

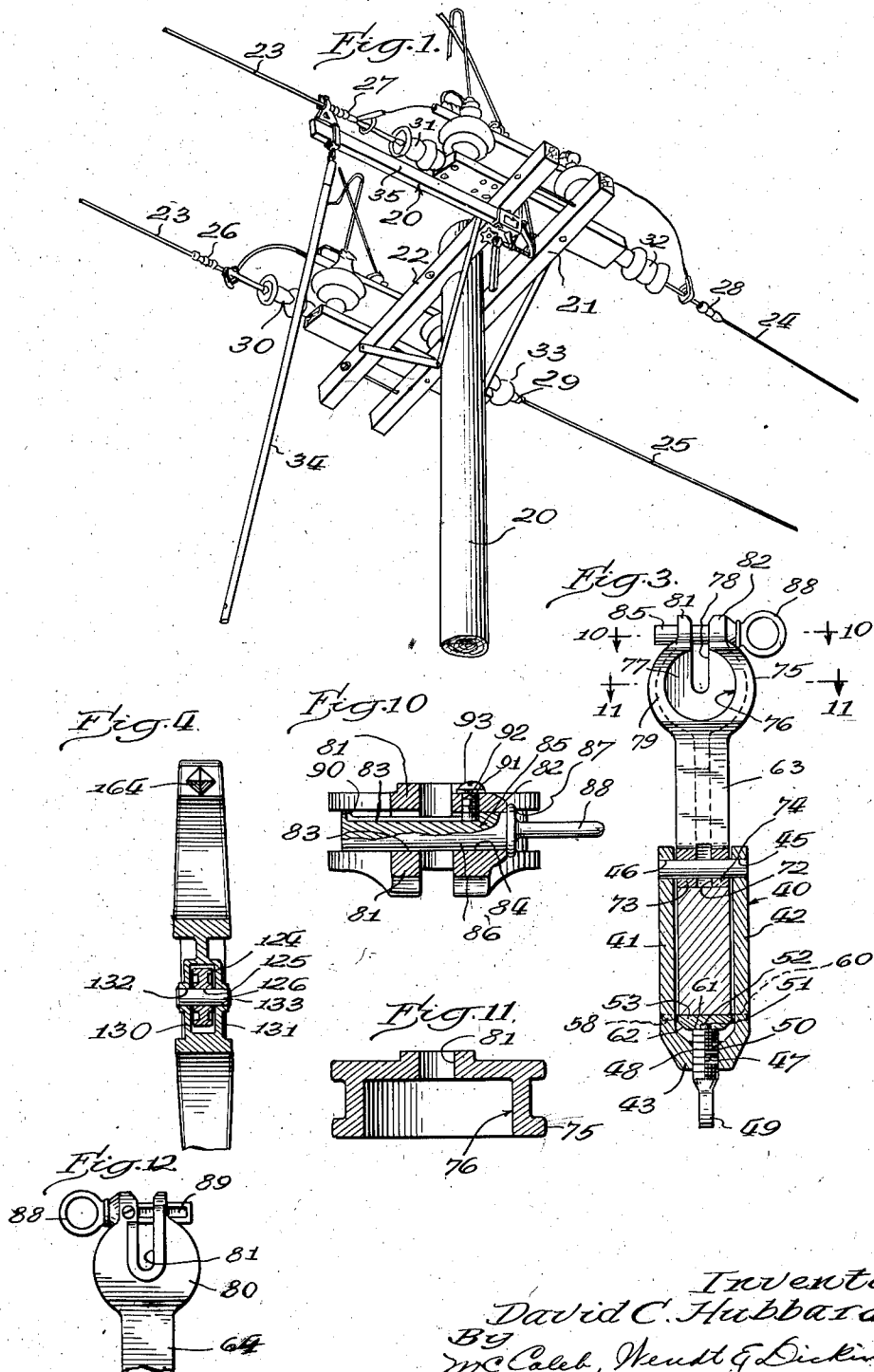
April 21, 1942.

D. C. HUBBARD
LINE MAINTENANCE TOOL

2,280,192

Filed April 10, 1941

3 Sheets-Sheet 1



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April 21, 1942.

