

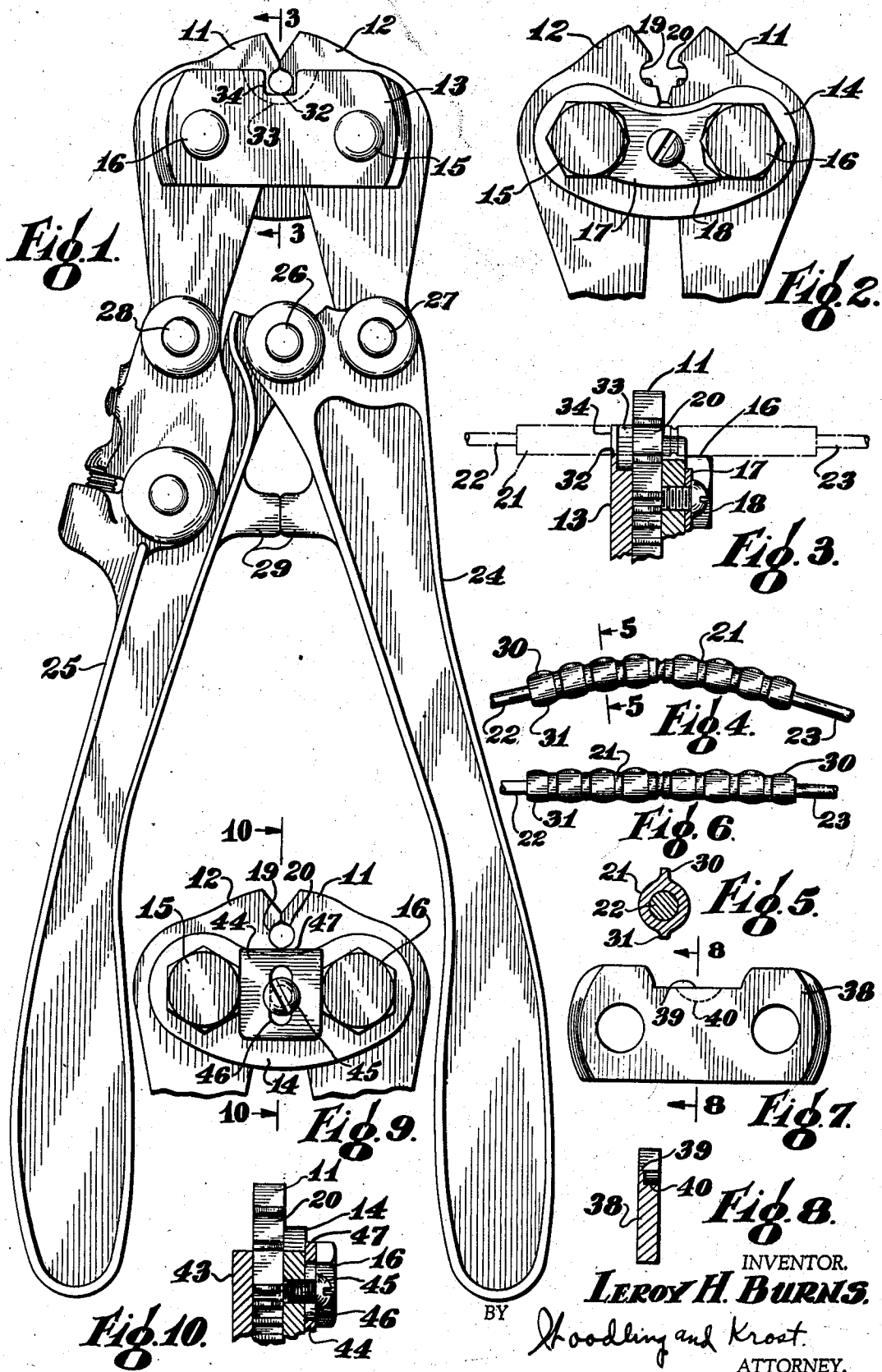
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COMPRESSION TOOL

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COMPRESSION TOOL

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My invention relates in general to compression tools adapted to compress sleeves on wires and more particularly to means for off-setting the bending action in the sleeves produced by the compression thereof by the compression tool.

