May 14, 1929. J. W. WRIGHT 1,712,541

WIRE SPLICING MACHINE

Filed Oct. 18, 1924

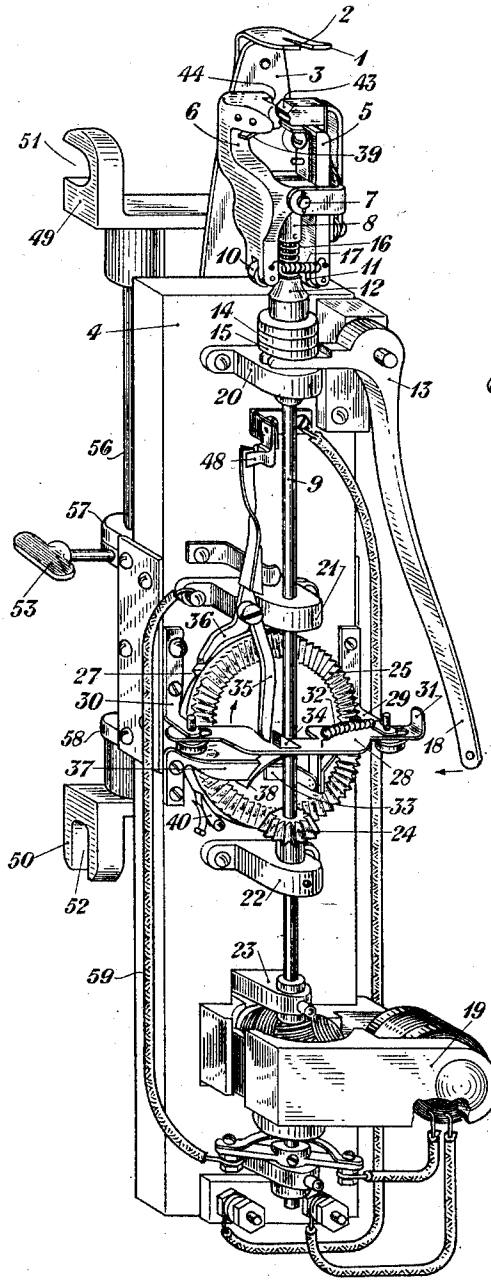


Fig. 1

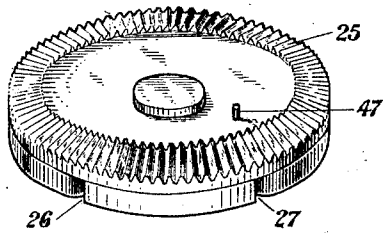


Fig. 2

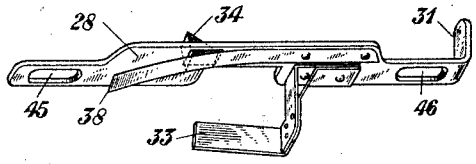


Fig. 3

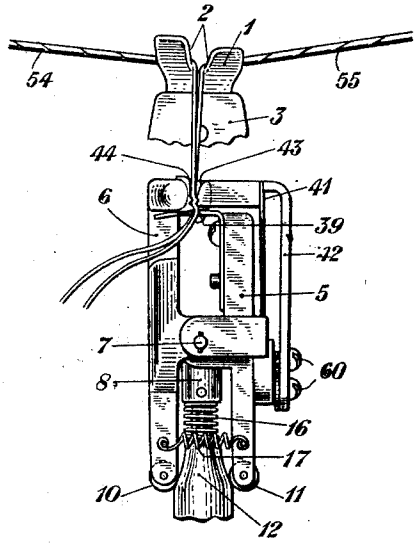


Fig. 4

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Patented May 14, 1929. 1,712,541

UNITED STATES PATENT OFFICE.

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WIRE-SPLICING MACHINE.

Application filed October 18, 1924. Serial No. 744,498.

This invention relates to wire twisting apparatus and particularly to means for splicing electrical conductors such, for example as the wires of telephone cables.