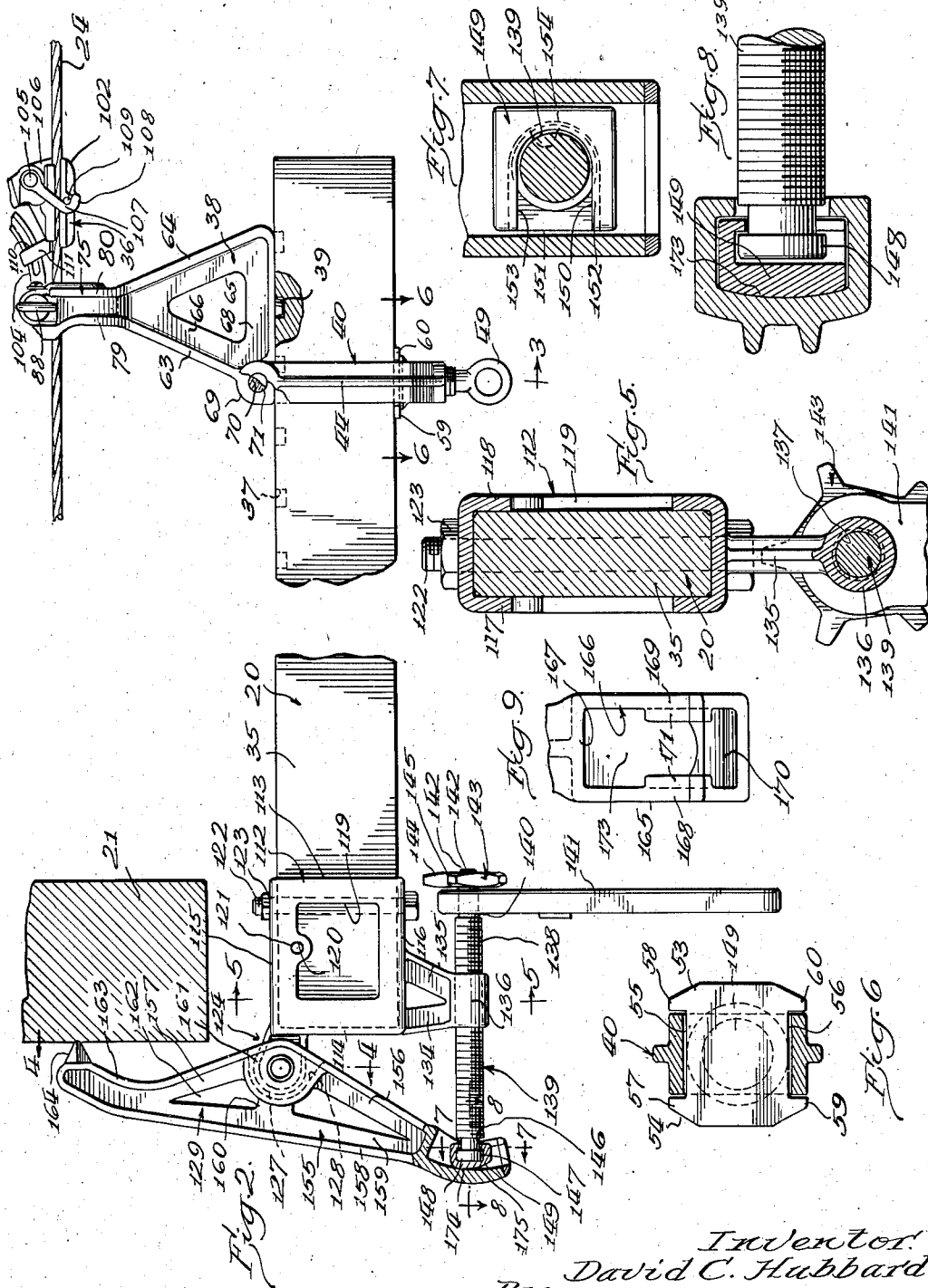
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LINE MAINTENANCE TOOL

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3 Sheets-Sheet 2



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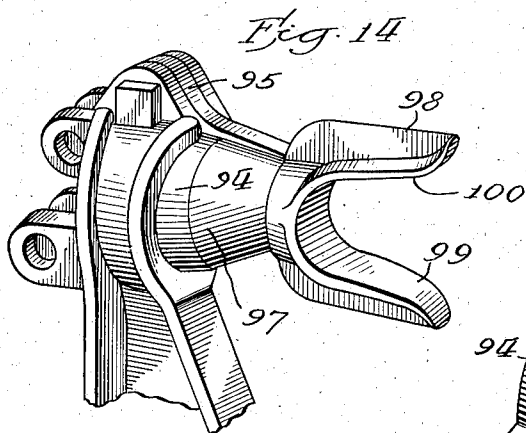
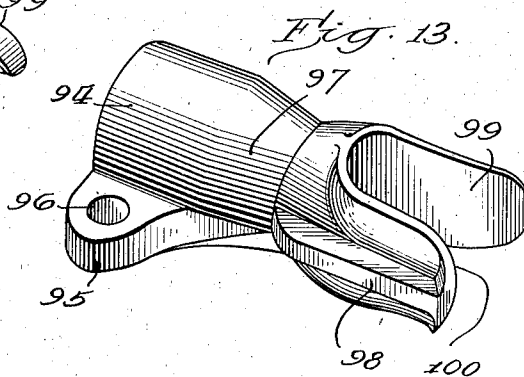
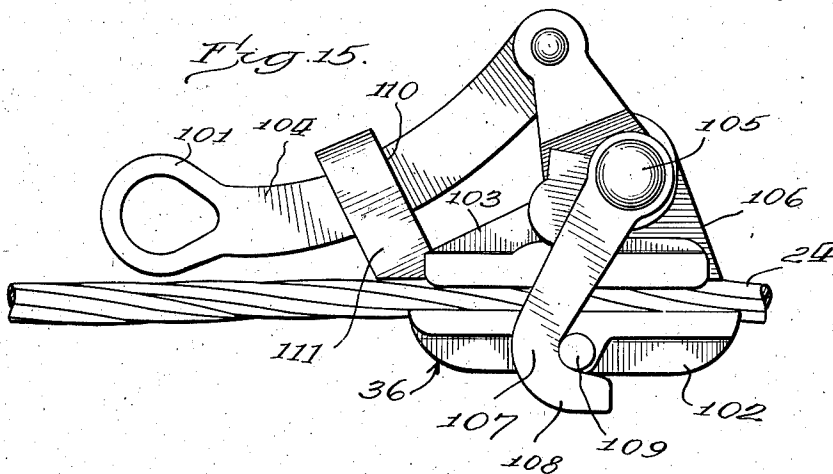
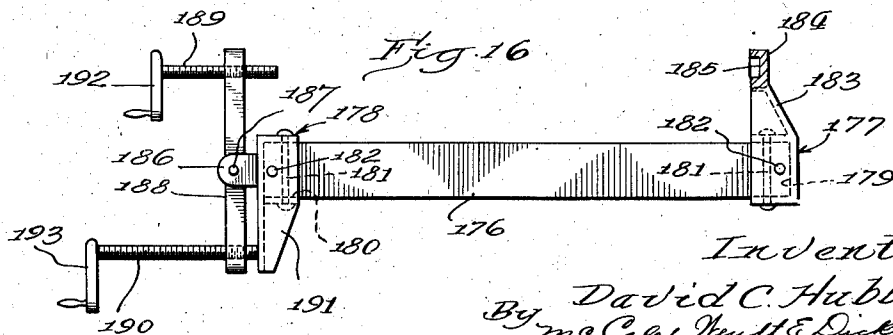
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,280,192

LINE MAINTENANCE TOOL

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Application April 10, 1941, Serial No. 387,883

19 Claims. (Cl. 254—77)

The present invention relates to line maintenance tools, and is particularly concerned with tools adapted to carry the strain of conductors or other members under tension, while work is being done on the line.

