Oct. 9, 1962 W. F. TURNER 3,057,233

LEVER HOT STICK FOR COMPRESSING SLEEVES AND CONNECTORS

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Fig. 1.

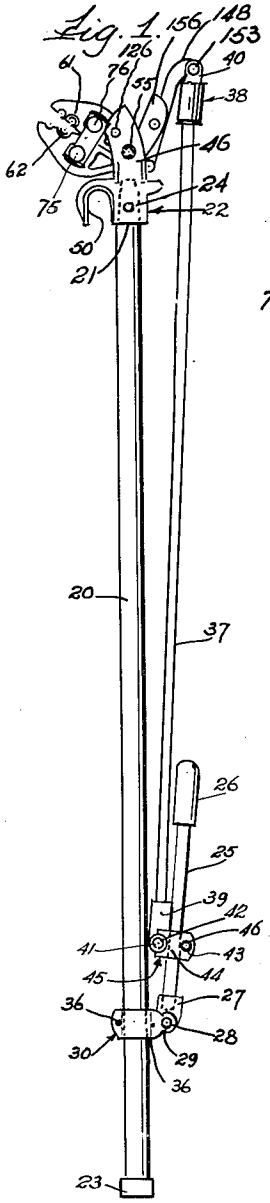


Fig 2.

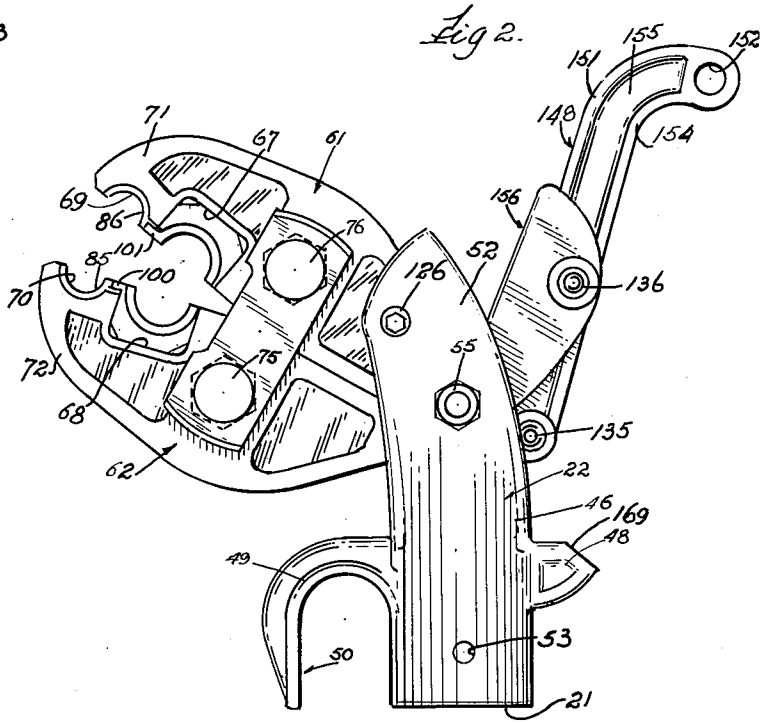


Fig 3.

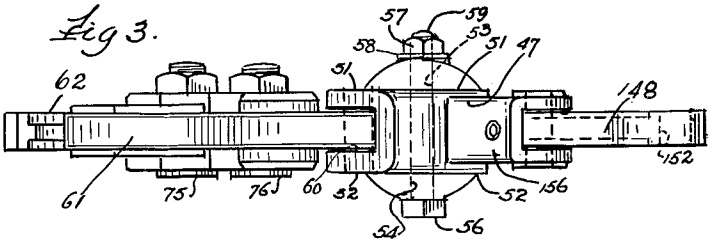
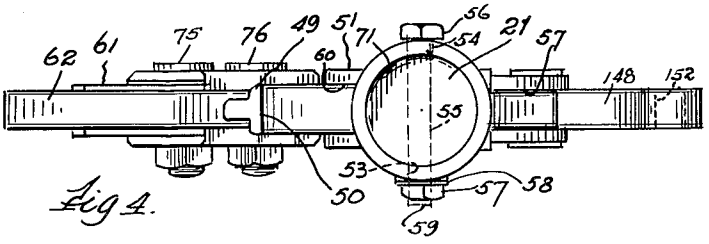


Fig 4.



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LEVER HOT STICK FOR COMPRESSING SLEEVES AND CONNECTORS

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Fig 5.

