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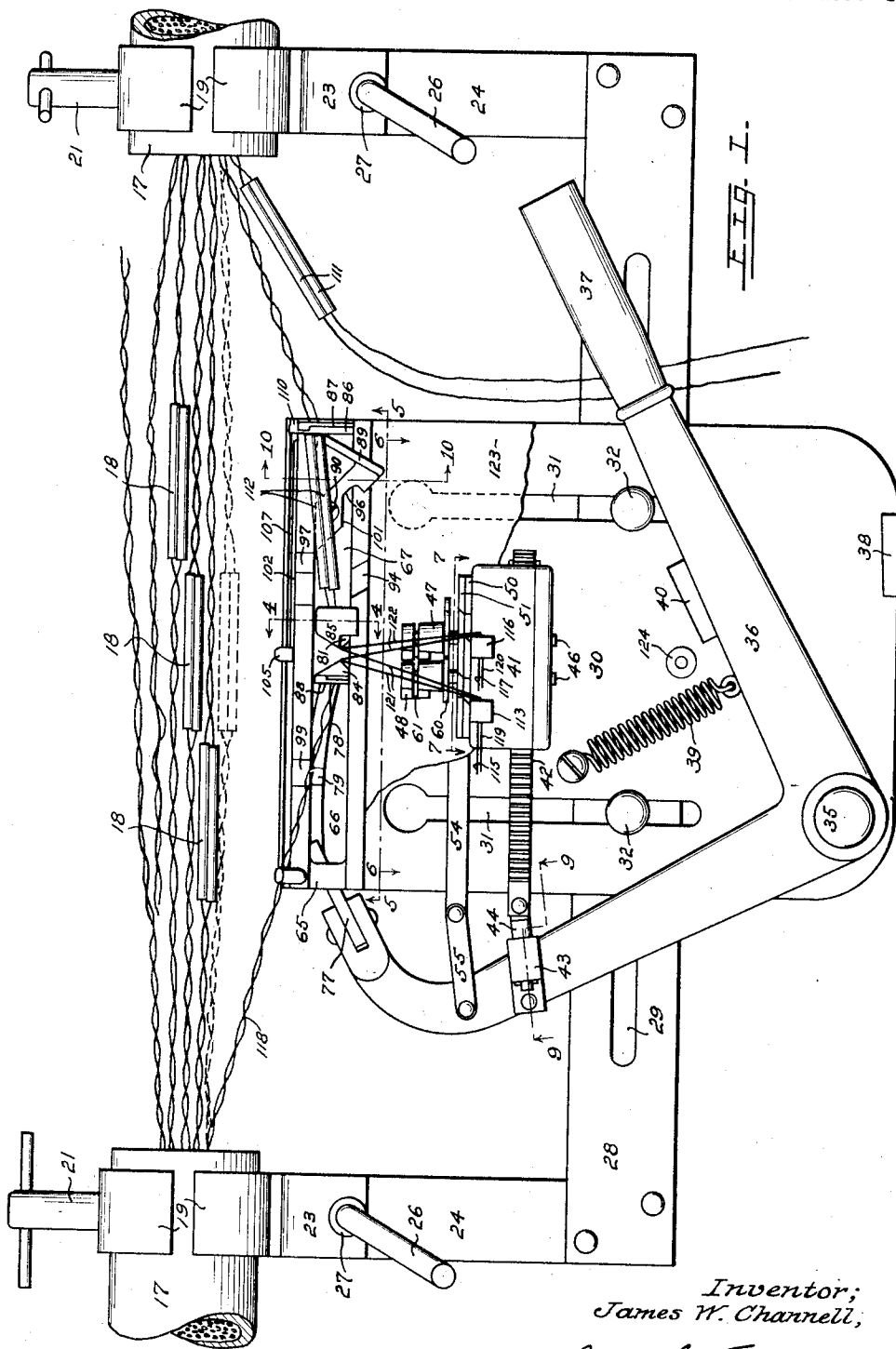
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CABLE SPLICING MACHINE