One of the objects of the invention is the provision of an improved dead end strain carrier which is simple in construction, sturdy, and adequately insulated, so that it is adapted to perform its functions for a long period of time with a maximum degree of safety.

Another object of the invention is the provision of an improved tool of the class described which is much easier to install, of lighter weight, and less expensive than the devices of the prior art.

Another object of the invention is the provision of a device of the class described which is so constructed that it may be engaged and handled by means of a clamp stick, a disconnect stick, a tie stick, or other similar insulated tool, so that that end of the tool which is adapted to be placed on the line or placed in engagement with a dead end clamp stick, cumalong, or similar device, may be handled without electrical hazard.

Another object of the invention is the provision of a device of the class described which is adapted to be adjustable in length for use on various types of installations in such manner that its force-multiplying take-up devices may be actuated most effectively to accomplish the purpose of taking up the strain on the line with which the device is engaged.

Another object of the invention is the provision of a device of the class described, having an improved form of take-up mechanism by means of which the take-up of the strain is adapted to be accomplished with a minimum amount of friction and a minimum amount of labor on the part of the operator.

Another object of the invention is the provision of an improved device of the class described, having means for engagement with the dead end strain clamps of a line or conductor gripping devices by means of which these devices may be positively locked to the tool so as to prevent any accidental dis-engagement of the line from the tool.

Referring to the drawings, of which there are three sheets,

Fig. 1 is a view in perspective of a transmission line installation showing the application of the present maintenance tool for the purpose of changing dead end insulators;

Fig. 2 is a fragmentary elevational view of the tool of Fig. 1, shown in side elevation and partial section;

Fig. 3 is a vertical sectional view, taken on the

plane of the line 3—3 of Fig. 2, with the device removed from the line;

Fig. 4 is a vertical sectional view, taken on the plane of the line 4—4 of Fig. 2, looking in the direction of the arrows;

Fig. 5 is a vertical sectional view, taken on the plane of the line 5—5 of Fig. 2, looking in the direction of the arrows;

Fig. 6 is a horizontal sectional view, taken on the plane of the line 6—6 of Fig. 2, looking in the direction of the arrows;

Fig. 7 is a fragmentary vertical sectional view, taken on the plane of the line 7—7 of Fig. 2, looking in the direction of the arrows;

Fig. 8 is a fragmentary horizontal sectional view, taken on the plane of the line 8—8 of Fig. 2, looking in the direction of the arrows;

Fig. 9 is a fragmentary plan view of the lower end of the rocker arm lever, with the operating screw and shoe removed;

Fig. 10 is a horizontal sectional view, taken on the plane of the line 10—10 of Fig. 3, looking in the direction of the arrows;

Fig. 11 is a horizontal sectional view, taken on the plane of the line 11—11 of Fig. 3, looking in the direction of the arrows;

Fig. 12 is a fragmentary elevational view, showing a rear view of the upper part of the fitting of Fig. 3;

Fig. 13 is a view in perspective of a fitting adapted to be used with the tool for engagement with a semi-corner clevice;

Fig. 14 is a fragmentary view showing the same fitting installed on the tool;

Fig. 15 is an elevational view of the cumalong, a fragment of which is shown in Fig. 2;

Fig. 16 is an elevational view of a modified form of device.

Referring to Fig. 1, 20 indicates in its entirety a tool constructed according to the invention, shown in connection with a transmission line installation, for the purpose of changing dead-end insulators.

The transmission line includes the pole 19, the cross arms 21, 22, the conductors 23 to 25, the dead-end clamps 26, 27, 28, 29, the insulators 30 to 33, and the other customary associated equipment.

In this use of the invention, the line maintenance tool 20 has one end engaged with the cross arm 22, and the other end engaged with the dead-end clamp 27 on the conductor 23. The end of the tool 20, which engages the conductor 23, is adapted to be handled by means of the clamp stick 34, which has its jaws engaging an eye carried by the left end of the tool 20 so that the tool may be installed and on the line without the necessity for the operator having one hand out on the wooden tension member 35, which forms the main body of the device.

Referring to Fig. 2, this is an elevational view in partial section, with the mid part of the wooden tension member 35 broken away. In this view the position of the tool is reversed, as it is shown in engagement with a cross arm, such as, for example, the cross arm 21, and it has its engagement with a conductor, such as the conductor 24 through the intermediary of a conductor clamping device or cumalong, indicated in its entirety by the numeral 36.

The main body of the tool is preferably constructed of a wooden member 35, which may comprise a board of suitable insulating wood, such as sugar maple of the ladder grade.

The board is preferably rectangular in cross section, and may be of the size usually referred to as "two by four," this size being purchasable on the open market at a more reasonable price than odd or special sizes. Such a board is, of course, not actually four inches in width nor two inches in thickness, but after planing it may be approximately one and three-eighths of an inch in thickness and three and one-half inches in width. All corners and sharp edges of the board are slightly chamfered, and the board is well seasoned and dried, and may be covered with an insulating varnish.

At its right end and top the body member 35 is provided with a plurality of shallow cylindrical sockets 37, which may be one-half inch holes approximately nine thirty-seconds of an inch deep, and two inches apart.

It should be understood that the dimensions given are merely exemplary of one preferred form of the device, and these may be varied, as the device may be constructed in various sizes for various purposes.

The boards 35 may be made of various lengths, such as, for example, forty-eight inches or seventy-two inches, and the sockets 37 may begin with the first socket suitably spaced from the end by approximately two and one-half inches, sufficient sockets being provided to utilize the major portion of the board for adjustment of the fitting 38, which carries the lug 39 engaging in one of the sockets 37.

The fitting 38 is adjustably mounted by means of a bracket constructed to be engaged with a wire clamp or with the dead-end clamp usually on the conductor of a transmission line.

It is adapted to be secured on the board 35 by means of a stirrup 40. The stirrup 40 is shown in section in Fig. 3. It comprises a cast metal member formed with a pair of parallel flanges 41, 42, joined by a relatively thicker yoke 43. The flanges 41, 42 may be reinforced by means of an outwardly projecting vertical rib 44, on each of them, the rib leading from the yoke 43 to the upper end of each flange 41, 42, where the flange is made thicker to provide a thicker body surrounding the cylindrical bores 45, 46 (Fig. 3).

