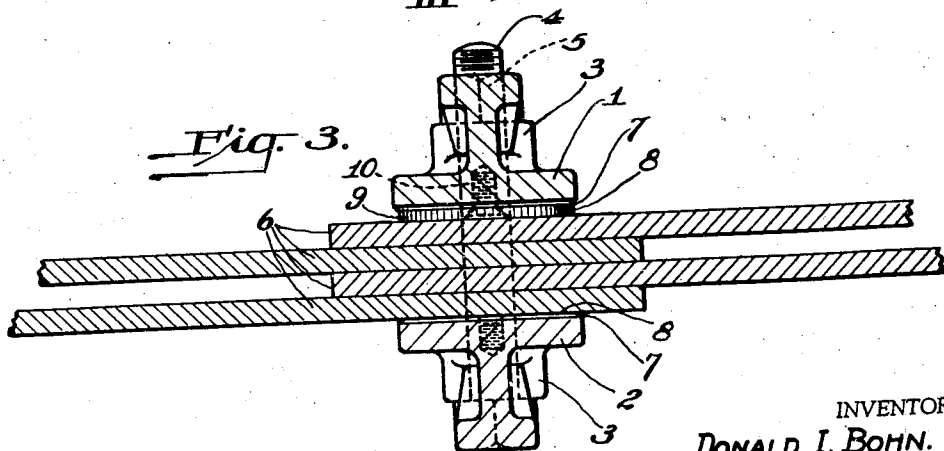
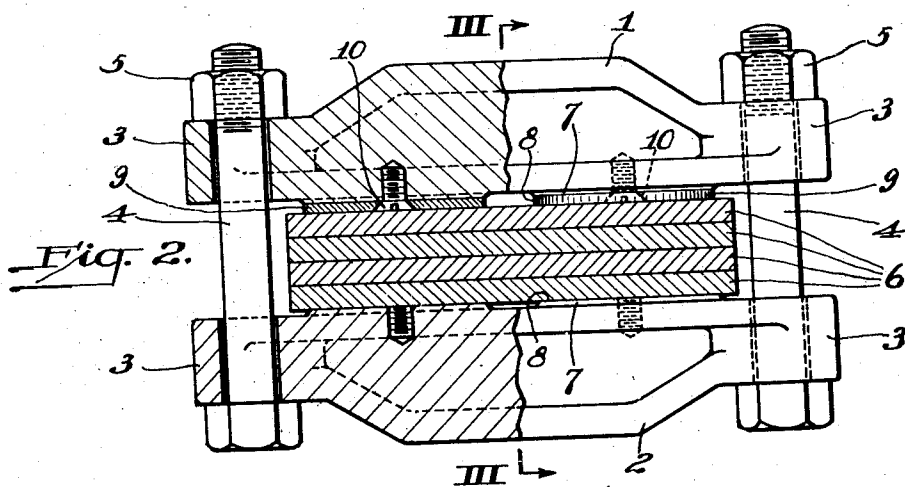
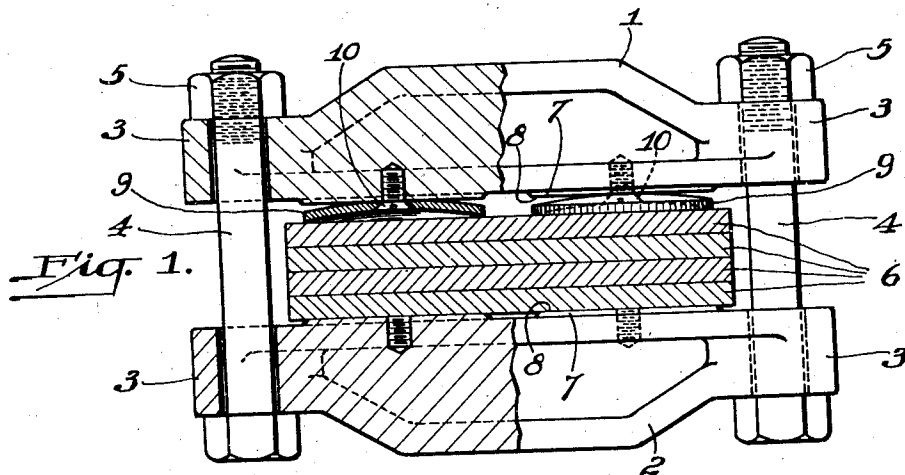


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D. I. BOHN
CONDUCTOR CLAMP

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BY

INVENTOR.
DONALD I. BOHN.

