Aug. 8, 1961 F. RECK 2,994,941

WIRE SPLICING

Filed Jan. 30, 1957 2 Sheets-Sheet 1

FIG. 1

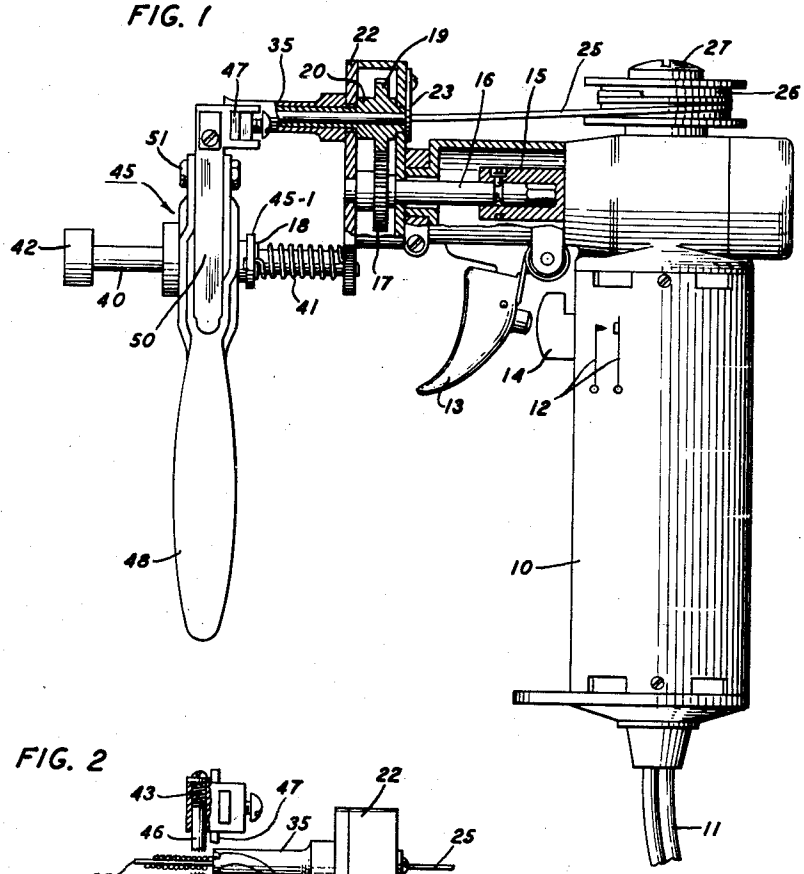
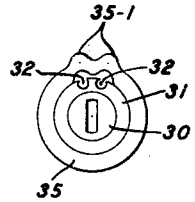


FIG. 2

FIG. 4



INVENTOR
F. RECK

BY John C. Morris

ATTORNEY

Aug. 8, 1961 F. RECK 2,994,941

WIRE SPLICING

Filed Jan. 30, 1957 2 Sheets-Sheet 2

FIG. 3

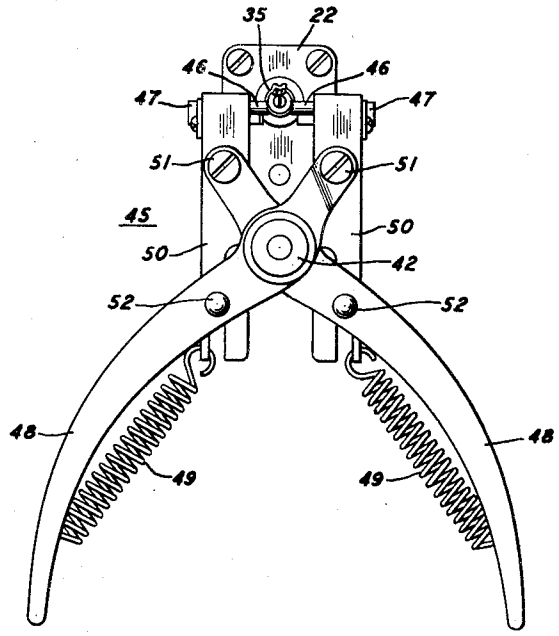


FIG. 5A

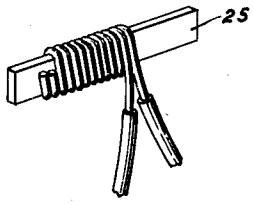
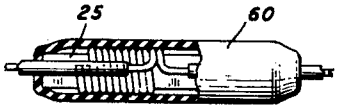