The yoke 43 is provided with a threaded bore 47, the axis of which extends parallel to the flanges 41, 42, and the bore 47 is adapted to receive the threaded body 48 of an eye screw 50 having an eye 49 of suitable size to be engaged by means of a clamp stick, disconnect stick, tie, or similar insulated tool carried by a pole, as shown at 34 in Fig. 1. In other words, the eye 49 is of the same size and construction as the eye of a hot wire clamp.

The eye screw 50 has its upper end provided with a cylindrical portion 51 of reduced diameter,

adapted to be received in a complementary socket 52 in a pressure plate 53.

The pressure plate 53 is shown in plan in Fig. 6. It may comprise a cast metal member of substantially rectangular shape in plan, the corners being beveled at 54. The pressure plate 53 is provided at each of its opposite sides with the rectangular grooves 55, 56, leaving the outwardly projecting legs 57 to 60, two of these legs being located on each of the edges of the flanges 41 and 42. Thus the pressure plate 53 is slidably mounted between the flanges 41 and 42, where it is held by the legs 57-60.

The reduced cylindrical portion 51 of the eye screw 50 has rotatable engagement with the pressure plate 53 in the socket 52, and the annular shoulder 61 at the end of the eye screw 50 engages the bottom of the pressure plate 53.

The pressure plate 53 may be made relatively thick, and may be provided with a frusto-conical surface 26, so that it tapers downward in size toward the eye screw 50.

In some embodiments of the invention the socket 52 may be extended into a bore extending through the pressure plate, and the lug 51 may be riveted over on the upper side of the pressure plate to fasten these parts together in such manner that rotation is permitted for the eye screw.

The pressure plate 53 is adapted to engage the lower plane side of the board or body member 35 and to clamp the stirrup 40 in any of its horizontally adjusted positions without damaging the lumber.

The fitting or bracket 38 may comprise a cast metal member which has its lower or body portion of substantially triangular shape. The three sides of this body portion are formed by the flanges 63, 64, 65, which are integrally joined to the reinforcing flanges 66, 67, 68. The reinforcing flanges 66-68 extend at right angles to the flanges 63-65, thus giving the sides of the triangle a substantially T cross section.

The lower flange 65 is adapted to have its lower plane surface in flat engagement with the top of the wooden tension member 35, and this flange 65 is provided with the cylindrical lugs 39, adapted to be received in one of the sockets 37.

The flanges 63-65 are integrally joined to a substantially cylindrical body portion 69 at the lower left corner, this body portion being provided with a cylindrical transverse bore 70, serving as a bearing for a pintle 71, which may consist of a headless rivet. This metal rivet passes through the two bores 45, 46 of the stirrup 40 and through the bore 70 of the bracket 38.

The cylindrical bearing body 69 may have its parts separated by a vertically extending slot 72, if desired, so that it has two bearing portions 73, 74 (Fig. 3). At its upper corner the triangular body of the bracket 38 is provided with a vertical extension 75, comprising a substantially cylindrical enlargement formed on one side with a cylindrical socket 76. The cylindrical socket 76 is closed by a rear wall 77 except for the fact that the rear wall is provided with a vertically extending slot 78.

The cylindrical enlargement 75 is bordered by the reinforcing flanges 79 and 80, which form extensions of the flanges 63, 64, respectively, and at its upper side the cylindrical enlargement 75 is provided with the vertically extending flanges 81, 82 (Fig. 3). These vertically extending flanges are provided with the registering cylin-

drical bores 83, 84 (Fig. 10) adapted to receive the retaining pin 85.

This retaining pin is provided with a substantially cylindrical body 86, an annular stop flange 87, and an eye member 88, which may be made of the same size as the eye member 49, so that it also may be engaged by a clamp stick or other insulated operating member 34, when desired.

The cylindrical body 86 is provided on one side with a longitudinally extending slot 89, which may be rectangular in cross section, and the slot 89 is closed at both ends, as indicated by the closed ends 90 and 91 (Fig. 10).

The upwardly extending flange 82, for example (Fig. 10), may be provided with a threaded bore 92 for receiving a screw bolt 93, the inner end of which projects into the slot 89. The screw bolt 91 may have a frictional engagement between its end and the base of the slot 89 so that the pin 85 is adapted to be retained frictionally in any position to which it is moved. The screw bolt 93 prevents rotation of the pin 85, but its most important function is to provide stops for limiting the axial movement of the pin 85 in the bores 83, 84.

The pin 85 may be moved toward the right in Fig. 10 to such a position that it does not obstruct the slot 78, or it may be moved to the position of Fig. 10, where the slot 78 is closed. When in the position of Fig. 10, head members having their shanks in the slot 78, are locked in the slot; but the pin 85 may also be used for being passed through apertured lugs of accessories which are used with the bracket.

Referring to Fig. 13, this is a view in perspective of a fitting which is adapted to be used with the bracket 38 in the manner illustrated in Fig. 14. The fitting comprises a cast metal member having a cylindrical body 94 (Fig. 14) provided with a radially projecting lug 95. The lug 95 has a through bore 96 of suitable size to receive the pin 85.

The body 94 is of suitable size to be received in the cylindrical socket 76, and when the fitting of Fig. 14 is located in this socket the aperture 96 of lug 95 registers with the bores 83, 84. The pin 85 must be withdrawn toward the right from the position of Fig. 10 before the fitting of Fig. 14 is inserted in the socket 76; and after it is inserted, the fitting may be fixedly secured by moving the pin 85 toward the left through aperture 96 of lug 95.

The fitting 97 of Fig. 13 is merely exemplary of one form of fitting that can be used in the socket 76. It is preferably provided with a pair of longitudinally extending integral legs 98, 99 separated from each other by the slot 100, which is adapted to receive a semi-corner clevice, when it is desired to exert a tension on a conductor or other member carrying such a clevice.

Referring to Fig. 2, in this modification the bracket 38 is shown with its pin 85 engaging the eye 101 of a cumalong 36. This cumalong is merely exemplary of many forms of wire clamping or gripping devices, which may be used with the tool.

