Sept. 13, 1932. W. D. STETSON 1,877,076

WIRE SPLICING TOOL

Filed Aug. 4, 1930 3 Sheets-Sheet 1

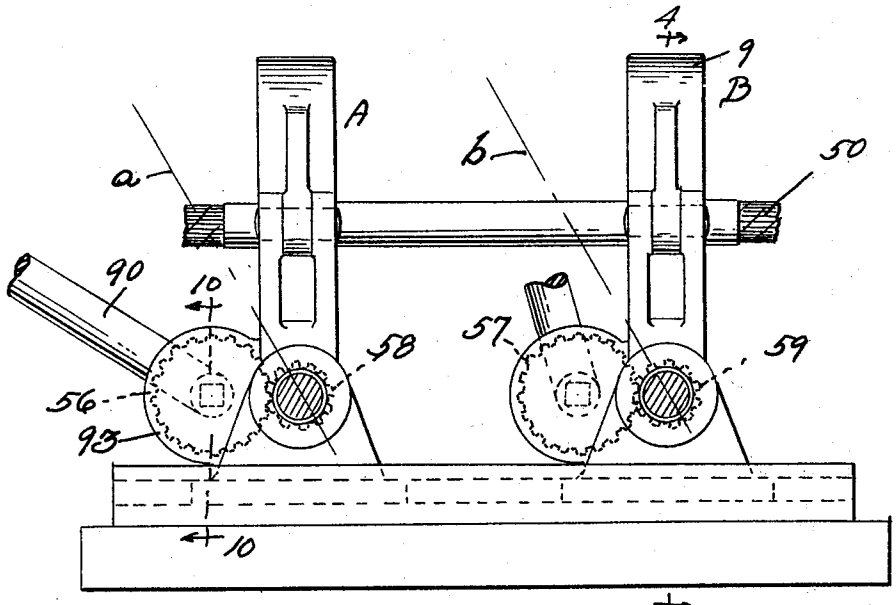


Fig. 1

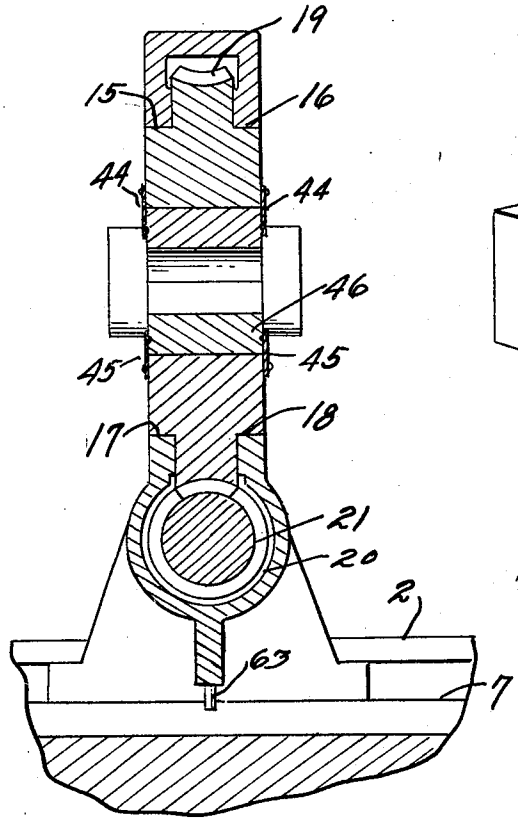


Fig. 2

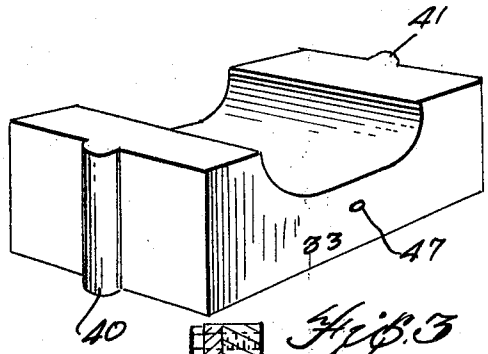


