

March 20, 1934.

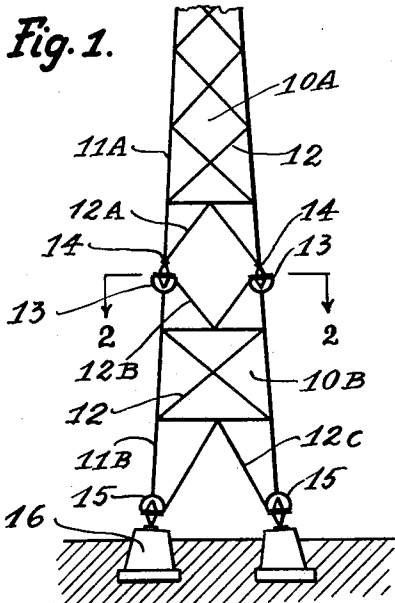
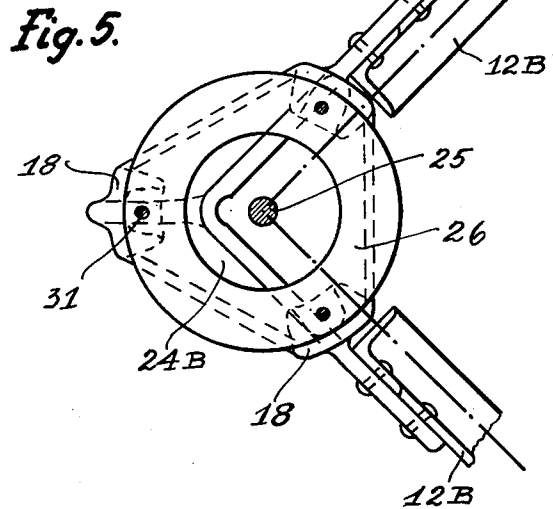
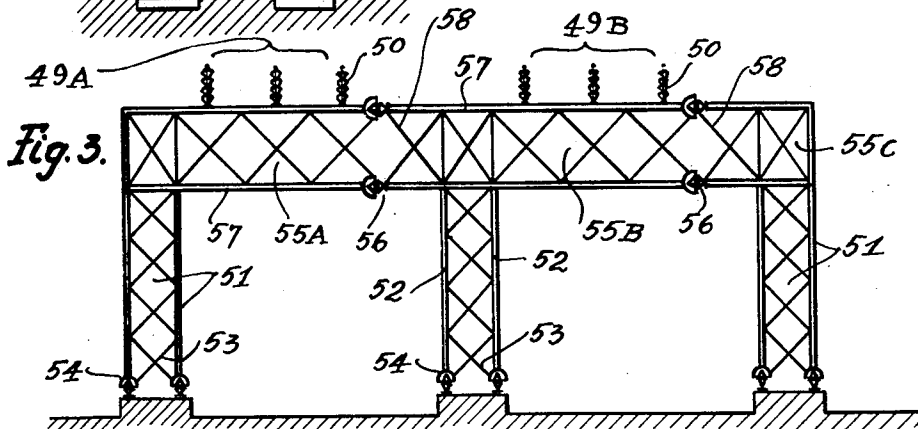
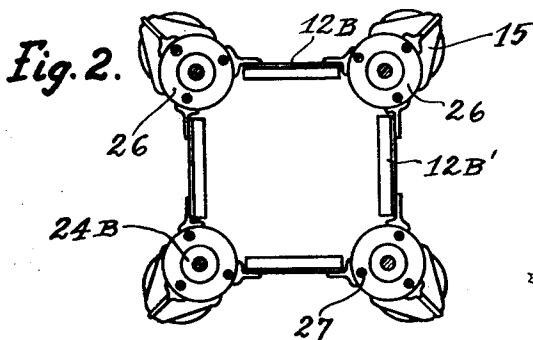
R. L. JENNER