FIG. 5B



INVENTOR
F. RECK
BY
John C. Morris
ATTORNEY

United States Patent Office 2,994,941 Patented Aug. 8, 1961

2,994,941

WIRE SPLICING

Frank Reck, Flushing, N.Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N.Y., a corporation of New York

Filed Jan. 30, 1957, Ser. No. 637,185
7 Claims. (Cl. 29—33.5)

This invention relates to splicing and more particularly to connecting together a plurality of wires in a new and improved manner.

Wire-splicing tools as heretofore constructed are generally designed to be employed in practicing methods of splicing which comprise twisting wires together in order to attain electrical and mechanical connections therebetween. Reliable prior art splicing methods often also include the step of soldering the twisted wires together, or of crimping a conductive sleeve member over the twisted wires. Such prior art methods are commonly very time consuming and, accordingly, expensive.

An object of the present invention is to facilitate the splicing of wires.

More specifically, an object of this invention is a new and improved method of wire splicing and a new and improved wire-splicing tool.

Another object of the present invention is a splice connection having novel characteristics.

These and other objects of this invention are attained in and by means of one specific illustrative device which is designed to wire wrap a number of wires onto an element of electroconductive material in a mechanically secure and electrically stable manner; the embodiment is designed to make wire-wrapped electrical connections of the type fully described in Patent 2,759,166, R. F. Mallina, August 14, 1956.

An illustrative tool embodying the basic principles of the present invention advantageously comprises a wire-wrapping assembly having an outer stationary housing, an inner longitudinally apertured conductor material receiving sleeve member, and an intermediate rotatable wrapping spindle having a plurality of wire receiving slots or orifices therein. Integrally associated with the wire-wrapping assembly are a conductor material feed assembly and a gripping and cutting plier device.

A method illustratively embodying the principles of this invention is practiced by employing the aforementioned tool. Each of the wires which it is desired to splice together is placed in one of the spindle slots, the conductor material being arranged to extend from the feed assembly and through the aperture in the conductor receiving member so as to project a preassigned distance beyond the end of the wire-wrapping assembly. Any suitable device is then employed to rotate the wrapping spindle and, thus, to wire wrap the wires in an interleaved fashion onto the projecting conductor portion.

At the completion of the wire-wrapping operation, the plier device, which is designed to have its jaws positioned in a straddling relation to a wrapped connection, is actuated so as to cause its jaws to grip the connection. The plier device is then moved along a guide shaft so as to pull the gripped connection and the conductor material attached thereto away from the end of the wire-wrapping assembly. When the plier device has been moved to the end of the guide shaft, it is further actuated so as to cause its cutting edges to shear through the conductor material in back of the splice connection. Thus, the splice connection comprises a portion of conductor material having a plurality of wires wire wrapped thereon in an interleaved fashion.

Accordingly, a feature of this invention is a wire-splicing tool comprising a wire-wrapping mechanism including a spindle having a longitudinal conductor material receiving opening therethrough and a plurality of wire receiving slots or orifices therein, a guide shaft secured to the wire-wrapping mechanism, and a gripping and cutting assembly translatably mounted on the guide shaft, whereby a plurality of wires can be connected together by wrapping them in an interleaved fashion on a portion of conductor material, the wrapped portion being gripped, advanced and cut free from the remainder of the conductor material by the translatable assembly.

Another feature of the present invention is a method of wire splicing comprising the step of simultaneously wire wrapping in an interleaved manner a plurality of wires onto an electroconductive member.

A further feature of this invention is a splice connection comprising an electroconductive member, and a plurality of wires wrapped thereon in an interleaved fashion, whereby the wires are joined together in a mechanically secure and electrically stable manner.