Fig. 3

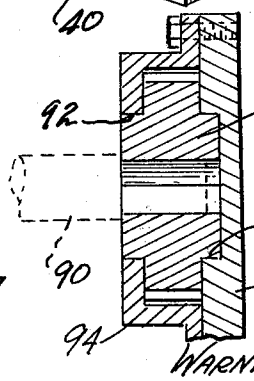


Fig. 10

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WIRE SPLICING TOOL

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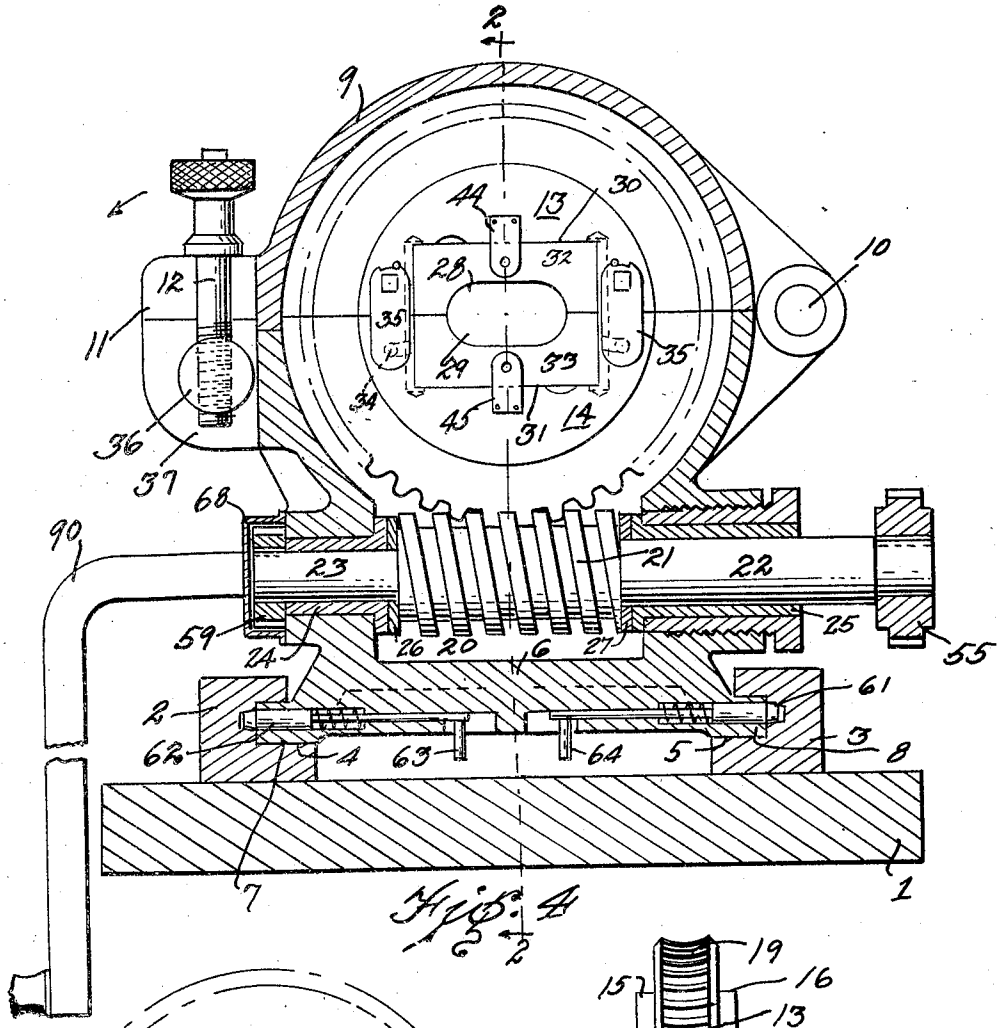