1,952,011

INSULATOR COUPLING MEANS

Filed Oct. 4, 1932

3 Sheets-Sheet 1



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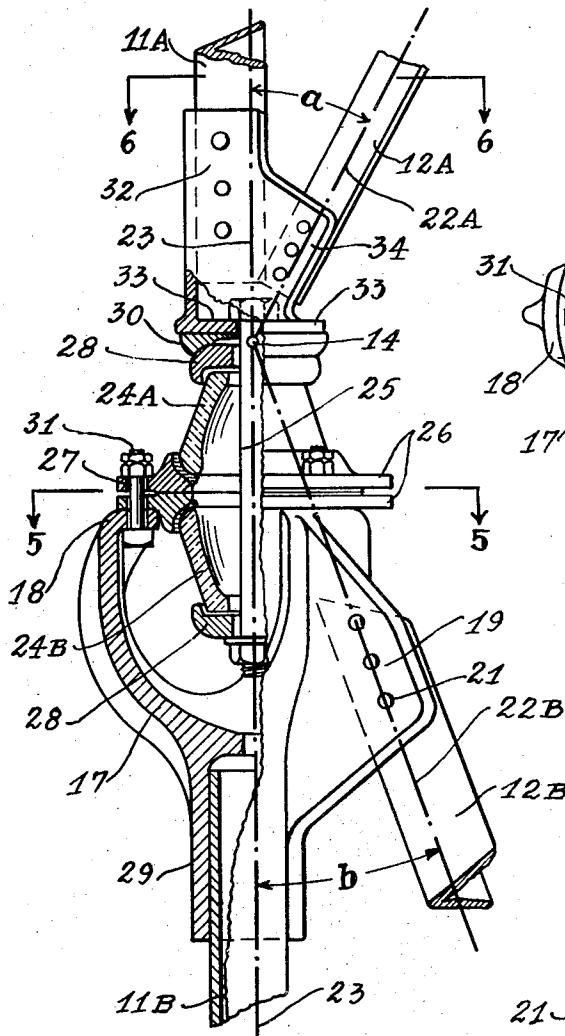
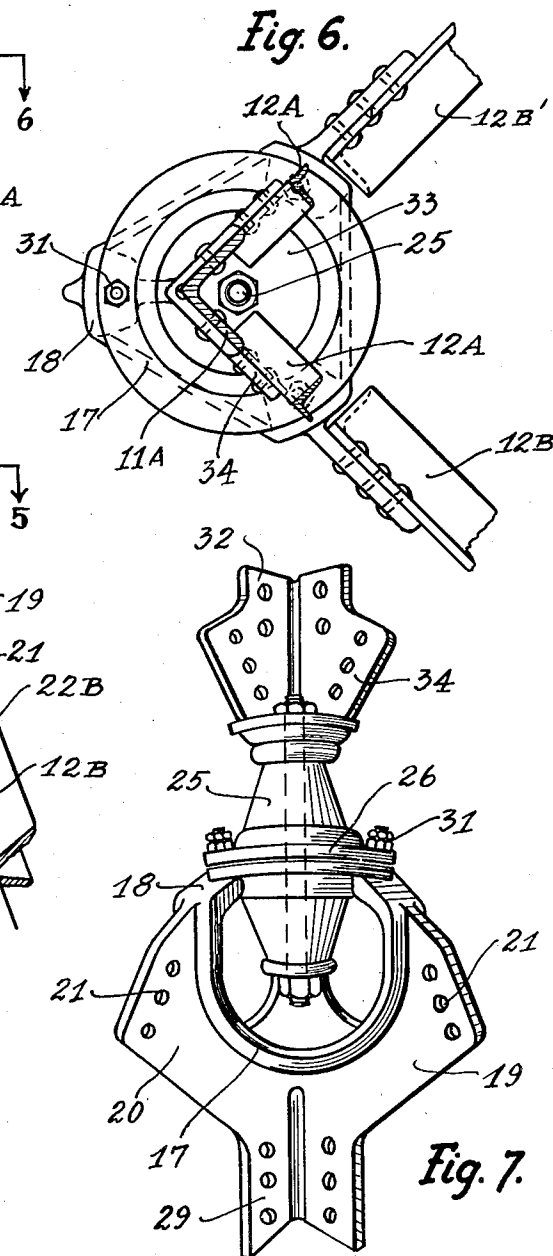
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INSULATOR COUPLING MEANS