A still further feature of the present invention is a wrapping assembly comprising a rotatable wire-wrapping spindle having a longitudinal conductor material receiving opening therethrough and a plurality of wire receiving slots or orifices therein, and an assembly for rotating the spindle, whereby a plurality of wires can be wire wrapped onto a conductor member in an interleaved manner.

And yet another feature of this invention is a wire-wrapping tool comprising a wrapping assembly having a longitudinal conductor material receiving opening therethrough and a plurality of wire receiving slots or orifices therein, an assembly connected to the wrapping assembly for rotation thereof, and a mechanism for feeding conductor material through the longitudinal opening.

A complete understanding of the invention and of these and other features thereof may be gained from consideration of the following detailed description in conjunction with the accompanying drawing in which:

FIG. 1 is an elevation view of one illustrative embodiment of the present invention, a portion thereof being broken away to show the invention more clearly;

FIG. 2 is a plan view of a portion of the embodiment of FIG. 1;

FIG. 3 is an end view of a portion of the embodiment of FIG. 1;

FIG. 4 is an enlarged end view of a portion of the assembly of FIG. 1; and

FIGS. 5A and 5B are enlarged perspective views of a connection made in accordance with the principles of the present invention.

Referring now of FIG. 1, there is shown a splicing tool illustratively embodying the basic concepts of this invention. The tool may be considered to comprise three components, each of which cooperates with the other two so as to produce a novel splice structure.

The first or driving component of the tool comprises a driving element, not shown, which is contained in a cylindrically shaped casing **10**. The element may advantageously be an electric motor, but other types of driving elements can be arranged in the casing **10** so as to perform the desired rotary driving function equally well. A conductor member **11** fits through the bottom of the casing **10** and is intended to supply the contained driving element with energy from an external source, also not shown. Switch elements **12**, which are operated by a trigger **13** and a button element **14**, are but illustrative of the manner in which an electric motor driving element, for example, can be controllably energized. An extension **15** of the driving element is securely connected to a drive shaft **16** which, in turn, is connected to a lower gear **17**. The gear **17** is arranged so as to engage an

upper gear element **19** which is formed as an integral part of a wrapping spindle **20**, the spindle being a part of the second or wrapping component of the tool.

The gears **17** and **19** are enclosed in a housing **22** to the back side of which is secured a guide plate **23**. The plate **23** has an opening therethrough which is designed to receive and guide conductor material **25**.

The material **25**, which may be in strip form as illustrated, is supplied from a reel **26**, the reel being mounted on the driving member by a supporting member **27**. The guide plate opening through which the material **25** extends is similar in cross section to that of the material and is sized so as to allow the mterial to slip freely therethrough.

Turning now to FIG. 4, there is shown an end view of the wrapping assembly. The assembly comprises a cylindrical, longitudinally apertured stationary guide sleeve **30**, the aperture of which is aligned so as to register with the aforementioned plate opening. A rotatable wrapping spindle **31** is coaxially positioned with respect to the guide sleeve **30** and is formed so that its generally cylindrical shape has a plurality of wire receiving orifices, e.g. slots **32**, formed in the outer surface thereof.

Surrounding the guide sleeve **30** and the wrapping spindle **31** is a stationary housing sleeve **35**, peripheral portions **35–1** of which are flared outwardly so as to facilitate the inserting of wire ends in the spindle slots **32**.

The wrapping spindle **31** and the housing sleeve **35** may, however, be formed as an integral piece. In that event, only the guide sleeve **30** would remain stationary during a wire-wrapping step.

Secured to a lower portion of the gear housing **22** in any suitable manner is a guide shaft **40** upon which is wound a spring **41**. One spring end is secured to the housing **22** and the other end is secured to a collar **45–1**.

The collar is a part of a gripping and cutting device **45** which is translatably mounted on the guide shaft **40**. A portion **42** of the shaft **40** serves as a stop, i.e. the portion **42** limits the movement of the device **45** away from the end of the wrapping assembly.