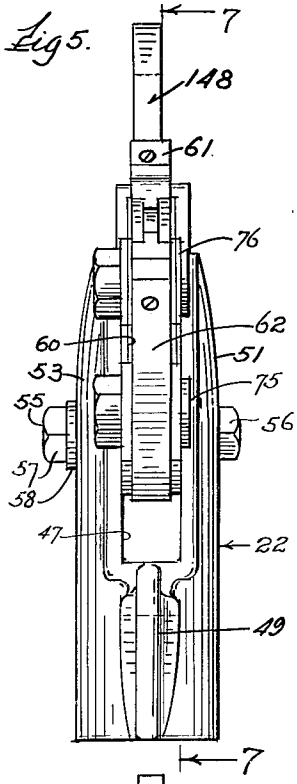


Fig 6.

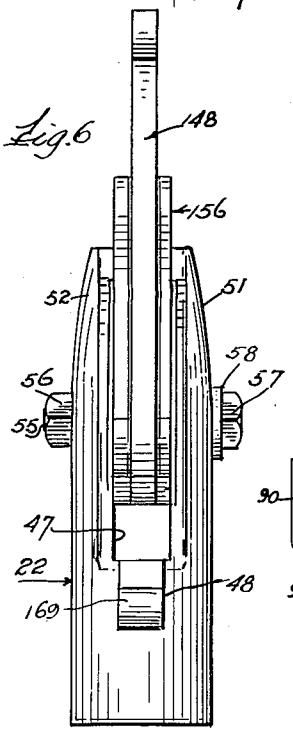


Fig 9.

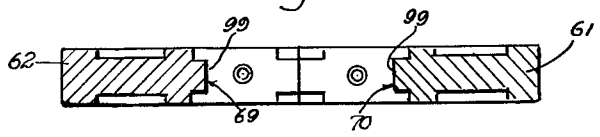


Fig 10.

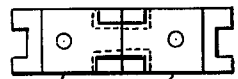


Fig 11.

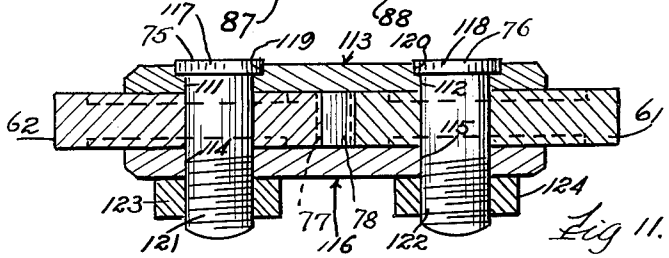


Fig 12.

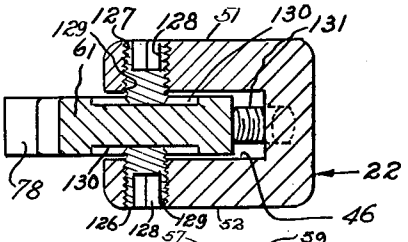


Fig 13.

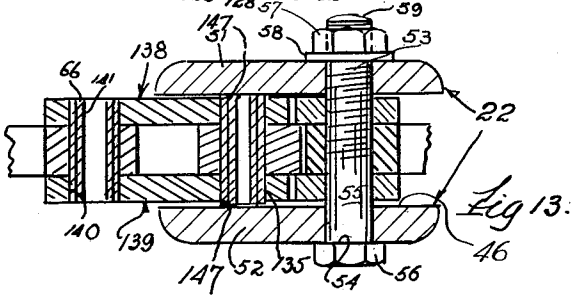


Fig 15.

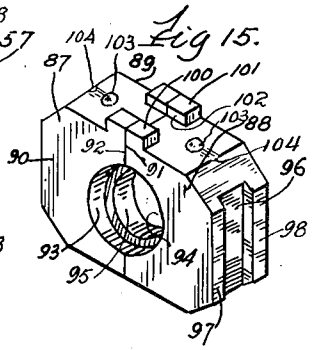
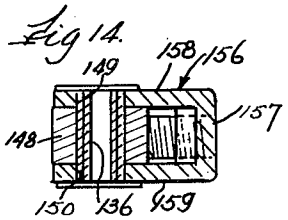


Fig 14.



