

March 27, 1928.

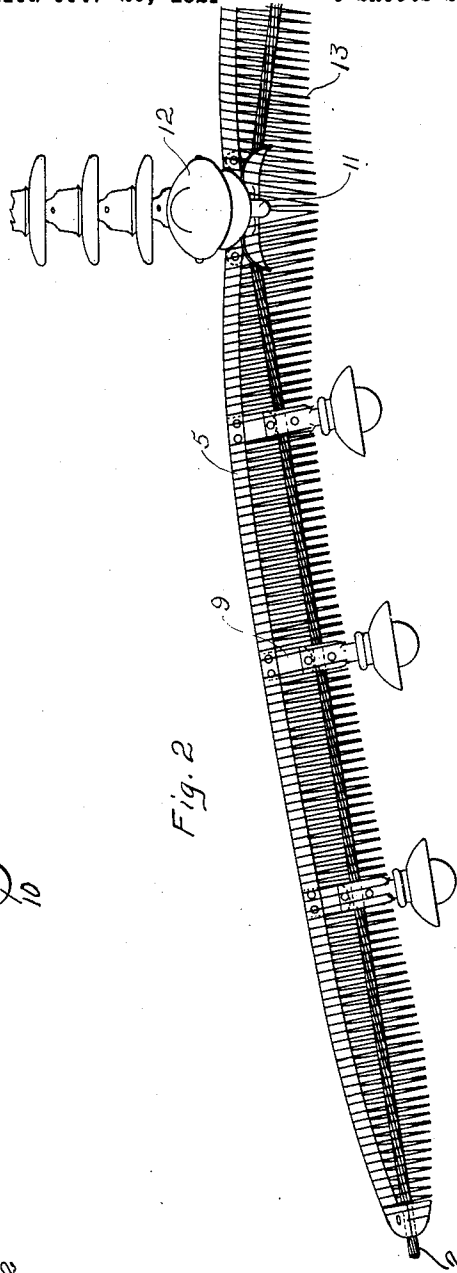
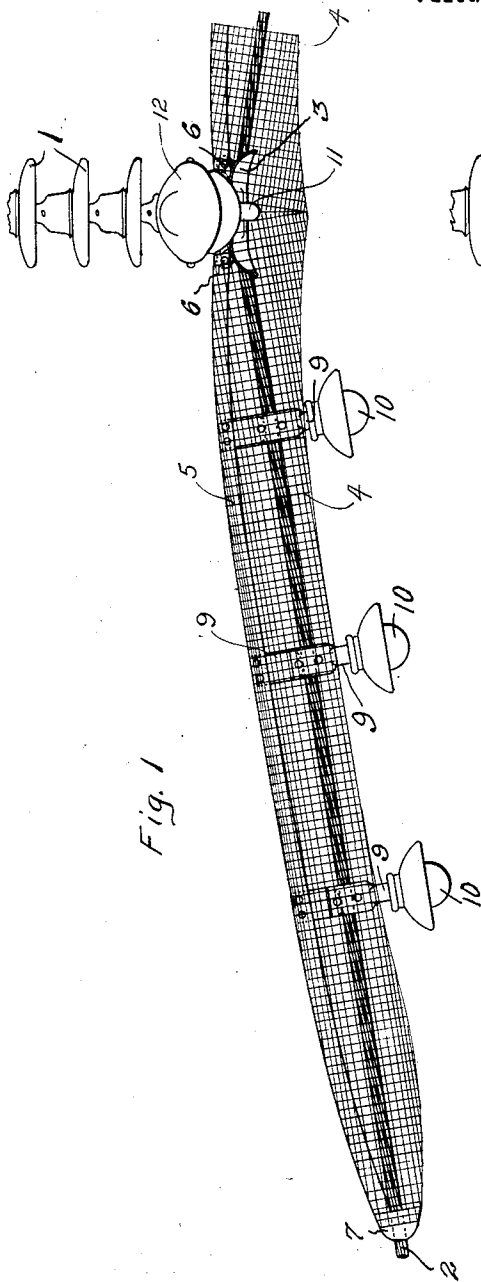
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HIGH TENSION INSTALLATION

Filed Oct. 20, 1921

6 Sheets-Sheet 1



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March 27, 1928.

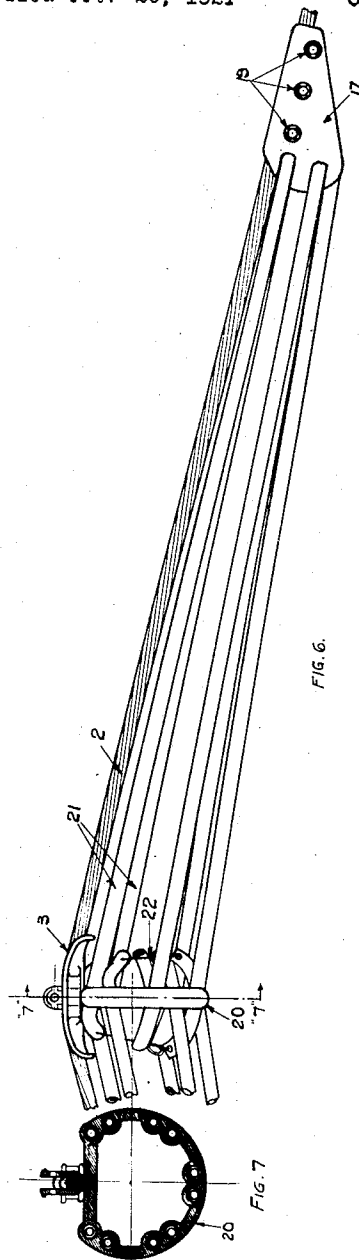
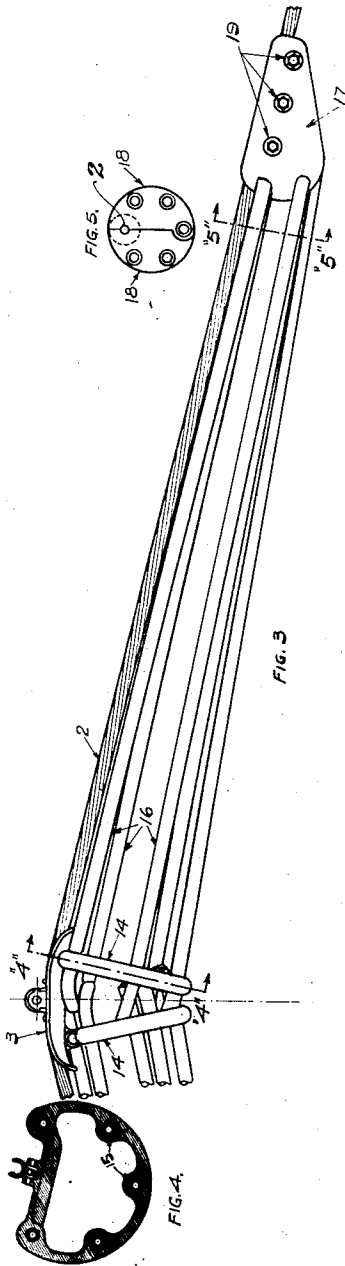
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6 Sheets-Sheet 2