Heretofore in the splicing of telephone cables it has been customary to twist together by hand the ends of the two conductors to be spliced. The manner in which this is done is as follows: After one pair of conductors in each section of cable has been selected to be joined together, one conductor from each pair is then chosen and a sleeve of paper or cotton is slipped over one of the conductors for the purpose of covering the joint between the wires after it has been made. The paper insulation from each wire is stripped off from a predetermined point thereon and the bare portions of the wires are then twisted together. The twisting operation is usually begun by taking a wire in each hand and twisting each about the other, the twist being made usually where the paper has been stripped from the wires and in such manner as to grip the insulation. Then the wires are tightly held at this point, and the free ends of the wires are gripped and rotated after the manner of a crank handle until the necessary number of twists have been inserted in the section of the wires from which the insulation has been removed. Upon the completion of the twisting operation the excess amount of wire is cut off, the twisted portion is bent parallel with the insulated part of the spliced wires, and the insulating sleeve is slipped over the bare portion. Owing to the great increase in size of telephone cables, that is to say, in the number of pairs contained therein, this method proves quite laborious and tends to increase the cost per pair of splicing such cables.

It is the object of this invention to provide a method and means for mechanically twisting the wires of such cables, the apparatus being characterized by means for controlling the length of the twisted portion of the conductors, and also by means for automatically limiting the number of twists that may be inserted therein.

Other objects of this invention will be apparent from the following description when read in connection with the attached drawing, of which Figure 1 is a perspective of one form of embodiment of the invention; Fig. 2 shows a gear having notches therein which engage with pawls to limit the rotation of the gear and thereby the number of twists in each splice; Fig. 3 shows a member controlled by the starting lever which starts the motor and releases the pawl so as to allow the gears to revolve; and Fig. 4 shows in greater detail the gripping and cutting member of the machine.

At the upper end of Fig. 1 is a wire-holding member 1, having therein a slot preferably V shaped, into which are placed the insulated conductors which are to be joined together. The slot 2 shown in more detail in Fig. 4, serves not only to hold the wires during the twisting operation, but also scores the insulation upon the wires so that it may be readily stripped from the wires between the point where they are held in the slot and their free ends. The member 1 serves in part to limit the length of the twisted wires. The member 1, as shown in Fig. 1, is attached to the back plate 3 in such manner that it may be moved longitudinally to vary the distance between the slot and the jaws 5 and 6 and fixedly clamped in the desired position. In this way the length of the twisted portion of the wires may be suited to wires of different sizes. The back plate 3 is rigidly fastened to the supporting plate 4, which carries the rest of the mechanism.

The gripping mechanism comprises two jaws 5 and 6, hinged together by the pin 7, which passes through a bearing 8 rigidly connected with the upper end of the shaft 9. The wire to be gripped passes between the roughened faces 43 and 44 of the jaws. The jaws 5 and 6 carry at their lower ends roller bearings 10 and 11 respectively which slidably engage the spreading member 12, which by spreading apart the lower ends of the said jaws brings together the faces 43 and 44 in order to grip the wire inserted there between. In Fig. 1 the faces are separated since the spreading member 12 is out of engagement with the bearings 10 and 11. Fig. 4 shows the jaws gripping the wires to be spliced, prior to the severance of the excess wire by the knife 39. From Fig. 4 it will be clearly seen that the face 43 is not an integral part of the jaw 5 but is mounted upon a spring 41 which is mounted upon the pin 7. A stopping member 42, which is a

stiffer spring than 41, has a curved upper-portion which touches the spring 41. The stopping member 42 is fastened to the lower part of the jaw 5 by means of the adjusting screws 60. The knife 39 is rigidly fastened to the jaw 5 upon its inner face. The spreading member 12, which is loosely mounted upon the shaft 9 so as not to rotate thereon, is forced into engagement with the lower ends of the jaws 5 and 6 by means of the arm 13. The upper end of the arm 13 consists of a U-shaped yoke which straddles the shaft 9. Inserted between the yoke of this arm and the spreading member 12 are the members 14 and 15, which constitute a ball thrust-bearing. A helical spring 16 is mounted upon the shaft 9 between the supporting member 8 and the upper end of the spreading member 12, which serves to move the said spreading member out of engagement with the lower ends of the jaws 5 and 6, and thereby restores the arm 13 to its normal position. Another spring 17, the ends of which are connected with the lower ends of the jaws 5 and 6, serves to draw together these lower ends after the spreading member has moved out of engagement therewith and thereby opens the upper ends of the said jaws. It will accordingly be seen that when the spreading member 12 is forced upwards and pushes apart the lower ends of the jaws 5 and 6, the stopping member 42 will press against the spring 41, which, in turn, will press the face 43 of jaw 5 against face 44 of jaw 6. The continued upward movement of the spreading member 12 will cause the jaw 5 to move further, thereby causing the knife 39 to shear off the wires just below the faces 43 and 44. The lower end 18 of the arm 13 is intended to be grasped by the hand of the splicer and to be moved toward the left in the direction of the arrow, not only to grip and to cut the wires in the manner just described, but also to start in operation the twisting mechanism which will now be described.

