Feb. 10, 1942. S. P. BECKER 2,272,630

CLAMP CONNECTOR

Filed March 24, 1939

FIG. 1.

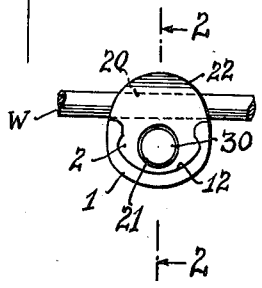


FIG. 2.

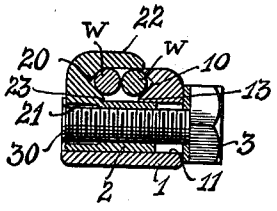


FIG. 4.

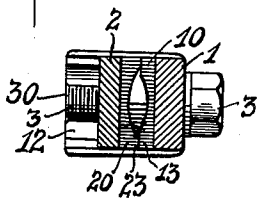


FIG. 3.

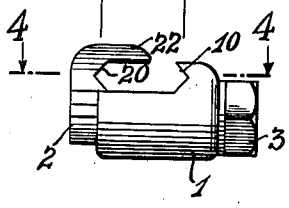


FIG. 6.

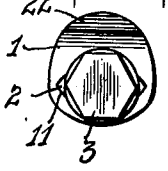


FIG. 5.

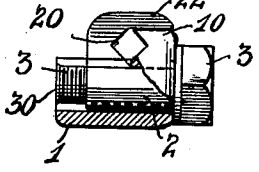
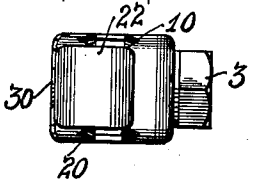


FIG. 7.



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Patented Feb. 10, 1942

2,272,630

UNITED STATES PATENT OFFICE

2,272,630

CLAMP CONNECTOR

Stephen P. Becker, Poughkeepsie, N. Y.

Application March 24, 1939, Serial No. 263,952

10 Claims. (Cl. 24—263)

My invention pertains to a connector of the clamp type for securing wires, such as electrical conductors, together, and more specifically to that class of such connectors having a pair of opposed jaws between which the wires are clamped. Such connectors are particularly useful for making solderless splices in electrical circuits, and for securing tap wires to a main or feeder conductor wire.

In general my clamp connector includes two opposed parallel jaws, each preferably being of the V type for best engagement with wires of various diameters. One jaw is formed integral with a slide extending toward the other jaw, while such other jaw is integral with a body provided with a guide cavity complemental to and receiving the slide. Since joints for which these clamp connectors are used must be taped, my connector is of minimum size and most appropriate shape to facilitate this operation, consistent with efficiency of its use and secure clamping of the number and sizes of wires to be joined. The head of a clamping screw engages the body of the connector and its shank is screwed into an axial bore in the slide for drawing the jaws toward each other to clamp the wires therebetween. To prevent appreciable turning of the slide in the body guide and yet to keep the slide of minimum size without sacrificing the requisite strength, the slide and body guide therefor are of approximately elliptical cross section, the minor axis of such section being just slightly greater in length than the bolt diameter. The junction of the slide sides at the ends of the major axis may be either a small arc or an angle, both types of junction being included within the description of the slide as of approximately or substantially elliptical cross section. The preferred type, illustrated in the drawing, is the latter, which may be said to be of double segmental cross section, each half defined by the major axis being substantially a segment of a circle.

This approximately elliptical slide has an axial bore extending therethrough which is threaded preferably from the jaw to the end telescoped into the body guide cavity. The slide jaw end of this bore is enlarged to a diameter greater than the root diameter of the thread. The bolt, having its head engaged with the body and being in tension during the clamping action, enters the threaded end of the slide bore first, and, with the parts in closed or nearly closed position, extends on through the enlarged and unthreaded portion of the guide's bore to project beyond the slide. The length of the bolt's shank is very nearly the same as the length of the body so that the bolt end will never appreciably propect beyond the body end opposite that engaged by the bolt head. So that the connector will always be a unit wherein the parts will not become disassembled and perhaps lost, the end of the bolt shank is enlarged, as by being peened, upset, or the end of the threads deformed, whereby the shank end cannot enter the threaded portion of the guide's bore, but may pass freely through the enlarged portion of such bore. The length of such enlarged bore portion will determine the maximum distance which the jaws can be separated and hence will limit the size of wire which can be inserted into the clamp between its overlapping jaws.

