases the surface resistance many times.

As it has been found that the treatment of the sort described is particularly effective where the surface is protected from extreme weathering and from the direct splash of rain, we employ in our preferred embodiment, a bushing within the insulator, surrounding the supporting pin, but out of contact therewith. This bushing is so

shaped as to restrict the entrance of both dirt and water into the interior of the insulator. Preferably, the bushing is composed of glass treated in the same manner as the insulator and shaped so as to further increase the leakage path and to provide a "shadow zone" within which dust accumulations are unlikely to occur.

The invention will be best understood by reference to the accompanying drawing, in which:

10 Figure 1 is a sectional view of a pole line insulator treated in accordance with the present invention, and

Figure 2 is a similar sectional view of the insulator applied to the supporting pin and provided with a protecting bushing.

The insulator 10 may be composed of a vitreous material, such as glass, and is of a conventional form in common use for telegraph pole lines. It has the usual annular groove 11 in its periphery for the anchorage of the line wire 9. The insulator is shown with a single skirt 12 although it is to be understood that it may be of any desired shape, for instance, it may be provided with the common form of double petticoat. It is supported by a steel spindle 13 having a wooden cob 14 threaded thereon and in turn threaded to the inner recess 15 of the insulator although, of course, the steel spindle may be threaded directly to the glass, if desired. The skirt portion 12 is also threaded for the reception of a bushing 16 which surrounds the spindle 13 out of contact therewith. It is to be understood, however, that the bushing 16 may be retained within the insulator in any other desired manner. It is cut away at 17 to provide an annular recess between the body of the insulator and the skirt portion 12, this recess being disposed out of the line of entrance of dirt and other material into the insulator, and therefore, in such position that accumulations of dirt therein are minimized. The bushing is preferably of insulating material, thereby increasing the surface leakage path between the wire anchoring groove 11 and the cob 14.

Both the inner and outer surfaces of the insulator are treated as well as the bushing 16. The process of applying the metallic compound to the surface of insulators, contemplated in this invention is similar to that which has been employed in the glass industry for coloration purposes, although for the purpose of this invention it is necessary to observe certain precautions and in some respects to modify the process to obtain the required surface characteristics of the insulator. The process consists in directing a fine spray of a solution of a metallic compound on to the heated surface of the insulator. In the case of treatment with iron chloride the iron chloride is dissolved in hydrochloric acid in the following proportions:

Iron chloride	grams	80
Hydrochloric acid	cc	10
Water	do	90

This solution is applied to the surface of the insulator when such surface is at a temperature of between 700° and 1100° F. This spraying operation is usually performed just after the insulator has been removed from the mold and is carried out in a normal atmosphere. After spraying the glass is annealed in the regular manner. This annealing does not appear to influence the treatment except that in some cases a change of color occurs as the glass cools.

75 A metallic compound which we have found par-

ticularly suitable from the standpoint of ease in application and of satisfactorily increasing the resistance to surface leakage is a chloride of iron, although various other metals in chloride form may be used, such as copper, tin, zinc, cobalt and nickel, which under the action of the heated glass forms a non-conducting surface on the insulator. Obviously materials which have a conducting surface would defeat the purpose of the treatment.

It is to be understood that there are other improved processes known for applying the metallic chloride coating, as for instance those employing a water suspension of the metal chloride. Therefore, we do not desire to be restricted to any particular process.

The treated surface has been found by extensive tests to increase very greatly the resistance of glass insulators to electrical leakage under moist conditions, this being true of both clean surfaces and those which have been contaminated to some extent by the deposition of dirt thereon through exposure to the weather. For instance, in comparative tests made after exposure of both treated and untreated insulators, without bushings, freely to the elements for a period of more than a year, the treated insulators were found to have a surface resistance of more than five times that of the untreated insulators. When bushings were employed the treated insulators proved to be about forty times better than the untreated insulators equipped with similar bushings and subjected to the same conditions.

There appears to be a particular cooperation between the use of glass treated as described and the use of a protective bushing whereby dirt is excluded to a large degree from the interior of the insulator since by this combination an increase in resistance to surface leakage is obtained many times greater than that obtained through the use of either treated glass alone or by the use of a protective bushing alone. Preferably the bushing is composed of glass treated in the same manner as the body of the insulator, but this is not essential to the obtaining of a substantial reduction in the leakage across the insulator.

It is to be understood that the comparative values referred to above are dependent to a large extent upon the actual conditions of use and will vary within wide limits, but in all cases the resistance against leakage of treated insulators, both new and after severe weathering, is greater than with the untreated insulators of the same type and under the same conditions. Moreover, the treated insulators provide a more uniform resistance between individual insulators of a given area than is obtained with clear glass with which wide variations of resistance often occur. This quality of the treated insulators is of particular importance in connection with certain of the more modern communication circuits, such as carrier current circuits wherein an accurate electrical balance must be maintained.

