April 9, 1963 C. H. KLEIN 3,084,575

COMPRESSION TOOL

Filed Oct. 19, 1960 2 Sheets-Sheet 1

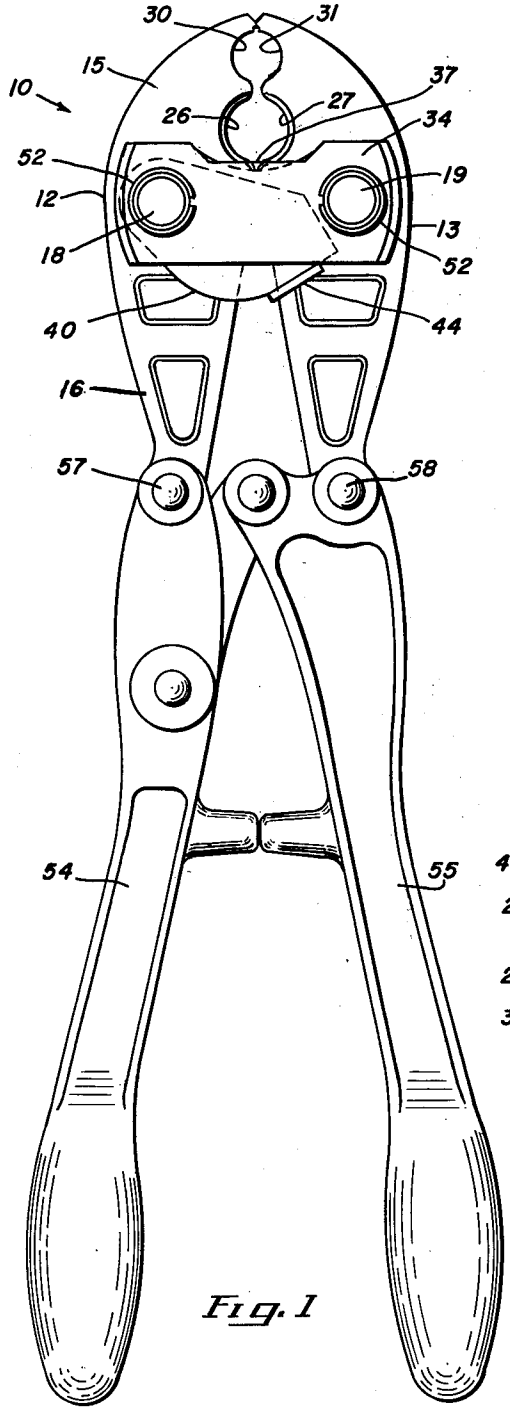


Fig. 1

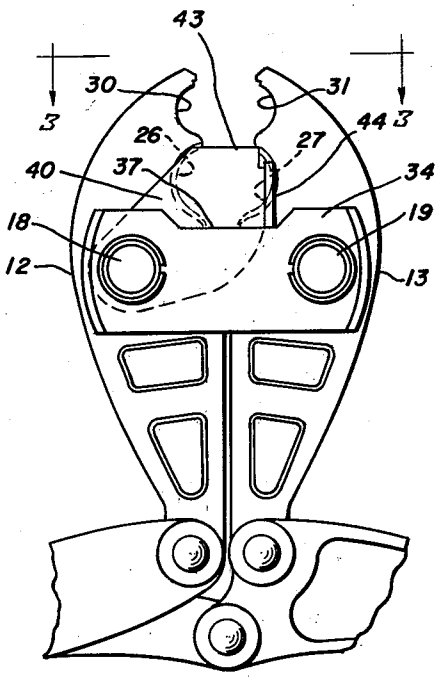


Fig. 2

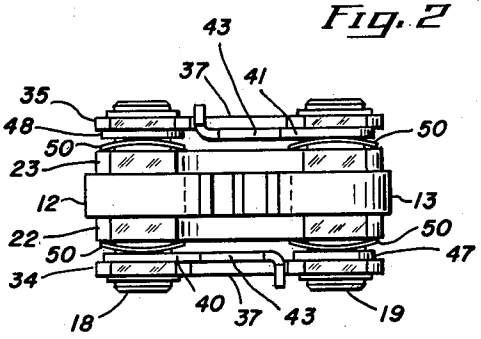


Fig. 3

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Fig. 6

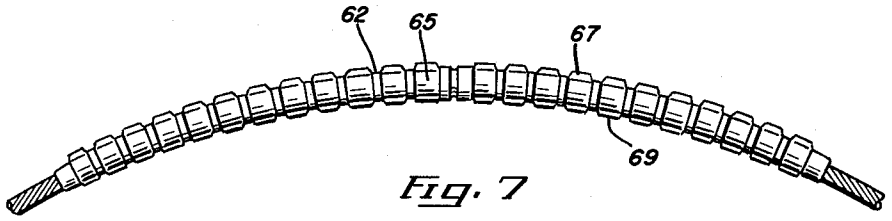


Fig. 7

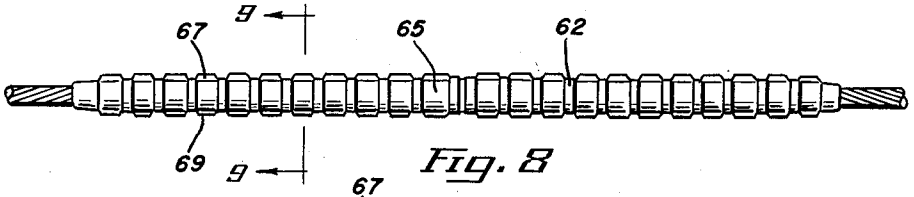


Fig. 8

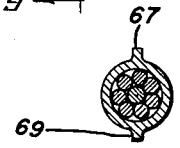


Fig. 9

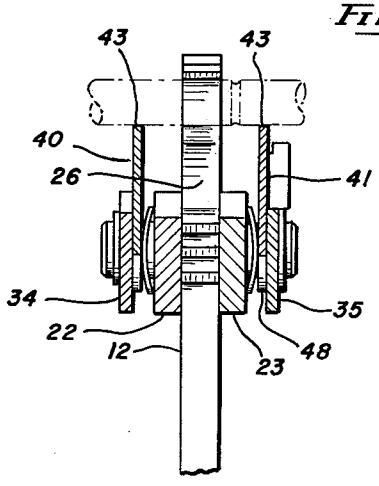


Fig. 5

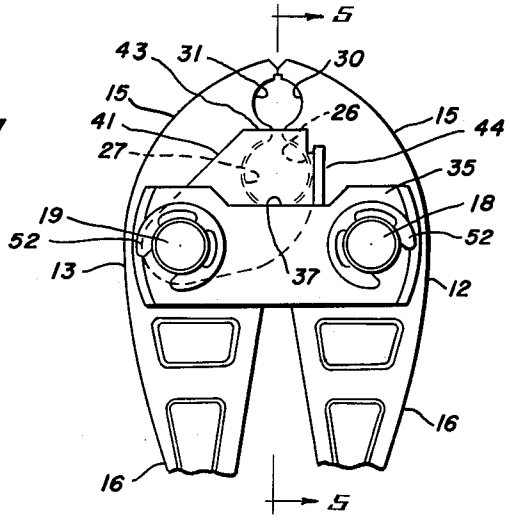


Fig. 4

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COMPRESSION TOOL

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11 Claims. (Cl. 81—15)

The invention relates in general to compression tools and more particularly to such tools for compressing sleeves on wires which tools have more than one set of compression portions with means for offsetting the bending caused in the sleeves, regardless of which set of compression portions are being used.

In using a tool of the type shown and disclosed herein, the dies or compression portions of the tool because of their travel and action on the sleeve set up a bending action in the sleeve which is in a plane generally normal to the plane of the tool. In using some sleeves, for example aluminum, which are used to connect the ends of aluminum-steel reinforced type cable, it is necessary to utilize a sleeve of substantial length since it is necessary to utilize more presses in order to obtain the required holding force. In instances such as these, the bending of the sleeve is very pronounced and, of course, completely unacceptable because it is obvious that the sleeve should be substantially straight in order to perform its required function.

In tools such as the one illustrated herein, it will be noted that two sets of compression portions or dies are provided on the levers or jaws of the tool. Each of the sets is for the purpose of compressing a sleeve of a different size. The lower or innermost set of compression portions have a substantially fixed straightener member for maintaining sleeves in this position substantially straight; however, it is necessary to have a straightener means for use with the outermost set of compression portions which can be moved out of the way when the innermost set of compression portions is used.