The shaft 9 is connected with the armature of a motor 19. This shaft is supported at a number of points along the base 4 by means of the ball-bearings 20, 21, 22 and 23. The shaft 9 carries a bevel pinion 24 which meshes with the bevel gear 25 mounted rotatably upon a shaft supported by a bearing upon the base 4 (not shown). The ratio of the gear to the pinion is such as to produce a predetermined number of twists in the wires, for each complete revolution of the gear. The outer periphery of the bevel gear 25 has therein two notches or indentations 26 and 27 which cooperate with two pawls 36 and 40 in the starting and stopping of the twisting operation. The purpose of these notches will be clear from the following description of the apparatus. The cross-member 28 is slidably supported by the members 29 and 30. The cross-member is slotted (as clearly indicated by 45 and 46 of Fig. 3) at the points of support 29 and 30 so as to move at right angles to the axis of the shaft 9 when the end 18 of the arm 13 is pressed against the end 31 of the cross-member 28. A spring 32, connected with the cross-member 28 and also with the support 29, serves to draw the cross-member toward the right after the arm 13 has been removed from contact with the end 31. The cross member 28 carries a member 33, the lower end of which is parallel with and close to the face of the gear 25, and so adjusted that when the cross-member 28 is moved a definite distance toward the left to press against a pin 47 (see Fig. 2) projecting from the face of the gear. The engagement of member 33 with the said pin serves to move the gear through a specified angular distance, the purpose of which will later be made clear. The cross-member 28 also carries upon the lower side as shown in Figs. 1 and 3 a spring 38 having a projection 34 extending through a correspondingly positioned slot in member 28. This member, when moved a sufficient distance toward the left, causes the projection 34 to press against one end of the arm 35, The pressure of the projection 34 against the arm 35 lifts the pawl 36 from the notch 26 and closes the contact 48 of the motor circuit. When the pawl has been lifted to clear the edge of the notch, the member 33 comes into contact with pin 47 and moves the gear through such an angular distance that the pawl 36 will not drop back into the notch until the gear 25 has made one revolution. The lifting of the pawl from the notch, the "kicking around" of the gear, and the closing of the switch are practically simultaneous. The operation of the motor causes the rotation of gear 25 through the pinion 24 connected with the shaft 9, and, at the same time, rotates the jaws of the gripping mechanism.

The projection 34, as briefly mentioned, is not rigidly carried by the cross-member 28 but is supported by a flexible member 38 fastened to the under side of the cross-member 28 and curving in the manner shown in the figure so as to be in position to touch the guide 37 when the cross-member has moved sufficiently far toward the left. The arrangement is so adjusted that this projection will touch the end of the arm 35 and it will cause that arm to close the electrical contact and lift the pawl 36 before the flexible support 38 to which it is attached comes in contact with the guide 37. As the cross-member 28 continues to move, under pressure of the arm 13 against the right-hand end 31, the spring 38 will be forced against the guide 37 which will cause a withdrawal of the projection 34 which has been pressing against the lower end of the arm 35.

The arm, however, will not drop back, and permit the opening of the switch contact 48, because the pawl 36 has been lifted from the notch 26 and rests upon the outer periphery of the gear 25. The pawl 36 is integral with or rigidly attached to the arm 35, and the angular distance through which the pawl moves in being lifted from the bottom of the notch 26 up to the periphery of the gear 25 is sufficient to close the switch 48. It is important to note that as long as the pawl 36 rests upon the outer periphery of the gear 25, that is to say, not in its notch, the switch 48 will remain closed and the motor will continue to operate. The pawl 40 cooperating with notch 27 simply prevents backward movement of the mechanism.