The device **45**, which is the third component of the tool, comprises gripping jaws **46**, knives **47**, handle elements **48** and handle springs **49**. The portions of the jaws **46** which are intended to grip a wrapped connection are serrated so as to insure firm engagement therewith. Furthermore, for the reason given below, the gripping jaws **46** are spring loaded; FIG. 2 clearly shows one of the loading springs **43**.

The knives **47** are secured in the device **45** by means of set screws. Both the knives **47** and the gripping jaws **46** are mounted in supporting elements **50** which are fastened to the device handles by suitable fastening means as, for example, screws **51** and rivets **52**.

The spring **41**, a back stop element **18** and the handle springs **49** serve to locate the plier device so that its gripping jaws are normally positioned in a straddling relation with respect to a wrapped connection, as shown most clearly in FIG. 2.

In operation, the above-described tool can advantageously be employed as follows:

Each of the wires which it is desired to splice together is placed in one of the spindle slots **32**, the conductor material **25** having previously been arranged so that it projects beyond the end of the wrapping assembly. The trigger **13** is moved so as to depress the button **14**, the driving element being thereby energized. The driving element causes the drive shaft **16** which is coupled to the gear **17** to rotate, and the gear **17** rotates the wrapping spindle **20** by driving the spindle gear **19**. The spindle **20** then wire wraps the wire ends in an interleaved fashion onto the projecting portion of the terminal material. The trigger is released when a sufficient number of turns have been wire wrapped onto the material. Then, the plier handles **48** are actuated so as to cause the jaws **46** to grip the connection, and the device **45** is moved along the shaft **40** until the end stop **42** is struck. At that point, further force on the plier handles **48** causes the knives **47** to contact and to cut through the material **25**. The jaws **46**, which are spring loaded, grip the connection in a resiliently firm manner and do not deform it during the conductor material cutting operation because the spring members **43** are selected and arranged so that less than a connection deforming force will cause them to be compressed.

At the completion of the cutting step, the plier device **45** is released and the spring **41** returns it to a position against the back stop **18**. The device **45** and the material **25** are then correctly positioned for the start of another splice connection.

Referring now to FIG. 5A, there is shown a splice connection made by the above-described tool. Furthermore, FIG. 5B shows a completed connection as it might advantageously be arranged so as to receive an insulating sleeve member **60** thereover.

The present invention comprises a tool of the type above described. Furthermore, the invention includes a method which is a rapid and efficient one and which is suited for making exactly reproducible splice connections. A splice connection made in accordance with the principles of the present invention includes a portion of conductor material upon which are wound in a neat compact interleaved mechanically secure and electrically stable manner a plurality of turns of skinned wires.

It is to be understood that the above-described arrangements are illustrative and not restrictive of the principles of this invention. Other arrangements may be devised by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. A tool for connecting together a plurality of wires comprising wire-wrapping means including a spindle having a longitudinal conductor strip receiving opening therethrough and a plurality of wire receiving orifices therein, a guide shaft secured to said wire-wrapping means, and connection gripping and strip cutting means translatably mounted on said guide shaft, whereby a plurality of wires can be connected together by wrapping them in an interleaved fashion on a portion of conductor strip, said wrapped portion being gripped, advanced and cut free from the remainder of said strip by said translatable means.

2. A wire-splicing tool comprising a housing, a wire-wrapping spindle projecting from the housing, a conductor guiding member within said spindle, and a translatable assembly secured to said housing, said spindle including a plurality of peripheral orifices for receiving, respectively, each wire to be spliced and for guiding these wires, upon rotation of the wrapping spindle, into an interleaved wire-wrapped connection around a conductor projecting from the guiding means, said conductor guiding means for guiding a continuous conductor through said spindle, said translatable assembly for moving a splice away from a wire-wrapping zone and positioning an adjacent portion of conductor therein and including gripping means, cutting means, and operating members, said gripping means for seizing, upon restricted movement of the operating members, a wrapped splice for translation away from the wire-wrapping zone, said cutting means for severing the splice from the continuous conductor upon further movement of the operating members, and motive means for rotating said spindle.