Filed Oct. 4, 1932

3 Sheets- Sheet 2



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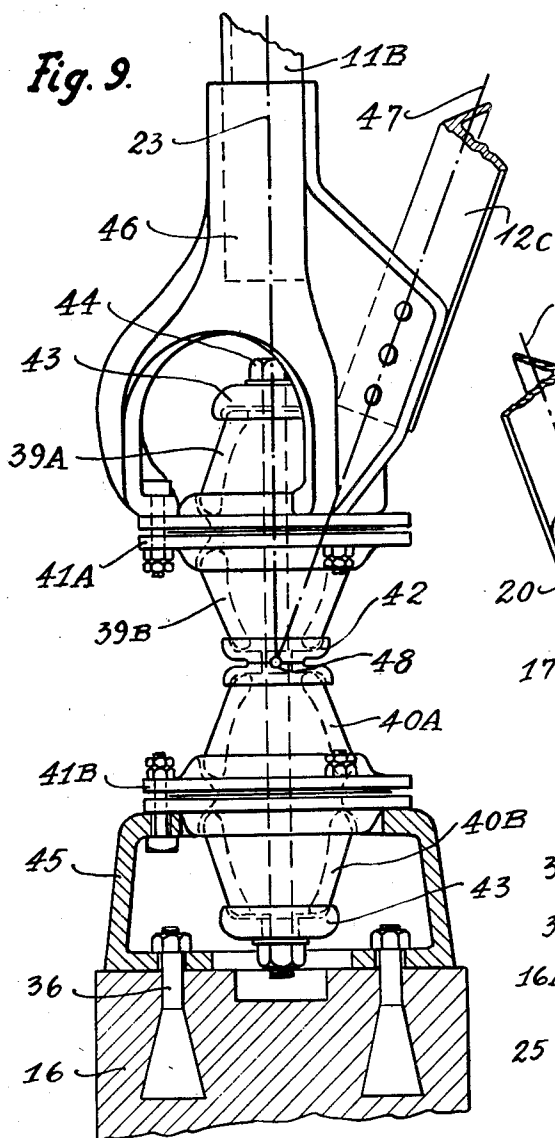
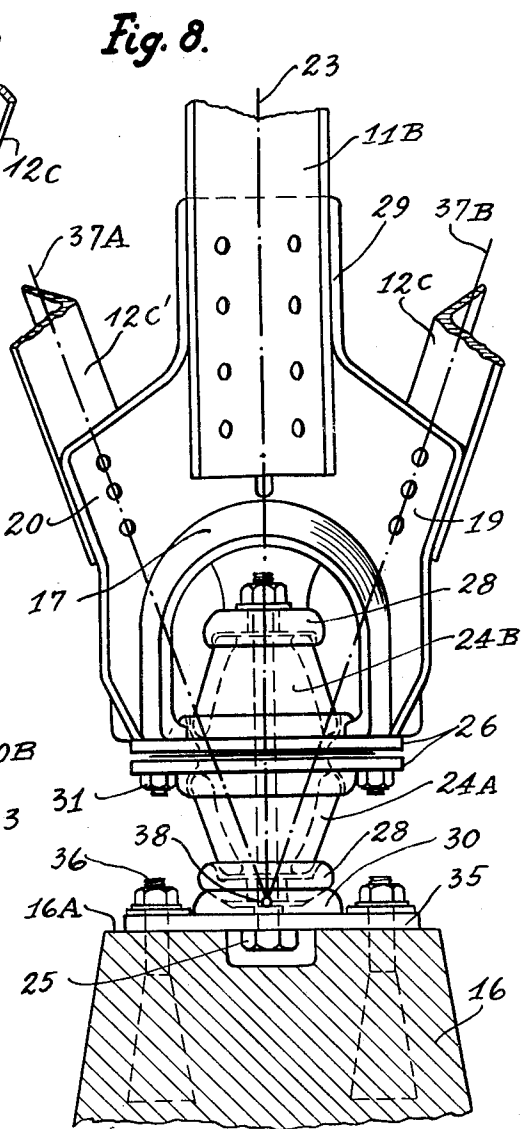
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1,952,011

INSULATOR COUPLING MEANS

Filed Oct. 4, 1932

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

1,952,011

INSULATOR COUPLING MEANS

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Application October 4, 1932, Serial No. 636,169

13 Claims. (Cl. 189—27)

This invention pertains to a novel system of insulator joint units adapted to interconnect a plurality of contiguous framework sections to form a unitary and selfsustaining mechanical structure of the laterally stabilized type, comprising a series of such sections that shall be electrically insulated from each other and which structure as a whole shall be capable of withstanding heavy working forces without sacrifice in normal load capacity because of the interposition of my insulator units. Said coupling may likewise be utilized as a foot or tie piece serving to uphold a massive tower or girder column in insulated relation with respect to the foundation pillars thereof.

My improved insulator coupling is particularly applicable to joining together fabricated metallic sections of the elongated box shaped girder type. Each such section may comprise one or more longitudinally disposed corner members or the like rectilinear chordbars which are kept rigidly spaced apart by means of diagonally disposed crossbraces or web straps. For present purposes, corresponding chordbars of the respective sections may be placed in direct tandem alignment and between each of these mated bar ends, a separate insulator coupling is preferably introduced. Each such joint may include a pair of separable clamping elements adapted to grip suitable insulator means therebetween, either or both of the respective clamping elements being provided with fastening means adapted to detachably secure an adjacent web strap thereto.