In the modification shown we have described both the inner and outer surfaces of the insulator as being treated, but it is to be understood that the principal reduction in leakage is obtained through the treatment of the inner surface alone. This is because the inner surface is protected from both dirt and the direct action of rain or snow. However, the treating of the outer surface as well further increases the resistance to leakage and is preferred.

The insulators, when treated according to our invention, are resistant to leakage, not only during heavy rain, but also to the more severe con-

dition imposed by humid weather, during which time moisture condenses both on the inner and outer surfaces of the insulator.

While the action on the treated surface in reducing electrical leakage is not fully understood, it is probable that it results from a change in the surface tension characteristics of the insulator surface by virtue of which the condensed moisture does not readily wet the surface and form a continuous conducting film in the usual manner, but on the contrary, due to the high interfacial tension existing between the treated surface and the water the latter collects in separate and disconnected globules. As long as a treated zone intervenes between the line conductor and the supporting pin over which a continuous moisture film will not form, a high resistance to electrical leakage is obtained.

It is evident that the invention may be applied to a large variety of electrical insulators other than pole line insulators and that many changes will be apparent to those skilled in the art, both in the production of the insulator and in their use, and therefore, we do not desire to be limited to the exact conditions described herein but contemplate all such variations as coming within the scope of the appended claims.

What we claim is:

1. In a communication system comprising a line conductor carrying signalling current of a value such that any substantial loss of the signalling current due to line leakage seriously interferes with the normal operation of the system, an electrical insulator comprising a vitreous body having a conductor supporting portion and a portion for engaging an insulator support, said insulator having a surface portion thereof intermediate the conductor supporting portion and insulator support-engaging portion comprising a non-conducting, metallic compound which when not contaminated by dirt and other foreign matter carried by the elements is resistant to wetting by moisture, and means for maintaining in service the initial non-wetting characteristic of said intermediate surface portion, said last named means comprising means for protecting said surface from direct action of the elements.

2. In a communication system comprising a line wire carrying signalling current of a value such that any substantial loss of the signalling current due to line leakage seriously interferes with the normal operation of the system, an insulator supporting said line wire, said insulator having a re-entrant inner surface, said inner surface having a superficial coating of a metallic compound which when not contaminated by dirt and other foreign matter carried by the elements exhibits high electrical resistivity and high interfacial tension with water, said re-entrant surface being shaped to prevent direct exposure of said superficial coating to the elements and cause said coating to substantially retain its initial high

insulation value under adverse service conditions.

3. In a communication system comprising a line wire carrying signalling current of a value such that any substantial loss of the signalling current due to line leakage seriously interferes with the normal operation of the system, an insulator supporting said line wire, said insulator having a re-entrant inner surface, said inner surface having a superficial coating of a metallic compound which when not contaminated by dirt or other foreign matter exhibits high electrical resistivity and high interfacial tension with water, and means for maintaining in service the initial high insulation value of said insulator, said last named means comprising a member shaped to prevent the admission of dirt and other foreign matter to said coating on the re-entrant inner surface.

4. In a communication system comprising a line wire carrying signalling current of a value such that any substantial loss of the signalling current due to line leakage seriously interferes with the normal operation of the system, a pole line insulator supporting said line wire, said insulation comprising a vitreous body having a recessed under surface, said surface being resistant to electrical leakage under adverse atmospheric conditions and comprising a non-conductive metallic compound which when not contaminated by dirt and other foreign matter carried by the elements exhibits high interfacial tension with water, a supporting pin secured to said insulator within said recess and means for maintaining in service the initial high interfacial tension of said surface with water, said means comprising a bushing in said recess surrounding said pin but spaced therefrom, said bushing being shaped to obstruct the entrance of water and dirt into the recess.

5. In a communication system comprising a line wire carrying signalling current of a value such that any substantial loss of the signalling current due to line leakage seriously interferes with the normal operation of the system, a pole line insulator supporting said line wire, said insulation comprising a vitreous body having a recessed under surface, said surface being resistant to electrical leakage under adverse atmospheric conditions and comprising a non-conducting metallic compound which when not contaminated by dirt and other foreign matter carried by the elements is not readily wet by moisture, a supporting pin secured to said insulator within said recess and means for maintaining in service the non-wetting property of said surface, said means comprising a bushing in said recess surrounding said pin but spaced therefrom, said bushing being shaped to obstruct the entrance of water and dirt into the recess and being composed of vitreous material having its surface similarly treated.

HERBERT H. WHEELER.
ORRIS MCGINNIS.