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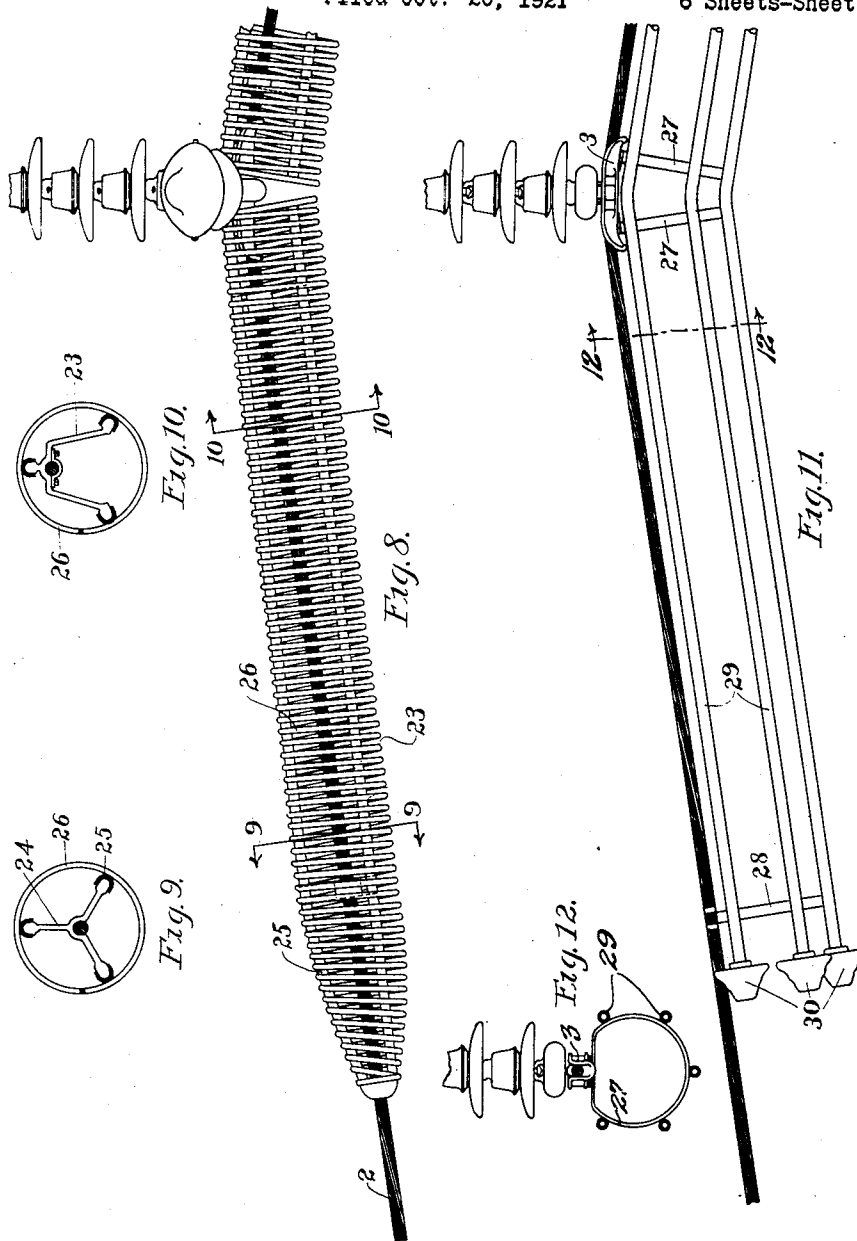
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6 Sheets-Sheet 3