Filed March 30, 1929

2 Sheets-Sheet 1



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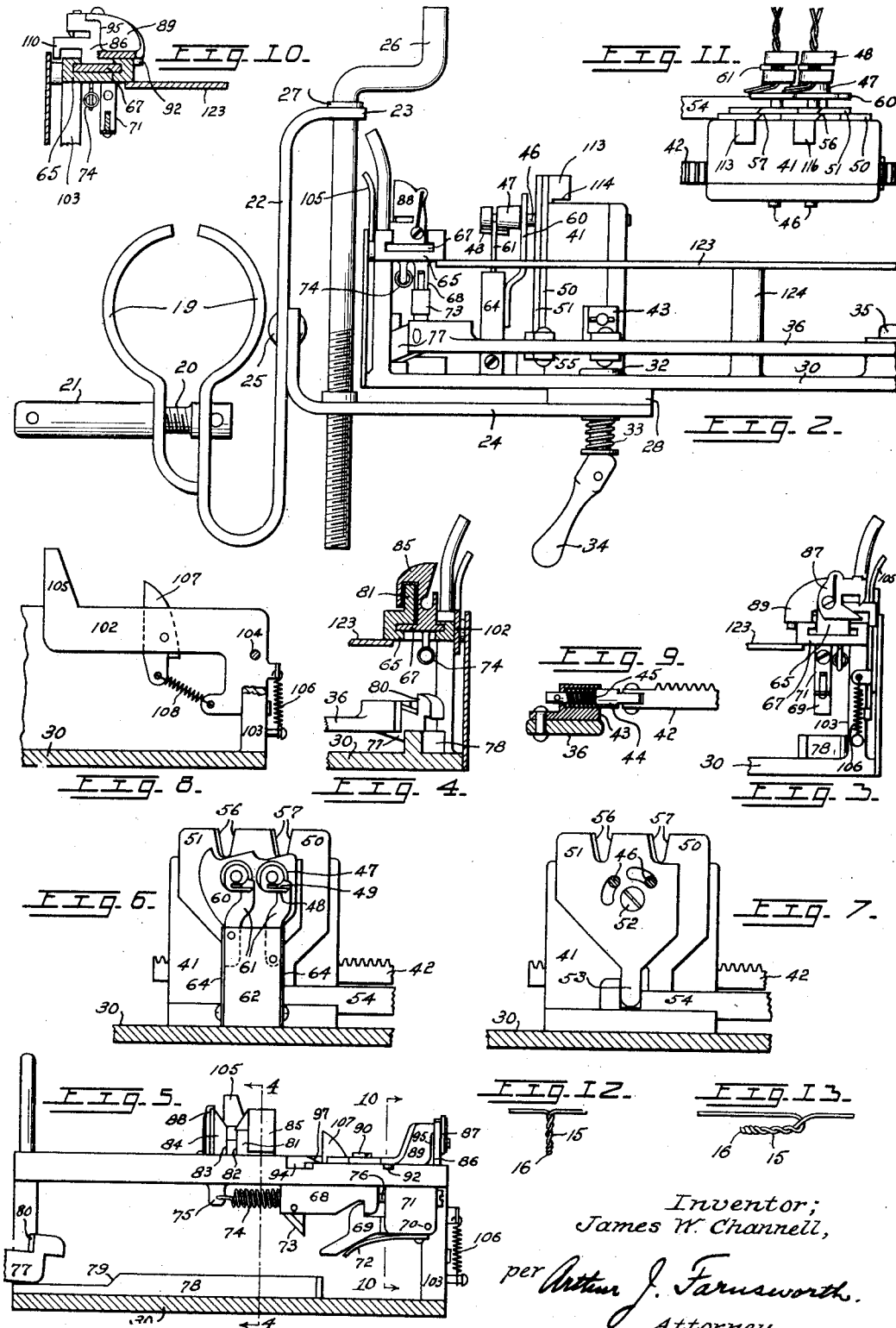
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UNITED STATES PATENT OFFICE

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CABLE-SPLICING MACHINE

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In this specification, and the accompanying drawings, I shall describe and show a preferred form of my invention, and specifically mention certain of its more important objects. I do not limit myself to the forms disclosed, since various changes and adaptations may be made therein without departing from the essence of my invention as hereinafter claimed, and objects and advantages, other than those specifically mentioned, are included within its scope.