It is therefore an object of the present invention to provide a means of straightening sleeves in the outer compression portions of a tool of the type described having more than one set of compression portions.

Another object of the invention is to provide in a tool having at least two sets of compression portions a substantionally fixed straightener member for use with the innermost compression portions and an adjustable straightener member for use with the outermost compression portions which can be moved out of the way of the innermost compression portions.

Other objects and a fuller understanding of this invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a side elevational view of a toggle action compression tool embodying the features of the invention;

FIGURE 2 is a fragmentary side elevational view similar to FIGURE 1 but showing the jaws or lever members of the tool in open position;

FIGURE 3 is a view taken generally along the line 3—3 of FIGURE 2;

FIGURE 4 is a fragmentary side elevational view similar to FIGURE 1 but showing the reverse side of the tool;

FIGURE 5 is a view taken generally along the line 5—5 of FIGURE 4;

FIGURE 6 is a view showing a connecting sleeve member of the type which the tool of the present invention is adapted to compress on wires;

FIGURE 7 illustrates a sleeve such as shown in FIGURE 6 after it has been compressed on wires by a tool which does not utilize the straightening principles as taught by the present invention;

FIGURE 8 illustrates a sleeve such as shown in FIGURE 6 after it has been compressed on wires by a tool which does utilize the straightening principles as taught by the present invention; and

FIGURE 9 is a view taken generally along the line 9—9 of FIGURE 8.

The toggle action compression tool of the present invention has been indicated generally by the reference numeral **10** and as discussed hereinabove, its purpose is compressing sleeves about wires to electrically and physically connect the wires together as will be discussed hereinafter in reference to FIGURES 6, 7 and 8. From viewing the other figures, it will be noted that the compression tool includes in combination first and second jaw or lever members **12** and **13**, respectively, each of which has first and second end portions **15** and **16**, respectively. Each of the lever members **12** and **13** is provided with a circular opening intermediate the end portions which opening extends completely through the lever member. Positioned in the openings are first and second pin or pivot members **18** and **19**, respectively, which as will be noted from FIGURE 3 extend completely through the openings and are generally parallel with each other.

First and second strap members **22** and **23**, respectively, are provided on opposite sides of the lever members and openings in the respective ends of the strap members receive the first and second pin members **18** and **19**. It might be pointed out at this time that the fit between the pin members and the openings in the strap members is comparatively accurate and as a result, the lever members are pivotally connected together in such a way that all the pivotal load is carried by the pin and strap members.

The inner facing edges of the jaw or lever members are provided with a first set or pair of semi-circular compression portions **26** and **27**, and these compression portions are located a first distance from the pin members **18** and **19**. A second set or pair of compression portions **30** and **31** are formed in the inner facing edges of the jaw or lever members; however, at a position outwardly of the first set of compression portions and at a second distance from the pin members which is greater than the first distance. First and second lower straightener members **34** and **35** are provided on opposite sides of the lever members **12** and **13** and are supported or maintained in position in a manner similar to the strap members **22** and **23**. In other words, openings are provided in the end portions of the straightener members **34** and **35** which openings receive the pin members **18** and **19** to fix them in position. It might be pointed out at this time that the openings in the lower straightener members which receive the pin members are made slightly larger than the pin members to assure that the pivotal load, which results when the tool is in use, is carried by the strap members **22** and **23**. Each of the lower straightener members **34** and **35** is provided with a first sleeve engaging surface **37** which as will be noted in FIGURES 1 and 4 extends substantially at a tangent to the circumference of the circle formed by the first set or pair of semi-circular compression portions **26** and **27** when the lever members are in their closed position. It may also be said that the surface extends at a tangent to the lower portion of the circle or that portion of the circle which is located on the axis of symmetry of the tool. In utilizing the two lower straightener members **34** and **35** on either side of the tool or lever members, it is impossible for a workman to make a mistake and extend a sleeve to be compressed the wrong way in the tool. It will thus be seen that regardless of which way a sleeve is placed in the tool, it has to engage or be acted upon by a first sleeve engaging surface.