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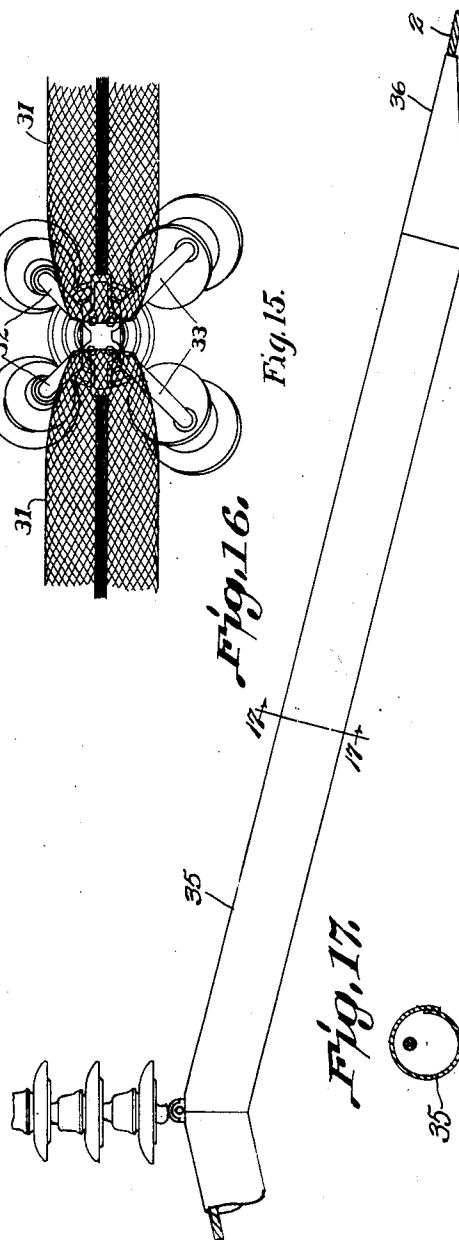
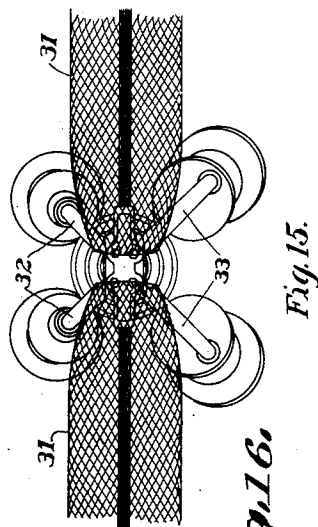
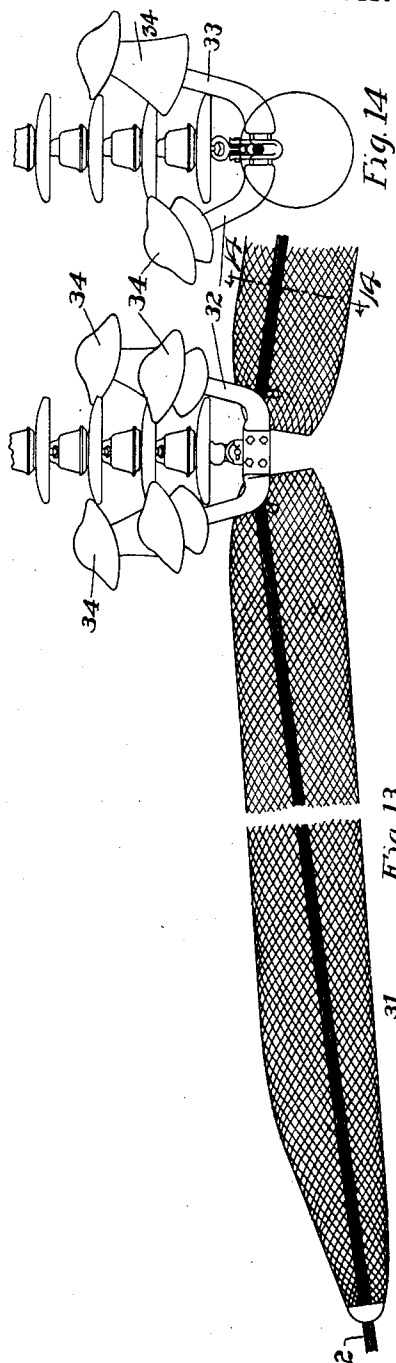
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HIGH TENSION INSTALLATION

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6 Sheets-Sheet 4



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HIGH TENSION INSTALLATION

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6 Sheets-Sheet 5

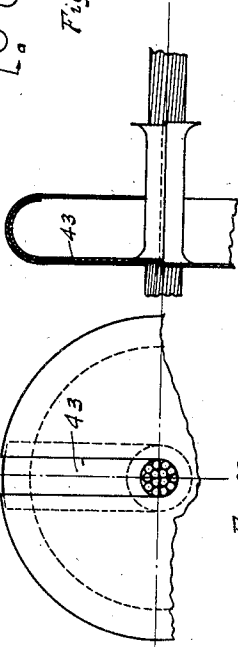
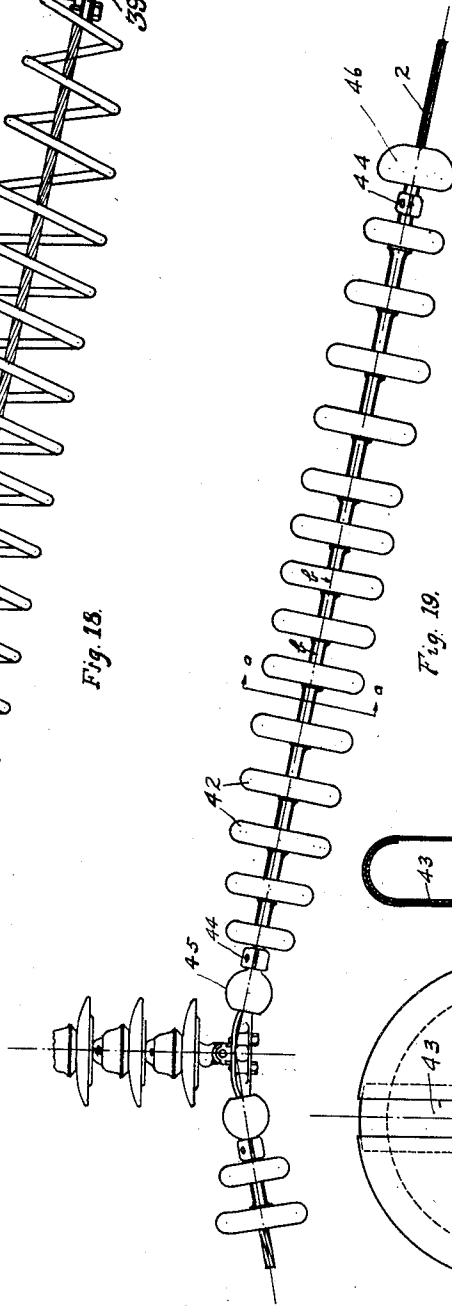
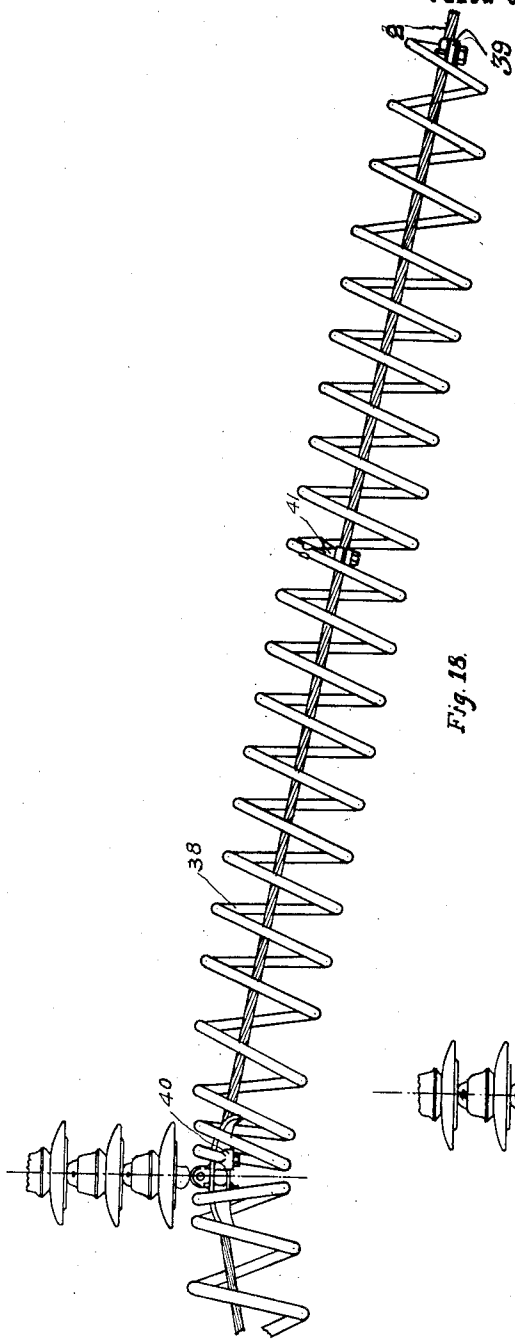