My invention relates to machines for splicing wires of telephone and telegraph cables or the like; and is an improvement on my prior structures of a similar nature, described in Patent #1,654,788 issued to me on January 3, 1928; and in Patent #1,715,641 issued to me on June 4, 1929.

Among the more important objects of the present invention, are; first, to provide a machine of the character mentioned, that is adapted to make a more efficient and satisfactory twisted pig-tail splice than has hitherto been possible; second, to produce such a machine that will not require severing the twisted splice, the surplus wire being twisted off when the splice is completed; third, to supply a construction of this character adapted for thus splicing two pairs of wires simultaneously; and, fourth, to accomplish the above objects in a simple and relatively inexpensive apparatus. Other objects of the present invention include a more satisfactory accomplishment of those mentioned in said patent and in said application.

My objects are attained in the manner illustrated in the accompanying drawings, in which—

Figure 1 is a plan view of my cable-splicing machine in operative relation to a pair of opposed cable-ends that are to be spliced; a portion of the cover plate of the machine being broken away to disclose the underlying parts, and pairs of the cable wires being shown more or less diagrammatically, as spliced and otherwise;

Figure 2 is a left hand elevation of the above construction, with the cable omitted;

Figure 3 is a fragmentary elevation of a right hand portion of the machine;

Figure 4 is a fragmentary cross-sectional elevation of the machine, taken on the line 4—4 of Figs. 1 and 5;

Figure 5 is a cross-sectional elevation of the machine, taken on the line 5—5 of Fig. 1, looking in the direction of the arrows;

Figure 6 is a detail elevation in section, taken on the line 6—6 of Fig. 1;

Figure 7 is a similar elevation, taken on the line 7—7 of Fig. 1;

Figure 8 is a detail elevation of certain elements of the mechanism at the extreme rear portion of the machine;

Figure 9 is a cross-sectional elevation of a portion of the drive mechanism, taken on the line 9—9 of Fig. 1;

Figure 10 is a detail cross-sectional elevation, taken on the line 10—10 of Fig. 1;

Figure 11 is a plan view of the twisting mechanism shown in Fig. 1, with the parts positioned after the first step of the splicing operation has been completed;

Figure 12 is a plan view of a twisted pig-tail splice, as formed after the completion of the second operation of the machine; and

Figure 13 is a view of the same splice, after being bent by the succeeding operation of the machine, and thus made ready to have an insulating sleeve slipped thereover.

Similar reference numerals refer to similar parts throughout the several views.

In the splicing of pairs of wires in telephone cables and the like, by means of pig-tail splices, it is desirable not to have the pitch of the twisted splice uniform. This lack of uniformity of the pitch tends to prevent an unscrewing action, when the splice is subjected to tension. When the loose ends of two adjacent parallel wires are gripped, and then twisted, the greatest twisting stress takes place at the point where the torque is applied. If the twisting is continued beyond a certain point, where the twist becomes very tight, the wires will be twisted off at the point of application of the torque. These principles are utilized by me in the construction of my present machine, which produces a splice of the kind illustrated in Figs. 12 and 13. It will be seen that the pitch of the

twists 15 is not uniform, and that the wires are very tightly twisted off at 16.

The form of my splicing machine selected for illustration, is adapted for splicing two pairs of conductors simultaneously. Figure 1 shows the machine set up in position to splice the conductors of a telephone cable, the opposed ends of which are indicated at 17. The cable ends are brought opposite to each other, sufficiently far apart to allow room for the splicing operation, and for the space that necessarily has to be occupied by the completed splice. The pig-tail splices, and the insulating sleeves that necessarily have to be placed over them, will require more space than is needed for straight conductors. If all of the splices are made at approximately the same point, the diameter of the spliced cable will have to be very much increased. Therefore it is better to locate the splices in longitudinally positioned groups. Fig. 1 indicates three pairs of completed splices at 18, showing how they may be thus longitudinally positioned, to keep the diameter of the completed cable splice within reasonable dimensions.