In actual practice, when a sleeve is compressed upon a wire by a toggle action compression tool the part of the die or the depressing groove portion on the jaw members of the tool which is most removed from the fulcrum means of the tool moves through a greater path and produces a greater flash of metal upon one side of the sleeve than the part of the die or compressing groove portion of the jaw members less removed from the fulcrum means, with the result that a bending action is produced in the sleeve. As a consequence, when a series of depressions are made in the connecting sleeve, the sleeve becomes somewhat curved. It is obvious that the connecting sleeve which connects the ends of the wires or cables together should be straight in line with the wire or cable itself. In working on this problem, I have observed several facts concerning this bending action. One is that the plane in which the bending occurs is perpendicular to the plane of the tool. Also, it is found that the end of the sleeve moves toward the tool so that the tool is always on the concave side of the bend. In the design of a compression tool, I have found that the sleeve bending increases as the dies or depressing groove portions in the jaw members of the tool which receive the sleeve are positioned closer to the fulcrum line of the jaw members. Furthermore, it is found that the deeper the compression or the press, the greater the flowing of the metal of the sleeve, with the result that more bending occurs. Conversely, a slight compression or press made with a tool having a depressing sleeve groove spaced quite a distance from the fulcrum of the jaw members shows very little bending. Of course, in a long sleeve the bending is more noticeable than in a short sleeve. In designing a toggle action compression tool for use with extra strong wires and with sleeves to provide the necessary strong holding power, I find that the tool must of necessity be of a nature as to increase the bending action in the sleeve. The results of a long series of experiments show that a tool and sleeve could not be developed with strong holding power without excessive sleeve bending produced by the compression by the movable jaw members of the tool. Development work was then initiated to reduce this sleeve bending by other means, and I finally developed what I call a "straightening

strap" principle. The application of this principle to the tool reduces the bending of the sleeve by setting up an opposing bending action to offset the bending action produced by the compression of the movable jaw members of the tool. The "straightening strap" principle makes use of the fact that while the dies or the depressing sleeve grooves in the movable jaw members of a toggle action compression tool approach each other in pressing the sleeve, they also move toward the fulcrum or the central part of the tool. That is to say, the sleeve is carried toward the fulcrum or the central portion of the tool while the press or depression is being made. The "straightening strap" principle comprises a suitable placed edge portion or impediment to the movement of the sleeve toward the fulcrum or central portion of the tool, with the result that while the sleeve is being pressed, a slight reverse bend is made in it which off-sets the bending incident to the compression operation of the tool.

Therefore, an object of my invention is to provide in a toggle action tool for producing a slight reverse bend in the sleeve which off-sets the bending action made by the compression of the jaw members of the tool.

Another object of my invention is to provide for adjustably varying the amount of the reverse bend in the sleeve being depressed.

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

Figure 1 represents a toggle action compression tool embodying the features of my invention;

Figure 2 is a fragmentary view of the movable jaw members of my tool, but showing the reverse side thereof as shown in Figure 1;

Figure 3 is a fragmentary and cross-sectional view taken along the line 3—3 of Figure 1;

Figure 4 shows a connecting sleeve having a series of compressions made therein and illustrates the manner in which a sleeve bends without the provision of my invention being incorporated in a toggle action compression tool;

Figure 5 is an enlarged cross-sectional view, taken along the line 5—5 of Figure 4;

Figure 6 shows a compressed connecting sleeve as produced by a toggle action compression tool embodying my "straightening strap" principle;

Figure 7 is a front view of a modified connecting link having my "straightening strap" principle embodied therein;

Figure 8 is a cross-sectional view, taken along the line 8—8 of Figure 7;

Figure 9 is a view of an adjustable "straightening strap" principle incorporated in a toggle action compression tool; and

Figure 10 is a cross-sectional view, taken along the line 10—10 of Figure 9.