First and second upper straightener members **40** and **41** are also provided on the tool for use with the second

compression portions 30 and 31 and each of these upper straightener members has first and second end portions. The first end portion of the first upper straightener member 40 is provided with an opening which receives the first pin member 18 and positions this end portion between the first strap member 22 and the first lower straightener member 34 on the front side of the tool as viewed in FIGURE 1. This serves to pivotally connect the first upper straightener member 40. The first end portion of the second upper straightener member 41 is provided with an opening which receives the second pin member 19 on the opposite side of the tool and between the second strap member 23 and the second lower straightener member 35. Lug members 44 are integrally formed on the second end portion of each of the upper straightener members 40 and 41 and these lug members limit the pivotal movement of the upper straightener members between operative and inoperative positions. FIGURE 1 shows the first upper straightener member in its inoperative position and in this position, substantially all of the straightener member is located between the first strap member 22 and the first lower straightener member 34 with the lug 44 engaging the lower surface or side of the lower straightener member 34. The operative position of the upper straightener member 40 is best shown in FIGURE 2 wherein the lug member 44 engages the first sleeve engaging surface 37 of the lower straightener member 34 to operatively position surface 43 with respect to the compression portions 30 and 31.

The second sleeve engaging surfaces 43 of the upper straightener members also extend substantially at a tangent to the circumference of the circle formed by the second pair of semi-circular compression portions 30 and 31 at the portion of the circle closest to the second sleeve engaging surface 43 when the upper straightener members and surface are in their operative position. This is best seen in FIGURE 4 of the drawings. A first spacer 47 is positioned on the second pin member 19 between the first strap member 22 and the first lower straightener member 34, and a second spacer 48 is positioned in a like manner on the first pin member between the second strap member 23 and the second lower straightener member 35. The upper straightener members themselves serve as spacers in the other two positions. Four bent washers 50 serve to hold the assembly in generally parallel alignment and snap washers 52 are provided on the ends of the pins 18 and 19 to maintain all of the other elements referred to in position. The jaw or lever members 12 and 13 are pivoted about pins 18 and 19 by means of handle members 54 and 55 which handles are connected to the second end portions of the lever members as at 57 and 58, respectively, in a manner which is well-known to those skilled in the art.

In operation, in order to secure the ends of first and second wires 60 and 61 together (FIGURE 6) the ends of wires 60 and 61 are inserted into the opposite ends of a sleeve 62 in a manner which is well known to those skilled in the art. When the first and lowermost compression portions 26 and 27 are to be utilized for a sleeve of a determined size, the upper straightener members 40 and 41 are moved to the position shown in FIGURE 1. The sleeve starting at a position intermediate the ends thereof is placed in the tool between the compression portions 26 and 27 with the lever members in the open position, the handles 54 and 55 are actuated to make a first press and as will be appreciated, a plurality of these presses are made working outwardly to the end of the sleeve. The same procedure is then utilized for the other end of the sleeve starting at the intermediate portion. In utilizing the first compression portions of the tool, the sleeve is engaged by the first sleeve engaging surfaces 37 and imparts a slight reverse bend to the sleeve which in effect maintains it in a substantially straight condition.

If the sleeve which is utilized is of a size such that the second compression portions 30 and 31 of the tool have to be utilized, the upper straightener members 40 and 41 are moved into operative position, shown for example in FIGURES 2, 3, 4 and 5. The ends of the wires are inserted into a sleeve member as described in conjunction with FIGURE 6 and a series of presses 65 are made starting at an intermediate portion (position shown in FIGURE 5) of the sleeve and working outwardly until the sleeve has been completely compressed about the wire. The other end of the sleeve is handled in a like manner. The bending tendency which is set up in the sleeve because of the outermost portion of the compression portions moving through a greater distance and moving more of the sleeve metal is offset by the engagement of the sleeve on the second sleeve engaging surface 43. The numeral 67 on FIGURES 7 and 8 indicates the greater flash produced by the outermost portion of the compression portions whereas the numeral 69 indicates the smaller flash produced by the innermost portion of the compression portions. A sleeve which has been compressed about wires in the outer or second compression portion of a tool which utilized the upper straightener members 40 and 41 is shown in FIGURE 8 and as will be noted, the sleeve has been maintained in a substantially straight condition. The sleeve shown in FIGURE 7 was also compressed about the wires in a tool which did not utilize the upper or outermost straightener members 40 and 41 and as a result, it will be seen that the sleeve assumes a curved condition, which is not at all acceptable. The cables 60 and 61 illustrated herein are aluminum-steel reinforced type cables and as seen in FIGURE 9 include an inner strand of steel and seven strands of aluminum.