Passing to a detail description of my machine and its attachments, I provide a pair of clamps 19, having jaws adapted for being tightened upon the cable-ends by means of bolts 20 and sleeve nuts 21. The front members of each clamp have relatively long shanks 22, that are doubled upwardly, and then bent forwardly at the top to form supporting flanges 23. Shanks 22 are longitudinally slotted (not shown), to allow the machine to be vertically positioned.

The supporting frame for the machine comprises angle bars 24, that are vertically slidable upon shanks 22, and engage the latter by means of shouldered headed rivets 25 passed through the vertical slots of shanks 22. Crank bolts 26 pass downwardly through holes in flanges 23, and tapped holes in angle bars 24. The crank bolts are provided with flanges 27, adapted to support the weight that is placed upon the bolts, and they are thus enabled to provide a vertical adjustment for the frame of the machine. The forward ends of angle bars 24 are permanently connected together by supporting bar 28, having a longitudinal slot 29 therein.

My machine is provided with a base 30, having a pair of slots 31 therein perpendicular to slot 29 of the supporting bar, and is attached to the latter by means of toggle bolts 32 passing through the slots of the base and supporting bar. The toggle bolts are conveniently made to have a resilient grip, as by means of the springs 33 shown in Fig. 2. The grip is quickly released by means of the toggle lever 34, in a manner that will be clearly apparent from the drawings. The above described mounting permits of placing the machine in almost any desired position with re-

spect to cable ends 17. Thus the machine may be raised or lowered at either side by means of the crank bolts 26, it may be moved parallel to the cable by virtue of slot 29, and perpendicularly to the cable by means of the slots 31.

Mounted upon the base, and pivoted thereto at 35, is a bell-crank lever 36. The operating end of this may be moved forwardly by means of handle 37, as far as the stop 38. A spring 39 restores the operating lever to its normal position against stop 40, as shown in Fig. 1. The other end of the bell-crank is adapted to operate the various elements of the mechanism, in a manner that will be described below.

Mounted upon the base of the machine is a gear box 41, containing a train of gears of large ultimate ratio. The gear train is driven by a horizontal rack 42, extending through the gear box and connected to operating lever 36 by means of a double pivoted and yieldable link device. This is shown in plan in Fig. 1, and in sectional elevation in Fig. 9. This yieldable connection comprises a pivoted body portion 43, a pivoted plunger 44 extending into a bore of the body and slidable therein, and a compression spring 45 tending to keep the plunger pressed outwardly. By this means the operating lever may be moved slightly without moving rack 42, this being necessary for a purpose to be mentioned presently.

The gear train described drives a pair of slightly spaced horizontal spindles 46, on the rear ends of which are mounted the twisting devices for splicing; the machine depicted being adapted for splicing two pairs of wires simultaneously. A top view of the twisters in normal inoperative position is shown in Fig. 1. An elevation of the twisters in the same position is shown in Fig. 6, and a plan of the twisters after they have been revolved 180 degrees is shown in Fig. 11. The twist-ers comprise conical shaped bodies 47 having pairs of tangential arms 48 extending therefrom. At the junctions of the arms and bodies, are relatively deep slots 49, as shown in Fig. 6. The dimensions of these parts are such that the arms in rotating can seize upon the pair of wires to be twisted, and force them into the slots, to be retained therein during the formation of the twisted splice.

On the back face of gear box 41 is mounted a fixed cutter blade 50, and in front of this is a movable cutter blade 51, pivoted at 52 as shown in Fig. 7. The latter blade has a downwardly extending arm 53, fitting a notch in sliding bar 54, which bar is pivotally connected to the operating lever by means of the link 55 shown in Fig. 1. The cutter blades have cooperating pairs of cutting edges viz, 56 and 57, and they constitute a double shearing device operated by arm 53

and sliding bar 54. The angular movement of blade 51 is limited by the fact that arm 53 comes out of its notch, and rides upon the upper surface of bar 54, after the cutters have discharged their function. This operation of the mechanism will be understood by a consideration of Fig. 7.