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LEVER HOT STICK FOR COMPRESSING SLEEVES AND CONNECTORS

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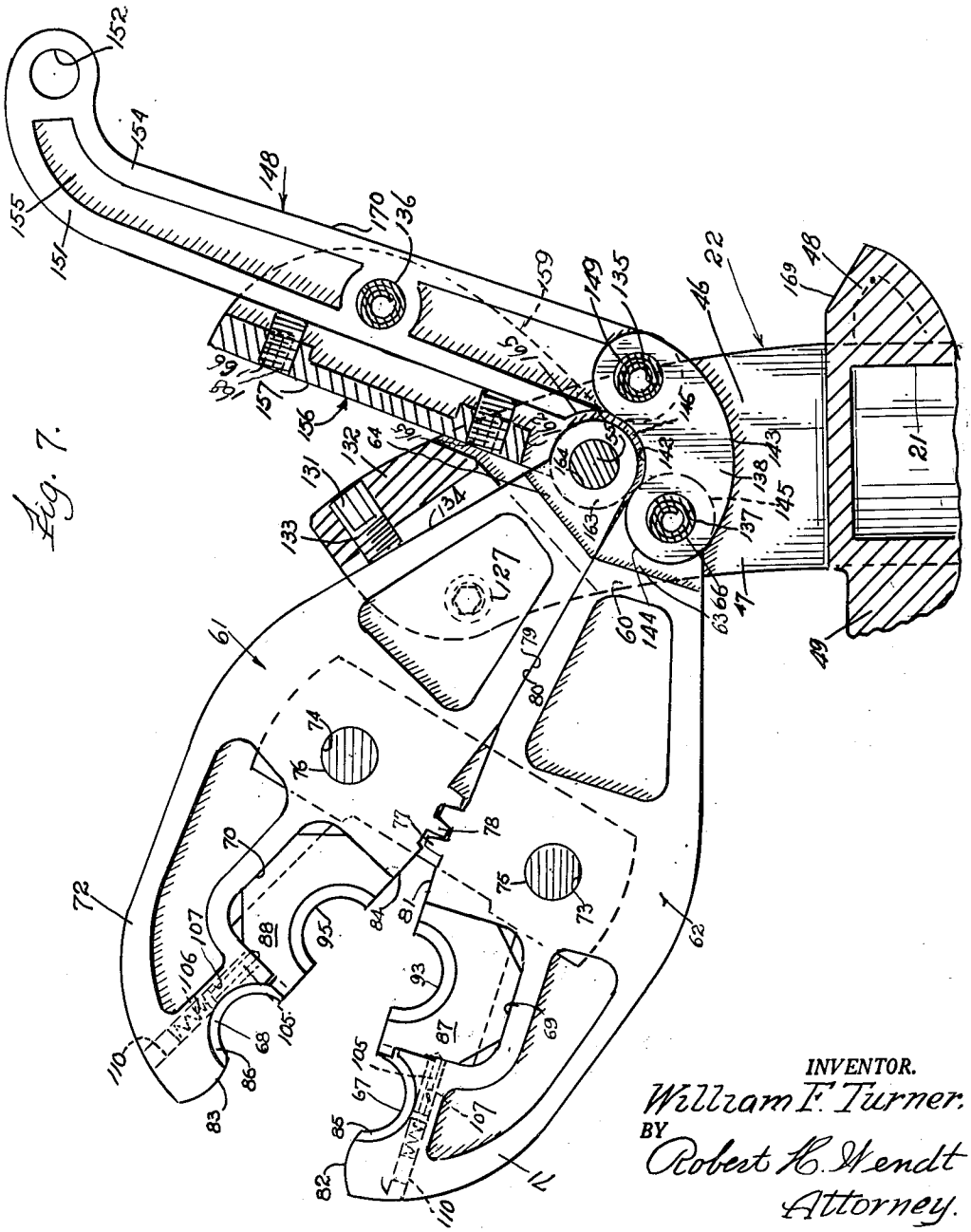
Fig. 7.