With reference to the several views of the drawing, the toggle action compression tool comprises a pair of movable jaw members 11 and 12, link members 13 and 14 positioned on opposite sides of the movable jaw members, and fulcrum members 15 and 16 extending through the movable jaw members and the link members and forming the fulcrum means for the movable jaw members 11 and 12.

The fulcrum members 15 and 16 may be in the form of bolts or threaded members having heads thereon for engaging the link 14 and having threads thereon for threadably engaging the threads in the link 13. A lock clip 17 attached to the link 14 by means of a screw 18 may be utilized to keep the heads of the bolts from turning or becoming loose. The inner edges of the movable jaw members 11 and 12 are provided with semi-circular grooves 19 and 20 constituting opposing compressing portions for engaging and compressing the sleeve on the wires.

The movable jaw members 11 and 12 may be actuated by handles 25 and 24 which pivotally turn about a fulcrum 26 and which are pivotally connected to the movable jaw members 11 and 12, respectively, at the fulcrum points 28 and 27. The termination of the movement of the handles 25 and 24 inwardly is governed by the stops 29. In operation, the movement of the handles 25 and 24 outwardly to their open position actuates the movable jaw members 11 and 12 to their open position as shown in Figure 2, and the movement of the handles 25 and 24 inwardly causes the movable jaw members 11 and 12 to move inwardly to their closed position as shown in Figure 1.

In joining the ends of wires, such for example, as the wires 22 and 23 in Figures 3 and 4, the ends thereof are inserted into a connecting sleeve 21, after which the sleeve is compressed at intervals between the opposing compressing portions 19 and 20 of the movable jaw members. In compressing a sleeve about a wire the operator begins in the middle of the sleeve and works outwardly for the reason that the sleeve elongates longitudinally. The part of the pressing grooves 19 and 20 most removed from the fulcrum means 15 and 16 moves through a greater path and produces an extra or greater flash of metal on the sleeve than the part of the pressing grooves 19 and 20 less removed from the fulcrum means. The flow of metal producing the extra flash of metal sets up a bending action in the sleeve to make the ends of the sleeve bend toward the tool. Thus, the reference character 30 represents the extra flash of metal produced by the part of the pressing grooves 19 and 20 most removed from the fulcrum means 15 and 16 and the reference character 31 represents the flash of the metal produced by the part of the pressing grooves 19 and 20 which are less removed from the fulcrum means. The producing of a greater or extra flash of metal on the outside of the sleeve over that on the inside causes the metal on the outside to elongate more than the metal on the inside, thus resulting in bending the sleeve in a plane substantially perpendicular to the plane of the tool with the ends of the sleeve moving toward the

tool so that the tool is always on the concave side of the bend.

The "straightening strap" principle which I employ to make a slight reverse bend in the sleeve to offset the bending made by the compression itself comprises a sleeve engaging portion 32 having an upper edge portion spaced from the jaw members 11 and 12. The sleeve engaging portion 32 may be integrally formed with the link 13 and may be constructed by milling out a substantially semi-circular portion 33 in the link 13 next adjacent to the jaw members 11 and 12 so that the sleeve engaging portion 32 gives a reverse bending action rather than a shearing action. As shown in Figures 1 and 3, the sleeve engaging portion 32 may have opposed side walls formed by the notch 34 therein. The engaging or top edge surface of the sleeve engaging portion 32 in the bottom of the notch 34 is positioned in relative alignment to the bottom edges of the sleeve grooves 19 and 20, so that as the sleeve, as shown by the dash-dot line in Figure 3, moves toward the sleeve engaging portion 32 while the press is being made, the bottom edge of the sleeve engages the top edge surface of the sleeve engaging portion 32 and makes a slight reverse bend in the sleeve which offsets the bend made by the compression itself. The sleeve in Figure 6 represents a sleeve as made by a toggle action compression tool having my "straightening strap" principle embodied therein. Inasmuch as the wall thickness of the sleeve engaging portion 32 is relatively thin one may carefully regulate the amount of the reverse bend by filing or otherwise making the height of the top edge thereof just right with reference to the bottom edges of the sleeve grooves 19 and 20 in the movable jaws of the tool.