Fig. 19-b.

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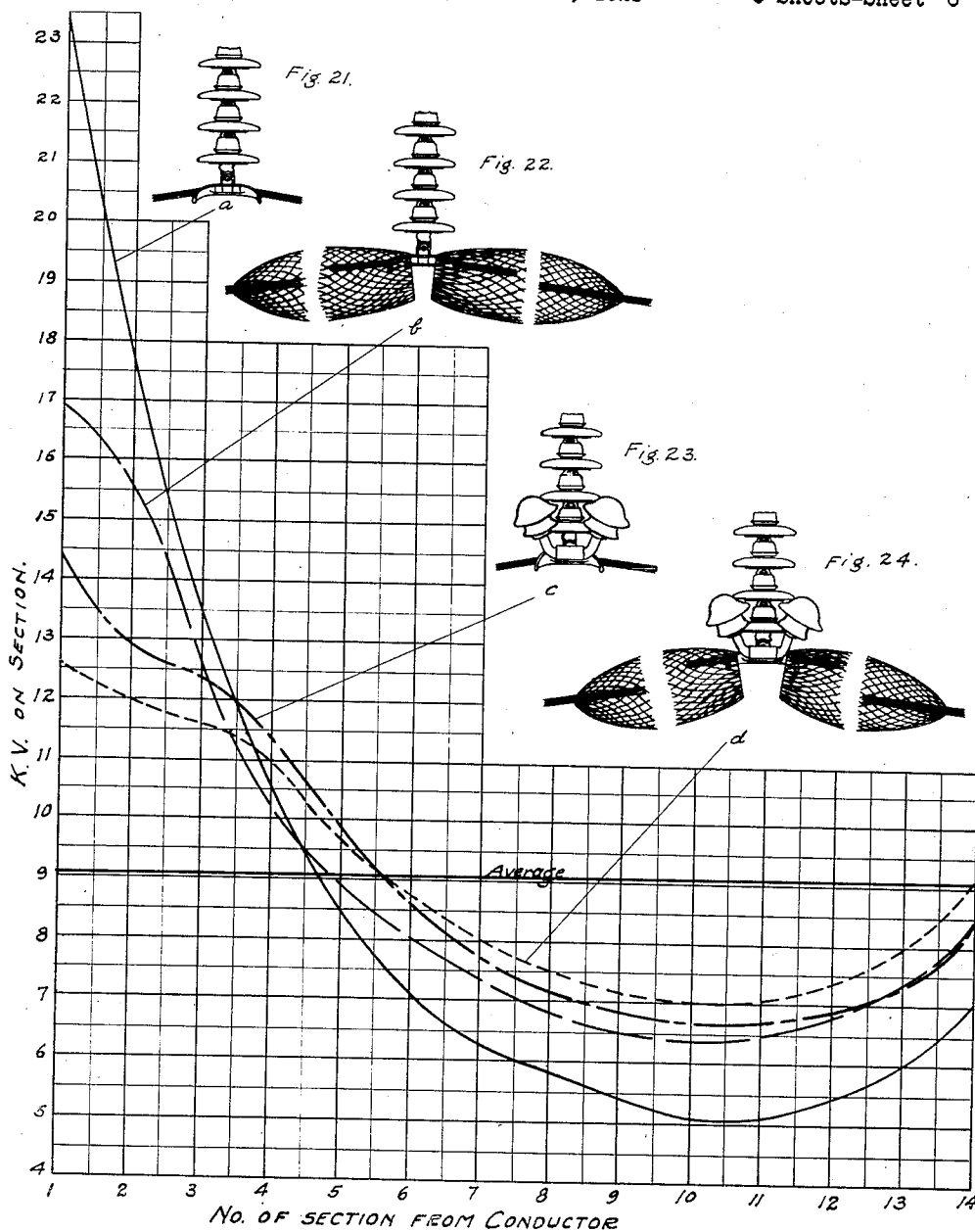


Fig. 20.

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HIGH-TENSION INSTALLATION.

Application filed October 20, 1921. Serial No. 508,933.

This invention relates to installations for high electrical potentials, such as high tension transmission lines, wireless apparatus, and other constructions, and has for its object the provision of mechanism of the class named which shall be of improved construction and operation and which shall reduce the tendency to discharges of various characters from the highly charged conductors through the control of the electro-static flux in the medium surrounding such conductors.

The invention is exemplified in the combination and arrangement of parts shown in the accompanying drawings and described in the following specification, and it is more particularly pointed out in the appended claims.

In the drawings—

Fig. 1 is an elevation of an installation embodying one form of the present invention;

Fig. 2 is a view similar to Fig. 1 of a slightly modified construction;

Fig. 3 is an elevation of an installation showing another modification;

Fig. 4 is a section on line 4—4 of Fig. 3;

Fig. 5 is a section on line 5—5 of Fig. 3;

Fig. 6 is a view similar to Fig. 3 of another form of the invention,

Fig. 7 is a section on line 7—7 of Fig. 6;

Fig. 8 is an elevation of a different form of the invention;

Fig. 9 is a section on line 9—9 of Fig. 8;

Fig. 10 is a section on line 10—10 of Fig. 8;

Fig. 11 is an elevation of a different form of the invention;

Fig. 12 is a section on line 12—12 of Fig. 11.