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LEVER HOT STICK FOR COMPRESSING SLEEVES AND CONNECTORS

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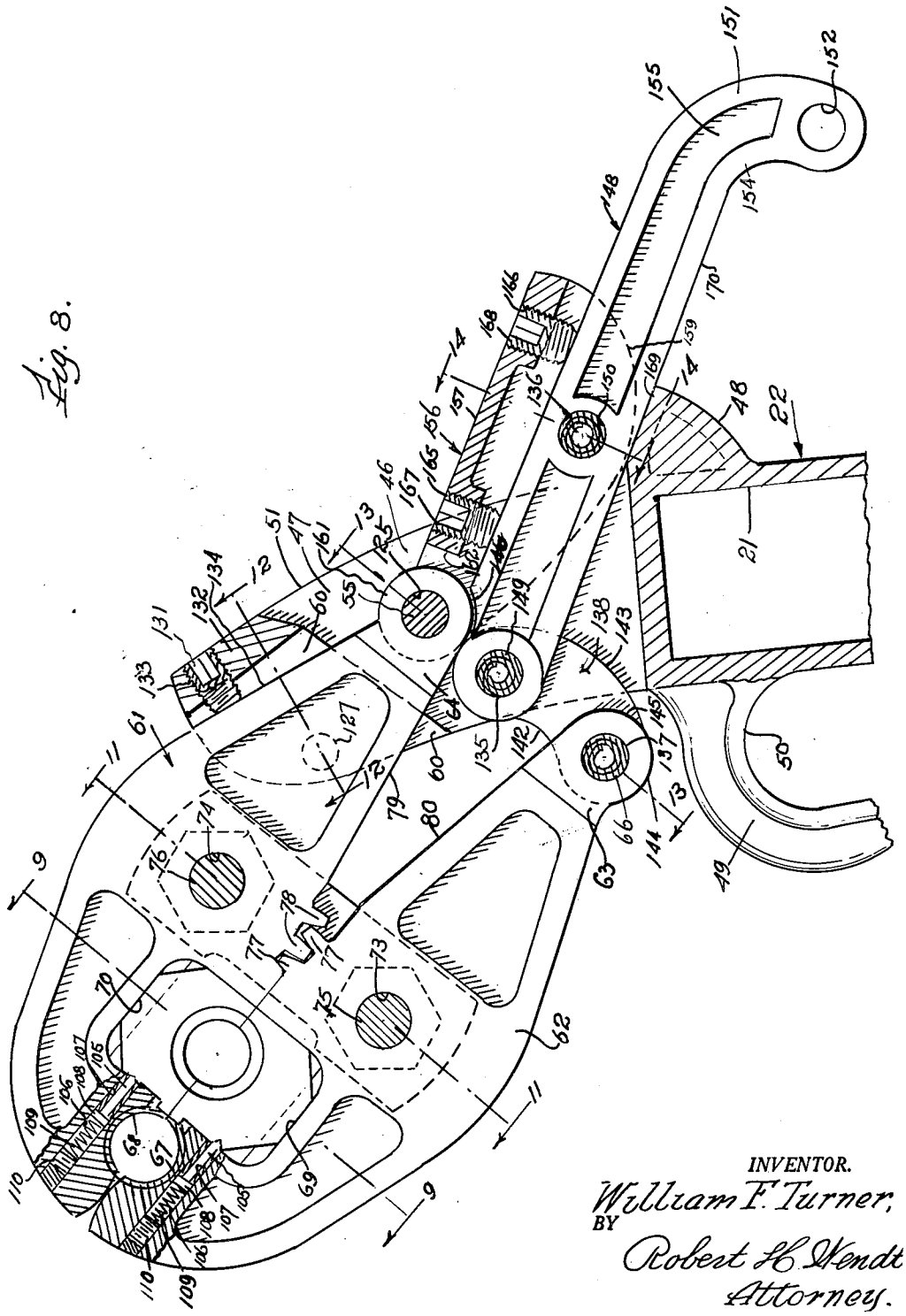
Fig. 8.



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United States Patent Office

3,057,233
Patented Oct. 9, 1962

3,057,233

LEVER HOT STICK FOR COMPRESSING SLEEVES AND CONNECTORS

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Filed Dec. 21, 1960, Ser. No. 77,299
4 Claims. (Cl. 81—15)

The present invention relates to lever hot sticks for compressing sleeves and connectors, and is particularly concerned with such hot sticks which are adapted to be used for various additional purposes.

One of the objects of the invention is the provision of a hot compression tool of the lever type which may be used for swaging sleeves and connectors on energized conductors, for splicing and making tap connections, and which can also be used with a U-shaped sleeve to reinforce conductors where a few strands have been broken.

Another object of the invention is the provision of a lever type compression tool which is suitably insulated so that it may be used on high voltage lines, and in which the degree of angle at which the upper jaw is held is adjustable, and adjustment is also provided for the over center pivoting of the toggle to provide a maximum pressure exerted by the jaw closure, and in which the range of movement of the insulated handle may be adjusted.

Another object of the invention is the provision of an improved lever type hot compression tool which is simple in construction, which is adapted to be manufactured at a low cost, which has a minimum number of parts, and which is so arranged that the jaws may be opened very quickly and brought to near closed position quickly, after which a maximum compression may be applied to the sleeves and connectors with a minimum amount of effort.

Another object of the invention is the provision of an improved toggle structure for a tool of the class described and the adaptation of the tool for use with bolt cutter jaws for cutting hard and soft conductors.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the four sheets of drawings accompanying this specification,

FIG. 1 is a side elevational view of the complete hot stick assembly with the jaws in the open position and the hand lever so adjusted that the assembly may be folded into a minimum amount of space;

FIG. 2 is a side elevational view of the operating head of the lever type compression tool;

FIG. 3 is a top plan view of FIG. 2;

FIG. 4 is a bottom plan view of FIG. 2;

FIG. 5 is a front elevational view of FIG. 2, taken from the left;

FIG. 6 is a rear elevational view of FIG. 2, taken from the right;