J. Ernest Law.
ATTORNEY.

UNITED STATES PATENT OFFICE

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CONDUCTOR CLAMP

Donald I. Bohn, South Hills, Pa., assignor to
Aluminum Company of America, Pittsburgh,
Pa., a corporation of Pennsylvania

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This invention relates to clamps for joining electrical conductors. The invention relates particularly to clamps for holding together portions of electrical conductors to produce a strong mechanical joint and good electrical connection therebetween.

Electrical conductors have been fastened together by several different means. For example, it has been common practice to join bus bars by drilling holes through overlapping end portions thereof and fastening them with bolts passing through the holes. This means has been found impractical in many instances, as, for example, where a large number of bus bars are to be joined together to form a single joint. In this case all of the bars must either be predrilled and all of the holes lined up before the bolts can be entered, or the holes must be drilled through a great thickness of metal after the bars have been overlapped. When it is considered that electrical conductors are often connected in inaccessible and elevated places, it is apparent that considerable inconvenience and delay are occasioned in joining them by this means.

Another known device for fastening together electrical conductors comprises two metal plates each having a uniplanar working face. The plates are placed one upon each side of the overlapped portions of the conductors and pulled together by bolts passing through lugs on the plates extending beyond the edges of the overlapped conductors. This type of clamp avoids the necessity for drilling the conductors but has the inherent disadvantage of causing permanent deformation of the conductors at their edges, with resultant relief of the pressure, as a result of bowing of the clamping plates between the bolts when the clamp is applied. This bowing also results in relatively low pressures upon the conductors in the areas toward the center of the clamp due to the arching of the working faces of the plates in these regions. The net result has been that this clamp has not been entirely satisfactory.

In order to compensate for this bowing effect, clamps have been developed having plates with normally convex working faces intended to concentrate the pressure intermediate the edges where the metal cannot be as easily deformed. When these clamps are applied to the conductors, it is intended that the bolts be drawn down until the working faces of the plates have become parallel, but it has been found difficult to determine when this condition existed, and the result has been that either too much force has

been exerted in turning down the bolts, so that bowing of the plates similar to that occurring in the clamp mentioned above has occurred, or insufficient pressure has been exerted, causing slipping and burning in the joint.

In either of the aforementioned clamps the proper degree of force to be applied in turning down the bolts to obtain the correct pressure desired upon the conductors is not readily determinable since it depends upon the estimation and judgment of the individuals applying the clamp, which are variable factors. Another difficulty inherent in such clamps is their tendency to loosen upon subjection to temperature changes, due to the difference in the coefficients of expansion of the conductors and the clamps.

One object of the present invention is to provide an improved clamp for joining electrical conductors which in use requires no drilling of the conductors. Another object of the invention is to provide such a conductor clamp capable of maintaining effective clamping pressure over relatively wide temperature changes. Another object is to provide a conductor clamp capable of exerting an increased, predetermined pressure concentrated inwardly of the longitudinal edges of the conductors clamped. The invention has as a further object the provision of a conductor clamp having telltale means by which it can be readily ascertained when the desired predetermined pressure has been applied. Another object is to provide a clamp which comprises oppositely-disposed plates having telltale means attached thereto and raised gripping surfaces cooperating with the telltale means to concentrate all of the pressure exerted by the clamp at areas intermediate the longitudinal edges of the conductors.