Because the slide is of approximately elliptical cross section instead of rectangular, the contour of the whole assembly, including the body and jaws can be made of generally elliptical cross section, preferably approaching a cylindrical shape, the major axis of the assembly coinciding with the minor axis of the slide. Since the bolt does not project appreciably beyond the body, all corners and sharp projections which would tend to cut the wrapping tape are eliminated. The continuously curved contour of the complete connector lends itself to smooth and easy wrapping of the least possible bulk.

The general object of my invention, therefore, is to provide a clamp connector of efficient structure, yet one which is exceedingly compact and of smoothly rounded contour, with no projections, which can be tape wrapped with the least effort and time expenditure, and which will require a minimum amount of tape both because of its shape and because there are no corners or sharp projections which must be padded with several layers of tape to prevent eventual puncture or severance of the insulating sheath.

It is a further object to make such clamp connector a unitary structure, the parts of which cannot become disassembled with the attendant danger of loss of parts thereof, and the parts of which cannot be swivelled or otherwise dislocated from their useful relationship, but are restricted to relative linear movement between clamped and unclamped positions.

Since it is intended that my clamp connector be furnished in several sizes, each to be used to clamp wires only within a certain range of diameters, it is an object of my invention to proportion and shape the parts of my clamp connector and to limit the movement of such parts so

that a wire of larger diameter than that intended to be accommodated cannot be inserted into the connector, and the connector cannot be made up tightly on wires of smaller diameter or aggregate bulk than those with which a connector of a particular size was intended to be used.

It is an object to provide a clamp connector as small as possible compatible with the strength and operation required, and to this end the nesting parts are made so that each is of a shape corresponding as closely as possible to the part next within it consistent with the respective functions of such parts, and as little larger than the next inner part as practicable for the strength necessary. Similarly, the parts which do not nest are designed to blend with the nesting parts in a manner to produce the most compact device as a whole capable of accomplishing the desired purpose in an efficient and convenient manner.

Still another object is to provide a clamp connector construction which will be easy to engage with the wires to be joined and in the use of which such wires may be retained in proper engagement with the connector with facility while it is being clamped.

It is also an object to provide a construction having the aforementioned characteristics of compactness, yet one in which the wires to be clamped and the clamping screw will be prevented from being forced together, and thereby mutilating each other, as the wires are drawn into clamped position.

More specific objects such as are inherent in various details of construction may be ascertained from the following description of a particular embodiment of my invention. The drawing illustrate a representative structure incorporating the principles and improved features of my clamp construction, the novel characteristics of which are particularly set forth in the appended claims.

Fig. 1 is an end elevation view of my clamp connector looking at the slide jaw end.

Fig. 2 is a longitudinal section taken on line 2—2 of Fig. 1 with the jaws in wire clamping position.

Fig. 3 is a side elevation view of my connector showing the jaws in fully extended position.

Fig. 4 is a longitudinal section on line 4—4 of Fig. 3, except that the jaws are fully closed.

Fig. 5 is a side elevation view of my connector similar to Fig. 3, except that the jaws are fully closed and part of the body is shown broken away to reveal the slide.

Fig. 6 is an end elevation view of the connector looking at the body jaw end.

Fig. 7 is a front elevation view of the connector.

Clamp connectors of the same general type are disclosed in my Patents 1,932,009 for a Wire clamp; 1,932,010, for a Line tap connector, and 1,950,771 for a Wire clamp and connector. The present connector incorporates improvements over the devices disclosed in these patents.