The manner in which this apparatus functions in the twisting of the wires is as follows: The insulated conductors 54 and 55 to be spliced together are placed within the slot 2 of the member 1, as shown in Fig. 4, and the insulation is stripped from the ends of the wires. The bared conductors are then inserted in the space between the faces 43 and 44 of the jaws 5 and 6, the excess wire being bent toward the left. The lower end 18 of the arm 13 is then moved toward the left, as indicated by the arrow, and the jaws are brought together until the wires are firmly gripped between the roughened faces of the jaws. Further movement of the arm 13 causes the knife 39 to cut the conductors just below the point where they are gripped between the faces of the jaws 5 and 6. As the arm 13 continues to move toward the left, it pushes the cross-member 28 which, by bringing the projection 34 against the arm 35, serves to lift the pawl 36 from the notch 26 in the periphery of the gear 25, and at the same time to close the contact 48 of the motor circuit. The said pawl is prevented from falling back into the notch by the movement of the gear 25 through a predetermined angular distance, which movement is effected by the member 33 pressing against the pin 47 set in the face of the gear. The continued movement of the cross-member 28 toward the left brings the curved end of the flexible support 38 in contact with the guide 37, thereby drawing the projection 34 downward and causing it to pass under the lower end of the arm 35. But, as stated hereinbefore, the arm 35 will not drop back because the gear has been moved in a clockwise direction, and the pawl 36, which is an integral part of the arm, rests upon the periphery of the gear 25. This serves to keep the contact 48 closed throughout the period in which the gear 25 rotates, that is to say, until the notch 26 again returns to the point just beneath the pawl 36. When this condition exists the switch will open the contact 48, thereby stopping the motor. A pawl 40 is adapted to cooperate with the notch 27 in the periphery of the gear 25 to prevent rotation of the gear in a counter-clockwise direction.

Briefly stated, the sequence of the events resulting from the movement of the arm 13 is the closing of the jaws and gripping of the wires, the raising of the pawl 36, a slight clockwise movement of the gear by pressure on the pin 47, the closing of the contact 48 of the motor circuit, and the rotation of the motor and its automatic stoppage after a predetermined number of revolutions have been completed. In practice the entire operation is completed very quickly.

It is desirable to point out that the normal non-operating position of the gear 25 is such that the pawls 36 and 40 will lie in the notches 26 and 27 of the gear and the pin 47 is to the left of the member 33. Fig. 1 shows the condition existing after the motor has caused the partial revolution of the gear 25. The notch 26 has been moved to such extent as not to be visible in the drawing. The notch 27 which is just about to pass under the pawl 36 will not engage the pawl 36 because it is designed to engage pawls extending from a direction opposite to 36. Furthermore, the passing of the pawl 36 over the notch 27 will not open the contact 48.

The reverse side of the base 4 carries supports by which the machine is held in close juxtaposition to the sections of cable to be spliced. These supports, designated 49 and 50, are intended to rest upon rods placed horizontally, for example, in a manhole beneath the cable to be spliced. One rod would extend through the slots 51 of support 49 and the other rod through slots 52 of support 50. The supports 49 and 50 are rigidly connected by the members 56 which pass through members 57 and 58. The latter members, viz, 57 and 58 are fastened to the back member 4 which carries the splicing mechanism. The splicing mechanism can thus be moved along the members 56 and clamped by the thumb-screw 53 in the desired position.

While I have shown an electric motor as the source of power for operating the mechanism it is to be understood that any source of power capable of rotating the shaft 9 may be used. Furthermore, the source may be remote from the mechanism and the power may be transmitted, for example, by a flexible shaft.

It is desired to point out that the arm 35 is conductively connected with the support 21 to which is also connected the conductor 59 connected with one of the brushes of the series motor 19. When the contact 48 is closed the circuit is completed through the bearing 21.

While this invention has been disclosed in a particular form of embodiment, it is not

so limited, but is capable of embodiment in other and different forms within the spirit and scope of the appended claims.

What is claimed is:

1. In a splicing machine, the combination with means to firmly grip the free ends of the wires to be twisted of means to rotate the gripping means, means to start the rotation of the said gripping means, and means to automatically stop the rotation of the said gripping means after a predetermined number of twists have been inserted in the said wires.