Fig. 13 is an elevation of another form of the invention;

Fig. 14 is a section on line 14—14 of Fig. 13;

Fig. 15 is a bottom plan view of the construction shown in Fig. 13;

Fig. 16 is an elevation of a different form of the invention;

Fig. 17 is a section on line 17—17 of Fig. 16;

Figs. 18 and 19 are elevations of still different forms of the invention; Figs. 19^a and

19^b are sections on lines *a—*a** and *b—*b** respectively of Fig. 19.

Fig. 20 contains a number of curves illustrating the effect of the invention on a high tension line.

Figs. 21 to 24 inclusive show the arrangements of the controls for the line corresponding to the different curves of Fig. 20.

In high tension insulators for transmission and radio work customarily used a six or eight section suspension insulator will ordinarily withstand a greater voltage at a high frequency without danger of arcing than will the conductor on which the voltage is impressed, unless the conductor is of abnormally large size. It is, of course, not economical to use a conductor which is so large that the first cost and interest on the investment will be excessive, therefore abnormally large conductors are not feasible. Even if there were sufficient power to warrant a very large conductor for transmitting power at a high voltage, the line reactance due to the large current necessary for economy would be too great to permit of a size sufficiently large to prevent arcing of the conductor in the vicinity of the supporting tower where the electro-static field is strong. Spreading or splitting the conductor into several parts so as to increase the effective diameter would be of material benefit, but this is open to serious mechanical objections when carried out throughout the line or in the vicinity of the tower.

The insulators or portion of insulators next the transmission lines carry higher electro-static stress than those farther from the line due to what may be termed the leakage of electro-static flux to ground from different members in the series. The use of a very large conductor in the vicinity of the insulator tends to prevent or make up for this loss of electro-static flux, thereby, greatly improving the stress distribution or gradient for the insulating member or members. The gradient or stress distribution in the series may be improved by horns or flux controls, as shown in my previous application, Serial No. 476,179, filed June 9, 1921, or by a large ring or shield. Where a ring or shield is used to control the flux this ring

or shield may lower the flash-over owing to its projecting into a strong field on the tower side so that it may more than offset the advantage of an improved gradient in the insulator.

An eight or ten section insulator of good design will usually withstand a higher voltage than that which will start an arc from the conductor to the tower, a distance of from five to ten feet, depending upon electrical conditions, although the length of the insulator may be only half this value. From this it will be seen that using a long string of insulators may be of little benefit in providing a larger factor of safety, as an arc may start from the conductor to the tower. This invention is designed to prevent this arcing from conductor to tower by raising the voltage to which arcing or pluming will occur and at the same time reduce the danger of arcing of the insulator string, by improving the distribution of stress in same.

Owing to the comparatively small diameter of the conductor and the comparatively short distance to the tower, there is a very strong field about the conductor in the vicinity of the tower so that by increasing the effective diameter of the conductor by means of a properly formed shield or screen running along or adjacent to the conductor, the stress in the air is lowered and the corona point or voltage necessary to start a plume or arc may be greatly raised and the danger of pluming or arcing to ground under high frequency disturbances may be greatly reduced or eliminated.

There are two classes of discharge into the air from insulators or high voltage conductors. One class affects the performance of transmission lines very seriously due to the arcing to ground at voltages much lower than would be indicated by the voltage which can be carried at normal frequency. Where a discharge from a conductor into the air is in the nature of a small streamer, the resistance of the streamer will be greatly reduced by increasing the current in the same. As this current may be regarded as a charging current the air acting as a dielectric in a condenser and a streamer as one of the conducting plates, it will be seen that by increasing the frequency the current in the streamer will be increased accordingly. Since, however, increasing the current in the streamer greatly reduces its resistance, the voltage drop along the streamer will be less, consequently the high stress of the conductor will be carried out further from the conductor. This will cause a further breakdown of the air, permitting an increase in the electro-static capacity of the condenser which affects the current and resistance of the streamer acting as one of the electrodes of the condenser. This further increase in current again reduces the resistance so that an

accumulated effect is produced which is very serious when a high frequency is impressed upon the line or insulator. This may be better understood when we consider that doubling the current in the streamer may cut its resistance in half.

From this it will be seen that while the resistance in a streamer might be excessively high at a normal frequency of twenty-five or sixty cycles, the same length of streamer would have almost a negligible resistance if the frequency is increased several thousand times, which might easily occur on the transmission line. This increase in frequency over the normal frequency may come from a number of different causes, such as lightning and arcing ground, the effect of corona on the line in producing a harmonic, the harmonics produced by connected apparatus, or other causes. A discharge then which will cascade because of the accumulative effect of current, either due to the reaching of a sufficiently high voltage, or partially due to the increased current from an increased frequency, or a combination of both, may cause serious arcing or at least arcing to ground at voltages much lower than would otherwise be the case.

A small diameter of conductor, as was pointed out, permits a highly concentrated field which tends to produce streamers at comparatively low voltages. These streamers may exist at or even below the normal transmitting frequency. While there may be no trouble from the same other than the loss of power at normal frequency, an increase in frequency, particularly when attended by an increase in voltage, may permit of the growth of a streamer resulting in an arc to ground, as previously explained. Where the size of the conductor is increased the concentration of the field is reduced, and even though a streamer starts, the accumulative effect will not be so great and a much higher voltage and frequency may be impressed without producing a plume or arc which will go to ground under a disturbance, permitting the energy of the line to follow.