The invention comprises broadly a clamp having two clamping members in the form of plates with oppositely-disposed faces adapted to be bolted or otherwise drawn together around the conductors to be clamped without drilling the conductors, and having disposed therebetween one or more springs of predetermined full load capacity, that is, capable of exerting a known predetermined force when completely compressed. The springs are so arranged that as the plates are drawn together the springs are compressed between a portion of the clamp and the conductor to apply and concentrate the clamping pressure at areas inwardly of the longitudinal edges of the latter, and that they serve, when totally compressed, to indicate that sufficient clamping force has been applied. The inven-

tion also contemplates the provision of raised gripping surfaces upon the clamping plates for cooperation with said springs in producing the pressure at said areas, which will be more fully described hereinbelow.

The invention will be more readily understood by reference to the accompanying drawing which illustrates the preferred embodiment thereof as applied to the joining of bus bars of rectangular cross-section.

In the drawing:

Fig. 1 represents an elevational view, partly in section, of the preferred embodiment of the invention showing the position of the parts before tightening of the clamp.

Fig. 2 is a view similar to Fig. 1 and shows the position of the parts when the clamp is in operative clamping position.

Fig. 3 is a sectional view taken on the line III—III of Fig. 2.

With reference now to the several figures, the conductor clamp of this invention comprises two clamping plates 1 and 2 provided with lugs 3 having holes therethrough for the reception of threaded bolts 4. Nuts 5 are provided on the threaded portion of bolts 4 for cooperation therewith in drawing the two plates together to clamp the overlapping ends of bus bars 6 between them. The plates 1 and 2 intermediate the lugs 3 are preferably of I cross-section, and on the opposing faces are provided with raised, oppositely-disposed, circular bosses 7 having flat working surfaces 8. Spring washers 9 of conical shape are mounted concentrically on the bosses 7 of plate 1 by means of threaded bolts 10 passing through countersunk holes in the washers and engaging with threaded holes in the plate.

Each washer is of no greater diameter, and preferably of the same diameter, when in flattened condition, as the working surface of the boss to which it is attached and that of the oppositely-disposed boss on plate 2, as clearly shown in Figs. 2 and 3. In addition the bolts 4 are spaced from the springs 9 and the bosses 7 so that the longitudinal edges of the bus bars may extend between the bolts and both the springs and bosses. Thus, the presence of the springs between the working face of one clamping plate and the bus bar spaces one plate from the longitudinal edges of the overlapped bus bars, and the oppositely-disposed boss on the other plate similarly spaces the other plate, so that the clamping pressure is applied and concentrated between the longitudinal edges of the bars. It is possible, by use of the clamp of this invention, which insures a properly distributed clamping pressure upon the conductors at the portions intermediate the edge portions, to obtain higher total pressure than in the known clamps of the same size.

In application, the clamp of this invention is provided with springs of the correct predetermined full load capacity depending upon the pressure desired and is placed around the overlapping ends of the bus bars to be joined in the position shown in Fig. 1. The nuts are then drawn down and the plates 1 and 2 approach one another as the washers are gradually compressed against the adjacent bus bar. When the springs become substantially flattened between the bus bar and the plate, as shown in Fig. 2, there is a sudden sensible increase in the force necessary to turn the nuts down any further and

in this position the predetermined clamping pressure exists and the nuts should not be further drawn down. Thus the springs act as a telltale or indicator in providing a simple and positive means for determining when the correct predetermined amount of pressure has been reached, in addition to concentrating the clamping pressure between the edge portions of the bus bars.

Springs may be selected having loading characteristics such that when slight movements of the clamping plates away from each other occur, due to temperature changes while the clamp is in use, the springs, even though not in completely flattened condition, will exert an effective clamping pressure and thus maintain the original high joint conductivity.

It is to be understood that the invention is not limited to the particular structure shown and that various modifications may be made without departing from the spirit of the invention. For instance, springs may be used on both plates of the clamp, in which case the bosses may be eliminated, if desired, or the springs may be used on a plate having a uniplanar surface with a second plate having cooperating raised bosses. Springs in suitable forms other than the conical washers shown may be used with bosses having working faces conforming to the shape of the springs when in flattened condition.