The part of the first and second pair of opposed compression portions (26—27 and 30—31) most removed from the pivot members 18 and 19 move through a greater path and produce a greater flow of metal (numeral 67, FIGURES 7 and 8) in the compressed sleeves than the part of the compression portions less removed from the pivot members. This sets up the bending action referred to above in the discussion of FIGURES 6, 7 and 8.

It will thus be seen that in the present invention a means has been provided for use with a tool of the class described wherein sleeves are maintained in a substantially straight condition whether they are compressed in the outer compression portions of the tool or in the inner compression portions. It will be noted that the means utilized for straightening sleeves in the outermost compression portions of the tool may be conveniently moved between operative and inoperative positions, depending upon which set of compression portions are to be used.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A toggle action compression tool for compressing sleeves about wires including in combination first and second lever members each having first and second end portions, first and second strap members on either side of said lever members and located intermediate said end portions, first and second pin members extending through said first and second lever members, respectively, and respective ends of said strap members to pivotally connect said first and second lever members together, a first pair of semi-circular compression portions formed in said first and second lever members a first distance from said pin members, a second pair of semi-circular compression portions formed in said first and second lever members a second distance from said pin members which second distance is greater than said first distance, first and second lower straightener members on either side of said lever members and positioned by said first and sec-

ond pin members, each said lower straightener member having a first sleeve engaging surface which surface extends substantially at a tangent to the circumference of the circle formed by said first pair of semi-circular compression portions at the portion of the circle closest to said first sleeve engaging surface, first and second upper straightener members each having first and second end portions, said first end portion of said first upper straightener member being pivotally connected to said first pin member on one side of said lever members between said first strap member and said first lower straightener member, said first end portion of said second upper straightener member being pivotally connected to said second pin member on the other side of said lever members between said second strap member and said second lower straightener member, a lug member on said second end portion of each of said upper straightener members, said lug members limiting the pivotal movement of said upper straightener members between operative and inoperative positions, each said upper straightener member having a second sleeve engaging surface which surface extends substantially at a tangent to the circumference of the circle formed by said second pair of semi-circular compression portions at the portion of the circle closest to said second sleeve engaging surface in its operative position, a first spacer on said second pin member between said first strap member and said first lower straightener member, a second spacer on said first pin member between said second strap member and said second lower straightener member, bent washers on either end portion of said pin members acting in combination with said spacers and said upper straightener members for maintaining said lower straightening members at a predetermined position relative to said strap members, and first and second handles pivotally connected to said second end portion of said first and second lever members to pivot said first and second lever members relative to each other about said first and second pin members.

2. A toggle action compression tool for compressing sleeves about wires including in combination first and second lever members each having first and second end portions, first and second strap members on either side of said lever members and located intermediate said end portions, first and second pin members extending through said first and second lever members, respectively, and respective ends of said strap members to pivotally connect said first and second lever members together, a first pair of semi-circular compression portions formed in said first and second lever members a first distance from said pin members, a second pair of semi-circular compression portions formed in said first and second lever members a second distance from said pin members which second distance is greater than said first distance, first and second lower straightener members on either side of said lever members and positioned by said first and second pin members, each said lower straightener member having a first sleeve engaging surface which surface extends substantially at a tangent to the circumference of the circle formed by said first pair of semi-circular compression portions at the portion of the circle closest to said first sleeve engaging surface, first and second upper straightener members each having first and second end portions, said first end portion of said first upper straightener member being pivotally connected to said first pin member on one side of said lever members between said first strap member and said first lower straightener member, said first end portion of said second upper straightener member being pivotally connected to said second pin member on the other side of said lever members between said second strap member and said second lower straightener member, a lug member on said second end portion of each of said upper straightener member, said lug members limiting the pivotal movement of said upper straightener members between operative and inoperative positions, each said upper straightener members having a second sleeve engaging surface which surface extends substantially at a tangent to the circumference of the circle formed by said second pair of semi-circular compression portions at the portion of the circle closest to said second sleeve engaging surface in its operative position, and first and second handles pivotally connected to said second end portion of said first and second lever members to pivotally move said first and second lever members relative to each other about said first and second pin members.

