

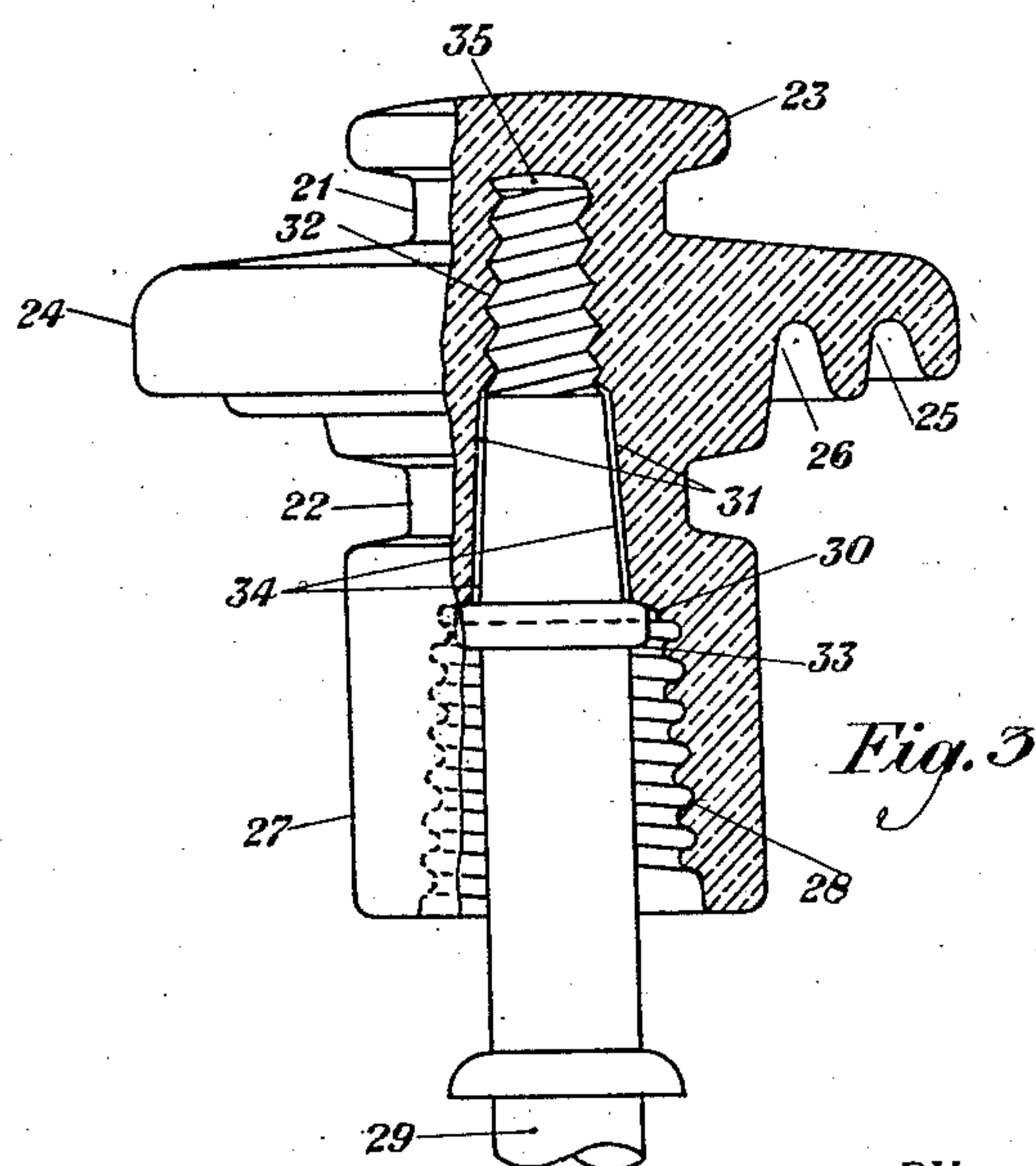
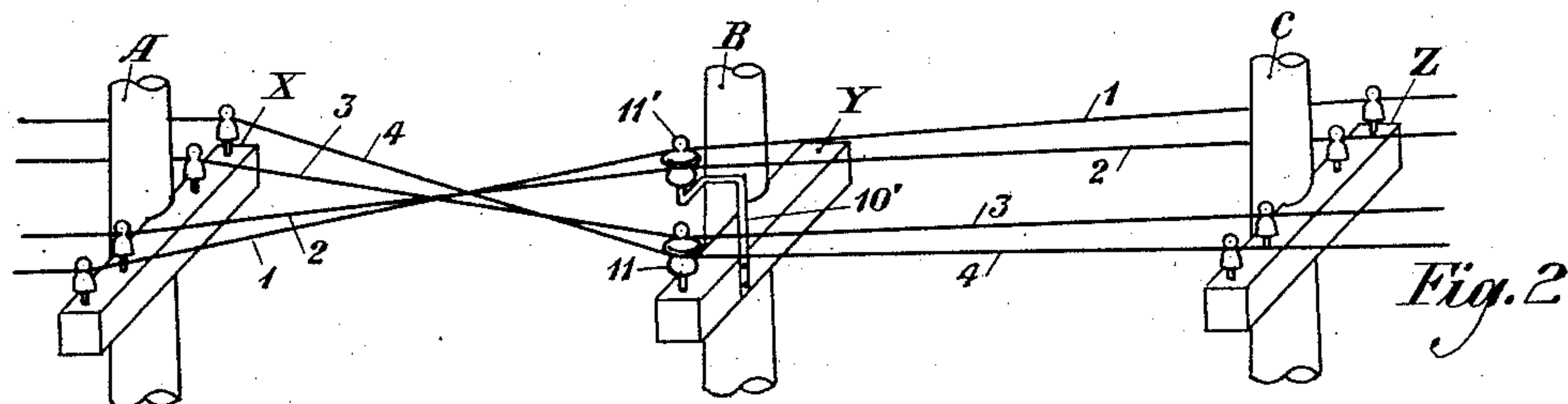