In Figures 7 and 8 I show a modified link 38 having a sleeve engaging portion 39 with a small arcuate undercut 40 adapted to be placed next adjacent to the jaw members to prevent the sleeve engaging portion from giving a shearing action as opposed to a reverse bending action. The main difference between the arrangement in Figures 7 and 8 over that shown in Figures 1 and 3 is that there is no notch forming side walls for the sleeve engaging portion.

In Figures 9 and 10, I show a modified arrangement of my invention in that it may be made adjustable to regulate the amount of the reverse bending. In this form of my invention the sleeve engaging member, indicated by the reference character 44, is adjustable and comprises a plate positioned on the side of the tool having the heads of the bolts 15 and 16 rather than on the reverse side of the tool as shown in Figure 1. In the adjustable form of my invention, the lock clip 17, as shown in Figure 2, is replaced by the adjustable sleeve engaging plate 44, which is adjustably connected to the link 14 by means of a screw 45 which extends through an elongated slot 46 in the sleeve engaging plate. The sleeve engaging plate 44 also constitutes a lock against the turning of the heads of the bolts 15 and 16. The upper engaging edge 47 of the adjustable plate 44 may be adjusted up and down relative to the bottom of the groove compressing portions 19 and 20 to regulate the amount of the reverse bend. The link on the opposite side of the jaw members in Figure 10 is illustrated by the reference character 43 and may be substantially the same as the link 13 in Figure 1 except that it does not have the sleeve engaging portion provided thereon.

Although I have described my invention with a

certain degree of particularity, it is understood that the present disclosure 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.

I claim as my invention:

1. In a toggle action compression tool adapted to compress sleeves on wires, the combination of a pair of movable jaw members each having opposing compressing portions for engaging and compressing the sleeves on the wires, link means positioned adjacent the jaw members and relatively close to the opposing compressing portions, two spaced substantially parallel fulcrum means engaging the link means and pivotally supporting the jaw members, the part of the compressing portions most removed from the fulcrum means moving through a greater path and producing a greater flow of metal in the compressed sleeve than the part of the compressing portions less removed from the fulcrum means and thus setting up a bending action in the sleeve, and sleeve engaging means having an edge portion spaced from the jaw members, said compressing portions upon the closing of the jaw members moving in a direction toward the sleeve engaging means and causing the sleeve to engage the said edge portion thereof to substantially off-set the bending action in the sleeve produced by the compression thereof by the movable jaw members, said compression portions of the movable jaw members and said edge portion of the sleeve engaging means directly transmitting at spaced distances apart opposing bending forces to the sleeve for maintaining the sleeve substantially straight.

2. In a toggle action compression tool adapted to compress sleeves on wires, the combination of a pair of movable jaw members each having opposing compressing portions for engaging and compressing the sleeves on the wires, link means positioned adjacent the jaw members and relatively close to the opposing compressing portions, two spaced substantially parallel fulcrum means engaging the link means and pivotally supporting the jaw members, the part of the compressing portions most removed from the fulcrum means moving through a greater path and producing a greater flow of metal in the compressed sleeve than the part of the compressing portions less removed from the fulcrum means and thus setting up a bending action in the sleeve, and sleeve engaging means having an edge portion spaced from the jaw members, said compressing portions upon the closing of the jaw members moving in a direction toward the sleeve engaging means and causing the sleeve to engage the said edge portion thereof to substantially off-set the bending action in the sleeve produced by the compression thereof by the movable jaw members, and means for adjustably setting the sleeve engaging means with reference to the opposing compressing portions of the jaw members to vary the off-set bending action produced thereby, said compression portions of the movable jaw members and said edge portion of the sleeve engaging means directly transmitting at spaced distances apart opposing bending forces to the sleeve for maintaining the sleeve substantially straight.

