Sept. 29, 1936. W. H. BURLESON 2,055,650

INSULATED STRAIN DEVICE

Filed March 28, 1935

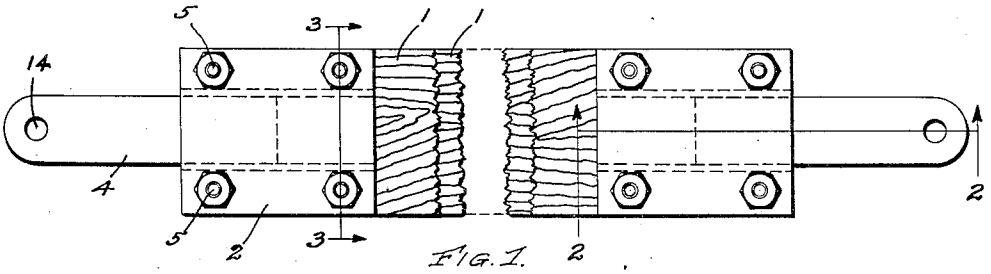


FIG. 1.

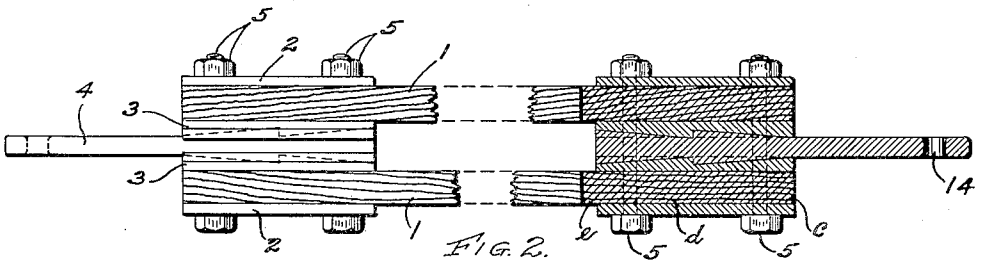


FIG. 2.

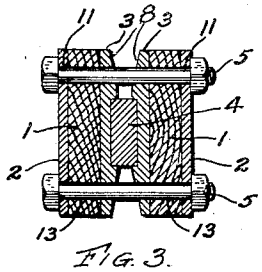


FIG. 3.

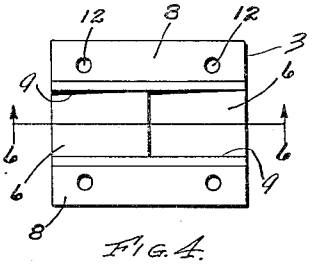


FIG. 4.



FIG. 5.

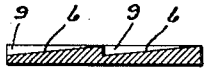


FIG. 6.

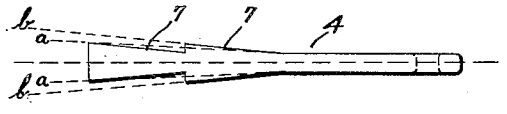


FIG. 7.

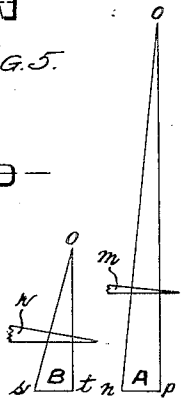


FIG. 9.

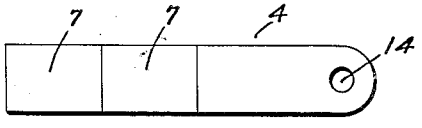


FIG. 8.

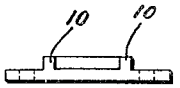


FIG. 11.

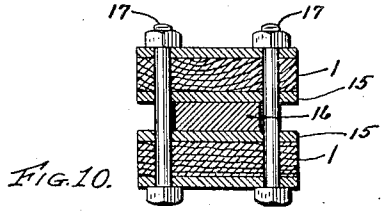


FIG. 10.

Inventor

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By

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UNITED STATES PATENT OFFICE

2,055,650

INSULATED STRAIN DEVICE

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Application March 28, 1935, Serial No. 13,525

11 Claims. (Cl. 173—366)

My invention relates to insulators comprising wood or other insulating material and provided with fittings for securing the device in service.

One of the objects of my invention is to provide an insulator in which the stresses tending to shear the insulating member are transferred from a small section of the insulating member to a larger area thus reducing the shear stress per unit area of the wood.

Other objects of my invention will be disclosed in the description to follow.