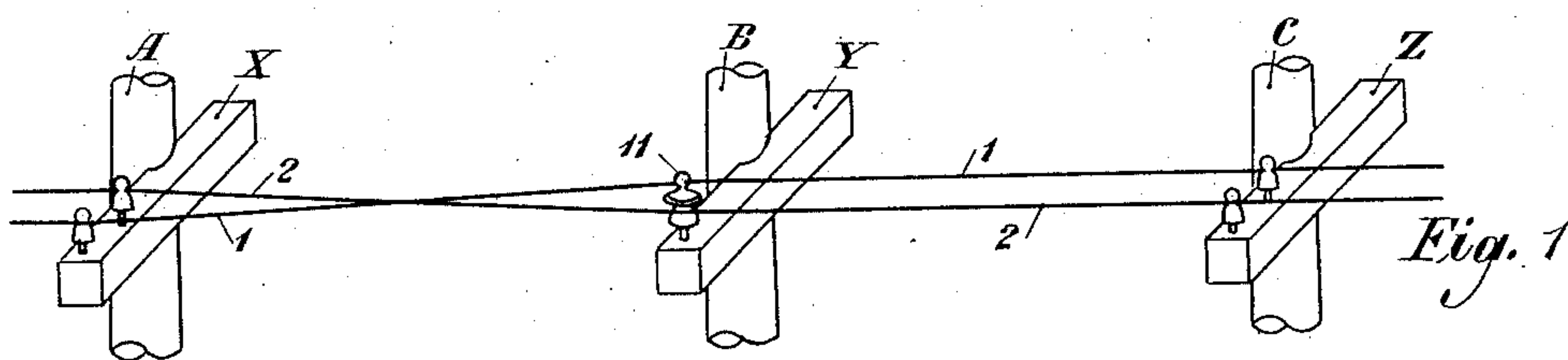
Oct. 16, 1928.