A more essential feature of the present invention resides in the use of a single pair of chordbars that are positively adjoined in endwise alignment by such an insulator unit and in which system an obliquely disposed brace strap is co-operatively associated to constitute a unitary sectionalized mast structure that shall be laterally stable when erected without the use of guy wires or other extraneous sustaining means. Another important aspect lies in a novel inclined disposition given to one or more such web straps with respect to the resultant line of force acting in a cooperating chordbar. Said reinforcing brace straps are preferably so arranged that the use of my interposed insulator joints shall not introduce any considerable extraneous secondary bending stress in any member comprised within the aforesaid framework beyond the primary stresses that would normally be expected when such structure is subjected to heavy transverse loading. By virtue of my improvements, I am therefore enabled to effectively insulate such tower, column or other girderlike sections at the minimum of fabrication weight and material requirements. It is further emphasized that my coupling may be inserted between an otherwise continuous chordbar as provided with a pair of diagonal brace straps that are oppositely directed away from said joint, to the end that a single insulator unit may appropriately interconnect said chordbars and at the same time serve to tie together the contiguous ends of such companion brace straps.

The object of my invention is to devise a simple and efficient insulator coupling of the indicated character and one that can readily be applied not only to radio or transmission towers, but also to columns, trusses and the like framework structures commonly used in high-tension substation or power house work. Embodied herein are other improved constructive features designed to facilitate the manufacture and application of my insulator unit to its intended purposes, all of which will hereinafter be set forth in detail.

Reference is had to the accompanying three sheets of drawings which are illustrative of certain specific embodiments of my invention, and in which drawings:

Fig. 1 schematically shows a fragmental side elevation of a sectionalized radio or antenna tower equipt with my insulator joint devices, while Fig. 2 is a transverse view thereof as taken along the parting line 2—2 of Fig. 1.

Fig. 3 illustrates an elevational view of a substation bay provided with sectionalized trusses and columns that are insulated by means of my couplings.

Fig. 4 represents an enlarged side view of one such insulator coupling unit applied to an intermediate tower portion of Fig. 1 as taken in partial section through the insulator cones of said coupling, and Fig. 5 is a transverse view thereof as taken through the parting line 5—5 of Fig. 4.

Fig. 6 details a top view of the Fig. 4 disclosure taken on the line 6—6 of Fig. 4, while Fig. 7 is a perspective assembly of my insulator coupling considered as a marketable commodity prior to being installed in place.

Fig. 8 shows an enlarged elevational view of an inverted coupling applied to the foot of a supporting column, and Fig. 9 discloses a similar but modified view in which multiple pairs of truncated cone insulators are axially superimposed.

The description will first be directed to the preferred mode of applying my insulator joint to certain structural purposes. Referring to Fig. 1, this represents an antenna mast or the like sus-

pension tower of the rigid quadrilateral type which may comprise a plurality of superimposed sections, 10A, 10B, etc. These tower sections may respectively include one or more angle iron corner members, such as a pair of tandem aligned upper and lower chordbars 11A and 11B that respectively cooperate with a plurality of independent latticed brace straps such as 12, secured to constitute a metal framework of the sectionalized open box type. As will be understood, the other tower sidefaces are usually given a like configuration.

Each pair of separable chordbars 11A and 11B has an insulator coupling 13 inserted therebetween, these joint units being here shown similarly located in a common transverse plane. In the vicinity of one such insulator coupling, the complementary adjacent brace straps 12A and 12B are preferably disposed in an oppositely inclined or K formation with respect to their cooperating chord bar. Another pair of similar straps lying in the adjoining rectangular tower face, may also be made to cooperate with this same chord bar, the arrangement then being such as to provide for two upwardly directed and two downwardly directed brace straps, respectively headed toward a common intersecting or crotch region designated 14. It is in this particular location that it is preferred to install my insulator coupling in a certain advantageous relation to said intersection.

The same general type of insulator joint designated 15, may also be interposed at the base of each upstanding tower leg so as to rest snugly upon their respective foundation blocks such as 16, in an improved manner presently to be pointed out in further detail.

It will be observed that the cross-sectionally square tower (Fig. 1) has by the use of my couplings, been divided into a plurality of insulated superstructure sections such as 10A and 10B, etc. The required number of sections depends upon the intended tower purposes; for high tension transmission work, it usually suffices to insulate each foot of the respective downcoming chordbars, while in the case of radio towers, the sectionalizing thereof may be similarly multiplied to any desired extent. In the latter instance, the effect is to alter the fundamental or natural electrical frequency of the tower, which in turn prevents undue dissipation or resonant interference with the wave energy that is being impressed upon or sent out from its suspended antenna medium.

Because of its own weight and transverse windage loading that is likely to be imposed upon an upstanding tower of this kind, stresses of considerable magnitude are normally anticipated in the chordbars and their various tie and strut cross straps. For present purposes, such bodily loading of the tower may be considered as being transmitted through the several tower members in their respective resultant lines of force which approximately coincide with the center of gravity of the sectional profile that may be given thereto, assuming all such component members to be mounted in the conventional straight line fashion of my exemplification.