FIG. 7 is a full size view in partial section on the line 7—7 of FIG. 5, looking in the direction of the arrows of the mechanism of the lever compression tool, with the parts in the open position;

FIG. 8 is a similar view with the parts in the closed jaw position;

FIG. 9 is a sectional view taken on the plane of the line 9—9 of FIG. 8, with the jaws removed, looking in the direction of the arrows;

FIG. 10 is a similar view of the jaws removed from FIG. 9;

FIG. 11 is a sectional view, taken on the plane of the line 11—11 of FIG. 8, looking in the direction of the arrows;

FIG. 12 is a fragmentary sectional view, taken on the plane of the line 12—12 of FIG. 8, looking in the direction of the arrows;

FIG. 13 is a fragmentary sectional view, taken on the plane of the line 13—13 of FIG. 8, looking in the direction of the arrows;

FIG. 14 is a fragmentary sectional view, taken on the plane of the line 14—14 of FIG. 8, looking in the direction of the arrows;

FIG. 15 is a view in perspective of a hardened jaw assembly.

Referring to FIG. 1, the present lever type hot compression tool preferably comprises an insulating pole 20, preferably cylindrical in shape and secured in a cylindrical socket 21 in the upper tool fitting 22, and provided with an insulating cylindrical cap 23 at the bottom, having a cylindrical socket frictionally gripping the lower end of the pole.

The tool fitting 22 may be secured in the upper end of the pole by means of a suitable through pin 24 riveted over at its ends. The pole may be made of suitably dried hard wood covered with insulating varnish, or it may be made of Fiberglas or other suitable insulation.

At its lower end, remote from the compression tool fitting 22, the pole is provided with an insulating hand lever 25, comprising a wooden or Fiberglas rod provided with a rubber or plastic tubular hand grip 26 frictionally secured or cemented on its free end.

The handle lever 25 has its lower end in a pivoted metal socket member 27, where it may be cemented, pinned, or held by friction; and this lever socket member is pivoted by means of a pin 28 between the parallel edges 29 of a metal clamping fitting 30, which may be made of two similar halves, forming a cylindrical bore for receiving and clamping the pole 20, on which it is adjustably secured by one or more clamping screw bolts 36 passing through one half and threaded into the other half of the fitting 30.

The fitting 30 is preferably so adjusted that when the jaws are wide open, the handle lever 25 is folded up against the insulating rod 37, which connects it to the compression head fitting 22.

The insulating rod 37 may likewise be made of dried hard wood, Fiberglas, or other insulating material; and the rod has its two ends provided with metal pivot members 38, 39, each of which has a socket for receiving the rod, which is cemented or pinned in the socket; and each fitting 38, 39 is provided with a pivot flange 40, 41.

The lower pivot flange is pivoted to a metal clamping member 45 by means of a pivot pin 42; and the clamping member 45 has a pair of flanges 43 on opposite sides of a bore 44, receiving the rod 25, on which the clamping member 45 is secured by a screw bolt 46, passing through one flange and threaded into the other flange.

Thus the leverage of the hand lever 25 may be adjusted by moving the clamping member 45 longitudinally of the rod 25. The hand lever 25 is preferably so adjusted that it moves from almost vertical position downward to a horizontal position in closing the jaws, exerting its maximum force on the rod 37 when the handle 25 reaches the approximate horizontal position.

The lever hot stick head 22 comprises a metal supporting member 46, preferably made of light metal, such as aluminum, and formed with a through slot 47 above the socket 21 for mounting the compression head mechanism. This metal supporting member 46 preferably has a radially projecting stop lug 48 on one side and a downwardly curved integral arm 49 on the other side, forming a hook shaped recess 50, which is useful for hot line work.

The through slot 47 provides the supporting member 46 with a pair of parallel supporting flanges 51, 52, which

are provided with aligned through bores 53, 54 for passing a pivot bolt 55 having a non-circular head 56 at one end and a nut and spring lock washer 57, 58 on the other threaded end 59.

The through slot 47 is wider at its lower end, but has a narrower portion 60 at its upper end, where it is of sufficient width to receive one of the jaw supporting members 61, which is the uppermost and fixed jaw supporting member.

The mechanism comprises two identical jaw supporting members or jaw supporting plates 61, 62, each of which is provided with a tapered end portion 63, 64 having a cylindrical pivot bolt 55, 66.

The jaw plates 61, 62 are preferably made of hardened forged steel provided with a plurality of jaw recesses 67, 68, 69, 70 at the forward end portions 71, 72 of the jaw plates. At their intermediate body portions the jaw plates are provided with cylindrical bores 73, 74 for receiving a pair of cylindrical trunnions 75, 76 on which the jaw plates are pivoted.