In Fig. 1 is shown a suspension string of insulators 1 supporting a conductor 2 by means of a saddle 3. The effective diameter of the conductor in the vicinity of the insulator and tower is increased by a metallic cage 4 supported by a bar 5 secured to the saddle 3 at 6 and connecting with the conductor 2 at 7. The cage 4 may be made of wire screen or other suitable material and extends for some distance along the conductor 2 away from the insulator 1. The cages 4 are made in duplicate extending in both directions from the insulator and may be spaced apart slightly, as shown in Figs. 8 and 13, to permit of movement of the conductor 2 without causing the ends of the

cages to interfere with one another. Suspended from the bar 5 and the conductor 2 at spaced intervals is a series of flux control members 9 which consists of metallic clamps secured to the conductor 2 and the support 5 and extending downwardly therefrom, the lower ends of the downwardly extending portions being covered by insulators 10 to provide insulated flux distributors. In this figure the cage 4 is shown as surrounding the conductor, but in some cases it may be advisable to place the cage adjacent to the conductor or to one side, or the conductor may be used to form part of the cage itself. It will be readily seen that this cage greatly increases the effective diameter of the conductor so that a much higher voltage must be impressed to cause a sufficient concentration of stress in the air to start a streamer than in the case of a relatively small diameter of a bare conductor. The suspension string of insulators on being made up of a series of condensers, one end of which is connected to the conductor, sets up an electro-static field. This electro-static field produced by the insulator approximating the voltage of the conductor improves the air gradient in its vicinity and will tend to prevent streamers starting in the immediate vicinity of the insulator.

As the potential of the insulator approximates that in a streamer tending to start an arc, there will be a tendency to cause repulsion due to the well-known electro-static law of repulsion of like charges. This repulsion will be increased for a streamer starting from the conductor as the potential in the insulator string approximates that of the conductor. As previously explained, the conductor cage 4 being of much larger diameter than the conductor 2 exerts a much greater effect on the electro-static distribution of stress in the string, the larger diameter tending to carry the conductor potential higher up in the string of insulators, thereby tending to reduce the current in a streamer starting near the insulator. Furthermore, if a streamer is started the tendency to carry the conductor potential higher up in the string will produce greater electro-static repulsion for the arc or streamer tending to keep same away from the insulator. This latter is important for if the energy in the arc following the discharge to ground takes place over the insulator, the insulator may be seriously damaged, whereas, if the arc can be kept away from the insulator, little or no damage may result other than a momentary interruption of service to permit the arc in the air to die out. From the above it will be seen that the increase in diameter due to the cage or conductor guard may be very beneficial in raising the voltage which it is possible to carry by a conductor or insulator string without arcing to ground.

In the installation shown in Fig. 1 a conductor arm 11 extending transversely of the line 2 carries an insulator 12 surrounding its outer end. This construction provides an insulated flux control member to control the field, particularly near the lower part of the insulator. Any desired number of these control members may be used and may extend in different directions from the saddle 3. This flux control improves the electrical gradient in the insulator string and lowers the air gradient around the clamp and insulator fittings. By improving the field and lowering the current in the streamers tending to discharge or plume at the clamp or insulator fittings, the flashover of the combination is raised from approximately 350 k. v. to 460 k. v. By shielding the conductor on each side of the insulator string in the vicinity of the tower by the metal cage 4, the flashover of the combination will be raised to approximately 545 k. v. from which it will be seen that by the use of the insulated flux control and the cage on the conductor, the flashover will be raised from 350 k. v. to 545 k. v. or approximately 56% increase without increasing the size of the insulator or the tower clearance.

If the insulator string is used with a larger or more expensive insulated flux control, the flashover voltage may be raised from approximately 350 k. v. to approximately 490 k. v. The voltage cannot be raised further by insulated flux controls in the immediate vicinity of the insulator string for an arc will start from the conductor two or three feet from the insulator string and go to the cross-arm or body of the tower or supporting structure. As the flashover obtained with the cage 4 and the smaller insulated control was approximately 545 k. v. it will be seen that the conductor screen increases the flash-over from 490 k. v. to 545 k. v. This higher flashover which cannot exceed 490 k. v. without screening or caging the conductor in the vicinity of the tower is made possible by the use of the cage 4, which in addition improves the stress distribution in the insulator string, and in some cases may permit the high flash-over without the use of insulated control or other control devices to control the gradient in the insulator or the field in the vicinity of the insulator.

In Fig. 20 the distribution of voltage for the different members in the insulator string is illustrated. The kilo-volts per section are laid off vertically and the different sections are represented by the different positions along the horizontal lines. Curve "a" in this figure shows the voltage duty of the various units without insulated controls or conductor cage. This curve corresponds to the arrangements shown in Figure 21. Curve "b" corresponds to the arrangement of Fig.

22 and shows the voltage duty of the various sections with the conductor cage alone. Curve "c" corresponds to Fig. 23 in which the insulated controls are used alone. Curve "d" shows the effect when both insulated controls and conductor cages are used. It will be seen that the conductor cage has a very beneficial effect in improving the distribution of stress or voltage among the various sections composing the insulator string. This improving of the stress distribution tends to permit the operation of the insulator at a higher voltage and also sets up a stronger field which tends to prevent the formation of an arc or plume in the vicinity of the insulator and while an arc is forming tends to repel same, as explained above. From the above it will be seen that caging the conductor not only raises the pluming point of the conductor in the vicinity of the tower where the field is stronger than out on the line, thus permitting a higher applied voltage without arcing to ground, but in addition the stress distribution of the insulator string is improved. Furthermore, the cage may be so made as to protect the conductor from power arcs which might seriously damage the same. The use of the cage has a further advantage in greatly increasing the flashover under high frequency disturbances where the tower clearance is small. The use of the cage will permit a given flashover, particularly under high frequency conditions with much smaller tower clearance or in a stronger field than is possible without guarding the conductor, thereby permitting considerable saving in the cost of supporting structures.