3. In a toggle action compression tool adapted to compress sleeves on wires, the combination of a pair of movable jaw members each having

opposing compressing portions for engaging and compressing the sleeves on the wires, link means positioned adjacent the jaw members and relatively close to the opposing compressing portions, two spaced substantially parallel fulcrum means engaging the link means and pivotally supporting the jaw members, the part of the compressing portions most removed from the fulcrum means moving through a greater path and producing a greater flow of metal in the compressed sleeve than the part of the compressing portions less removed from the fulcrum means and thus setting up a bending action in the sleeve, and sleeve engaging means having an edge portion spaced from the jaw members, said compressing portions upon the closing of the jaw members moving in a direction toward the sleeve engaging means and causing the sleeve to engage the said edge portion thereof to substantially off-set the bending action in the sleeve produced by the compression thereof by the movable jaw members, said sleeve engaging means being an integral part of the link means, said compression portions of the movable jaw members and said edge portion of the sleeve engaging means directly transmitting at spaced distances apart opposing bending forces to the sleeve for maintaining the sleeve substantially straight.

4. In a toggle action compression tool adapted to compress sleeves on wires, the combination of a pair of movable jaw members each having opposing compressing portions for engaging and compressing the sleeves on the wires, link means positioned adjacent the jaw members and relatively close to the opposing compressing portions, two spaced substantially parallel fulcrum means engaging the link means and pivotally supporting the jaw members, the part of the compressing portions most removed from the fulcrum means moving through a greater path and producing a greater flow of metal in the compressed sleeve than the part of the compressing portions less removed from the fulcrum means and thus setting up a bending action in the sleeve, said link means having an edge portion spaced from the jaw members, said compressing portions upon the closing of the jaw members moving in a direction toward the said edge portion and causing the sleeve to engage the said edge portion to substantially off-set the bending action in the sleeve produced by the compression thereof by the movable jaw members, said compression portions of the movable jaw members and said edge portion of the sleeve engaging means directly transmitting at spaced distances apart opposing bending forces to the sleeve for maintaining the sleeve substantially straight.

5. In a compression tool adapted to compress sleeves on wires, the combination of a pair of fulcrumed movable jaw members having opposing compressing portions for engaging and compressing the sleeves on the wires, the part of the compressing portions most removed from the fulcrum moving through a greater path and producing a greater flow of metal in the compressed sleeve than the part of the compressing portions less removed from the fulcrum and thus setting up a bending action in the sleeve, and sleeve engaging means having an edge portion spaced from the jaw members, said compressing portions upon the closing of the jaw members moving in a direction toward the sleeve engaging means and causing the sleeve to engage the

said edge portion thereof to substantially off-set the bending action in the sleeve produced by the compression thereof by the movable jaw members, said compression portions of the movable jaw members and said edge portion of the sleeve engaging means directly transmitting at spaced distances apart opposing bending forces to the sleeve for maintaining the sleeve substantially straight.

6. In a toggle action compression tool adapted to compress sleeves on wires, the combination of a pair of movable jaw members each having opposing compressing portions for engaging and compressing the sleeves on the wires, link means positioned adjacent the jaw members and relatively close to the opposing compressing portions, two spaced substantially parallel fulcrum means engaging the link means and pivotally supporting the jaw members, the part of the compressing portions most removed from the fulcrum means moving through a greater path and producing a

greater flow of metal in the compressed sleeve than the part of the compressing portions less removed from the fulcrum means and thus setting up a bending action in the sleeve, said link means having an edge portion spaced from the jaw members, said edge portion extending from, and comprising an integral part of, the link means, said compressing portions upon the closing of the jaw members moving in a direction toward the said edge portion and causing the sleeve to engage the said edge portion to substantially off-set the bending action in the sleeve produced by the compression thereof by the movable jaw members, said compression portions of the movable jaw members and said edge portion of the sleeve engaging means directly transmitting at spaced distances apart opposing bending forces to the sleeve for maintaining the sleeve substantially straight.

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