Referring now to Figs. 4 to 7 which disclose the more pertinent structural aspects of an insulator coupling, this may comprise a chalice-shaped body or other style of chambered housing 17. The forked lip end of said metal casting may be suitably ribbed and turned to provide for a plurality of apertured flange segments such as 18

that are shown perimetrically spaced apart. The dome surface of said housing is shown equipt with one or more radially outstanding attaching fins 19 and 20 which are respectively adapted to have an aligning brace strap end such as 12B, bolted or otherwise secured thereto. To this end, a series of drilled fin holes 21 may be disposed lengthwise of the auxiliary resultant force line 22B that is represented in dotted and dashed outline to correspond with the diagonal brace strap 12B. Said force line is preferably disposed in an inclined relation with respect to the major axis of my chalice-shaped housing as measured by the acute angle "b" (see Fig. 4) and which axis is preferably kept in substantial alignment with the principal resultant line of force 23 of the angle iron chordbars 11A and 11B in order to obviate eccentric loading on part of the interconnecting housing 17. To facilitate the desired connection between the last named chordbars, the housing dome region may be extended as at 29 and given a trough shape adapted to snugly embrace its overlapping chordbar for riveting purposes. As shown, the housing extension may be merged and formed as a continuation of the fins 19 and 20.

As a further improvement, the auxiliary or strap force line 22B when projected upwardly, is made to intersect with its cooperating principal force line 23 at a predetermined point designated as 14. This preferred disposition likewise applies to the corresponding diagonal brace strap 12B' (see Fig. 5) that may be disposed in rectangular relation to its mate in an adjoining tower face. It is emphasized that this common intersecting point 14 is preferably chosen to coincide with the crotch region of the previously described K bracing members with the result that no substantial secondary or increased bending forces will be set up in a truss or tower framework because of the introduction of my insulator coupling. That is to say, the anticipated normal brace stresses prevailing in said tower would not be materially altered by the installation of my coupling in the above defined manner.

My insulator medium may comprise the use of a pair of superimposed and reversely mounted, tubular frustrums or truncated cones 24A and 24B, preferably fabricated from porcelain, ceramic, or other suitable insulator material. Owing to the fragile nature and low inherent tensile strength of such material as compared to its compression strength, it is preferred to maintain both such inverted twin cones under a relatively heavy initial clamping pressure by the use of an internally disposed tie bolt 25 or the like means.

For the purpose of insulator securement, I may provide for a centering ring 26 of the laminated plate type which is shown cemented between the bases of said complementary cones, the circumscribing portion of said ring being kept amply spaced from said bolt and equipt with perimetrically disposed flange holes such as 27. The disclosed ring affords a parting surface therebetween to facilitate the dismantling of the insulator unit, but if desired, a substitute one-piece ring may be resorted to. The outermost or apex ends of the insulator cones are respectively provided with oppositely disposed crown plates such as 28. Each plate is shown centrally apertured and has the bolt loosely fitted therethrough to provide for lateral clearance and its free topmost surface may be given a spherical edge formation. A dished universal slipper 30 is adapted to slidably seat in socketed fashion upon the spherical edge of one such plate.

When my insulator is mounted in place as shown in Fig. 4, the ring 26 may be made to span the intumed housing flange segments 18 and be secured thereto by the use of the flange bolts 31 or the like fastening means. The slipper cap 30 is shown snugly fitted around the bolt 25; superimposed upon this cap is a chordshoe 32 comprising an apertured foot flange or other supplementary plate 33 through which the bolt 25 is also assembled. If preferred, the slipper cap and foot flange may be integrally formed. Said shoe is oppositely disposed with respect to the housing element 29 and adapted to have a downcoming chordbar such as 11A securely fastened thereto. After tightly pulling upon said through bolt 25, the contiguous ends of the aligned corner cars 11A and 11B will be firmly coupled together by means of my interposed insulator unit.

The shoe 32 may further be equipt with one or more extended brace ears such as 34, which correspond to the inverted similar housing fins 19 and 20. The ear 34 serves to attach a downwardly inclined brace strap thereto in substantial alignment with its particular force line such as 22A (see Fig. 4). This line may be directed to the common crotch point 14, its inclination with respect to the principal force line 23 being measured by the acute angle "a". The diverging brace straps 12A and 12A' (see Fig. 6) are preferably arranged in an oppositely inclined relation with respect to their common chordbar 11A.

It will be observed that the force line intersecting point 14 is so located as to fall centrally within the region of the cap 30, also that should the component structural members tend to spread apart or contract transversely of the tower axis at different rates, relief will be afforded by virtue of my slip joint means which allow a limited movement to occur between the respective seated caps 30 and their underlying crown plates 28.