Fig. 4

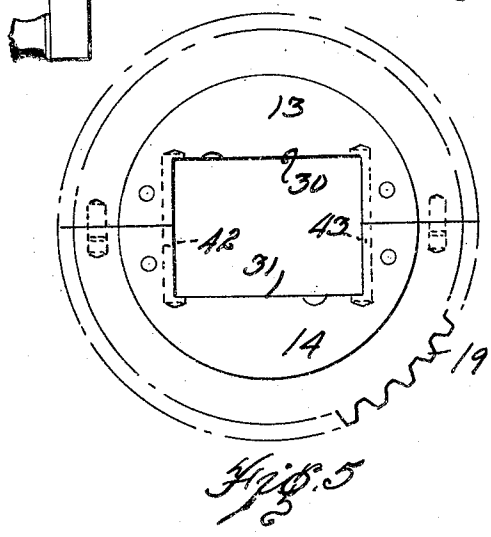


Fig. 5

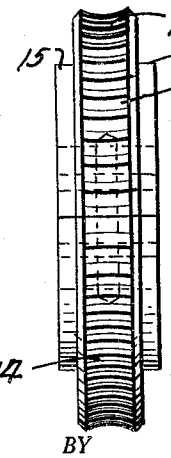


Fig. 6

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WIRE SPLICING TOOL

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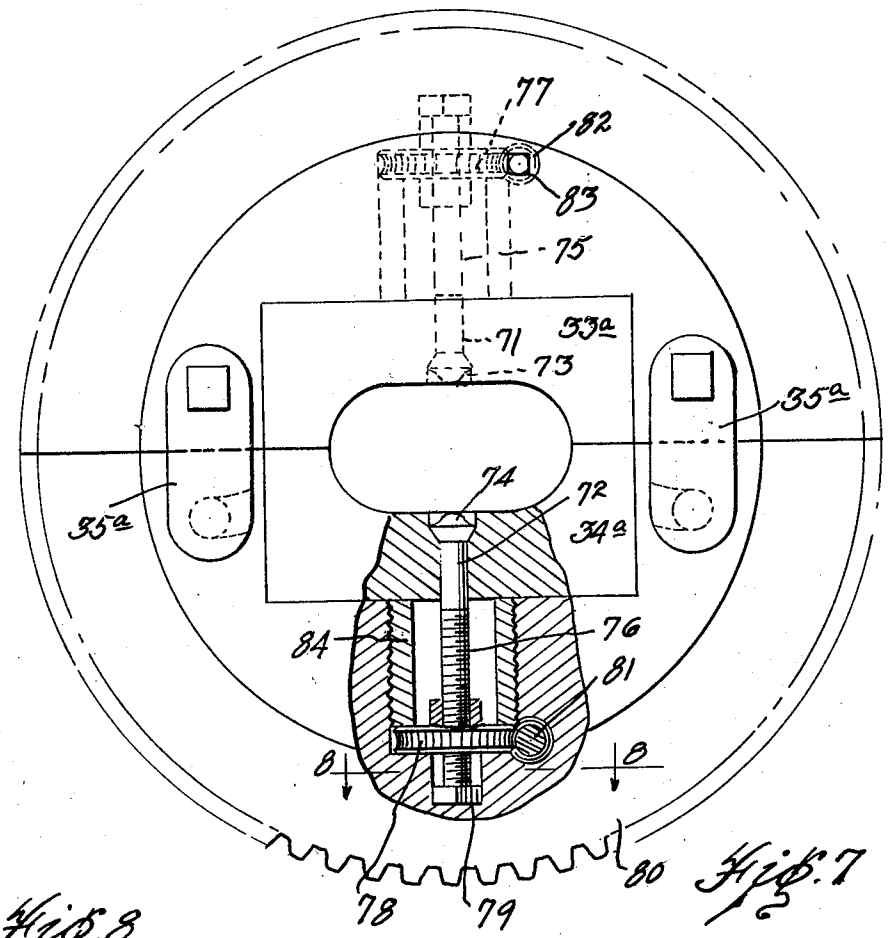


Fig. 7

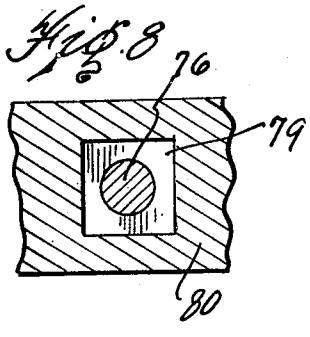


Fig. 8

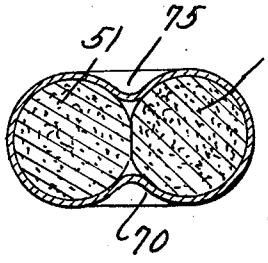


Fig. 9

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Patented Sept. 13, 1932 1,877,076

UNITED STATES PATENT OFFICE

WARNER D. STETSON, OF FERNDALE, MICHIGAN, ASSIGNOR OF ONE-FOURTH TO CHARLES E. WISNER, OF DETROIT, MICHIGAN

WIRE SPLICING TOOL

Application filed August 4, 1930. Serial No. 473,070.

This invention relates to wire splicing apparatus, its purpose being to provide a device for twisting a sleeve into which adjacent ends of the wires to be spliced are positioned to form a metallic contact between the wires at the joint of a character to withstand tension strains.

The object of the invention is to provide a device capable of twisting sleeves for various sizes of wire used in distribution of electric current that may be used in the air or on the ground and of a character to twist the sleeve about an axis whereby the axis of the finished joint is a straight line.

The principal feature of construction is in the provision of two rotatable dies held in heads or housings upon the same base whereby the axes of the two die parts are in alignment. This results in a structure for twisting a sleeve in the splicing of a wire in which the strains imposed on the sleeve in the twisting operation and which tend to shorten the sleeve are applied axially of the sleeve due to the rigidly supported die parts rotatable on the same axis.

A further object and feature of the invention is in providing the twisting device consisting of a pair of heads adjustably supported in a framework thereby holding the same with the axes thereof in alignment and enabling sleeves of various length to be twisted.