1,687,495

C. S. GORDON ET AL

INSULATOR

Filed Dec. 19, 1925



BY

INVENTORS
C. S. Gordon and
J. T. Lowe
J. T. Lowe
ATTORNEY

UNITED STATES PATENT OFFICE.

CHESTER S. GORDON, OF BOONTON, AND JAMES T. LOWE, OF NEWARK, NEW JERSEY,
ASSIGNORS TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

INSULATOR.

Application filed December 19, 1925. Serial No. 76,504.

This invention relates to insulators, and more particularly to insulators adapted to carry more than one conductor.

In a transmission system such as a telephone system, it is customary to transpose conductors at certain points along pole lines in order to reduce cross-talk. Where the lines are phantom, it is the practice not only to transpose the two conductors forming each side circuit but to transpose the pairs of the phantom as well. In order to do this, it is necessary to provide at the pole where the transposition takes place some arrangement whereby the two insulators carrying two line conductors may be arranged one above the other instead of horizontally. In the case of a phantom transposition, it is necessary to arrange four insulators one above the other. This result has heretofore been accomplished by mounting brackets upon the crossarms which may carry one or more insulators above a given insulator on the crossarm.

The provision of the brackets and other hardware necessary to accomplish this result involves a considerable amount of expense, rendering it desirable to have available for use at transposition points an insulator capable of carrying at least two wires, one above the other. Such an insulator would permit of transposing a pair of wires without the use of any brackets whatever, and in the case of a phantom transposition, a single bracket carrying a single double insulator would be all that would be required. When this is contrasted with the complicated form of bracket capable of carrying three insulators, which must be used for the ordinary phantom transpositions, it is readily seen that a double insulator will effect a considerable saving.

Heretofore double insulators have been proposed made up of two units, one mounted upon the pin above the other, each unit serving to carry an individual wire. Such structures have, however, not been practical because it has been impossible to provide a moisture-proof joint between the two units, and when moisture collects at the joint of the two parts of the insulator, a double leakage path to the pin is provided, at least for the lower unit, which, of course, results in a considerable transmission loss.

It is, therefore, one of the objects of the present invention to provide a double insu-

lator, that is, an insulator capable of carrying at least two wires, which may be molded in the form of a unitary structure so that there is no possibility of a second leakage path due to moisture between the two parts of the insulator.

This object, as well as other objects of the invention, is accomplished by means of the arrangements shown in the drawing, in which Figure 1 illustrates how a side circuit transposition is made in accordance with the present invention; Fig. 2 illustrates how a phantom transposition is made in accordance with the present invention; and Fig. 3 illustrates in detail the form of the insulator constituting the present invention.

Referring to Fig. 1, poles A, B and C are provided with crossarms X, Y and Z, respectively, and each crossarm carries a pair of insulators upon which the line wire conductors 1 and 2 may be mounted. In effecting a transposition, the problem is to cross the conductors 1 and 2 between the poles A and C. The crossing is effected at the pole B by means of a double insulator such as is illustrated at 11, capable of carrying two wires, this double insulator taking the place of the two insulators and bracket customarily used in transposition arrangements of the prior art. The transposition may be effected by connecting the conductor 1 as it comes from the pole A to the upper part of the insulator 11 and the conductor 2 to the lower part of the insulator 11. The conductors are then given another quarter-twist as they pass from the insulator 11 to the two insulators at pole C.

If it is desired to make a phantom transposition, it will be necessary to provide a bracket to carry three single insulators above the insulator on the crossarm at the pole B, if no double insulators are available. Fig. 2 shows, however, how relatively simple it is to effect a phantom transposition if double insulators are used. Here a bracket 10 is provided which carries a double insulator 11' above the double insulator 11, mounted directly upon the crossarm of the pole B. The side circuit conductors 1 and 2 may be given a quarter-twist with respect to each other by connecting them to the upper and lower mounting grooves of the double insulator 11'. Likewise, side circuit conductors 3 and 4 may be given a quarter-twist with respect to

each other by connecting them to the upper and lower mounting grooves of the double insulator 11. At the same time, due to the fact that the insulator 11' is above the insulator 11, the pair 1—2 is given a quarter-twist with respect to the pair 3—4. The conductors 1 and 2 are given a further quarter-twist with respect to each other by connecting them to the fourth and third insulators, respectively, of the pole C. Likewise, the conductors 3 and 4 are given an additional quarter-twist with respect to each other by connecting them to the second and first insulators, respectively, of the pole C. Since the pair 1—2 is connected to the third and fourth insulators at the pole C and the pair 3—4 to the first and second insulators at the pole C, it is evident that the pairs have been given a further quarter-twist with respect to each other. Consequently, not only are the conductors of each pair completely transposed but the pairs themselves are transposed. All of this is accomplished by using a bracket capable of carrying one insulator.