The cumalong in question has a body, the lower flange 102 of which has a groove for receiving the conductor 24. A gripping shoe 103 has a similar partially cylindrical groove for engaging the upper side of the conductor 24. The shoe 103 is pivotally connected to the arm 104, which carries the eye 101, and the shoe 103 is pivotally mounted on a pintle 105 carried by the upper part of the body 106.

A safety hook 107 has its lower hook end 108 engaged over a pin 109, and is also pivotally mounted on the pintle 105.

The arm 104 is guided with respect to the wire grip by passing through an aperture 110 in an arm 111 carried by the body 106. The arm 104 is suitably curved so as to slide in the aperture 110 when it exerts a pull on the shoe 103.

The tension exerted on the arm 104 by means of the eye 101 drives the shoe 103 into engagement with the conductor 24 and the conductor is clamped between the shoe 103 and grooved flange 102. As the cumalong 36 has its eye 101 secured by the pin 85, there is no possibility of dis-engagement of the cumalong from the bracket 38, and any suitable tension may be applied to the conductor 24.

Referring to the left hand end of Fig. 2, the wooden body member 35 is provided at this end with a cast metal fitting or ferrule 112, which is fixedly secured on this end of the board 35. This ferrule 112 preferably comprises a box-like metal member which is open at one end 113, and is adapted to receive the end of the wooden member 35 with a close frictional fit.

The box-like member 112 may have the flat end wall 114, a flat top flange 115, and a flat bottom flange 116. Its side walls 117, 118 may be provided with rectangular apertures 119 for the purpose of saving metal. The side wall portions 117 surrounding the aperture 119 form a frame for engaging the sides of the wooden member 35, and the uppermost of these side wall portions may be provided with an aperture 120 for receiving a rivet 121, which passes through the side walls and the wooden member 35, and is preferably riveted over at each end.

In addition to this, the ferrule 112 is secured on the wooden member 35 by means of a through bolt 122, which passes through apertures in the upper and lower walls 115, 116, and a registering aperture in the wooden member 35, the bolt being secured in place by means of a nut 123.

The ferrule 112 is provided on its closed end with a rearwardly projecting bearing flange 124. This bearing flange may be seen in section in Fig. 4, and it is provided with a through bore 125, forming a bearing for a pintle 126.

The outer end of the bearing flange 124 may be partially cylindrical at 127, and may have a suitable clearance with respect to the partially cylindrical socket 128, which is formed in the rocker arm, indicated in its entirety by the numeral 129.

The sides of the socket 128 are formed by flanges 130 and 131, and the socket 128 is provided with a relatively large front opening, so that it will have such a clearance with respect to the bearing lug 124 that it may have a wide range of pivotal movement.

The flanges 131 have bores 132, 133, which register with the bore 125 in the bearing lug 124, and are also adapted to receive the pintle 126. The pintle 126 may comprise a metal rivet which has both of its ends riveted over outside the bores 132, 133 so that it is permanently retained in these bores. Thus the rocker arm 129 is pivotally mounted on the ferrule 112. The ferrule 112 is also provided with a pair of depending arms 134, 135, each of which may be of substantially T cross section, and the arms 134, 135 are integrally joined to the bottom wall 116.

The arms 134, 135 converge at their lower ends, and are integrally joined to a cylindrical body portion 136, which is provided with a threaded

bore 137 (Fig. 5) adapted to receive the threaded body 138 of the operating screw, which is indicated by the numeral 139.

The cylindrical member 136 is preferably elongated in order to provide a relatively long threaded surface for holding the threaded rod or operating screw 139 substantially parallel to the body member 35.

The operating screw 139 is provided with a non-circular portion of reduced size, indicated at 140 on its right end, and this non-circular portion is adapted to receive the socket of a ratchet lever 141. The ratchet lever 141 is preferably of the reversible type, having a pawl which may be applied to the ratchet for right hand or left hand drive, or which may be released entirely. Beyond the non-circular portion 140 of the operating screw 139 there is a still smaller circular portion 142 which is threaded to receive a complementary thread in a take-up wheel 143.

The end 142 of the rod may be battered over or riveted so that the take-up wheel 143 is secured against the adjacent shoulder on the rod. The take-up wheel 143 may comprise a generally round hand wheel, which may be provided with arcuate grooves 144, separating the radially projecting spokes 145 for convenient grip by the fingers.

The opposite end of the operating screw 139 is preferably formed with a cylindrical portion 146 of reduced diameter, and with a substantially cylindrical head 147. The corners of this head are chamfered at 148, and the head is adapted to be rotatably received in an operating screw shoe 149.

This head and shoe are both shown in greater detail in Figs. 7 and 8. The shoe comprises a metal member, which is generally rectangular in plan, as shown in Fig. 7, and which has a laterally open socket 150 for receiving the shank 146 and head 147. The socket 150 is open toward the side at 151 and open toward its front, where the operating screw 139 enters.

It has an inwardly projecting flange 152 bordering the straight side walls 152 and the cylindrical portion 154 of the socket. The inwardly projecting flange 152 has a clearance with the shank 146, but it overhangs the lower edge of the head 147 to retain the head in the socket 150.

As the socket has straight sides leading to the opening 151, the head and shank may be inserted from the left of the shoe 149, when the shoe is removed from the rocker arm 129. The openings of the shoe and rocker arm are so arranged, however, that when the parts are assembled as shown in Fig. 2, the shoe is retained in the rocker arm and the operating screw retains the shoe.

The rocker arm 129 comprises a lever preferably made of cast metal, which is also preferably provided with a truss-like construction to increase its strength with the use of a minimum amount of metal. Thus the rocker arm 129 preferably has its main body 155 and the bracing portions 156, 157 formed of substantially T-shaped cross section. Each of these members comprises a transversely extending and outwardly projecting flange 158 and an inwardly extending flange 159. The members 155, 156, and 157 are joined integrally in the form of a triangle, and are further joined by a central frame member 160 leading to the bearing portion 161.