A further object and feature of the invention is in the provision of a separable die for engaging the sleeve and means for locking the parts of the dies together to prevent separation thereof in the twisting operation and a housing in which the die is located and revoluble, the housing having a separable portion permitting the dies to be removed or inserted or separated to receive the wire and sleeve to be twisted.

A further object of the invention is to provide separable die parts adapted to be locked together, the said die parts when locked together providing a worm wheel, and a worm or screw shaft in a housing for the die engaging the worm wheel for rotating the same.

Another object of the invention is to provide a device for splicing wires by means of a sleeve that is adaptable for use with sleeves for any size of wire, means being provided for a slow twisting of the wires for use with the larger diameter wires and sleeves therefor and more rapidly operating the parts for the smaller sizes.

A further object and feature of the invention is in the provision of a device having a pair of rotatable elements at opposite ends respectively to engage opposite ends of the sleeve with the wire ends positioned therein and an arrangement and construction of the parts whereby an operation may stand intermediate the twisting heads and by successive movements of the levers associated with each of the respective twisting devices in alternate directions the twisting devices are rotated sequentially in opposite directions.

These and other objects and novel features of the invention are hereinafter more fully described and claimed, and the preferred form of construction of a wire splicing apparatus embodying my invention is shown in the accompanying drawings in which—

Fig. 1 is a side elevation of the apparatus.

Fig. 2 is an enlarged section through one of the heads on line 2—2 of Fig. 4.

Fig. 3 is a perspective view of a half die.

Fig. 4 is a section through one of the wire twisting elements taken on line 4—4 of Fig. 1.

Fig. 5 is an enlarged elevation showing the die parts assembled.

Fig. 6 is an edge elevation thereof.

Fig. 7 is a detail of a different form of die parts.

Fig. 8 is a section taken on lines 8—8 of Fig. 7.

Fig. 9 is a cross section of a sleeve with the wire ends enclosed.

Fig. 10 is a section through one of the driving gears taken on line 10—10 of Fig. 1.

My improved wire splicing apparatus in its preferred form comprises a substantially rectangular frame mounted in a base 1 and having the side rails 2 and 3 provided respectively with oppositely facing grooves 4 and 5 in which the base casting 6 of each of the twisting heads engages, it being provided with feet 7 and 8 slidably engaging the respective grooves.

Each twisting device consists of this base casting 6 to which is hinged a cap element 9, it being pivoted thereto by the pivot pin 10, and the other side is provided with an outwardly projecting bifurcated portion 11 to receive a locking bolt 12 hereinafter more fully described and by means of which the cap member is rigidly secured in place. The cap member and base together form a circular opening to receive the separable die parts 13 and 14 as will be more fully understood from Fig. 4. The cap portion 9 is U shaped in cross section and has the edges 15 and 16 while the upper portion of the base part 6 completing the circular portion of the housing is likewise formed to receive the die parts and provide the shoulders 17 and 18. The two die parts together form a worm wheel which, as shown in cross section in Fig. 2, has a toothed peripheral portion 19 riding in the channel of the cap member 9 and base member 6 and has shoulders fitting the edges 15, 16, 17 and 18 of the housing. The base 6 below the upper half-circular portion thereof, in which the lower part of the die parts are housed, is recessed at 20 to receive the worm 21 which has shaft like part 22 on one side extending outwardly from the housing and a like extension 23 on the opposite end projecting through the said casting. Both these shaft ends 22 and 23 are less in diameter than the body of the screw portion and are supported in bushings 24 and 25 providing bearings for the shaft ends. Thrust bearings 26 and 27 of any desired form are provided between the end of the screw portion and the bushings in the construction shown.

The arrangement is such that through rotation of the screw by any convenient device, such as a ratchet wrench attached to either shaft end, the die parts are turned in the casting and cap member providing a housing therefor.

I have termed the portions 13 and 14 "die parts" as each half part is provided with a half recess 28 and 29 respectively of a shape to receive the end of the sleeve to be twisted. These die parts 13 and 14, if made of a single piece, preferably are formed with a rectangular recess the outline of which is indicated by the lines 30 and 31 for the respective die parts to receive the half dies 32 and 33 which may be made of a much higher grade of material than the remaining portion of the die part and enables dies having different shaped recesses to be readily mounted in each of the said die parts 13 and 14. By making these insertible pieces 32 and 33 the necessity of making the entire worm wheel of the hardened tool steel or like material is avoided.