I claim:

1. A clamp for fastening together a plurality of substantially flat conductors and the like comprising a pair of opposed clamping members, a cambered spring washer secured at the center of convexity thereof to a flat inner face of one of said members, said washer being adapted to be compressed toward and flattened against said face of said member, a boss raised from the inner face of the other of said members having a surface forming a flat clamping face, said boss encompassing an area substantially coextensive with that encompassed by said washer and disposed opposite said washer, said washer and said boss serving as means for spacing said members from objects clamped and for thus confining applied clamping pressure within the areas mutually encompassed thereby, and means releasably connecting opposed ends of said members but spaced from said washer and said boss for drawing up said members and holding the same in clamped relationship on opposite sides of objects clamped, said means being thus adapted to compress and flatten said washer between said washer securing member and objects clamped, whereby flattening of the washer upon drawing up the clamping members produces a predetermined pressure in the clamp and telltale indication that such pressure has been produced noticeable by visual inspection and by manually sensible change in the resistance of the clamp to being drawn up.

2. A clamp for fastening together a plurality of substantially flat conductors and the like comprising a pair of opposed clamping members, a plurality of cambered spring washers secured at the centers of convexity thereof to a flat inner face of one of said members, said washers being adapted to be compressed toward and flattened against said face of said member, a like plurality of bosses raised from the inner face of the other of said members having surfaces forming flat

clamping faces, said bosses encompassing areas substantially coextensive with those encompassed by said washers and being disposed opposite said washers, said washers and said bosses serving as means for spacing said members from the objects clamped and for thus confining applied clamping pressure within the areas mutually encompassed thereby, bolts releasably connecting opposed ends of said members but spaced from said washers and said bosses, and nuts for drawing up said bolts and holding said members in clamped relationship on opposite sides of objects clamped, said nuts and bolts being thus adapted to compress and flatten said washers between said washer securing member and objects clamped, whereby drawing up the nuts and bolts flattens the washers to produce a predetermined pressure in the clamp noticeable by visual inspection and by sensible change in the resistance of the clamp to being drawn up.

3. A clamp for fastening together a plurality of substantially flat conductors and the like comprising a pair of opposed clamping members, a substantially conical spring washer secured at the center thereof to a flat inner face of one of said members, said washer being adapted to be compressed toward and flattened against said face of said member, a boss raised from the inner face of the other of said members having a surface forming a flat clamping face, said boss encompassing an area substantially coextensive with that encompassed by said washer and disposed concentrically with said washer, said washer and said boss serving as means for spacing said members from objects clamped and for thus confining applied clamping pressure within the areas mutually encompassed thereby, and means releasably connecting opposed ends of said members but spaced from said washer and said boss for drawing up said members and holding the same in clamped relationship on opposite sides of objects clamped, said means being thus adapt-

ed to compress and flatten said washer between said washer securing member and objects clamped, whereby flattening of the washer upon drawing up the clamping members produces a predetermined pressure in the clamp and tell-tale indication that such pressure has been produced noticeable by visual inspection and by manually sensible change in the resistance of the clamp to being drawn up.

4. A clamp for fastening together a plurality of substantially flat conductors and the like comprising a pair of opposed clamping members, a plurality of substantially conical washers secured at the centers thereof to a flat inner face of one of said members, said washers being adapted to be compressed toward and flattened against said face of said member, a like plurality of bosses raised from the inner face of the other of said members having surfaces forming flat clamping faces, said bosses encompassing areas substantially coextensive with those encompassed by said washers, said washers and said bosses being located along end to end axes of said members and serving as means for spacing said members from objects clamped and for thus confining applied clamping pressure within the areas mutually encompassed thereby, bolts releasably connecting opposing ends of said members but spaced from said washers and said bosses, and nuts for drawing up said bolts and holding said members in clamped relationship on opposite sides of objects clamped, said nuts and bolts being thus adapted to compress and flatten said washers between said washer securing members and objects clamped, whereby drawing up the nuts and bolts flattens the washers to produce a predetermined pressure in the clamp noticeable by visual inspection and by sensible change in the resistance of the clamp to being drawn up.

DONALD I. BOHN.