To the rear of the shearing device just described, and adjacent the forward ends of 10 twisters 47, is a stationary plate 60, shaped approximately as shown in Fig. 6, the function of which will be described below.

The two arms of the twisters are spaced, and the bodies of the twisters are circumferentially 15 grooved opposite these spaces, to permit the use of simple ejecting devices for discharging wire ends that may be retained in slots 49 after the splicing operation is completed and the splices are twisted off. 20 These ejecting devices comprise thin bars 61, pivoted to a standard 62, as shown in Fig. 6. Flat springs 64, attached to standard 62, keep the upper ends of the ejector bars yieldingly pressed against the bottoms of the circumferential grooves of the twisters, and the length of the bars is such that their upper edges are opposite and at the same level as the axes of the twisters. It is also to be noted that the circumferential grooves in the 30 twisters extend inwardly toward the axes fully as far as wire slots 49. Thus if any wire ends are retained in the slots, after the twisted splices have been completed and twisted off, they will be thrown out of the slots by the ejector bars, when the direction of rotation of the twisters is reversed. 35

At the rear of the base, and mounted above it, is a slideway 65. The bottom of this is open for a considerable distance, indicated 40 at 66 in Fig. 1. A carriage 67 is slidably positioned within the slideway, and has several parts extending downwardly therefrom through opening 66. One of these is a projection 68, by means of which the carriage is retained in its normal position at the right 45 hand side of the machine until released by the operation of a trigger 69; the latter being pivoted at 70 to a part 71 of the slideway, and is pressed upwardly by a spring 72. 50 This construction is clearly indicated in Fig. 5. Projection 68 carries a pivoted pawl 73, by means of which the carriage may be moved to the left when trigger 69 is released.

The carriage is restored to its normal position at the right hand side of the machine 55 by means of a helical tension spring 74. One end of this spring is attached to the slideway, and the other end is attached to a downwardly projecting lug 75 on the carriage.

In order to take up the shock caused by the quick return of the carriage under the action of spring 74, I employ a cushioning bumper. This comprises a plunger 76, projecting from part 71, and working in a bore 60 thereof. The plunger is kept pressed outwardly by means of a helical compression

spring (not shown) within the bore, the construction being sufficiently indicated in Fig. 5.

The inner end of operating lever 34 carries a pivoted hook-bar 77. The free end of this rides upon a circular track 78 extending 70 upwardly from the base. This track is at two levels, connected by an incline 79 as shown in Fig. 5. The free end of the hook bar, when raised upon the right hand portion of the track, is adapted to engage and release trigger 69. At this time its hook 80 will have passed by, and be in position to engage pawl 73, so that, by the return of the operating lever to its normal position the carriage will be pulled to the left within its slideway, 80 until the hook-bar drops downwardly over incline 79 to release pawl 73. The carriage will then fly back to its right hand position under the action of tension spring 74, the shock of its return being taken up by the bumper plunger 76, and trigger 69 re-engaging the carriage to retain it in its inoperative position. 85

The central portion of the slideway has an upstanding lug 81 thereon having an acute vertical edge 82. A similar spaced edge 83 is provided upon an upstanding lug 84 on the carriage. These acute edges are for the purpose of breaking paper insulations and the like when thus insulated wires are sharply 90 bent around them, so that the insulations may be pulled off of the ends of the wires to be spliced. An inverted U-shaped lug 85 upon the carriage passes over lug 81 on the slideway, and extends downwardly in front thereof. 100

At the right hand end of the carriage is an upstanding lug 86. This is horizontally notched for receiving a pair of insulated wires, and is provided with a pivoted trigger plate 87 for retaining the wires in the notch. 105 Lug 84, at the left of the carriage, has a similar wire notch, and a wire retaining trigger plate 88, as shown in Fig. 2.