One of the insertible pieces of hardened steel is shown in Fig. 3 in which it will be seen that at its two ends it is provided with the ribs 40 and 41 and these fit similar grooves 42 and 43 in the die parts 13 and 14 as more clearly shown in Figs. 4 and 5. These ribs prevent lateral displacement of the dies and preferably these two half die parts 13 and 14 are provided with spring clips 44 and 45 respectively on opposite sides of each die part as illustrated in Fig. 2. These have a stamped in pin like portion 46 engaging in a recess in which the insertible pieces 32 and 33 are provided as indicated at 47 of Fig. 3. These spring clips tend to hold the insertible pieces in place when the die parts are separated in introduction of a sleeve or in the removal of a twisted sleeve therefor.

An essential characteristic of this die structure, however, resides in the fact that the two die parts together provide a worm wheel at the center of which is provided a recess fitting the end of the sleeve to be twisted. Due to the fact that rotation of the worm wheel tends to twist the sleeve on its longitudinal axis pressure thus developed tends to spread the die parts which would cause them to bind against the shoulders 15, 16, 17 and 18 and thus be impossible to rotate the die element due to the braking effect. To prevent such spreading of the die parts, each die part has a pin 34 parallel with the axis of rotation of the die and the other die part has a latch element 35 pivotally supported thereon having a recess in its free or movable end as shown by dotted lines in Fig. 4 to engage the pin 34 of the other die part and thus lock the two die parts together to prevent spreading therefrom. By this arrangement and construction the die parts are not permitted to expand and thus under all strains to which the dies are subjected the die parts are freely revoluble in the housing provided therefor.

It is to be noted that the die parts are separated on a diametrical line of the worm wheel and that the teeth of the worm wheel are at an angle thereto and as more than one tooth of the worm wheel is engaged by the teeth of the worm at the same time there is no point at which the entire pressure would be taken by a split tooth of the worm wheel.

It is necessary to lock the cap member to the base member for which purpose the locking element 12 is provided. This consists of a shaft 12 threaded in a cross shaft 36 rotatably mounted in the bifurcated projection 37 of the base element 6. By unscrewing the member 12 from the position shown in Fig. 4 the lock shaft 12 may be turned in the direction indicated by the arrow out of the bifurcated end 11 of the cap member permitting the cap to be swung on its hinge 10 which will thus permit the die parts to be removed upon completion of the twisting of the sleeve for instance. Also, in the positioning of the sleeve it is necessary to place the die parts with the dividing line passing directly through the axis of the pivot 10. The first half part 14 is then positioned in each of the

two members at opposite ends of the base, the sleeve with the wire ends therein laid in place, and then the upper die part 13 is placed thereover and locked to the first part by the members 35 of which there may be four, two on one side of the combined elements 13 and 14 and two on the opposite side and the cap 9 then placed in position as in Fig. 4.

In operation of the device, the moving gear and die parts are rotated to occupy the position shown in section in Fig. 4 with the line of separation in a plane cutting the longitudinal axis of the pivot point 10. The screw 12 is then released and turned to the left as shown by the arrow in Fig. 4 permitting the cap 9 to be turned upwardly in the opposite direction about the pivot 10.

By releasing the latch elements 35 on opposite sides of the gear and die parts, the upper die 13 may be removed permitting introduction of the sleeve with the wires therein in place in the lower half of the die parts of the two heads, the top die part then replaced and the cap 9 turned to position shown in Fig. 4 and the cap retaining screw 12 positioned as shown. Under this condition the screw shaft 22 may be rotated to thereby turn the worm wheel and die parts about the axis extending between the two heads when the parts are in the position shown in Fig. 1.

It is necessary that the die parts of one head rotate in one direction while those in the other rotate in the opposite direction in order to secure the desired twist in the sleeve and the contained wire ends indicated at 50 and 51 in Fig. 9. In twisting the sleeve the ends of the wire lying within the sleeve are twisted one upon the other in a long spiral and thus a metallic contact is produced between the wires and the casing so that the joint is capable of carrying as great an amount of current as any single wire 50 or 51.

Preferably, to turn the screw shafts 22 of the respective heads A and B, I provide each shaft end with a notched or toothed element 55 and use a ratchet tool having an aperture to fit the same. Such a tool is shown in my United States Patent No. 1,645,668, and there are two such tools or similar ratchet wrenches used preferably with a fairly long handle and one of the tools ratchets in one direction and the other tool in the opposite direction.

Thus, the two tools, which may be assumed to be positioned as shown by the dotted lines *a* and *b* in Fig. 1 are moved simultaneously, one of them twisting the sleeve while the other, due to its ratchet form, permits its worm shaft to remain idle and in movement in the opposite direction a reverse operation takes place, the tool in the head A for instance being twisted by movement in one direction and the other die being turned when the ratchet tools are moved in the other direction. Any type of ratchet wrench can be utilized it only being necessary that the end of the shaft 22 be shaped or provided with a means to fit the aperture provided in the ratchet wrench or to receive the ratchet wheel of the wrench.