Between the trunnions 75, 76 each jaw plate is provided with a plurality of inter-engaging gear teeth 77, 78 separated by grooves so that these teeth may mesh with each other, and are preferably so formed that they have rolling contact with each other.

The gear teeth maintain the alignment of the jaw plate recesses 67—70.

At the rear end of the jaw plates 61, 62 they are provided with flat edge surfaces 79, 80, which come into contact with each other when the jaws are wide open; and at the forward end portions 71, 72, adjacent the jaw recesses 67—70, the jaw plates have flat surfaces 81, 82, 83, 84, which clear each other so that the jaws may be provided with free range of action without the surfaces 81—84 engaging each other.

The front jaw recesses 67, 68 comprises a pair of half cylindrical integral jaw formations, each of which has an inwardly projecting half cylindrical rib 85, 86; and these form jaws which are used for sleeves of different size than the removable jaws 87, 88 located in the rear jaw recesses 69, 70.

The removable jaws 87, 88 are shown in perspective in FIG. 15; and these are of standard shape and construction so that the tool may be used with the compression heads or jaws of various manufacturers, as well as standard bolt cutter jaws for cutting conductors.

The jaws or compression heads 87, 88 may be identical in construction; and they comprise hardened forged steel members which are generally rectangular in shape, having front and rear plane sides 89, 90 and inner plane faces 91, 92, which are provided with substantially half cylindrical recesses 93 and 94 having the inwardly projecting half cylindrical compression ribs 95 for engaging the sleeves and connectors.

The recesses described as half cylindrical are actually slightly less than half cylindrical so that the faces 91, 92 of the dies may have a clearance, permitting the half cylindrical formations 93—95 to compress cylindrical sleeves.

Each jaw or compression head has a groove 96 of rectangular shape on its outer face, leaving two parallel flanges 97, 98 which engage on the opposite sides of a rectangular rib 99, which is formed on each jaw plate in the jaw plate recesses 69 and 70.

The ribs 99 in the grooves 96 hold the compression heads or jaws in alignment with the jaw plates 61, 62. Additional means for aligning the compression heads is provided adjacent the other faces 91, 92 by a pair of spaced rectangular lugs 100, 101, having a rectangular groove 102 between them; and these are adapted to engage on the opposite sides of the rear portion of the rectangular ribs 85, 86.

Each compression jaw 87, 88 is also provided with means for securing it in the jaw plates, comprising a circular depression 103 and a camming groove 104 having

a partially cylindrical beveled surface in each case for camming backward the end of a retaining plunger 105 (FIG. 8) carried by the two jaw plates 61, 62.

These jaw retaining plungers 105 are slidably mounted in the bore 106, which has a guide sleeve 107 provided with a bore for receiving each plunger 105. Each plunger 105 has a head 108 against which a coil spring 109 bears; and the other end of the spring is seated against a threaded plug 110.

When the jaws 87, 88 are pressed into the recesses 69, 70, the retaining plungers 105, which have rounded ends, are cammed backward by the camming surface 104 in each case until they ride over the plane surface into the partially spherical depressions 103, thus retaining the jaws in their recesses in the jaw plates.

The gear teeth 77, 78 between the jaw plates maintain the alignment between the jaws; but the jaw plates are pivoted on the trunnions 75, 76, which also pass through cylindrical bores 111, 112 in a rectangular steel strap 113 on one side of the jaw plates and through similar bores 114, 115 in a similar steel strap 116 on the other side of the jaw plates.

The trunnions 75, 76 may be provided with heads 117, 118, which are countersunk in counterbores 119, 120 (FIG. 11) in the strap 113, wherein the trunnions 75, 76 may be frictionally held. The other ends of the trunnions 75, 76 are provided with threaded portions 121, 122 for receiving the threaded nuts 123, 124 which secure the straps 113, 116 on the opposite sides of the jaw plates 61, 62.

Thus the straps 113, 116 are adapted to resist the spreading of the jaws when they are compressing a connector sleeve or other part; and the trunnions 75, 76 pivotally support the jaws.

One of the important features of the present invention lies in the fact that the upper jaw plate 61 is fixed on the supporting fixture 22 and pole 20 so that only the lower jaw plate 62 moves.

In the compression tools of the prior art neither one of the jaws was held firmly, but both were permitted to rotate; and sufficient pressure was sometimes exerted to allow both jaws to move as much as 70 degrees during their closing action. The rotation of the jaws would either tend to twist the wire and the sleeve which was being compressed or the jaws would slip on the sleeve.

In some cases, with the devices of the prior art the tool might start out beneath the conductor; and because of the rotation of the jaws, when the squeeze was completed, the tool would be out at one side of the conductor.

This was an undesirable condition because there may not be sufficient room for the compressor to rotate in this manner, as there may be rope blocks, wire grips, and other equipment around the conductor on which the work is done.