The members 155, 156, 157, 160 are separated by triangular apertures 162. The bearing portion 161 at the right hand central portion of

the rocker arm is formed with two flanges 130, 131 that carry the pintle 126 by means of which the rocker arm is pivotally mounted on the lug 124, as previously described.

At its upper end, after the juncture of the parts 155, 157 of the rocker arm 129, there is an integral extension, and the arm is preferably turned laterally at 163, and its right hand end is preferably provided with a pointed member 164. This pointed member may be pyramidal or cone-shaped, the pyramidal point being preferred on account of the fact that it tends to prevent rotation of the entire tool with respect to the cross arm 21, after the point 164 has formed a complementary socket in the wood of the cross arm.

In some uses of the tool the point may engage the pole or other wooden structure.

At the other end of the rocker arm 129 the portions 155, 156 are joined, and an enlargement 165 is provided, which is substantially rectangular in appearance, when viewed from the right in Fig. 2.

This enlargement 165 is provided with a rectangular socket 166, which is bordered at one side by the wall 167, at the two opposite sides by the walls 168 and 169, which communicate with an end opening 170.

The face of the socket in Fig. 9 is also open except for the provision of a pair of inwardly extending flanges 171. The socket 166 is provided with a bottom surface 173, which is partially cylindrical and formed on a relatively large radius.

The adjacent surface 174 of the shoe 149 is also partially cylindrical, but also has its upper half formed on a smaller radius, which may be regarded as having the same center, when the shoe is disposed as shown in Fig. 2.

The lower half of the shoe surface shown at 175 (Fig. 2) is preferably relieved still further, and may be formed on a still smaller radius so as to permit the shoe a wide range of rocking movement and to facilitate the movement of the rocker arm in a counterclockwise direction until the frame member 156 strikes the ferrule 112.

Thus the shoe is adapted to have its surface 174 rocked against the surface 173 with a line contact, the point of contact varying with the angle between the operating screw 139 and the rocker arm 129. There is a suitable clearance between the shank 146 of the operating screw 139 and the adjacent parts of the socket 166 so that the rocker arm and operating screw do not interfere with each other at this point.

Looking at the shoe 149 from the top, in the section of Fig. 8, it will be observed that the shoe is uniformly curved from side to side on its surface 174 on the curvature of a relatively large circle, which may correspond substantially with the lateral curvature of the surface 173. Thus the shoe surface 174, 175 and the arm surface 173 are adapted to have a line contact as described.

The parts are assembled as follows: The ferrule 112 having been secured on the board 35 and the operating screw having been placed in its threaded bore 136, the shoe 149 may then be slid on the head 147 of the operating shoe and disposed with its opening 151 extending laterally. The shoe 149 and operating screw head 147 may then be slid into the socket 166 of the rocker arm 129 through the opening 173, the shank 146 of the operating screw passing between the flanges 171.

The opening 173 is large enough to pass the

shoe 149 which can be slid into the socket 166 of the rocker arm when the rocker arm and rod 139 are held at the proper angle, the shoe being moved in a circular path. The bridge 171a is adapted to reinforce the flanges 171.

The shoe is retained in the socket by the flanges 171. When the parts are in this position, the bearing portion 161 of the rocker arm may be mounted on the lug 124 and pivotally secured by means of the pintle 126, as previously described.

Since the rocker arm 129 is mounted for pivotal movement and the operating screw is held by its bracket portion 136, the shoe cannot slide out of the socket 166.

The operation of the tool is as follows: In some installations the conductor is inserted in the slot 78 after the pin 85 has been withdrawn, and the pin is again driven back to the position of Fig. 3, so that the wire is locked in the slot 78. Then the bracket 38 may engage the usual dead end clamp 27, as shown in Fig. 1, to exert a tension on the wire 23.

These operations may be accomplished by means of clamp sticks or other tools carried by poles, such as shown at 34 (Fig. 1), and another clamp stick may engage the eye 88 of the pin 85.

In other installations it may be necessary to use a wire grip or cumalong, as shown in Fig. 2; and in such case the eye of the wire grip is again secured by means of the pin 85 passing through the eye. In other cases the shank of the eye may be located in the slot 78, and the length of the slot between its base and the pin is of less size than the head of the eye. The eye may then be confined with its shank in the slot 75 by means of the pin 85.

The length of the arm 35 of the tool is preferably adjusted before the application of the tool to the line by releasing the pressure plate 53 by means of the eye screw 49.

This will permit the stirrup 40 to move upward on the board 35 until the lug 39 may move upward out of its socket. The stirrup 40 and bracket 38 may then be moved longitudinally of the arm 35 to the desired position. This position is such that when the rocker arm is engaged with its point 164 on the cross arm 121, the bracket 38 is located beyond the insulator which it is desired to change or relieve of strain.

Before making any such adjustment, it is, of course, desirable to retract the operating screw 39 to the right as far as it will go. This is done by withdrawing the pawls of the ratchet lever 141 from the ratchet so that the ratchet is free, and then twirling the hand wheel 143 by the fingers until the operating screw 139 has been moved to the right in Fig. 2 and the rocker arm 129 has its frame member 156 against the ferrule 112. This will give the rocker arm the maximum degree of movement after the device has been attached to the line, and will facilitate the transfer of the tension of the line to the tool in such a way as to relieve all strain from the insulator which is to be changed.

The bracket 38 having been secured to the line by means of a suitable fixture or by means of a cumalong, or by the locking arrangement of the pin 85 on the line, the bracket engaging a dead end clamp, the point 164 may then be engaged with the cross arm, and the slack taken up by turning the hand wheel 143 in a clockwise direction by means of the fingers.

As soon as there is a suitable resistance to the actuation of the hand wheel by the fingers, the proper pawl of the ratchet lever 141 is moved

into engagement with its ratchet, and the ratchet lever is thereafter used to turn the operating screw 139 in a clockwise direction when viewed from the right.

This causes the operating screw 139 to move toward the left in its bearing 136 and to force the rocker arm 139 in a clockwise direction. During this movement the work is accomplished with a minimum amount of friction, as the head 147 rotates in the shoe 149, and the shoe 149 has a line contact with the surface 173 in the socket of the rocker arm.