The tool is adapted to twist any size of sleeve and wire therefor and for the larger sizes of wire the ratchet wrenches are applied directly to the shafts 22 in which the slower revolution of the screw shaft will be attained. Where less power is required or if for any other reason it is desired to more rapidly rotate the die parts as with the smaller size wire sleeves, I provide a gear 56 for the head A and a similar gear 57 for the head B each of which meshes with a companion gear 58 and 59 respectively on the end 23 of the screw shaft which, for this purpose, may project to receive the gear 59 for instance as shown in Fig. 4. This is preferably covered by a cap 60.

The shaft for the gears 56 and 57 projects from the casting and may be formed to receive the ratchet wrench as in the case with the shaft end 22 heretofore mentioned and will be rotated in the same manner by means of a ratchet wrench but on the opposite side of the tool from that in the previously described operation and will have the same resultant action by the turning of the screw shaft.

In view of the increased leverage secured by the gear arrangement, these two gears may be rotated by means of a crank indicated at 90 in Fig. 4. The gears 56 and 57 may be provided with a squared aperture into which the squared end of the crank 90 may be positioned. The gear for this character of operating device, as shown in Fig. 10, may be constructed with a hub fitting the shoulders 91 and 92 formed in the housing 93 and cover 94 therefor which extends to one side of each of the parts A and B of the device as shown in Fig. 1.

It will be noted that these die parts engage the sleeve adjacent the ends thereof and the two heads A and B may be spaced different distances apart for different lengths of sleeve but should be fixed in position and for this purpose the rails 2 and 3 have the faces of the grooves 4 and 5 notched or toothed to receive the spring-pressed plungers 61 and 62 carried in the foot portions 7 and 8 of the head. These spring-pressed plungers may be constructed substantially as shown in Fig. 4 having the depending pins 63 and 64 by means of which they may be withdrawn and the head then moved longitudinally of the base to the desired spaced position.

By mounting the heads A and B in a relatively fixed position on a base they are held with the axes of the die parts in alignment and the strains imposed on the sleeve in turning the same by rotation of the die parts tends to shorten the sleeve drawing the sleeve ends through the die parts. This turning strain

results in a shrinkage longitudinally of the tube and causes it to remain in a straight line which is the shortest distance between the two points of revolution at the opposite ends and the resultant joint is perfectly straight which is a result not obtained by any other sleeve twisting device within my knowledge. Also, due to the regularity of the operation in first twisting one end and then the other, each die part is turned exactly alike and the twist of the sleeve is uniform between the two heads. Usually four to five turns are sufficient to provide a joint that will withstand the pulling or tension strains to which the joint may be subjected in erecting wire, or due to a load imposed on the erected wire by snow and ice or wind.

As previously stated, the insertible die pieces 33 and 34 may provide an opening of any form such for instance as shown in Fig. 4 or it may be of any form fitting the sleeve 70, a cross section of which is shown in Fig. 9 which is a common form of sleeve in use preferably with copper wire.

Where the sleeve is oval in form corresponding to the aperture provided by the assembled parts 33 and 34 shown in Fig. 4, it is preferable that means be provided to crimp the ends of such oval sleeve to the form shown at 70 in Fig. 9. For this purpose the die parts 33*a* and 34*a* shown in Fig. 7 may be provided with movable portions 71 and 72 which have ends 73 and 74 of approximately the same width as the inserted part 33*a* and 34*a* and of a shape such that when the die parts are assembled and the members 71 and 72 forced inwardly a crimp such as is shown at 75 in Fig. 9 is placed in the opposite sides of an oval tube at the end which brings the wires 50 and 51 tightly to engagement through the taking up of the slack in the tube or sleeve. These end portions 73 and 74 are rounded and do not prevent the longitudinal contraction of the tube due to the twisting operation. The parts 73 and 74 are formed on the end of the parts 71 and 72 which extend into apertures in the respective die block projecting slightly therefrom to end engagement with the respective screw shafts 75 and 76. Each of these screw shafts, as shown in full lines in Fig. 7, is threaded in the hub of the respective worm wheel 77 or 78 and are each provided with a head 79 extending into a square recess in the worm gear 80 which is to be understood as being positioned in a housing or head as is the case with the worm gear formed of two parts 13 and 14 shown in Fig. 4. By means of this head 79 practically fitting in the recess provided therefor in the worm gear, the screw shafts 75 and 76 are held from rotation.