3. A tool for making splice connections comprising a wire-wrapping assembly, guide shaft means connected to said assembly, and translatable means mounted on said guide shaft means, said wrapping assembly including a conductor receiving element, and said translatable means having gripping and cutting members, whereby said assembly wire-wraps a plurality of wires in an interleaved fashion onto a portion of material, and said translatable

means grips, advances and cuts free the portion of material having a plurality of wires wrapped thereon.

4. A wire-splicing tool comprising a housing, a hollow rotatable wire-wrapping spindle projecting from the housing, a conductor guiding member within said spindle, and a translatable assembly secured to said housing, said spindle including a plurality of peripheral orifices for receiving, respectively, each wire to be spliced and for guiding these wires, upon rotation of the wrapping spindle, into an interleaved wire-wrapped connection around a conductor projecting from the conductor guiding member into a wire-wrapping zone, said conductor guiding member for guiding a continuous conductor through said spindle, said translatable assembly for moving a splice away from the wire-wrapping zone and positioning an adjacent portion of conductor therein and including gripping means, cutting means, and operating members, said gripping means for seizing, upon restricted movement of the operating members, a wrapped splice for translation away from the wire-wrapping zone, said cutting means for severing the splice from the continuous conductor upon further movement of the operating members, and motive means for rotating said spindle.

5. A splicing tool comprising a wrapping spindle having a longitudinal opening therethrough and a plurality of slots formed on the surface thereof, means for rotating said spindle, means for feeding conductor material from the back or rotating means end to the front of said spindle through said opening, whereby a plurality of wires, each of which is placed in a spindle slot, can be wire wrapped in an interleaved fashion onto a frontwardly projecting portion of the material, and means integrally formed with said spindle, said rotating means, and said feeding means, for gripping, advancing and cutting free the wire-wrapped conductor portion so as to form a mechanically secure and electrically stable connection.

6. A wire-connecting tool comprising a housing, a wire-wrapping spindle projecting from one face of the housing, the spindle having a through bore for guiding a conductor strip, and wire-controlling openings for wires to be connected and for guiding these wires into an interleaved wrapped connection on a portion of the conductive strip projecting from the spindle, means for rotating the spindle, translatable means for feeding a suitable length of connector strip for each connection and for severing a completed connection from the strip comprising a guide shaft projecting from said one face of the housing in parallel relation to the spindle, gripping means, cutting means, and operating means therefor slidably mounted on said shaft, means for biasing the translatable means to a home position relative to the indicated housing face, and stop means for arresting the translatable means at said suitable length from its home position.

7. A tool for connecting a plurality of wires by wire wrapping the end portion of each of such wires around a rectangular section conducting strip adjacent an end thereof, said tool comprising a housing, means for storing the conductive strip, a rectangular orifice on one side of the housing for orienting the strip, a wire-wrapping spindle projecting from the other side of the housing, the spindle having a through bore juxtaposed to the orifice for guiding the strip and wire-receiving and -controlling openings for receiving the wires to be connected and for guiding these wires into an interleaved wrapped connection adjacent the end portion of said strip projecting from the spindle, means for rotating the spindle, translatable means for feeding a suitable measured length of connector strip from said spindle for each connection and for severing a completed connection from the strip, said means comprising a guiding shaft projecting from said other face of the housing and parallel to the spindle, grasping means, cutting means, and operating means therefor slidably mounted on the shaft, spring means for urging the translatable means to a home position relative to said other housing face, and stop means on the outer end of the shaft for arresting the translatable means at said measured length from its home position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,108,917	Elder	Feb. 22, 1938
2,688,449	Haagensen	Sept. 7, 1954
2,697,213	Patton	Dec. 14, 1954
2,732,139	Shaff	Jan. 24, 1956
2,741,436	Belek	Apr. 10, 1956
2,743,502	Reck	May 1, 1956
2,758,797	Miklau	Aug. 14, 1956
2,759,166	Mallina	Aug. 14, 1956