The cited slip provision serves to reduce the corresponding tilting moment which might otherwise be imposed upon the confined insulator cones and thus protects such inherently fragile material against injury under unwonted service conditions. The use of the clamping bolt 25 subjects the superimposed insulator cones to considerable initial endwise thrust. In order to obtain a diagonally directed compression in the porcelain as measured with respect to the bolt axis, the crown plate 28 is preferably given a smaller diametral dimension than the cone base. Furthermore, in the event any cocking moment should be imposed tending to bodily tilt the tower superstructure, the resulting pull or thrust falling along certain of its chordbars, will augment the initially balanced compression in one of the insulators and correspondingly reduce the compression in its mate. As will be obvious, the interposed Fig. 4 style of coupling may also be reversely mounted without change in the function thereof.

The further description will now be centered upon the minor modification required to apply the same style of insulator coupling 15 at the base of the Fig. 1 tower or any similar column-like structure. Referring to Fig. 8, the housing 17 has here been inverted. The lowermost crown plate 28 and its cooperating universal slipper cap 30 may now be mounted upon an apertured sole or supplementary plate 35 which is shown secured to its block 16 by means of the foundation bolts 36, in which rearrangement, the function of said supplementary plate virtually corre-

sponds to the shoe foot flange 33 as used in Fig. 4.

When projected, the principal resultant line of force 23 falls in substantial alignment with the insulator bolt 25. The lowermost diagonal brace straps such as 12C and 12C' are again given the defined characteristic inclination in order that their respective auxiliary force lines 37A and 37B may intersect in a common point such as 38, which is preferably lodged within the crown plate confines, as shown. Said intersection has been purposely carried closely contiguous to the upturned block face 16A to permit of safely using relatively small foundation bolts.

Should the upstanding tower be subjected to a strong crosswind or the like tilting moment about its foundation, this is likely to exert a heavy upward pull lengthwise of certain force lines, which in turn may subject the sole plate 35 to a severe localized cocking moment. A resulting equivalent transverse force component may be considered as applied at the intersection 38 and should this point be raised further above the face 16A, a proportionately augmented cocking moment would have to be counteracted by the sole plate bolts 36. By holding at a minimum the distance between the intersecting point 38 and the face 16A, the load imposed upon the laterally spaced foundation bolts may be correspondingly reduced.

In Fig. 9 there is represented another modification of my insulator joint which may likewise be applied for foot coupling purposes. In this alternative, multiple twin insulator cones (namely 39A and 39B, also 40A and 40B) have been arranged in tandem to withstand a correspondingly higher electrical tension. Each twin unit may be equipt with an independent centering ring such as 41A or 41B. The abutting cone apexes may be adjoined through a pair of slidably disposed separator caps such as 42 or if preferred, the insulator cones 39B and 40A may be integrally formed. A separate crown plate 43 covers each outermost free end of these aligned cones and a through tie bolt 44 may be made to hold such insulators in the desired assembled relation.

Resting upon the foundation block 16 is shown a hollow base casting 45 adapted to mount the ring 41B from which the lowermost cone 40B depends. Suitably placed foundation bolts serve to fixedly retain said casting in place. The uppermost ring 41A may be demountably attached to the inverted housing member 46 which latter may be substantially identical with the similar structure 17 previously described in connection with Fig. 4. The projected primary resultant force line 23 is here made to intersect with an auxiliary force line such as 47 at a point 48 lying within the region of the caps 42. As will be apparent, the Fig. 9 multiple type of twin cones may be substituted for any of the previously described more elemental insulator assembly.

Fig. 3 illustrates the manner in which a fabricated truss may be similarly sectionalized. In this instance, said insulator couplings are applied to a substation bay or the like power distributing framework adapted to carry a series of three phase, high tension conductors such as 49A, 49B, etc. In addition to their conventional pedestal insulators such as 50, the respective electrical circuits are kept further insulated from each other by my coupling units, although supported by a common sectionalized metal structure.

Such bays generally comprise a plurality of laterally spaced columns or the like supplement-

tary structures such as 51, which may be built up to include vertical chordbars such as 52 and cross straps such as 53 in a fashion substantially similar to the previously defined tower components. The lowermost column straps are preferably made to terminate in a diagonal relation to their contiguous chordbars as shown. At the respective projected force line intersections thereof, I again introduce an insulator unit such as 54 which corresponds to the tower base unit 15. Supported upon said columns, is a virtually continuous girder comprising the sections 55A, 55B, 55C, etc. which are electrically separated from each other by use of insulator couplings such as 56 that are essentially similar in structure to the interposed tower unit 13 (see Fig. 1). Each girder section preferably comprises a plurality of chordbars or horizontally disposed corner members such as 57 which at their respective terminal regions cooperate with a diagonal brace strap such as 58. While in the present disclosure, each insulated section comprises a column and an interconnected girder element, the arrangement may readily be altered to suit requirements.