The carriage is provided with a means for 110 ejecting conductors from the machine when fully spliced, and these means cooperate with means for keeping the ejected wires away from the machine. The ejector means on the carriage comprises an element 89, pivoted to the carriage at 90, and shaped as shown most 115 clearly in Figs. 1, 5, and 10. The left hand end of this element normally engages the inner face of the rear flange of slideway 65. A downwardly projecting button, 92 of this ejector, normally engages the outer face of the forward flange of the slideway, but is adapted to pass through a notch 94 in said flange. The right hand end of element 89 carries a vertical ejecting edge 95, as shown 120 in Fig. 10. When the carriage is moved to the left a sufficient distance, the point 96 of the ejector element will come in contact with upstanding lug 81. In this position button 92 will be able to move through notch 94 and 125 130

allow the element to turn counter clockwise on its pivot.

Ejecting edge 95 will then move rearwardly, to eject the wires that have been spliced from the machine. Just prior to this happening trigger plate 87 has been raised by passing upwardly on inclined surface 97 to a higher level of the rear flange of the slideway; and trigger plate 88 has been raised by passing upwardly on inclined surface 99 to a higher level of this same flange. Thus the wires that previously were held in place by these respective trigger plates will be free to escape when ejecting element 89 operates. The ejector element 89 is restored to its normal position, shown in Fig. 1, by point 101 coming into contact with the left hand upstanding edge of lug 81 of the slideway.

The mechanism for keeping the ejected wires away from the machine, as shown in Fig. 8, comprises; a horizontal bar 102, pivoted to post 103 of the base at 104, and having an upstanding arm 105 at the opposite end. Bar 102 is normally retained in a horizontal position by a tension spring 106. Pivotaly mounted upon the bar, and movable therewith, is a trigger 107, normally retained in the position shown in Fig. 8 by tension spring 108 reacting against a lug on the trigger. When the carriage moves to the left, a projection 110 thereon (shown in Fig. 10) will engage trigger 107 and thereby depress the horizontal bar 102 with its upstanding arm 105, just prior to the time the wires are ejected from the machine by the ejecting edge 95. As soon as the carriage passes beyond trigger 107, the horizontal bar is restored to its normal position by tension spring 106, and upstanding arm 105 keeps the wires from returning to the machine. Upon the return stroke of the carriage to the right, trigger 107 will be depressed without disturbing the position of horizontal bar 102.

When the ends of two cables are to be spliced by the use of my machine, they are spaced opposite, with sufficient room for the splice therebetween, as shown in Fig. 1. The machine support is then attached to the cable ends by means of the clamps 19, and the splicing machine is positioned on bar 28 by means of its toggle bolts 32. We will assume that two pairs of conductors are to be spliced simultaneously, the machine illustrated being adapted for this purpose. The right hand pair of wires are untwisted, and a short insulating sleeve is slipped upon each in the manner indicated at 111 of Fig. 1. This pair of wires is then slipped under trigger plate 87 into the wire slot of lug 86, at the right hand end of the carriage, the sleeves being placed as shown at 112 in Fig. 1. The wires are then sharply bent around acute edge 82 (see Fig. 5) to break the paper insulations thereon, and the insulations are pulled off of the wire ends, leaving them bare for splicing.

One of the wires is next drawn over the twist-ers and bent around an upstanding lug 113 on the top of gear box 41, and is retained in a horizontal slot 114 in said lug, as shown at 115. The other wire of this pair is similarly bent around a second lug 116 and into a horizontal slot therein, as shown at 117.

The corresponding pair of conductors shown at 118 is similarly treated. The wires are sharply bent around acute edge 83 (see Fig. 5) and their insulations are pulled off. The bare wire ends are then placed respectively in the slots of lugs 113 and 116, as indicated at 119 and 120. The two pairs of conductors are now ready to be spliced by the machine. This is accomplished by quickly pulling forward operating lever 36 to its front stop, and then allowing it to be retracted by spring 39 to its back stop. Both splices will be formed, the insulating sleeves slipped there-over, and the spliced pairs ejected from the machine, during the brief interval required to move the operating lever forward and back. A number of distinct operations occur in this brief interval however, and these will now be described in steps.