The form of the double insulator of the present invention is illustrated in Fig. 3. As will be seen, the main body of the insulator is provided with two grooves 21 and 22, in which the two conductors may be led and secured by means of tie-wires in a manner well understood in the art. Above the upper groove, a flange 23 projects outwardly to complete the groove for retaining the upper wire in position. Between the two grooves an umbrella or mushroom-like flange 24 extends outwardly, this flange being formed on its under side with a plurality of deep corrugations 25—26 to form an effective dry path between the conductor attached to the groove 21 and the conductor attached to the groove 22. Below the groove 22 a skirt 27 projects downwardly, the skirt being corrugated on its inner side as shown at 28 to form an effective dry path between the conductor of the groove 22 and the supporting pin 29. On the interior of the skirt 27 a shoulder 30 is formed, a tapered pin opening 31 extending upwardly from the shoulder 30. The pin opening 31 is interiorly screw-threaded as shown at 32.

The pin 29 is provided with a flange 33 upon which the shoulder 30 of the insulator may rest and the upper part of the pin is tapered as shown at 34, the tapered part being screw-threaded near its upper end so that the pin may be screwed into the thread 32 of the insulator. The tapered part 34 of the pin is of smaller diameter than the tapered opening 31 of the insulator, so that when the insulator is screwed upon the pin until its shoulder 30 rests upon the flange 33, a small air-space is provided between the material of the insulator and the pin.

This air-space is an important feature of the present invention as it serves to decrease

the attenuation due to leakage. As is now well understood, the attenuation due to the use of insulators is to a large extent made up by leakage losses due to the material of the insulator. These leakage losses are in the nature of a hysteresis loss which is a function of the capacity of the insulator acting as a condenser. The condenser action is due to the line conductor and the wet surface (if any) on the outside of the insulator forming one plate, the other plate being formed by the supporting pin which may be, and frequently is, metallic, and even if not metallic, becomes conductive when wet. The body of the insulator, of course, constitutes the dielectric.

Now, if the dielectric material of which the insulator is composed has a small loss angle, the attenuation will be reduced. This will be clear from the fact that if we consider the insulator as a condenser, we may represent its effect as that of a conductance shunted about a capacity, the conductance being the factor which produces the dielectric loss. If this conductance component which produces the dielectric loss is zero, the only effect on transmission through the condenser is to produce a change in phase without loss of energy. In other words, only a wattless current flows through the insulator in such case.

Consequently, if the material of the insulator be a material having a low loss angle, and consequently a low conductance component, the leakage loss will be greatly reduced. It has been found that the commercial form of glass known as pyrex B has a very low loss angle and for this reason it is preferred to construct the insulator of this material. The effectiveness of the structure to reduce losses is very materially increased, as already stated, by means of the air-space between the tapered portion of the pin and the inner wall of the insulator adjacent to the groove 22. This is for the reason that the air-space forms part of the dielectric, and air, as a dielectric, has a loss angle very closely approaching zero. Consequently, the combined effort of having a glass of low loss angle between the groove 22 and the pin, together with a layer of air, results in a very material decrease in the leakage loss of the insulator so far as the conductor attached to the groove 22 is concerned.

Another factor producing an attenuation loss is the direct current leakage due to moisture extending from the conductor in the groove 22 over the skirt to the pin 29. By providing the corrugations 28 on the inside of the skirt, a part of this path will be practically dry so that the leakage loss due to this factor will be to a considerable extent eliminated. In a similar manner, the direct current leakage due to moisture will be reduced so far as the conductor applied to the groove 21 is concerned, by means of the corrugations

25 and 26 on the under side of the wide flange 24. This flange also extends out a considerable distance for the purpose of maintaining the upper part of the outer surface of the skirt 27 dry just below the groove 22. This results in a substantial elimination of direct current leakage except when a driving rain occurs.