Wires W are inserted between and clamped together by two jaws, preferably of the V type. These jaws may be provided with transverse corrugations, if desired, to afford a better grip on the wires. One of these jaws 10 is formed integral with the body 1 of the connector, and is disposed transversely of such body alongside one end thereof. In the end of the body at which the jaw is located is formed a guide aperture extending lengthwise of the body. From the clamping side of the jaw 10 to its opposite end the body becomes a generally semi-elliptical shell or trough 12 in continuation of the guide aperture, serving as a guide for slide 2, its inner surface 12 being complemental in shape to the exterior surface of the slide. The longitudinal beaded trough edges of body 1 overhang the edges of the slide 2 at the ends of its major axis and fit into lateral indentations at the base of the slide jaw 20 formed integral with slide 2 at one end thereof. As shown clearly in Fig. 2, slide 2 extends from slide jaw 20 toward body jaw 10.

Jaws 10 and 20 are drawn toward each other, slide 2 telescoping within the body 1, by means such as a bolt 3. The head of this bolt engages the end of the body 1 adjacent to jaw 10. A washer, as shown, may be employed between the bolt head and body to give smoother operation. The shank of bolt 3 extends through the body guide aperture 11, through which slide 2 may extend, and is threaded into bore 21 of the slide. As shown in Figs. 2 and 4 the end of the bolt shank is very nearly flush with the end of body 1 remote from jaw 10. As the bolt is turned, slide 2 acts as a nut and moves along the bolt toward or away from the bolt head. The slide jaw 20 is thereby caused to approach or to recede from jaw 10 correspondingly, but the bolt does not move lengthwise. Hence whether the jaws are in the fully closed position of Figs. 4 and 5, the fully open position of Fig. 3, or the clamped position of Fig. 2 the end of the bolt shank can in no case project appreciably beyond the end of body 1.

Slide jaw 20 is shown as incorporating a lip 22 which is disposed to overlap jaw 10. This lip may be hooked over a conductor wire to support the connector while the wire to be joined thereto is being made ready for engagement with the connector. The workman's hands are thus left free for other duties. If desired, this lip might alternatively be provided on jaw 10 to overlap jaw 20, but the arrangement shown is preferred because the connector will most often be used in a vertical position and the head of bolt 3 will ordinarily be most easily accessible when hanging downward. Moreover the center of gravity of the assembly is closer to jaw 10 than to jaw 20, and the connector will therefore hang more nearly vertical and there will be less danger of it becoming disengaged from the wire when it is hung by jaw 20 than if it were hung by jaw 10. When all the wires to be clamped have been inserted between the jaws, turning of bolt 3 will quickly move lip 22 toward jaw 10 sufficiently to trap the wires between the body and slide on one side, the two jaws, and, on the side opposite to that first mentioned, lip 22. Thereafter, unless there is danger of a wire pulling out endwise, no attention need be given to holding the wires in place while the clamping operation is being completed.

Lip 22 serves another useful purpose, namely, preventing the employment of such a connector for clamping a wire of larger diameter than such connector was designed to accommodate. For one reason the width of the slot formed between the inner surface of lip 22 and the slide and body is a limiting feature. Also the degree of separation of jaws 10 and 20 permitted may be set so that the space between the adjacent, telescoping ends of lip 22 and jaw 10 will be only very slightly greater than the diameter of the largest wire with which the particular con-

nector is intended to be used. Separation of jaws 10 and 20 may be limited at the point desired despite the use of a bolt 3 having a shank not appreciably longer than the body 1 by a unique construction. Instead of being threaded throughout its entire length, the axial bore 21 of slide 2 has a portion with a diameter larger than the root diameter of the threaded portion, which extends inward from the slide jaw end of the slide. The end of the bolt shank is enlarged at 30 so that it will not pass into the threaded portion of bore 21, although it may move freely through the enlarged portion of this bore. Such enlargement of the end of the bolt shank will, of course, not be formed until after the parts of the connector have been assembled and the bolt has been screwed into slide 2 a distance sufficient so that its end projects beyond the slide jaw. It may then be enlarged either by a peening or other upsetting operation, or merely by deforming the shank end or the threads thereon sufficiently to prevent such end passing back into the threaded part of the bore. It is to be understood that reference to the end of the bolt shank as enlarged is intended to include any such deforming operation which will accomplish the intended purpose. The linear extent of the shank enlarging operation may be coordinated with the length of the enlarged portion of bore 21 so that extension movement of jaws 10 and 20 will be stopped by abutment of the bolt end 30 against the bore threads when the space between the adjacent edges of lip 22 and jaw 10 has increased to exactly the opening desired. In this way engagement of the connector with an appreciably oversize wire is prevented.