By means of the described sectionalized bay sections, any flash over or other grounding fault suffered by one of the power circuits, will not disturb an adjoining circuit. A separate relay transformer may be operatively connected between the ground and each of said bay sections to automatically throw the circuit breakers of any faulty power circuit supported by said bay structure.

In the various disclosed coupling installations, each pair of my tubular insulators is preferably disposed to lie wholly to one and the same side with respect to the force line intersection associated therewith and have the common longitudinal axis of such superimposed insulators placed in substantial alignment with one such force line. It is believed the foregoing description taken in connection with the accompanying drawings, will make evident how to interpose my insulator couplings for the purpose of electrically sectionalizing a metallic tower or the like mechanically continuous girder structure. It will further be obvious that equivalent expedients may bodily replace or eliminate one or more of the conical insulator elements that have been described in association with my coupling devices; also that the cooperating brace straps may be adjoined to such coupling without necessarily having their respective force lines meet in a common point or disposed in a common plane.

It is emphasized that the described coupling unit is also adapted to be incorporated into certain existing tower or bay sections of suitable framework design without demanding supplemental reinforcement because of the installation of my insulator devices. Other advantages afforded by my improved mode of insulating fabricated structures are thought apparent to those skilled in this art and it is to be understood that I reserve the right to materially modify my illustrative embodiments, all without departing from the spirit and scope of my invention heretofore described and more particularly pointed out in the appended claims.

I claim:

1. A sectionalized framework of the selfsustaining and laterally stabilized type comprising a chordbar for each section thereof respectively mounted endwise in mated contiguous alignment, a two part insulator coupling provided with tie-bolt means and which coupling is interposed be-

tween a pair of contiguous chordbar ends, and a reenforcing strap mounted obliquely with respect to the coupled chordbars and of which strap its converging end region is directly connected in bracing relation to one of the coupling parts and positively retained with respect to the other coupling part through the medium of the aforesaid tie bolt means, the longitudinal axis of said means being placed in substantial lengthwise alignment with the mated chordbars.

2. A multifaced framework comprising adjoining sidefaces arranged in intersecting relation, complementary chordbars disposed end to end in substantial lengthwise alignment with the intersecting region of said sidefaces, an insulator coupling interposed between said chordbars and which coupling includes oppositely disposed attaching means respectively serving to secure an adjacent chordbar end thereto, and a separate brace strap associated with each of the sidefaces, said brace straps being divergently mounted and having their respective converging end regions secured to said coupling attaching means.

3. In a sectionalized framework of the selfsustaining type adapted to withstand transverse loading and have certain of its component parts subjected to stress along the respective resultant force lines thereof, a chordbar for each section thereof respectively disposed in mated endwise alignment, an interposed insulator coupling serving to positively interconnect two contiguous chord bar ends in a laterally stabilized relationship, and a pair of brace straps obliquely associated with the aforesaid two chordbars in coplanar relation thereto and which brace straps are oppositely inclined toward and positively secured to said coupling, said brace straps being arranged to have their respective force lines intersect in a common point that is coincident with the force line location of one such chordbar.

4. In a sectionalized framework structure of the selfsustaining type adapted to withstand transverse loading and have certain of its component parts subjected to stress along the respective resultant force lines thereof, said structure comprising a chordbar for each section thereof respectively disposed in spaced endwise alignment, a pair of brace straps obliquely associated with said chordbars and divergently arranged to have their respective force lines intersect in a common point lying intermediate the contiguous ends of a certain mated pair of such spaced chordbars, and an interposed coupling provided with an apertured insulator element having tiebolt means extending therethrough and which means serves to positively unite the aforesaid certain pair of spaced chordbar ends in a laterally stabilized relationship, said insulator element being disposed between one such chordbar end and the aforesaid force line intersection.

5. A fabricated metal structure comprising a series of adjoined framework sections, each such section including a pair of laterally spaced chordbars mounted in a substantially aligned and mated endwise relationship to the corresponding chordbars of the next adjoining section, an independent brace strap disposed diagonally across certain of such chordbar pairs, and two-part insulator coupling means of the separable type interposed between adjacent end regions of correspondingly mated chordbars, one part of such coupling being provided with fastening means serving to secure a contiguous brace strap thereto.