During this movement of the operating screw the prong 164 forms a socket in the wood of the cross arm 21 and becomes more firmly fixed, as the tension is taken up between the line and the cross arm by the tool.

The tool is preferably so disposed that it hangs downwardly from the line by means of the bracket 38 and the rocker arm 129, and thus it is always in a stable condition; but in some uses of the invention it may be used in another position and held there by the engagement of the pyramidal point 164 in its complementary socket formed in the wood.

Due to the engagement of the shoe 149 with the flanges 171 of the rocker arm 129 and the engagement of the head 147 of the operating screw 139 with the flanges 152 of the shoe, the operating screw is adapted to exert a pull on the rocker arm 129 to move it in a counterclockwise direction when the device is released from the line.

The operating screw and the rocker arm are always maintained in engagement with each other at the head 147 and shoe 149, and there is no possibility of any part of the device becoming lost.

Referring to Fig. 16, this is a simplified form of line maintenance tool comprising a modification of the invention.

In this embodiment the member 176 comprises a rectangular wooden bar of the same material previously described, which is provided at each end with a metal fixture 177, 178. The metal fixtures 177, 178 are each provided with rectangular sockets 179, 180 adapted to receive the end of the wooden bar 176 with a close frictional fit, and the fittings are secured in place by pairs of transversely extending rivets 181, 182.

The fixture 177 has a laterally projecting arm 183 provided with an enlargement 184, having a socket 185, which is again accessible at the top by means of a slot so that the line may be inserted in the slot and a dead end clamp located in the socket to exert tension on the line.

The fixture 178 is provided with a pair of bearing lugs 186, projecting longitudinally therefrom and provided with a pintle 187 by means of which the lever 188 is pivotally mounted on the lug 186.

One end of the lever 188 has a threaded bore for receiving a pointed threaded member 189, the point being used to engage a cross arm or pole. The other end of the lever 188 has a threaded bore for receiving the threaded member 190, the end of which engages a laterally projecting arm 191 carried by the fixture 178. Both threaded members 189, 190 may have laterally projecting crank arms 192, 193.

In this embodiment the tension is applied to the member 176 by means of the screw 189, which may have its point driven in, and by means of further force applied to the lever 188 with the screw 190. As the screw 190 engages the arm

191, it slides outwardly thereon, and lever 188 is pivoted clockwise to react against the cross arm and exert a pull on the bar 176.

It will thus be observed that I have invented an improved line maintenance tool which is adapted to relieve the strain on a conductor for the changing of an insulator, or any other purpose. The length of the tool may be very quickly adjusted to the particular conditions of any installation, and the tool may be used in connection with a cross arm, pole, or other fixed part.

The line engaging fixture pivots in a clockwise direction on the stirrup 40 when tension is applied, and the lug 39 is brought into firmer engagement with its socket 37 in the wooden arm 35. The line engaging bracket may be secured in any of a multiplicity of different positions and clamped without damaging or weakening the wooden arm, and this end of the device may be used in connection with various line engaging fixtures, wire grips, etc., or may be arranged to exert a tension on the line by locking engagement with an ordinary dead end clamp.

The device may be actuated with a minimum amount of effort, due to the reduced amount of friction, and it may be handled at the end which engages the energized line by means of clamp sticks or other tools on insulating poles. There is no possibility of an accidental disengagement of the tool from the line, and the structure of the tool is such that it insures a maximum degree of safety to the operator.

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 line maintenance tool, the combination of an insulating bar member with a fixture carried thereby for attachment to a line conductor, said fixture comprising a stirrup member embracing said insulating bar, and a bracket pivotally mounted on said stirrup member, said bracket pivoting into engagement with said insulating bar when force is applied to said bracket in the tensioning of a line.

2. In a line maintenance tool, the combination of an insulating bar member with a fixture carried thereby for attachment to a line conductor, said fixture comprising a stirrup member embracing said insulating bar, and a bracket pivotally mounted on said stirrup member, said bracket pivoting into engagement with said insulating bar when force is applied to said bracket in the tensioning of a line, said bracket and bar being provided with complementary engaging members brought into engagement with each other by the application of force to the bracket in the tensioning of a line.

3. In a line maintenance tool, the combination of an insulating bar member with a fixture carried thereby for attachment to a line conductor, said fixture comprising a stirrup member embracing said insulating bar, and a bracket pivotally mounted on said stirrup member, said bracket pivoting into engagement with said insulating bar when force is applied to said bracket in the tensioning of a line, and threaded means carried by said stirrup for engagement

with said insulating bar to fix the stirrup in any of a plurality of predetermined positions on said bar.

4. In a line maintenance tool, the combination of an insulating bar member with a fixture carried thereby for attachment to a line conductor, said fixture comprising a stirrup member embracing said insulating bar, and a bracket pivotally mounted on said stirrup member, said bracket pivoting into engagement with said insulating bar when force is applied to said bracket in the tensioning of a line, and threaded means carried by said stirrup for engagement with said insulating bar to fix the stirrup in any of a plurality of predetermined positions on said bar, said threaded means having a standard head adapted to be engaged by a clamp stick or other insulated tool.

5. A line engaging fixture for a maintenance tool, comprising a stirrup, a bracket pivotally mounted on said stirrup, and having a bearing surface carried by its lower face, said bracket being of substantially truss shape, and an enlargement carried by the upper end of said bracket, said enlargement having a socket for reception of a clamping member carried by a line.

6. A line engaging fixture for a maintenance tool, comprising a stirrup, a bracket pivotally mounted on said stirrup, and having a bearing surface carried by its lower face, said bracket being of substantially truss shape, and an enlargement carried by the upper end of said bracket, said enlargement having a socket for reception of a clamping member carried by a line, said socket having an open slot communicating therewith for insertion of the line laterally into the slot.