My invention resides in the new and novel construction, combination and relation of the parts shown in the accompanying drawing and described in the following specification and as particularly pointed out in the claims.

In the drawing:—

Fig. 1 is a face view of my invention.

Fig. 2 is an edge view of Fig. 1.

Fig. 3 is a partial section on the line 3—3 of Fig. 1.

Fig. 4 is a face view of the inside plate which I employ.

Fig. 5 is an end view of Fig. 4.

Fig. 6 is a section of Fig. 4 on the line 6—6.

Fig. 7 is an edge view of the wedging member I employ.

Fig. 8 is a plan view of Fig. 7.

Fig. 9 shows two force diagrams as later explained.

Fig. 10 is a partial section on the line 3—3 of Fig. 1 showing a modified construction.

Fig. 11 is an end view of a modified form of inner plate shown in Fig. 5.

In the construction of high voltage lines, it is often desirable and very advantageous to employ insulators in which wood is the insulating medium as it lends itself to the economical and practical construction of insulators suitable for extremely high voltages.

In the past the constructions of such insulators have been such as did not permit putting to full use the ultimate safe strength of the insulating material as such past constructions limited the portion of the wood member to which the working stress was applied thus subjecting such limited portion to a high unit stress and endangering the device to a breakdown mechanically at a low value as compared with the total value of the wood portion and greatly reducing reliability and dependability.

In my improved construction I transfer the working load applied to the device from one of shear over a limited section of the wood to a shear over practically the entire cross-section of the wood, thus reducing the shear stress per unit area of the wood, which permits the application of a greater mechanical stress to the insulator or of increasing the reliability at a lower stress.

In the preferred construction of my invention I employ a pair of parallel and spaced members 1 of insulating material, preferably wood, on account of its cheapness and ease of forming to the shape and size desired and its proven adaptability for the purpose required. To the ends of the members 1 are secured a series of fittings through the medium of which attachments may be made to the device and whereby increase in stress upon the device will automatically increase the compressive stress upon the wood members thus relieving the shear on the wood back of the bolts (between end of members 1 and bolts) and transferring such shear to the full section of the wood ahead of the bolts.

The end fittings comprise outer plates 2, inner plates 3, wedge attachment members 4 and the holding bolts and nuts 5.

The faces of the cooperating members 3 and 4 have wedge bearing surfaces 6 and 7 respectively. I prefer to have the cooperating members 3 and 4 provided with a plurality of wedge surfaces in place of a single wedge surface, as it is possible to vary the angle of the wedging surfaces and thus vary the wedging force without varying the spacing between the members 1, as will be noted in Fig. 7. The wedge as shown is provided with two wedging surfaces on each face and if this member were furnished with single wedge bearing surfaces on each face such surfaces would correspond to the dotted lines *a*. Such wedge would have the same spacing as the wedge as shown in full lines with double wedge surfaces but the wedging action would be much greater than in the double surface wedge.

If the wedge shown in Fig. 7 were constructed with single wedging surfaces corresponding to the dotted lines *b* it would give the same wedging effect as the double wedge surface, but the spacing of the members 1 would be increased. It is desirable to keep all parts as close to the longitudinal or neutral axis of the device as possible.

The inner plate 3 is shown with wedge bearing surfaces midway of the sides and corresponding to those on the wedge, and the sides 8 are tapered in order that the compressive forces applied to the wood members 1 by the wedging action of the members 3 and 4 will be distributed more uniformly throughout the portion of the members 1 subjected to such force. If the wedge members 4 were made the full width of the plate 3 then the plate 3 could be made of substantially uniform construction throughout, but in my preferred construction I find it possible to subject a rather limited portion of the inner plate to the wedging force and, therefore, to distribute the stress uniformly over the plate I find it advisable to taper the side portions 8.

The side walls 9 of the inner plate act as lateral guides for the wedge member 4 thus keeping it aligned with the longitudinal axis of the device.

In Fig. 11 I have shown a modification of the inner plate which is substantially uniform in thickness but provided with the upstanding side members 10 for guiding the wedge member 4. This form is adapted where the stress upon the device is of limited character.

The outer plates 2 are shown as of uniform cross-section throughout but may be arched or ribbed if so desired to distribute the stress.

The outer plates 2 and the inner plates 3 are each provided with holes 11 and 12 respectively to receive the bolts 5. The members 1 are also provided with openings 13 to receive the bolts 5.

The wedge member 4 is provided with an opening 14 by means of which attachment may be made thereto.