2. In a splicing machine, the combination with means to firmly grip the free ends of the wires to be twisted of means to hold together the said wires at a definite distance from the said gripping means, means to rotate the said gripping means, and means to automatically stop the rotation of the said gripping means after a definite number of twists have been inserted in the portion of the wires between the said holding means and the said gripping means.

3. In a splicing machine, the combination with means to firmly grip the free ends of the wires to be twisted of means to rotate the said gripping means, means to confine the twisting within a predetermined length of wire, means to automatically stop the twisting of the said wires after a predetermined number of twists have been inserted in said length, and means to cut off the excess amount of wires beyond the twisted portion of the said wires.

4. In a machine for splicing electrical conductors, the combination with guiding means for holding together at a fixed point the conductors to be spliced, the said means being adapted to score the insulation upon the said conductors, means to grip the free ends of the said conductors, and means to rotate the said gripping means.

5. In a machine for splicing electrical conductors, the combination with guiding means for holding together at a fixed point the conductors to be spliced and to score the insulation upon the said conductors at that point, of means to grip the free ends of the conductors, means to rotate the said gripping means, and means to control the number of twists inserted between the said guiding means and the said gripping means.

6. In a machine for splicing electrical conductors, the combination with guiding means for firmly holding at a fixed point the conductors to be spliced, of means to grip the free ends of the said conductors, means associated with the said gripping means to cut off the excess wire of the free ends beyond the point where they are gripped, and means to rotate the said gripping means.

7. In a machine for splicing electrical conductors, the combination with guiding means to hold together at a fixed point the conductors to be spliced, of means to grip the free ends of the said conductors, means to vary at will the distance between the said guiding means and the said gripping means, means to rotate the said gripping means, and means to control the number of twists inserted between the said guiding means and the said gripping means.

8. In a machine for splicing electrical conductors, the combination with guiding means to firmly hold together at a fixed point the conductors to be spliced, of means to grip the free ends of the said conductors, means associated with the said gripping means to cut off the excess of the said free ends beyond the gripping point, means to rotate the said gripping means, and means to automatically control the number of twists put into the said conductors as thus twisted.

9. In a splicing machine the combination with means to firmly grip the free ends of the wires to be twisted, of means controlled by the same means that control the said gripping means to rotate the said gripping means, and automatic means to effectively disconnect the said rotating means from the said gripping means after a predetermined number of twists have been inserted in the said wires.

10. In a machine for splicing electrical conductors the combination with means adapted to firmly grip the free ends of the wires to be twisted, of means for rotating the said gripping means, means to control the duration of rotation of the said gripping means, and operating means to cause the said gripping means to grip the said wires and to initiate the operation of the said controlling means.

11. In a machine for splicing electrical conductors the combination with a slotted guide for holding together the conductors to be spliced, the edges of the said slot being designed to score the insulation of the said conductors, means to grip the free ends of the said conductors, means to rotate the said gripping means, and means to effectively operate the said gripping means and to set in operation the said rotating means.

12. In a machine for splicing electrical conductors the combination with a slotted guide for holding together the conductors to be spliced, the said guide being so mounted as to be movable at will, and the edges of the said slot being designed to score the insulation of the said conductors, means to grip the free ends of the said conductors, means to rotate the said gripping means, and means to effectively operate the said gripping means and to set in operation the said rotating means.

13. In a machine for splicing electrical conductors the combination with a slotted

guide for holding together the conductors to be spliced, of gripping jaws to hold the free ends of the said conductors, a shaft upon which the said jaws are mounted, the jaws being non-rotatable independently of the said shaft, a motor connected with the said shaft, and operating means adapted to control the opening and closing of the said jaws and also to control the operation of the said motor.

14. In a machine for splicing electrical conductors the combination with a rotatable shaft of a motor connected with the said shaft, a bevelled pinion fixedly mounted on the said shaft, a gear rotatably supported to coact with the said pinion, an indentation in the said gear, a switch lever having a pawl adapted to coact with the said indentation, and means adapted to lift the pawl from the said indentation and to energize the said motor by the operation of the said switch lever to effect the rotation of the said shaft.

In testimony whereof, I have signed my name to this specification this 14th day of October, 1924.

JOHN W. WRIGHT.