It is, therefore, highly desirable to limit the amount of movement of the tool on the conductor. This is accomplished in the present tool by making the upper jaw plate 61 a fixed jaw plate and confining movement and rotation to the lower jaw plate 62.

For this reason the rear or tapered end of the upper jaw plate 61 is fixedly secured at that end by the pivot bolt 55, which is located in a cylindrical bore 125 in jaw plate 61. For adjustment, jaw plate 61 is pivotally mounted upon the bolt 55; but it is held in fixed position by the adjustable set screws 126, 127 located in the parallel supporting flanges 51, 52 of the fitting 22, as shown in FIG. 12.

Set screws 126, 127 are preferably of the non-circular socket type, having sockets 128 for receiving a wrench; and they are secured in threaded bores 129 and brought into engagement with the sides 130 of the jaw plates to aid in securing the upper jaw plate 61 in fixed position.

A third set screw 131 of the same type is located in the yoke 132 of the fitting 22 in a threaded bore 133 in

position to have its end engage the edge **134** of the upper jaw plate **61**.

Thus by means of the three set screws **126**, **127**, and **131** the position of the upper jaw plate **61** may be adjusted; and this jaw plate may be secured against any further movement on the bolt **55**.

Thus the compression tool does not rotate on the conductor, but maintains its position substantially as shown in FIGS. 1 or 8.

The movable jaw plate **62** preferably has its pivot bolt **66** of the type which is also employed as the pivot pin **135** (FIG. 8) and the pivot pin **136**. These are preferably pins formed of spring sheet steel wrapped spirally so that they are adapted to exert an expansive force, holding themselves in position by friction exerted by their own spring action.

These pivot pins are slightly tapered on their ends so that they may be driven in place with a hammer, but are generally cylindrical in form and are slightly over-sized at the portions which are to be fixed in the bores in which they are mounted.

Thus the pivot pin **66** rotates relative to the jaw plate **62**, which has a cylindrical bore **137** for rotatably receiving pivot pin **66**, which carries at its ends a pair of compression links **138**, **139** mounted on the ends of pivot pin **66** by means of bores **140**, **141** which are suitably sized so that these bores grip the pivot pin **66**.

The links **138**, **139** are preferably of nickel aluminum bronze; and they are both curved, as shown at **142**, on the inside curved concavely, and **143** on the outside, where the links are curved convexly.

The ends of the links are cylindrical, as indicated at **144**, conforming to the cylindrical end surfaces **145** on the jaw plates; and the concave surface **142** on the links is adapted to nest with the cylindrical end surface **146** on the end of jaw plate **61**, as shown in FIG. 7, thus facilitating the wider opening of the jaws.

The other ends of the two links **138**, **139** are provided with cylindrical bores **147** for gripping the spiral pivot pin **135**, which pivots on the actuating arm **148** for the compression head. This arm **148** has a cylindrical bore **149** at its inner end, a cylindrical bore **150** intermediate its ends on the pivot pin **136**, and a downwardly curved end **151** provided with a cylindrical bore **152**.

The bore **152** has a pivot bolt **153** (FIG. 1) pivoted on the pivot flange **40** at the upper end of the actuating rod **37**.

The arm **148** is preferably of nickel aluminum bronze and provided with border ribs **154** on both sides of a central web **155** for maximum reinforcing strength; and the actuating arm is thickened at its bearing portions at the bores **149**, **150**, and **152**.

The arm **148** is connected to the upper jaw plate **61** by means of an upper shackle **156** (FIG. 1), which is substantially U shaped in cross section, as shown in FIG. 14. The shackle **156** is preferably of nickel aluminum bronze provided with a yoke **157** and a pair of parallel side flanges **158**, **159** mounted on opposite sides of the arm **148**.

The arm **148** is provided with a cylindrically curved portion **160** adjacent the cylindrically curved end **161** of the fixed jaw **61**; and the arm **148** is pivotally mounted on pivot pin **136** of the sheet spring steel type by having a bore **150** for this pin, which has its ends fixedly mounted in the side flanges **158**, **159** of the shackle **156**.

The shackle **156** is pivotally mounted on the pivot bolt **55** by having its yoke **157** terminate at **162** adjacent a cylindrical end portion **163** of the side flanges **158** and **159**. The side flanges **158** and **159** have bores **164** for pivot bolt **55**; and the actuating arm **148** is in effect pivotally connected to the fixed jaw plate **61** by means of the shackle **156**, which is adjustably mounted on the arm by means of a pair of set screws **165**, **166** mounted in threaded bores **167** and **168** in the yoke **157** of the shackle **156**.