As soon as the operating lever starts forward, the rack bar 42 moves to the right, causing the twist-ers to revolve clockwise as viewed from the front and their arms to respectively engage the pairs of wires 121 and 122 above them. The wires will be forced into twister slots 49, and further rotation of the twist-ers is then momentarily arrested by the fact that the ends of the wires are substantially fastened. Rack bar 42 will then cease to move, and spring 45 in connecting link 43 will be compressed to allow this to happen. During the moment that the rack bar ceases to move, sliding bar 54 continues to move to the right and operates movable cutter blade 51 to shear off the outer ends of each pair of the conductors. As soon as this happens the twist-ers are again free to rotate, and in doing this will bend the free ends of the wire pairs by dragging them over the stationary bending plate 60, as shown in Fig. 11. This effectually locks the wires behind the front arms of the twist-ers, as shown in the latter figure. The twist-ers then continue to revolve and tightly twist the wires of the respective pairs of conductors together, finally twist them off to form pig-tail splices of the kind shown in Fig. 12. The short pieces of wires remaining in the twister slots after this happens are ejected therefrom by ejecting bars 61, when the operating handle is released and the rotation of the twist-ers is thereby reversed.

When the operating handle has been pulled forward to its stop, hook bar 77 will have released trigger 69 and engaged pawl 73. On the backward movement of the operating lever, the carriage will be pulled to the left, thereby causing the left hand edge of inverted U-lug 85 to bend the pig-tail splices in the

manner indicated in Fig. 13. At the same time the insulating sleeves 112 will be pushed to the left, and ultimately over the bent splices. The continued motion of the carriage to the left will then actuate ejector element 89 to throw the wires out of the machine after depressing arm 105. Immediately thereafter this arm again rises to keep the wires from returning into the machine. Finally the carriage is released by the dropping of hook bar 77 on incline 79 of its circular track, and the carriage is returned to its normal position by the action of restoring spring 74.

The other pairs of cable conductors are spliced in order in precisely the same manner described, until the job is completed. The splicing machine is shifted occasionally so that the whole number of splices will be divided into groups containing approximately the same number, in the manner indicated at 18 in Fig. 1.

The machine is provided with a cover plate 123, supported at the rear in any convenient manner, as by slideway 65, and at the front by a post 124 rising from the base.

I desire particularly to call attention to the very rapid operation of my machine, and to the fact that the splices made thereby conform to the requirements of the most satisfactory pig-tail splices that can be made; being tightly twisted on a varying pitch, and finally twisted off.

Having thus finally described my invention, I claim:

1. A splicing machine comprising; a rapidly rotatable member adapted to loosely engage and twist together a pair of approximately parallel wire-ends brought adjacent thereto, and to form thereof a twisted-off pig-tail splice.

2. A splicing machine comprising; a rapidly rotatable member adapted to loosely engage and twist together a pair of approximately parallel wire-ends brought adjacent thereto, and to form thereof a twisted-off pig-tail splice of non-uniform pitch.

3. A splicing machine comprising; a rapidly rotatable member adapted to loosely engage and twist together a pair of approximately parallel wire-ends brought adjacent thereto, and to form thereof a twisted-off pig-tail splice; and means for ejecting the twisted-off portions of said wires from said member when its rotation is reversed.

4. A splicing machine comprising; a rapidly rotatable member adapted to loosely engage and twist together a pair of approximately parallel wire-ends brought adjacent thereto, and to form thereof a twisted-off pig-tail splice; means for severing surplus material from said ends beyond said member immediately after said engagement; and means for ejecting the twisted-off portions

of said wires from said member when its rotation is reversed.