7. A line engaging fixture for a maintenance tool, comprising a stirrup, a bracket pivotally mounted on said stirrup, and having a bearing surface carried by its lower face, said bracket being of substantially truss shape, and an enlargement carried by the upper end of said bracket, said enlargement having a socket for reception of a clamping member carried by a line, said socket having an open slot communicating therewith for insertion of the line laterally into the slot, and said enlargement having a pair of registering bores on opposite sides of said slot, and a locking member slidably mounted in said bores for closing said slot.

8. A line engaging fixture for a maintenance tool, comprising a stirrup, a bracket pivotally mounted on said stirrup, and having a bearing surface carried by its lower face, said bracket being of substantially truss shape, and an enlargement carried by the upper end of said bracket, said enlargement having a socket for reception of a clamping member carried by a line, said socket having an open slot communicating therewith for insertion of the line laterally into the slot, and said enlargement having a pair of registering bores on opposite sides of said slot, and a locking member slidably mounted in said bores for closing said slot, and stop means for limiting the movement of said locking member to the open position and closed position of the slot.

9. In a line maintenance tool a force-applying fixture comprising a metal member adapted to be secured to an insulating bar, a rocker arm lever pivotally mounted on a bearing lug carried by said member, said rocker arm lever having a rearwardly projecting part for engagement with

a wooden part of the line, and a threaded member engaging said metal member and adapted to actuate the other end of said rocker arm lever.

10. In a line maintenance tool, a force-applying fixture comprising a metal member adapted to be secured to an insulating bar, a rocker arm lever pivotally mounted on a bearing lug carried by said member, said rocker arm lever having a rearwardly projecting part for engagement with a wooden part of the line, and a threaded member engaging said metal member and adapted to actuate the other end of said rocker arm lever, and an operating connecting means between said threaded member and said rocker arm whereby the threaded member may move the rocker arm in either direction.

11. In a line maintenance tool, a force-applying fixture comprising a metal member adapted to be secured to an insulating bar, a rocker arm lever pivotally mounted on a bearing lug carried by said member, said rocker arm lever having a rearwardly projecting part for engagement with a wooden part of the line, and a threaded member engaging said metal member and adapted to actuate the other end of said rocker arm lever, said metal member having a threaded bore for receiving said threaded member, and manual means carried by said threaded member for rotating the threaded member.

12. In a line maintenance tool, a force-applying fixture comprising a metal member adapted to be secured to an insulating bar, a rocker arm lever pivotally mounted on a bearing lug carried by said member, said rocker arm lever having a rearwardly projecting part for engagement with a wooden part of the line, and a threaded member engaging said metal member and adapted to actuate the other end of said rocker arm lever, said metal member having a threaded bore for receiving said threaded member, and manual means carried by said threaded member for rotating the threaded member, said manual means including a hand wheel and releasable ratchet lever.

13. In a line-engaging fixture, the combination of a bracket adapted to be carried by an insulating bar, said bracket having an enlargement provided with a socket and with a lateral slot leading to said socket, a forked fixture having a body adapted to be received in said socket, and having a lug adapted to be received in said slot, and a locking member passing through said lug and through the parts of said enlargement to secure said body in said socket.

14. In a line maintenance tool, the combination of an insulating bar with a rocker arm lever pivotally mounted thereon, and a threaded member carried by said bar and engaging one end of said rocker lever, said threaded member having a round head, a shoe having a socket for receiving said head, said socket being open at one side, said lever having a socket for slidably receiving said shoe, said shoe being slid into said lever socket with the lateral opening of said shoe closed by the walls of the lever socket, said lever socket having means for retaining said shoe therein, and said shoe having means for retaining said member, whereby the threaded means may actuate the threaded member in either direction.

15. In a line tensioning device for high voltage transmission lines, the combination of an elongated

insulating bar with a fixture carried by one end of said bar for attachment to a line conductor, said fixture having a securing member provided with an eye adapted to be engaged by a clamp stick, a movably mounted member carried by the other end of said bar for engagement with a fixed part of the line installation, and threaded means carried by said other end for moving said member to place a tension on said bar, said fixture also having an eye adapted to be engaged by a clamp stick in the application of the tool to the line.

16. In a line maintenance tool, a force-applying fixture comprising a metal member adapted to be secured to an insulating bar, a rocker arm lever pivotally mounted on a bearing lug carried by said member, said rocker arm lever having a rearwardly projecting part for engagement with a wooden part of the line, and a threaded member engaging said metal member and adapted to actuate the other end of said rocker arm lever, an insulating bar carrying said metal member, and a fixture carried by said insulating bar and adapted to be secured to a line conductor, whereby the line conductor may be tensioned.

17. In a line maintenance tool, a force-applying fixture comprising a metal member adapted to be secured to an insulating bar, a rocker arm lever pivotally mounted on a bearing lug carried by said member, said rocker arm lever having a rearwardly projecting part for engagement with a wooden part of the line, and a threaded member engaging said metal member and adapted to actuate the other end of said rocker arm lever, an insulating bar carrying said metal member, and a fixture carried by said insulating bar and adapted to be secured to a line conductor, whereby the line conductor may be tensioned, and means for adjusting the effective length of said tool, whereby various transmission line dead end spacings may be accommodated.

18. In a line maintenance tool, a force-applying fixture comprising a metal member adapted to be secured to an insulating bar, a rocker arm lever pivotally mounted on a bearing lug carried by said member, said rocker arm lever having a rearwardly projecting part for engagement with a wooden part of the line, and a threaded member engaging said metal member and adapted to actuate the other end of said rocker arm lever, said metal member having a threaded bore for receiving said threaded member, and manual means carried by said threaded member for rotating the threaded member, an insulating bar carrying said metal member, and a fixture carried by said insulating bar and adapted to be secured to a line conductor, whereby the line conductor may be tensioned.

19. In a line maintenance tool, a force-applying fixture comprising a metal member adapted to be secured to an insulating bar, a rocker arm lever pivotally mounted on a bearing lug carried by said member, said rocker arm lever having a rearwardly projecting part for engagement with a wooden part of the line, and a threaded member engaging said metal member and adapted to actuate the other end of said rocker arm lever, said rearwardly projecting part comprising a threaded member carried by said lever, and means for actuating said threaded member for varying the effective length of said insulating bar.

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