It is also desirable to control the minimum aggregate size of the wires to be clamped by a connector of given size. This is accomplished by providing a shoulder or ledge 13 on the body with which a shoulder or ledge 23 on the slide will abut to limit positively approach movement of jaws 10 and 20. It is to be particularly noted that these shoulders or ledges should abut to halt such jaw movement before the telescoping end of slide 2 reaches the jaw end of body 1 where it would engage the head of bolt 3 or its washer, as shown in Fig. 5. If movement of the jaws were not thus stopped the bolt would cease having any contracting action on the parts. Instead the bolt would no longer be pressed against the end of body 1 but would merely be screwed fully into its nut formed by slide 2. This would give the impression that the wires were being clamped, whereas actually the body and slide would be freely movable within the limits imposed by the body striking the bolt head or washer and engagement of the jaws proper.

In addition to limiting extension movement of the jaws for the reasons given, the structure described to accomplish that end serves another useful purpose, namely, it makes the connector a unit which cannot become disassembled. Heretofore this result has been accomplished by using a long screw as shown in my Patents 1,932,010 and 1,950,771 referred to above. Such sharp projecting part, however, makes complete taping of the installed connector difficult, requires more tape and the final joint is considerably more bulky. This is necessarily so because the sharp, projecting end of the upset bolt must be thickly wrapped with tape in order to prevent it eventually puncturing or splitting the insulating wrapping. The other alternative of the prior art was to utilize a short bolt such as shown in my Patent 1,932,009, to which previous reference was also made. In such case the disadvantages of the sharp edged, protruding bolt end were eliminated, but these were replaced by the clamp being readily and often unintentionally separable into the elements shown in Fig. 5 of that patent. This has proved to be such an undesirable characteristic that the long screw type has been most generally used in preference. Required strength is not sacrified by using only a part of bore 21 as the nut for bolt 3, for the full thread engaged thereby is of ample length. The length of slide 2 is also sufficient to prevent contact between the threads of bolt 3 and any wire before the clamping operation has progressed very much. The bolt threads and the wires are then mutually protected from mutilation.

As has been mentioned heretofore, after the joint has been made up it is usually completely wrapped with insulating tape. My connector enables such wrapping to be done in the shortest possible time and by the use of the least amount of tape, yet the completed joint is of symmetrical appearance and is smaller than where connectors of types known heretofore are used. The resulting saving in time and material possible by the use of my connector is a considerable economy on any job where a large number of splices or taps must be made.

It will be noted in Fig. 1 that the slide 2 is of approximately elliptical shape and that the guide cavity 11 of the body 1 is of similar, complemental shape. As shown in this figure the diameter of the bolt shank 1 approaches the length of the minor axis of the elliptical slide. In designing such a connector the first consideration is that the bolt be of a size to have sufficient strength to withstand the stress to which it is subjected. The minimum transverse dimension of slide 2 must, of course, be slightly greater than the diameter of bolt 3. It is desired also that the slide be other than cylindrical so that the engagement of the slide with the body guide cavity will prevent relative rotation of the slide and body, and hence the two jaws 10 and 20 will be kept parallel. Thus making the slide 2 of approximately elliptical contour will give the operation desired and, moreover, will enable the body shell to be given a rounded exterior contour. The sides of slide 2 have been illustrated as meeting at an angle forming a cross section of double segmental shape, but they may meet in a small arc, as in a true ellipse, while preserving practically the same shape of cross section. A section with any such slight variation I intend to embrace within the designation approximately or substantially elliptical. To complete a connector which will be of minimum size, of maximum strength and yet which will be as free from corners and as symmetrical as possible, the jaws 10 and 20 and the lip 22 are shaped to blend with the rounded body to form an assembly having a generally elliptical cross section, the major axis of which coincides with the minor axis of the elliptical slide. Where the shell portion of the body 1 stops, as shown in Fig. 1, the sides of jaw 20 continue in unbroken contour and such sides merge in gentle curves with the outer face of lip 22. Jaw 10, bridging one end of the guide shell's edges, similarly blends with contours of the body and lip 22 as seen in Fig. 6, and defines a generally elliptical aperture 11, or specifically an aperture of double segmental shape, adapted to receive