5. A splicing machine comprising; a rapidly rotatable member adapted to loosely engage and twist together a pair of approximately parallel wire-ends brought adjacent thereto, and to form thereof a twisted-off pig-tail splice; means for bending said splice parallel and adjacent to one of the spliced wires; and means for sliding an insulating sleeve, previously placed upon the other said wire, over said bent splice.

6. A splicing machine comprising; an acute edge adapted for breaking wire insulation by bending an insulated wire-end therearound, so that the insulation may thereafter be pulled off of said end; a rapidly rotatable member adapted to loosely engage and twist together a pair of thus bared ends when brought approximately parallel adjacent thereto, and to form thereof a twisted-off pig-tail splice; means for bending said splice parallel and adjacent to one of the spliced wires; and means for sliding an insulating sleeve, previously placed upon the other said wire, over said bent splice.

7. A construction as set forth in claim 1 in combination with a mechanism adapted to push the spliced wires away from the machine, and to prevent their return.

8. A construction as set forth in claim 1, wherein the twisting member comprises an axially rotatable body and a tangential arm projecting from said body, there being a slot at the junction of the arm and body adapted to receive the wires to be twisted.

9. A construction as set forth in claim 3, wherein the twisting member comprises an axially rotatable body and a pair of opposed and spaced tangential arms projecting from said body, there being slots at the junctions of the arms and body adapted to receive the wires to be twisted; and wherein the said ejecting means comprises a pivoted bar between said respective arms and slots; said bar having an edge directed toward the axis of said member, and being yieldingly constrained to bear against a surface of revolution associated with said member.

10. A construction as set forth in claim 4, in combination with a stationary plate intermediate the twisting and severing means; said plate being adapted to bend the extremities of the severed wires around a portion of the twisting member, to assist in maintaining the engagement of the latter with the wires to be twisted.

11. A construction as set forth in claim 4, in combination with a yieldable drive for the rotatable member, permitting of arresting the rotation of said member momentarily after it has engaged said wires, and prior to the severance of the surplus material from the ends thereof.

12. A construction as set forth in claim 4, in

in combination with a single cooperative lever adapted, within a single cycle of its operation, to fully actuate all of said mechanism and means, for functioning respectively in the manner set forth.

13. A construction as set forth in claim 5, in combination with a single cooperative lever adapted, within a single cycle of its operation, to fully actuate all of said mechanism and means, for functioning respectively in the manner set forth.

14. A construction as set forth in claim 6, in combination with a single cooperative lever adapted, within a single cycle of its operation, to fully actuate all of said movable mechanism and means, for functioning respectively in the manner set forth.

15. A splicing machine comprising; a rapidly rotatable member adapted to loosely engage and to twist together a pair of approximately parallel wire ends brought adjacent thereto, and to form thereof a twisted-off pig-tail splice of non-uniform pitch; and means spaced from the wire ends for holding the wires in fixed position while forming the splice; said holding means and said rotatable member being opposed, and spaced in fixed relation.

16. A splicing machine comprising; means, back of their extremities, for positioning a pair of protruding wire ends; a rapidly rotatable member adapted to loosely engage and to twist together said ends to form thereof a twisted-off pig-tail splice of non-uniform pitch; and means for maintaining a constant length of the twisted wire ends until they have been twisted off.

17. A splicing machine comprising; means for bending the ends of a pair of wires in such manner that said ends will extend adjacent and approximately parallel to each other; means for holding the wires in fixed position adjacent their bends; a rapidly rotatable member adapted to loosely engage and twist together said extended wire ends, and to form thereof a twisted-off pig-tail splice of non-uniform pitch; and means for maintaining a constant length of the twisted portions of the wires until they have been twisted off.

18. A splicing machine comprising; means for bending adjacent ends of a pair of wires in such manner that said ends will extend laterally, adjacent and approximately parallel to each other; means for holding the wires in fixed position adjacent their bends; a rapidly rotatable member adapted to loosely engage and twist together said extended wire ends, and to form thereof a twisted-off pig-tail splice, of non-uniform pitch and most tightly twisted at its extremity; and means for maintaining a constant length of the twisted portions of the wires until they have been twisted off.

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