The use of the conductor guard is not necessarily confined to suspension insulators, but may be very efficient in improving the distribution of stress in a strain or dead-end insulator and in raising the arcing or pluming voltage of the jumper connecting the two dead-end strings on either side of the tower. The conductor cage may be made in a variety of forms, and the size of the spiral or cage and its relation to the conductor may be varied so as to develop the maximum flashover for a given position of a conductor. In Fig. 1 the relative position of the cage and conductor may be controlled by the supporting bar 5 and the clamping members 9. By making the conductor guard of open construction, the concentration of drip water is eliminated and the cost of the guard kept down. The concentration of drip water, if permitted, would tend to form a conducting path which would start a plume and lower the flashover, particularly where the cage or guard has a large projecting surface, which accumulates and concentrates considerable drip water. Where the conductor guard is made of a solid member, such as a tube of sheet metal, it is advisable to corrugate or

perforate the guard so that the drip water will not be concentrated. The conductor cage may be so made that it will not only improve the gradient of the conductor in the vicinity of the tower, thereby raising its flashover, but will improve the stress distribution in the insulator string, and further can be made to protect the conductor from damage by power arcs and can be so formed and installed as to eliminate serious discharge from the clamping or other insulator attachments. The use of the conductor guard permits higher operating voltages and frequencies without arcing from insulators, conductors and fittings from a given tower clearance, which will permit smaller clearance and thereby effect a considerable saving. The cage may so improve the stress distribution and flashover values of the combination that the use of the insulators in the string having different relative electro-static capacities can be eliminated where a fine distribution of stress is desired. This would permit the use of one insulator throughout the string with its attendant advantages as regards first cost and maintenance. Where it is desired to raise the voltage after an installation is made it frequently occurs that there is not sufficient clearance to permit an insulator of sufficient size without reducing the clearance so that arcing will occur. It will be seen that the conductor guard is of particular advantage in a case of this kind as it permits an increase in the voltage without danger of arcing, such as would occur in ordinary construction, due not only to high pluming voltage of the conductor, but also to the greater efficiency of the insulator permitting a shorter insulator with greater clearance.

The insulator shown in Fig. 2 is similar to that shown in Fig. 1, except that the screen 4 is replaced by a spiral wire or rod 13 of conducting material.

In Fig. 3 a pair of brackets 14 are suspended from the saddle 3 and these brackets are provided with openings 15, as shown in Fig. 4. Rods or hollow pipes 16 are supported in the openings 15 and extend along the conductor 2, the rods or pipes 16 with the conductor 2 forming a cage of approximately cylindrical shape. The outer ends of the pipes 16 are supported by a fitting 17 comprising a pair of clamp blocks 18, Fig. 5, held together by bolts 19. The blocks 18 are clamped over the conductor 2 and are provided with openings in which the pipes 16 are secured in any suitable manner.

The construction shown in Fig. 6 is somewhat similar to that of Fig. 3, except that in this case a single supporting bracket 20 is suspended from the saddle 3, the bracket being provided with a series of openings for receiving the pipes 21 extending in both directions from the insulator string. The

outer ends of the pipes are supported from the conductor by a fitting similar to that shown in Fig. 3. In the construction shown in both Figs. 3 and 6 the ends of the pipes 5 are turned inwardly to prevent danger of arcing from their ends. A wire or other suitable holding device may be threaded through the ends of the pipes, as shown at 22, to hold the bent ends in their inward 10 position.

The construction shown in Figs. 8, 9 and 10 is somewhat similar to that shown in Fig. 2, except that in this case a series of brackets or spiders 23 and 24 are distributed 15 along the conductor 2 and carry at their outer ends a plurality of bars 25 which retain the coil 26 in fixed position relative to the conductor 2. By controlling the space of the coil 26 from the conductor the 20 strength of the field surrounding the conductor may be correspondingly controlled for different positions to best protect it for particular installations.

In Fig. 11 a pair of rings 27 are supported 25 from the saddle 3 adjacent the insulator string and similar rings 28 are connected to the conductor at points spaced from the insulator string. A series of pipes 29 are welded or otherwise secured to the periphery of 30 the rings 27 and 28 and extend along the conductor forming a cylindrical cage therewith. In order to prevent arcing from the ends of the pipes 29 an insulator 30 may be placed over the end of each of these pipes.

In Fig. 13 a cage 31 is shown which is 35 formed of expanded metal and placed over the conductor 2. This arrangement affords a relatively inexpensive and easily installed construction and one which is very 40 satisfactory in operation. In this construction a series of flux control members 32 and 33 are shown, the flux controls on one side of the line being longer than those on the 45 other, because of the closer proximity of one side to the tower. The ends of the controls 32 and 33 may be covered by insulators 34.

In Fig. 16 a cage 35 is shown formed of sheet metal tubing surrounding the conductor. The tubing is given a cone-shape 36 at 50 its outer end tapering to conductor 2. It may be supported by any suitable bracket at its inner end.

In the form of the invention shown in Fig. 18, a tubular member 38 is spirally 55 wound around the conductor 2, one end of the member being secured to the supporting saddle—at 40, and the other end being attached to the cable 2 by clamp 39. Supporting bracket 41 may be provided at intermediate 60 positions as required.

In the form of the invention shown in Fig. 19 a series of hollow discs 42 are spaced along the conductor 2. The discs are made of thin sheet metal and each disc may have

a sleeve formed integral therewith, or at- 65 tached thereto for surrounding the conductor. Each disc has a radial opening to permit it to be placed upon the conductor and a sliding closure 43 is provided to close the opening when the disc is in place. Suitable 70 clamps 44 may be provided for holding the series of discs from sliding along the conductor 2 and at the ends of the series of discs ball shaped members 45 and 46 may 75 be provided. The discs may be graded in size as shown, and the gradation may be varied to suit different conditions.

I claim:—

1. The combination with a conductor, of an openwork conducting cage surrounding 80 said conductor and spaced outwardly therefrom for increasing the effective diameter of said conductor, said cage being of less length than said conductor.

2. The combination with a conductor, of 85 a series string of insulators connected therewith, and an open-work cage of conducting material for increasing the effective diameter of said conductor and surrounding said conductor adjacent said string of insulators, 90 but terminating at a point along said conductor spaced from said insulator string while said conductor continues beyond said point.

3. The combination with a conductor, of 95 a series string of insulators therefor supporting said conductor from one side thereof, and means extending along said conductor adjacent said insulator string for increasing the effective diameter of said conductor to prevent concentration of flux at 100 the surface of said conductor and to improve the potential gradient in said string, said conductor extending beyond said means and being substantially uniform in size. 105

4. The combination with a conductor, of an insulator supporting said conductor and disposed at one side thereof, and a member of conducting material extending along said conductor adjacent said insulator and spaced 110 from said conductor to increase the effective diameter thereof and thus prevent concentration of electro-static flux at the surface of said conductor adjacent said insulator, said conductor extending beyond the termi- 115 nation of said member.