The shackle is thus adapted to rock on the pivot pin **136** to adjust the pivotal relation of the shackle **156** relative to the arm **148**, where the shackle is secured by the set screws **165**, **166**, thereafter rotating with the arm **148**.

The fixture **22** has a stop surface **169** engaging the lower edge **170** of the actuating arm **148**; and the adjustment of the shackle on the actuating arm is accomplished as follows. The rod **37** is detached from the upper arm **148**; and the set screws **165**, **166** in the shackle **156** are so adjusted that the over-center line toggle, comprising the links **138**, **139**, exerts maximum compressive force at the jaws.

When this is satisfactory, the set screws in the aluminum fixture **22**, indicated at **126**, **127**, and **131**, are backed out so that the head can be adjusted in the fixture **22**.

The upper set screw is so adjusted that the position of the upper jaw plate **61** is such that the arm **148** comes down against the stop **169** just after the arm **148** has gone over center. The upper jaw plate **61** is then secured by driving in the set screws **126**, **127**; and the rod **37** is then re-connected.

The pivot **28** on the pole is so adjusted longitudinally of the pole that the handle **25** is all the way forward when the arm **148** is all the way up and the jaws are fully open. This is the adjustment that produces maximum efficiency; and the tool may be adjusted to take various types of standard compressor heads and also to take bolt cutter jaws.

One of the results of the foregoing construction is to reduce to a minimum bending moment in the head assembly and placing most of the tension stresses on the stick in the head area. Most of the bending stresses that are applied to the pole **20** occur down at the handle; and the construction is such that the bending stresses cause the pole to spring somewhat when maximum force is exerted at the jaws; that is, when the arm **148** strikes the stop **169**.

A hardwood pole or an extra strength Fiberglas pole having equal or greater rigidity is preferably employed and full strength of the jaws, which are rated for three and one-half tons, is developed by this construction.

It will thus be observed that I have invented an improved lever hot stick which is adapted to exert maximum pressure on the jaws, while preventing the rotation of the jaws on the conductor or connector. The present tool is capable of accurate adjustment to meet all the conditions which are encountered in practical use.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a lever hot stick for compressing sleeves and connectors, the combination of a metal supporting fixture having a lower round body formed with a socket for receiving an insulating pole, said body having a pair of upper spaced parallel pivot flanges for supporting compressor jaws, a pair of hardened metal jaw supporting plates, said plates having their forward ends provided with aligned jaw recesses for supporting jaws, and said plates being provided with rear actuating portions, interengaging gear teeth on the adjacent edges of said plates for maintaining alignment of said jaw recesses, a pair of hardened metal straps extending from the first plate to the second plate, said straps being located, one above and the other below said plates and said straps supporting a pair of cylindrical trunnions extending from the upper strap to the lower strap, and each trunnion passing through a cylindrical bore in one of said plates on said straps, the said straps holding the gear teeth on

one plate in engagement with the gear teeth on the other plate, and the straps resisting the spreading of said jaw recesses under load, a yoke joining said parallel flanges along one side thereof at the upper ends of the flanges, a pair of set screws, one carried by each of said flanges, and a third set screw carried by said yoke, all in threaded bores, engaging and securing the upper one of said jaw plates against movement, said jaw plates tapering toward their rear end, and each having a cylindrical bore at its end, an elongated actuating lever having cylindrical bores at each end and having an intermediate cylindrical bore, an elongated U-shaped shackle having parallel flanges and provided with a pivot in said intermediate bore and said latter flanges, said shackle having a yoke provided with a pair of spaced set screws engaging the edge of said actuating lever to adjust the position of the shackle and secure it relative to said actuating lever, said shackle and said upper jaw plate being pivotally mounted on said first-mentioned parallel flanges by a common pivot bolt, a curved toggle link pivoted to the end of said actuating lever and pivotally connected to said lower jaw plate and curved to nest about the end of the upper jaw plate, said shackle being adjustable relative to said actuating lever to permit maximum opening of the jaw plates and application of maximum force to sleeves and connectors.

2. A lever hot stick according to claim 1, in which the pivots of said shackle and the toggle link comprise spirally formed spring members frictionally secured in cylindrical bores.

3. A lever hot stick according to claim 1, in which the supporting fixture is mounted upon an insulating pole and the actuating lever is pivotally secured to an insulating rod extending to a hand lever upon which it is pivotally and adjustably mounted and the hand lever is pivotally and adjustably mounted on the pole, for maximum jaw opening with the rod folded against the pole.

4. A lever hot stick according to claim 1, in which a pair of jaw blocks are slidably and removably mounted on a pair of guide ribs in a jaw recess in each jaw plate and held by retractable spring pressed plungers carried by the plates and engaging the jaw blocks.

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