3. A toggle action compression tool for compressing sleeves about wires including in combination first and second lever members each having first and second end portions, first and second strap members on either side of said lever members and located intermediate said end portions, first and second pin members extending through said first and second lever members, respectively, and respective ends of said strap members to pivotally connect said first and second lever members together, a first pair of compression portions formed in said first and second lever members a first distance from said pin members, a second pair of compression portions formed in said first and second lever members a second distance from said pin members which second distance is greater than said first distance, first and second lower straightener members on either side of said lever members and positioned by said first and second pin members, each said lower straightener member having a first sleeve engaging surface, first and second upper straightener members each having first and second end portions, said first end portion of said first upper straightener member being pivotally connected to said first pin member, said first end portion of said second upper straightener member being pivotally connected to said second pin member, a lug member on said second end portion of each of said upper straightener members, said lug members limiting the pivotal movement of said upper straightener members between operative and inoperative positions, each said upper straightener members having a second sleeve engaging surface, and handles pivotally connected to said second end portion of said first and second lever members to pivot said lever members relative to each other about said first and second pin members.

4. A toggle action compression tool for compressing sleeves about wires including in combination first and second lever members each having first and second end portions, a strap member on one side of said lever members and located intermediate said end portions thereof, first and second pin members extending through said first and second lever members, respectively, and respective ends of said strap member to pivotally connect said first and second lever members together, a first pair of compression portions formed in said first and second lever members a first distance from said pin members, a second pair of compression portions formed in said first and second lever members a second distance from said pin members which second distance is greater than said first distance, a lower straightener member on one side of said lever members and positioned by said first and second pin members, said lower straightener member having a first sleeve engaging surface for engagement with a sleeve in said first pair of compression portions, an upper straightener member having first and second end portions, said first end portion of said upper straightener member being pivotally connected to said first pin member on one side of said lever members whereby same may be moved between operative and inoperative positions, said upper straightener member at said second end portion having a second sleeve engaging surface for engagement with a sleeve in said second pair of compression portions, and handles pivotally connected to said second end portion of said first and second lever members to pivot said lever members relative to each other about said first and second pin members.

5. In a toggle action compression tool adapted to compress sleeves on wires, the combination of a pair of movable jaw members each having first and second opposing compression portions for engaging and compressing sleeves on wires, link means positioned adjacent said jaw members and relatively close to the opposing compression portions, two spaced substantially parallel pivot members engaging the link means and pivotally supporting said jaw members, the part of the first and second compression portions on each jaw member most removed from said pivot members moving through a greater path and producing a greater flow of metal in the compressed sleeves than the part of said first and second compression portions less removed from said pivot members and thus setting up a bending action in the sleeves, first sleeve engaging means having a first surface portion spaced from said jaw members, said first compression portions upon the closing of said jaw members moving in a direction toward said first sleeve engaging means and causing a first sleeve to engage said first surface portion thereof to substantially offset the bending action in the first sleeve produced by the compression thereof by the first compression portions of said movable jaw members, second sleeve engaging means having a second surface portion spaced from said jaw members and means mounting said second sleeve engaging means whereby said second surface portion thereof may be moved between operative and inoperative positions relative to said second compression portions of said jaw members, said second compression portions upon closing of said jaw members moving in a direction toward said second sleeve engaging means in its operative position and causing a second sleeve to engage said second surface portion thereof to substantially offset the bending action in the second sleeve produced by the compression thereof by said second compression portions of said movable jaw members.

6. In a toggle action compression tool adapted to compress sleeves on wires, the combination of a pair of movable jaw members each having first and second opposing compression portions for engaging and compressing sleeves on wires, pivot means pivotally mounting said jaw members, the part of the first and second compression portions on each jaw member most removed from said pivot means moving through a greater path and producing a greater flow of metal in the compressed sleeves than the part of said first and second compression portions less removed from said pivot means and thus setting up a bending action in the sleeves, first sleeve engaging means having a first surface portion spaced from said jaw members, said first compression portions upon the closing of said jaw members moving in a direction toward said first sleeve engaging means and causing a first sleeve to engage said first surface portion thereof to substantially offset the bending action in the first sleeve produced by the compression thereof by the first compression portions of said movable jaw members, second sleeve engaging means having a second surface portion spaced from said jaw members and means mounting said second sleeve engaging means whereby said second surface portion thereof may be moved between operative and inoperative positions relative to said second compression portions of said jaw members, said second compression portions upon closing of said jaw members moving in a direction toward said second sleeve engaging means in its operative position and causing a second sleeve to engage said second surface portion thereof to substantially offset the bending action in the second sleeve produced by the compression thereof by said second compression portions of said movable jaw members.