6. A plurality of coupling units adapted to electrically insulate a metallic framework struc-

ture provided with longitudinally disposed chordbars that are laterally spaced apart and interconnected by obliquely disposed brace strap means, each such unit comprising a coupling housing equipt with a lip flange element and also with an extension element which latter serves to secure a chordbar and a brace strap thereto, relatively flat centering means mounted upon said lip flange, complementary tubular insulators respectively superimposed in reversed upstanding relation upon opposite sidefaces of the centering means, apertured crownplate means cooperating with each of the respective free extremities of said insulators, supplementary plate means operatively associated with one of said crown plates, and tie means entered through the respective crownplate apertures and serving to mutually compress said insulators toward the interposed centering means.

7. A plurality of coupling units adapted to electrically insulate a metallic framework structure provided with a plurality of chordbars that are laterally spaced apart and interconnected by obliquely disposed brace strap means, each such unit comprising a flanged coupling housing having an extension element serving to secure a chordbar and a brace strap thereto, relatively flat centering means superimposed upon and secured to said lip flange, complementary tubular insulators reversely disposed upon opposite sidefaces of the centering means, apertured crownplate means cooperating with each of the respective free extremities of said insulators, a socketed slipper member operatively mounted upon one such crownplate in a laterally slidable relationship thereto, and tie means entered interiorly of the insulators through the respective crownplates and serving to retain said slipper in the aforesaid slidable relationship.

8. A plurality of insulator coupling units adapted to electrically insulate a metallic superstructure provided with a pair of longitudinally disposed chordbars that are laterally spaced apart and interconnected by brace strap means, each such unit comprising a flanged coupling housing equipt with an extension element serving to attach thereto one such chordbar and an adjacent brace strap, relatively flat ring means mounted upon the coupling flange, a pair of tubular insulators reversely superimposed upon opposite sidefaces of said ring to constitute an insulator assembly, an additional similar ring and insulator assembly disposed in tandem relation to the first named assembly, an apertured crown plate for each free terminal region of the respective insulator assemblies, and clamping bolt means entered interiorly of the several insulators and through the respective crownplates thereof.

9. A plurality of insulator coupling units adapted to insulate and support a superstructure provided with a pair of longitudinally disposed chordbars that are laterally spaced apart and interconnected by brace strap means, each such unit comprising a flanged coupling housing equipt with an upturned extension element serving to attach one such chordbar thereto and which flange is transversely disposed at the opposite lowermost region of said housing, relatively flat ringlike means mounted upon the coupling

flange, a tubular insulator superimposed in endwise relation upon the lowermost sideface of said ringlike means, a crownplate associated with the free extremity of said insulator, supplementary plate means placed beneath said crown plate, and tie means securing the supplementary plate and serving to compress the interposed insulator toward said ring.

10. In a framework superstructure provided with longitudinally disposed chordbars that are held apart laterally by diagonal brace strap means and which components are subjected to stress along the respective resultant force lines thereof, a plurality of laterally spaced insulator coupling units interposed beneath said superstructure, each such unit comprising a coupling housing equipt with a downwardly faced flange and an upturned extension element serving to attach a chordbar and also a divergent brace strap thereto arranged to have their respective force lines intersect, relatively flat ringlike means mounted upon said flange, a tubular insulator depending from the lowermost sideface of said ringlike means, and plate means associated with the free extremity of said insulator, the divergence between the aforesaid force lines being such as to place their intersection in the region of said plate.

11. A framework superstructure provided with a chordbar and a diagonal brace strap disposed in acute angular relation, the converging ends of said chordbar and brace strap being kept laterally spaced apart and the respective axes thereof when projected, being arranged to intersect some distance beyond the adjacent chordbar end, and a coupling provided with fin housing means serving to interconnect the aforesaid contiguous ends and which coupling is equipt with depending insulator means interposed wholly between said intersection and the adjacent chordbar end.

12. A framework structure provided with a chordbar and a diagonal brace strap disposed in acute angular relation, the converging ends of said chordbar and brace strap being kept laterally spaced apart and the respective longitudinal axes thereof when projected being arranged to intersect outwardly beyond the adjacent chordbar end, and a coupling provided with means serving to interconnect the aforesaid contiguous ends and which coupling is equipt with multiple pairs of insulators interposed in series between said intersection and the adjacent chordbar end.

13. In a supported superstructure provided with a longitudinally disposed chordbar having a brace strap cooperating with said chordbar in an obliquely disposed relation thereto, the combination of an insulator coupling comprising a housing serving to mount centering ring means together with a pair of tubular insulators reversely superimposed upon opposite faces of said ring and which coupling further includes tie means for exerting an initially balanced thrust upon the interposed ring, said housing being fixedly attached to the centering ring and provided with means extending outwardly away from one ring face into a positively secured relationship with the aforesaid chordbar and also its cooperating brace strap.

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