The selection of the angle for the wedging surfaces can be considerably varied and the results materially changed. The angle of the surfaces 6 and 7 will depend upon three factors, namely, (1) the relationship of the longitudinal force placed upon the device to the perpendicular force to which it is desired to subject the members 1; (2) the separation of the members 1; and (3) the amount of yield of the members 1 and stretch of the bolts which must be compensated for by longitudinal movement of the wedges.

In order to reduce the shear in the portions *c* and *d* back of the bolts 5 and transfer such shear to the wood members ahead of the bolts 5, as at *e*, it is necessary to place sufficient compression upon the members 1 between the plates 2 and 3 to distribute the longitudinal stress as much as possible uniformly over the entire end portion of the members 1 and it is evident that this compressive force can be varied by changing the angle of the wedging surfaces as shown in Fig. 9 by the diagram of forces.

If the wedge angle is *m* as in Fig. 9A, the longitudinal force *np* will exert upon the wood member 1 a compressive force *op* while if the wedge angle is *r* as in Fig. 9B, then the longitudinal force *st*, which is shown as equal to the longitudinal force *np*, will produce a compressive force upon the members 1 equal to *ot*, which is somewhat less than half of the force *op*. The wedging angles should be such that the compressive or transverse force upon the members 1 shall be large as compared with the longitudinal force.

The openings 11, 12 and 13 are made to receive the bolt 5 with practically no clearance, therefore, the plates 2 and 3 and bolts 5 are fixed relative to the members 1 and any relative movement which takes place between the parts is that between the members 3 and 4 due to the aforesaid yielding of the parts 1 and 5.

The use of two parallel insulating members in place of a single member has particular advantage where the device is used on high tension lines subject to lightning disturbances and electrical discharges which would form over or through the members 1 and would tend to shatter the same and thus destroy its mechanical value. Where a plurality of members 1 are used, the chance of total destruction of the device is greatly reduced which is not true if the device is constructed of a single strain member.

It is quite evident that if the direction of slope of the wedging surfaces 6 and 7 be reversed then a compressive force can be applied to the members 4 in a longitudinal direction and the device employed as a supporting element in compression in place of a supporting element in tension as shown in Figs. 1 and 2.

In Fig. 10 I have shown the inner plate 2 as a plain plate 15 and the wedge 16 made of such width as to extend the full width of the space between the bolts 17, thus the bolts 17 will act as guides to maintain the wedging member 16 in aligned relation with the longitudinal axis of the device and the compressive stress set up will be directly distributed over a larger area of the members 1.

Wood has a tendency to shrink regardless apparently of the degree to which it has been dried and with a constant force applied to the members 4, the compression upon the members 2 will be constant regardless of the shrinkage therein within reasonable limits.

Modifications will suggest themselves to those skilled in the art, hence I wish to be limited only by my claims.

I claim:—

1. A strain device comprising in combination a stress member comprising a pair of spaced elongated and parallel members of insulating material having parallel outer and inner faces, a metallic plate positioned on opposite outer faces at each end of the stress member, a metallic plate positioned on the opposite inner faces at each end of the stress member, each of the last said plates having one or more tapered surfaces, a wedge member positioned between the last said plates at each end and having one or more wedge surfaces on opposite faces of the wedge member corresponding and coacting with the wedge surfaces on the inner plates tending to spread the plates when a longitudinal stress is applied to the wedge members tending to separate the plates in a transverse direction, fastening means holding the said spaced members from separating when the wedge members are strained in a longitudinal direction and so interlocked with the plates and stress members as to prevent relative movement between these parts and means on the wedge members to make an attachment thereto and means on the inner plates to guide the wedge member and prevent transverse displacement thereof.

2. A stress device comprising in combination an elongated stress member of spaced and parallel members of insulating material, metallic plates at each end of the stress member on its outer opposite faces and fastening means extending through the plates and stress member to hold the parallel members against separation beyond a predetermined spacing and hold the plates and parallel members against relative movement, a one-piece slidable wedge member positioned between the parallel members at each end and having a wedging bearing surface and means for attachment thereto, plates interposed between each wedge member and each parallel member and having wedging bearing surfaces to be engaged by the corresponding surfaces on the wedge member, the coacting wedging surfaces being clamped tightly together by the fastening means and resisting movement of the wedge members relative to each other when a force is applied to each tending to change their longitudinal relation.