Each worm gear is driven by a worm or screw shaft 81 and 82 respectively which is provided with a squared projecting end 83 as shown at the upper side of Fig. 7 by which it may be turned thus causing longitudinal movement of the respective screw shafts 75 and 76. The worm gears 77 and 78 are held in position between a threaded ferrule 84 on the one side and the bottom of the recess in which the ferrule is threaded on the other. The two half gear parts forming the worm gear 80 shown in Fig. 5 are connected by means of the latch members 35*a* corresponding to the latch members 35 of Fig. 4 and functioning in the same manner as heretofore described. It will be seen from the foregoing description that the device is comparatively simple and inexpensive in construction and is very efficient in operation, one of the principal features being in the use of the two twisting heads held in a fixed relationship each including the revoluble element, preferably a worm gear as described, and the heads and the gear are separable in order to position the opposite ends of the sleeve in the apertured revolving elements and by which the sleeve is firmly held and still is permitted to move longitudinally due to the twisting operation. This arrangement secures a new result, namely, that the twisted sleeve is perfectly straight between the two heads and thus a more perfect joint is obtained and one more workmanlike in appearance than has heretofore been possible with the ordinary hand-operated ratchet devices in use.

A further feature and object of the invention is obtained by use of the insertible die parts in each half of the rotatable element which permits a change in size of the aperture to fit different sizes of sleeves required for use with different sizes of wire.

A further feature and object of the invention is obtained through use of the separable worm gear and worm for driving the same. The worms are intermittently operated by means of a wrench applied thereto as indicated by dotted lines *a* and *b* of Fig. 1 and both may be turned at the same time to effect the twisting of the sleeve as heretofore stated or one worm and worm wheel may be right hand and the other left hand. In either case, by the same direction of movement of the operating handles, indicated by the lines *a* and *b*, one worm gear is turned in one direction and the other in the opposite direction about their respective axes.

It is not necessary, however, that the worm or screw shafts be simultaneously operated as one head may be turned and the other remain stationary as the worm gear is held by its worm from rotation and thus especially when utilizing the gears 56 and 57 for increased speed of rotation a crank may be used on one gear and then subsequently another if desired.

While I have shown two heads as applied to opposite ends of the sleeve it is to be understood that where long sleeves are to be

twisted it is possible to position one of the heads intermediate the ends of the sleeve in which case the head adjacent the end of the sleeve would be turned to effect a twist for a part of the length of the sleeve and the sleeve then moved to reposition the same in such manner that the head previously at the end of the sleeve engages the same at the point previously engaged by the other head and then the remaining part of the sleeve may be twisted by rotation of one of the heads, the idle head in each case holding the sleeve from rotation. It is further to be observed that the die parts may be of any form depending upon the form of the sleeve either the OO form or the crimped form of sleeve and that the die parts may have adjustable elements to crimp the sleeve at the point engaged by the die. It therefore is evident that the various objects of the invention are attained by the structure described.

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

1. In a wire splicing tool, a base, a pair of twisting heads secured thereon in adjustably spaced relation, said heads providing the sole means to hold a sleeve and enclosed wire ends on an axis extending from center to center thereof, and means for operating the said heads to twist the sleeve.

2. A wire splicing tool comprising a base, a pair of heads mounted therein in adjustably fixed relation, each of said heads including an axially apertured rotatable element adapted to receive a sleeve and enclosed wire ends to be spliced, and means for rotating the said rotatable elements in opposite directions.

3. In a wire splicing tool for twisting a sleeve and enclosed wire ends, a base, a pair of spaced heads in adjustably fixed relation thereon, an axially apertured rotatable element in each head adapted to receive a sleeve, and means for causing rotation of said elements in opposite directions to twist the sleeve about an axis extending between the centers of the two heads.

4. In a wire splicing tool for twisting a sleeve and enclosed wire ends, a pair of spaced heads, an axially apertured worm gear in each head formed of two halves adapted to be separated to receive a sleeve, said heads having a separable part to permit separation of the worm wheel parts and to hold the same in position when assembled on a sleeve, means for locking the two parts of the worm wheel together to prevent separation thereof through the strains imposed by twisting the sleeves, and a worm shaft mounted in each head meshing with the worm wheel through rotation of which the worm wheel is rotated to twist the sleeve.

5. In a wire splicing tool for twisting a sleeve and enclosed wire ends, a pair of spaced heads, a worm wheel rotatable in each head formed of two separable halves, each of the heads also having a separable part to permit the same to be opened to permit removal or introduction of the worm wheel parts and also to permit introduction of the sleeve, the said parts of each worm wheel together being arranged to form a central aperture for the sleeve, a worm for each worm wheel adapted to be turned to cause rotation of the worm wheels, the worm of one head being arranged to turn its worm wheel in a direction opposite that of the worm wheel of the other head whereby through simultaneous operation of the screw shafts the worm wheels may be turned in opposite directions to twist the sleeves.