5. The combination with a conductor, of a supporting insulator therefor, a flux control member connected with said conductor adjacent said insulator, and a cage of con- 120 ducting material extending continuously along said conductor adjacent said insulator and control member for a limited distance, said conductor continuing beyond said cage.

6. The combination with a conductor, of a 125 supporting insulator therefor, a flux control member connected with said conductor adjacent said insulator, and a cage of openwork

conducting material extending along said conductor adjacent said insulator and arranged to increase the effective diameter of said conductor to prevent concentration of stress at the surface of said conductor and to improve the potential gradient in said insulator, said conductor continuing beyond said cage.

7. The combination with a conductor having a substantially uniform diameter, of a supporting insulator string therefor, a flux control member connected with said conductor adjacent said insulator and operating to control the electro static gradient in said string, an insulator covering for said flux control member and an openwork conductor cage spaced outwardly from said conductor and extending continuously for a limited distance along said conductor adjacent said insulator, and flux control member to increase the effective diameter of said conductor for preventing concentration of flux and to improve the potential gradient in said insulator, the conductor extending beyond said cage.

8. The combination with a conductor, of an openwork cage of conducting material extending along said conductor, and means for spacing said cage varying distances from said conductor at different points along the length thereof.

9. The combination with a conductor, of a supporting insulator therefor, said conductor being suspended from said insulator, a cage of conducting material extending along said conductor adjacent said insulator for increasing the effective size of said conductor, and means for spacing said cage varying distances from said conductor at different points spaced at different distances from said insulator.

10. The combination with a conductor, of a series string of insulators therefor, a flux control member connected with said conductor adjacent said insulator, an open-work cage of conducting material extending along said conductor for a limited distance on each side of said insulator, and means for supporting said cage from said conductor at points spaced from said insulator.

11. The combination with a conductor, of a series string of insulators for supporting said conductor, a flux control member connected with said conductor adjacent said insulator, an open-work cage of conducting material extending along said conductor adjacent said insulator to increase the effective diameter of said conductor and prevent concentration of stress at the surface of said conductor and improve the potential gradient along said insulator, and means for spacing said cage from said conductor at points along the length thereof to control the electro-static field along said conductor.

12. The combination with a high potential conductor line, of an insulator for supporting said line, an open work cage surrounding said line adjacent said insulator, said cage terminating along said conductor at a point spaced from said insulator while said conductor continues beyond said point of termination of said cage.

13. In combination, a high potential conductor line substantially uniform in diameter, an insulator for supporting said line intermediate the ends thereof, conductor cages extending along said conductor in opposite directions from said insulator, said conductor cages terminating at points along said line spaced from said insulator while said line extends beyond said cages at opposite sides of said insulator.

14. In combination, a high potential conductor line of substantially uniform diameter, an insulator for supporting said line, and a cage of conducting material surrounding said line adjacent said insulator, said cage extending along said line away from said insulator and terminating at a point on said line spaced from said insulator, said cage being supported upon said line at a point spaced from said insulator.

15. In combination, a high potential conductor line, an insulator for supporting said line, a bar having one end thereof supported adjacent said insulator and having the other end thereof supported by said line at a point spaced from said insulator, and an open work conductor cage supported by said bar and surrounding said line.

16. In combination, a high potential conductor line, an insulator for supporting said line, and an open work cage of expanded metal surrounding said line adjacent said insulator and terminating at a point along said line spaced from said insulator.

17. In combination, a high potential conductor, a suspension insulator for supporting said conductor intermediate the ends thereof, a bar having one end thereof connected to said insulator and having its opposite end supported on said conductor at a point spaced from said insulator, said bar being curved upwardly away from said conductor intermediate its ends, and a cage of open work material supported on said bar and surrounding said conductor.

18. A structure for increasing the effective diameter of a conductor comprising a hollow member, and means for supporting said hollow member in electrical contact with a conductor adjacent the point of support of said conductor, said conductor extending beyond the termination of said hollow member.

19. A structure for increasing the effective diameter of a conductor comprising a hollow skeleton member surrounding said

conductor and extending longitudinally thereof for a limited distance at either side of the point of support for said conductor, the conductor extending beyond the termination of the hollow skeleton member. 40

20. A structure for increasing the effective diameter of a conductor comprising an elongated skeleton cage surrounding said conductor, one end of said cage being disposed adjacent a point of support for said conductor while the other end of said cage terminates at a point along said conductor, the termination of said cage being provided with means for minimizing the liability of discharge therefrom. 45

21. A structure for preventing the formation of corona along a conductor comprising an openwork cage surrounding a portion of said conductor adjacent the point of support therefor, said cage having the end thereof tapered inwardly towards said conductor at a point spaced from said point of support and provided with a rounded terminal member. 50

22. A structure for preventing corona losses from a high potential conductor comprising a skeleton cage surrounding said conductor adjacent a point of support therefor, said conductor having a terminal member provided with a rounded surface at a point spaced from said point of support. 55

23. A structure for preventing corona losses from a conductor and for effecting an advantageous distribution of stress adjacent a point of support for said conductor, said structure comprising a skeleton cage surrounding said conductor and having one end thereof disposed adjacent said point of support, the other end thereof being provided 60

with a rounded terminal surface at a point spaced from said point of support. 40

24. A structure for preventing corona losses from a high potential conductor and for effecting an advantageous distribution of stress adjacent a point of support for said conductor, said structure comprising an openwork cage extending along said conductor, supporting means for said cage mounted on said conductor, a terminal member for said cage spaced from said point of support and having a rounded surface, and an insulated flux control member connected with said supporting means. 45

25. The combination with a conductor having a portion of substantially uniform diameter, of a conductor cage of openwork material extending for a limited distance along said conductor and surrounding said conductor and spaced outwardly therefrom, said conductor extending beyond the termination of said conductor cage. 50

26. The combination with a conductor having a portion of substantially uniform diameter, of a support for suspending said conductor at a point between the ends thereof, and conductor cages of open work material surrounding said conductor and disposed at opposite sides of said point of support, said conductor cages being spaced outwardly from said conductor and extending for limited distances on opposite sides of said point of support while said conductor extends beyond the terminations of said conductor cages. 65

In testimony whereof I have signed my name to this specification on this 12th day of October A. D. 1921. 70

ARTHUR O. AUSTIN.