3. A stress device comprising in combination a stress member having a pair of spaced elongated members of insulating material and means extending transversely through the spaced members to maintain them against separation beyond

a predetermined amount, wedging members positioned between the spaced members and having wedging bearing surfaces and attaching means, guide and stress distributing plates interposed between the wedging members and the spaced members and having wedging bearing surfaces cooperating with those on the wedging members and tending to further separate the spaced members when stress is applied to the wedging members in opposite directions.

4. A stress device comprising in combination a stress member having a pair of spaced members of insulating material, holding means interlocked with the spaced members to maintain them against separation beyond a predetermined spacing, metallic means positioned against the inner faces of the spaced members and held in fixed position relative to the spaced members by the holding means and spreading means positioned between the said metallic means to maintain the predetermined separation of the spaced members and cooperating with the metallic means to resist slipping of the spreading means and exert a further spreading force upon the spaced members when longitudinal strain is placed upon the spreading means.

5. A stress device comprising in combination a stress member having a pair of spaced members of insulating material, holding means interlocked with the spaced members to maintain them against separation beyond a predetermined spacing, metallic means positioned against the inner faces of the spaced members and held in fixed position relative to the spaced members by the holding means and spreading means positioned between the said metallic means to maintain the predetermined separation of the spaced members and cooperating with the metallic means to resist slipping of the spreading means and exert a further spreading force upon the spaced members when longitudinal strain is placed upon the spreading means and means on the confronting faces of the metallic means cooperating with the spreading means to maintain the spreading means in alignment with the longitudinal axis of the stress member.

6. An insulator comprising in combination, a pair of spaced elongated insulating members, plates positioned against the inner faces of the said members adjacent their ends and having wedging bearing surfaces on their inner faces, one-piece stress members of less width than the said plates positioned between the plates and having wedging bearing surfaces cooperating with those on the plates, and means holding the spaced member against further separation when the stress members are subjected to longitudinal forces and preventing relative movement of the plates and spaced members.

7. An insulator comprising a stress member having a pair of spaced elongated insulating members, metallic plates disposed on opposite sides of each spaced member adjacent the ends thereof and arranged to grip the spaced members, the inner plates provided with inclined bearing surfaces on their inner faces, strain members positioned between the inner plates and having inclined bearing surfaces cooperating with the bearing surfaces on the plates, means interlocked with the spaced members to hold the said parts in assembled relation and resist the spreading of the spaced members when the strain members are placed under stress and guide the strain members for longitudinal movement.

8. A stress device comprising a stress member having spaced members of insulating material and an outer and an inner gripping plate engaging each spaced member adjacent its end, the confronting faces of said inner gripping plates, each having an inclined bearing surface thereon, means holding the said parts in fixed relation and the spaced members against spreading, strain fittings of less width than the inner plates positioned between the inner plates and having inclined bearing surfaces to exert a wedging force pressing the inner plates against the spaced members and transferring the strain placed upon the strain fittings to the spaced members connecting the gripping plates and means to prevent lateral movement of the strain fittings relative to the plates.

9. An insulator comprising a pair of spaced elongated insulating members, holding plates engaging the adjacent inner faces of said members, said holding plates having wedging bearing surfaces on their adjacent inner faces, a stress member positioned between said holding plates and movable relative thereto in a longitudinal direction and having wedging bearing surfaces cooperating with the wedging bearing surfaces of said holding plates and means holding said spaced insulating members from further separation when said stress member is subjected to a load tending to produce relative movement of said cooperating wedging surfaces.

10. An insulator comprising a pair of elongated insulating members, holding plates engaging the adjacent inner faces of said members adjacent each end thereof, said holding plates having wedging bearing surfaces on their adjacent inner faces, a stress member disposed between the plates at each end of said insulating members and movable relative to the plates in a longitudinal direction, said stress members having wedging bearing surfaces cooperating with the wedging bearing surfaces of said holding plates and means holding the spaced insulating members from further separation when the stress members are subjected to longitudinal forces tending to produce relative movement of said cooperating wedging bearing surfaces and guide the movement of the stress members in a longitudinal direction.

11. An insulator comprising a stress member having a pair of spaced members of insulating material and gripping plates in pairs and each pair of plates comprising an inner and an outer plate engaging with and gripping an end of one of said spaced members and the plates of each pair having a plurality of registering openings, the inner plate of each pair having a plurality of inclined bearing surfaces on one face, a strain fitting having a plurality of inclined bearing surfaces to engage and coact with the bearing surfaces on two adjacent and inner plates for transferring the load on the strain fittings to the stress member and cause each pair of plates to grip its spaced members and transversely disposed means extending through the openings to interlock with the plates and spaced members to hold them against relative movement and guide the strain fittings.

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