7. A tool for compressing sleeves on wires including in combination first and second lever members, pivot means pivotally connecting said lever members together, said lever members at one end portion having first and second pairs of opposed compression portions each of which is adapted to compress a sleeve on a wire, a first straightener member having a first sleeve engaging surface and mounted by said lever members in a substantially fixed position adjacent said first pair of opposed compression portions in position for said first sleeve engaging surface to engage a sleeve being compressed in said first pair of opposed compression portions and offset bending in the sleeve, a second straightener member having a second sleeve engaging surface, pivot means pivotally mounting said second straightener member to said lever members whereby same may be pivoted between operative and inoperative positions, said second straightener member in operative position engaging and being supported by said first straightener member adjacent said second opposed compression portions in position for said second sleeve engaging surface to engage a sleeve being compressed in said second pair of opposed compression portions and offset bending in the sleeve.

8. A tool for compressing sleeves on wires including in combination first and second jaw members, pivot means pivotally connecting said jaw members together, said jaw members at one end portion having first and second pairs of opposed compression portions each of which is adapted to compress a sleeve on a wire, a first straightener member having a first sleeve engaging surface and mounted by said jaw members adjacent said first pair of opposed compression portions in position for said first sleeve engaging surface to engage a sleeve and offset any bending in the sleeve, a second straightener member having a second sleeve engaging surface, means mounting said second straightener member on said jaw members whereby same may be moved between operative and inoperative positions, said second straightener member in operative position being supported by said first straightener member adjacent said second pair of opposed compression portions in position for said second sleeve engaging surface to engage a sleeve and offset any bending in the sleeve.

9. A tool for compressing sleeves on wires including in combination first and second lever members, pivot means pivotally connecting said lever members together, said lever members at one end portion having first and second pairs of opposed compression portions each of which is adapted to compress a sleeve on a wire, a first straightener member having a first sleeve engaging surface and mounted by said lever members adjacent said first pair of opposed compression portions in position for said first sleeve engaging surface to engage a sleeve and offset any bending in the sleeve, a second straightener member having a second sleeve engaging surface, means mounting said second straightener member to said lever members whereby same may be moved between operative and inoperative positions, said second straightener member in operative position being located adjacent said second pair of opposed compression portions in position for said second sleeve engaging surface to engage a sleeve and offset any bending in the sleeve.

10. A tool for compressing sleeves on wires including in combination first and second lever members, pivot means pivotally connecting said lever members together, said lever members at one end portion having first and second pairs of opposed compression portions each of which is adapted to compress a sleeve on a wire, a first straightener member having a first sleeve engaging surface and mounted by said lever members in position adjacent said first pair of opposed compression portions in position for said first sleeve engaging surface to engage a sleeve being compressed in said first pair of opposed compression portions and offset bending in the sleeve, a second straightener member having a second sleeve engaging surface, pivot means pivotally mounting said second straightener member to said lever members whereby same may be pivoted between operative and inoperative positions, said second straightener member in operative position being located adjacent said second opposed compression portions in position for said second sleeve en-

gaging surface to engage a sleeve being compressed in said second pair of opposed compression portions and offset bending in the sleeve.

11. A tool for compressing sleeves on wires including in combination first and second lever members, pivot means pivotally connecting said lever members together, said lever members at one end portion having first and second pairs of opposed compression portions each of which is adapted to compress a sleeve on a wire, a first straightener member having a first sleeve engaging surface and mounted by said lever members adjacent said first pair of opposed compression portions in position for said first sleeve engaging surface to engage a sleeve and offset any bending in the sleeve, a second straightener member having a second sleeve engaging surface and mounted by said lever members adjacent said second pair of opposed compression portions in position for said second sleeve engaging surface to engage a sleeve and offset any bending in the sleeve.

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