6. In a wire splicing tool for twisting a sleeve and enclosed wire ends, a separable two-part head apertured to receive a rotatable element, a rotatable element mounted therein consisting of a peripherally toothed gear formed of two separable halves adapted when positioned together to form a central aperture, a locking means having complemental parts on the respective gear halves for locking the two gear halves together, and rotatable means supported by the head and meshing with the said gear for driving the same.

7. In a wire splicing tool for twisting a sleeve and enclosed wire ends, a separable two-part head arranged to support a rotatable element, a rotatable element mounted therein consisting of a worm gear formed of two separable halves, the meeting faces of which are formed with notches in registration when the two parts are assembled, a die part insertible in each of the said notches and together providing an aperture on the axis of the gear of a form to receive and tightly engage the sleeve, means for locking the two gear halves together whereby the same are held from separation through the pressures imposed thereon in twisting the sleeve, and a worm shaft through rotation of which the worm wheel is rotated.

8. In a wire splicing tool for twisting a sleeve and enclosed wire ends, a separable two-part head arranged to support a rotatable element, a rotatable element mounted therein consisting of a worm gear formed of two separable halves, the meeting faces of which are formed with notches each adapted to receive a half die part, an insertible half die part for each of the said worm gear parts together providing an aperture at the center of the gear, when the gear parts are assembled, of a form to receive and tightly engage a sleeve, means for locking the two gear halves together to prevent separation thereof through pressures imposed thereon in the twisting operation, a worm shaft mounted in the head and meshing with the worm gear, said worm shaft extending to one side

of the head and arranged to receive a turning element, the opposite end of the shaft projecting from the opposite side of the head, a gear thereon, a larger diameter gear rotatably supported by the head and meshing with the said gear on the worm shaft, and means for rotating the large diameter gear.

9. In a wire splicing tool for twisting a sleeve having enclosed wire ends, a separable two-part head arranged to support a rotatable element, a rotatable element therein consisting of a worm gear formed of two separable halves, the meeting faces of which are notched, a half die part insertible in each of the said worm gear parts, releasable means for supporting the half die parts in place, said half die parts together providing an aperture at the center of the gear when the gear parts are assembled of a form to receive and engage a sleeve, said die parts each having a movable portion at its center, a worm and screw shaft for projecting each of said movable portions of the die parts to centrally clamp the enclosed sleeve to thereby cause the sleeve to bindingly engage the wire ends, means for locking the two gear halves together to prevent separation, and means for rotating the gear in the head.

10. A wire splicing tool for twisting a sleeve and enclosed wire ends comprising a base member, two heads supported thereon, means for adjusting the heads toward or from each other, each head including a rotatable element having an aperture to receive the sleeve, the said apertures of the two heads being in axial alignment and providing the sole support for the sleeve and wire ends therein, and means individual to each head for rotating the respective rotatable element.

11. A wire splicing tool for twisting a sleeve and enclosed wire ends comprising a base member, two heads slidably mounted on the base member, means for securing the heads at a predetermined distance apart, each of said heads including a rotatable element, a rotatable gear formed of two complemental parts and together providing an aperture to receive the sleeve, and means individual to each head for rotating the respective gears.

12. In a wire splicing tool for twisting a sleeve and enclosed wire ends, a base, a pair of heads mounted thereon in spaced relation, an axially apertured rotatable element in each head adapted to receive the sleeve and providing the sole means of support therefor, and independently operable means for rotating the rotatable element of each head to twist the sleeve in opposite directions between the said rotatable elements.

13. In a wire splicing tool for twisting a sleeve and enclosed wire ends, a base, a pair of heads mounted thereon in spaced relation, an axially apertured rotatable element in each head adapted to receive the sleeve, the aperture of the said rotatable element being of the same form as the form of the sleeve in cross section and fitting the same, and independently operable means for rotating the rotatable element of each head to twist the sleeve in opposite directions between the said rotatable elements.

14. In a wire splicing tool for twisting a sleeve and enclosed wire ends, a base, a pair of heads mounted thereon in spaced relation, an axially apertured rotatable element in each head adapted to receive the sleeve, the said aperture being of a form complemental to the form of the sleeve in cross section and fitting the sleeve, and a rotatable means in each head adapted on rotation to rotate the respective rotatable element.

In testimony whereof I sign this specification.

WARNER D. STETSON.