In mounting the insulator upon the pin, the flange 33 of the pin, which coacts with the shoulder 30 upon the insulator, is a very important factor as the interior bore of the insulator is made of such length that when the insulator is screwed on to the pin until the shoulder 30 is firmly seated upon the flange 33, there will be a small air-space between the upper end of the pin and the upper part of the insulator as shown at 35. When the insulator is wet, the entire upper surface of the flange 23 becomes conductive, and with the conductor in the groove 21, comprises one plate of a condenser of which the other plate is formed by the upper part of the pin 29. This would result in an increase of the capacity of the insulator during wet weather and since, in general, the hysteresis loss increases with the increase in capacity, there will be an increase in the attenuation under these conditions. The fact that a small air-gap 35 is included between the pin and the upper surface of the insulator results in decreasing the dielectric hysteresis due to the flux passing from the upper surface of the insulator to the upper surface of the pin. This again is for the reason that air has a very low loss angle.

It will be observed that the insulator described is so shaped that it is readily possible to mold it by the use of molds which are not unduly complicated from a mechanical standpoint. For example, a split mold may be provided to form the top, including the groove 21, extending down to the underside of the flange 24. The forming of the corrugations 25 and 26 may be accomplished by a draw ring mold which extends to the top of the lower wire groove 22. A split mold may be clamped in place to form the lower wire groove 22 and the skirt 27. The threaded plunger for forming the interior opening of the insulator will complete the mold. If necessary, a ramming operation may precede the forming of the screw thread cavity, in order to force the plastic material out to form the projection beyond the corrugations 25 and 26. Other methods of molding the insulator will also readily suggest themselves.

It will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated, without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. An insulator for transmission conduc-

tors comprising a unitary mass of dielectric material of a generally cylindrical form having a plurality of grooves in its outer surface for the accommodation of electrical conductors, and an interiorly screw-threaded opening for mounting the insulator upon a flanged pin, the diameter of said opening in the neighborhood of one of the external grooves being somewhat greater than the diameter of the supporting pin at that point, so as to provide an air-gap between the conductor mounted in the groove and the pin, the insulator being provided with a shoulder for co-operation with the corresponding flange upon the supporting pin, and the length of the interior opening above the shoulder being somewhat longer than the length of the pin above the flange, so that when the insulator is screwed upon the flange with the shoulder resting upon the flange, a small air-space will be provided between the upper part of the pin and the material of the insulator in the neighborhood of the upper groove.

2. An insulator for transmission conductors comprising a unitary mass of dielectric material of a generally cylindrical form having a plurality of grooves in its outer surface for the accommodation of electrical conductors, an interiorly screw-threaded opening for mounting the insulator upon a flanged pin, the diameter of said opening in the neighborhood of one of the external grooves being somewhat greater than the diameter of the supporting pin at that point, so as to provide an air-gap between the conductor mounted in the groove and the pin, the insulator being provided with a shoulder for co-operation with the corresponding flange upon the supporting pin and the length of the interior opening above the shoulder being somewhat longer than the length of the pin above the flange, so that when the insulator is screwed upon the flange with the shoulder resting upon the flange, a small air-space will be provided between the upper part of the pin and the material of the insulator in the neighborhood of the upper groove, and an outwardly extending flange between adjacent grooves, said flange being corrugated on its under surface.

3. An insulator for transmission conductors comprising a unitary mass of dielectric material of a generally cylindrical form having a plurality of grooves in its outer surface for the accommodation of electrical conductors, an interiorly screw-threaded opening for mounting the insulator upon a flanged pin, the diameter of said opening in the neighborhood of one of the external grooves being somewhat greater than the diameter of the supporting pin at that point, so as to provide an air-gap between the conductor mounted in the groove and the pin, the insulator being provided with a shoulder for co-operation with the corresponding flange upon

the supporting pin, the length of the interior opening above the shoulder being somewhat longer than the length of the pin above the flange, so that when the insulator is screwed
5 upon the flange with the shoulder resting upon the flange, a small air-space will be provided between the upper part of the pin and the material of the insulator in the neighborhood of the upper groove, an outwardly ex-
10 tending flange between adjacent grooves, said

flange being corrugated upon its under surface, and a downwardly projecting skirt below the lower groove, said skirt being corrugated upon its inner surface.

In testimony whereof, we have signed our
names to this specification this 15th day of
December, 1925.

CHESTER S. GORDON.
JAMES T. LOWE.