complementally the end of slide 2, as shown in Figs. 2, 5 and 6. A strong joint between this jaw and the guide shell is thereby formed, because the aperture is of minimum possible size compatible with the other features mentioned above. The result is that each part cooperates and blends with each other part to produce the operation desired by a clamp of the most efficient shape.

As my invention I claim:

1. A clamp connector, comprising a body jaw, a slide jaw, a slide of substantially elliptical cross section integral with said slide jaw and extending toward said body jaw, a body integral with said body jaw, complemental to and snugly embracing said slide over the major portion of its length, and means cooperating between said slide and said body operable to draw the slide jaw and body jaw toward each other and to telescope the slide into the body, thereby to clamp wires between said jaws.

2. A clamp connector, comprising a body jaw, a slide jaw, a slide of substantially elliptical cross section integral with said slide jaw and extending toward said body jaw, a body integral with said body jaw, complemental to and snugly embracing said slide over the major portion of its length, said slide jaw and said body cooperating to form a structure of generally elliptical cross section with its major axial plane coincident with the minor axial plane of said slide, and means cooperating between said slide and said body operable to draw the slide jaw and body jaw toward each other and to telescope the slide into the body, thereby to clamp wires between said jaws.

3. A clamp connector, comprising a body jaw, a slide jaw, a slide integral with said slide jaw and extending toward said body jaw, said slide having therethrough an axial bore threaded over a portion only of its length, that portion thereof extending inward from the slide jaw end having a diameter greater than the root threaded diameter, a body integral with said body jaw embracing said slide in a guide cavity complemental thereto, and a bolt with a shank of a length not substantially greater than the length of said body, having its head engaged with said body and screwed into the slide bore for drawing the slide into said body cavity, thereby to clamp wires between said jaws, and the end of the bolt's shank being receivable in said portion of the slide's bore having a greater diameter but being enlarged sufficiently to limit the maximum gap for admission of wire between said jaws by jamming against the internal end of said threaded portion of the slide's bore.

4. A clamp connector, comprising a body jaw, a slide jaw, a slide integral with such slide jaw and extending toward said body jaw, said slide having therethrough an axial bore threaded over a portion only of its length, that portion thereof extending inward from the slide jaw end having a diameter greater than the root threaded diameter, a body integral with said body jaw embracing said slide in a guide cavity complemental thereto, said slide and guide cavity being of non-cylindrical shape, thereby to prevent rotation of said slide relative to said body, and a bolt with a shank of a length not substantially greater than said body, having its head engaged with said body and screwed into the slide bore for drawing the slide into said body cavity, thereby to clamp wires between said jaws, and the end of the bolt's shank being receivable in said portion of said slide's bore having a greater diameter but being enlarged sufficiently to limit the maximum gap for admission of wire between said jaws by jamming against the internal end of said threaded portion of the slide's bore.

5. A clamp connector, comprising a body jaw, a slide jaw, a slide integral with said slide jaw and extending toward said body jaw, said slide having therein an axial, threaded bore provided with an enlarged counter bore at the jaw end thereof, a body integral with said body jaw, complemental to and embracing said slide, said slide and said body each having thereon a shoulder, said shoulders adapted to be brought into abutting engagement to limit telescoping movement of said slide and body sufficiently to prevent clamping of undersized wires, and a bolt having its head engaged with said body and screwed into the slide bore for drawing the slide jaw and body jaw toward each other, and said slide into said body, thereby to clamp wires between said jaws, and the end of the bolt's shank being enlarged sufficiently to limit the maximum gap for admission of wire between said jaws by jamming against the internal end of said slide's threaded bore.

6. A clamp connector, comprising a body jaw, a slide jaw, a slide of substantially elliptical cross section integral with such slide jaw and extending toward said body jaw, said slide having therethrough an axial bore threaded over a portion only of its length, that portion thereof extending inward from the slide jaw end having a diameter greater than the root threaded diameter, and the diameter of said bore approaching the length of the slide's transverse minor axis, a body integral with said body jaw embracing said slide in a guide cavity complemental thereto, said slide jaw and said body cooperating to form a structure of generally elliptical cross section with its major axial plane coincident with the minor axial plane of said slide, a lip integral with said slide jaw adapted to overlap closely said body jaw, and a bolt with a shank of a length not substantially greater than the length of said body having its head engaged with said body and screwed into the slide bore for drawing the slide into said body cavity, thereby to clamp wires between said jaws, and the end of the bolt's shank being receivable in said portion of the slide's bore having a greater diameter but being enlarged sufficiently to limit the maximum gap for admission of wire between said body jaw and said slide jaw lip by jamming against the internal end of said threaded portion of the slide's bore.

7. A clamp connector, comprising a slide having an integral jaw projecting laterally from one end thereof and disposed perpendicular to its axis, a guide shell complementally embracing said slide, said guide shell having an integral jaw parallel to said slide jaw and projecting laterally from the end of said guide shell remote from the slide jaw and on the corresponding side of the guide shell, said two jaws being formed and arranged for mutual telescoping disposition with such jaws in clamping position, said slide having a bore extending axially therethrough, including a threaded portion at the end of the slide remote from its jaw and an enlarged portion at the jaw end of the slide of greater diameter than such threaded portion, and a bolt of a length substantially equal to the length of said guide shell, screwed into the threaded end of the slide bore, and the end of

said bolt being enlarged for reception in the portion of said bore of greater diameter, but to limit the maximum gap for admission of wire between said jaws by jamming against the internal end of said threaded portion of the slide's bore, the head of said bolt reacting from the jaw end of said guide shell for drawing said slide into said guide shell for clamping wires between said jaws.

8. A clamp connector, comprising a body jaw, a slide jaw, a slide integral with such slide jaw and extending toward said body jaw, its side opposite such jaw being curved transversely, and said slide having therein an axial, threaded bore, a body integral with said body jaw having its wall opposite such jaw of substantially constant thickness and exteriorly curved transversely, and interiorly curved complemental to and snugly embracing said slide over the major portion of its length, and a bolt having its head engaged with said body and screwed into the slide bore for drawing the slide jaw and body jaw toward each other and said slide into said body, thereby to clamp wires between said jaws.

9. A clamp connector, comprising a slide of double segmental cross section having an integral jaw projecting laterally from one end thereof and disposed perpendicular to said slide's minor axial plane, a guide shell complemental to said slide, snugly embracing the side of said slide opposite its jaw over its entire width and for the major portion of its length, and having two longitudinal beaded edges overhanging and snugly embracing the longitudinal edges of the side of said slide from which its jaw projects, said guide shell having an integral jaw parallel to and facing said slide jaw, bridging one end of the shell's beaded edges to leave an aperture of double segmental cross section complemental to the end of said slide remote from its jaw, for snugly embracing such slide end when the slide jaw and guide shell are moved close together, reinforcing fillets along each end of said guide shell jaw base being formed by the surface of such aperture next to such jaw, said slide being bored axially, and a bolt extending into said slide bore with its head reacting from the jaw end of said guide shell.

10. A clamp connector, comprising a slide of generally elliptical cross section having an integral jaw projecting laterally from one end thereof and disposed perpendicular to said slide's minor axial plane, a body complemental to and snugly embracing said slide over the major portion of its length, and having an integral jaw projecting laterally from one end thereof, parallel to said slide jaw, and a bolt threaded in said slide, extending through said body and having its head seated against the jaw end of said body, and rotatable to draw the slide jaw and body jaw toward each other and to telescope the slide into the body, thereby to clamp wires between said jaws.

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