

[54] LEAD SLEEVE CUTTING TOOL

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[58] Field of Search 30/168; 145/24, 25, 26; 29/95

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[57] ABSTRACT

A ripper tool usable with a pneumatic hammer or the like is provided to cut a soft ductile material such as a lead splice sleeve at a fast rate and with a clean cut. On a forward end of the tool is a ripper section having a pair of spaced toes for sliding along the sleeve and having a ripping tooth which projects inwardly into the sleeve and forces lead which, as it compresses and expands laterally, is forced rearwardly and upwardly through a wide slot between the toes and outwardly above the ripping tooth. Tools to make a circumferentially extending cut may be provided with a downwardly and forwardly projecting ripper section; and tools to make a longitudinally extending cut may be provided with an upwardly and forwardly projecting ripper section.

6 Claims, 10 Drawing Figures

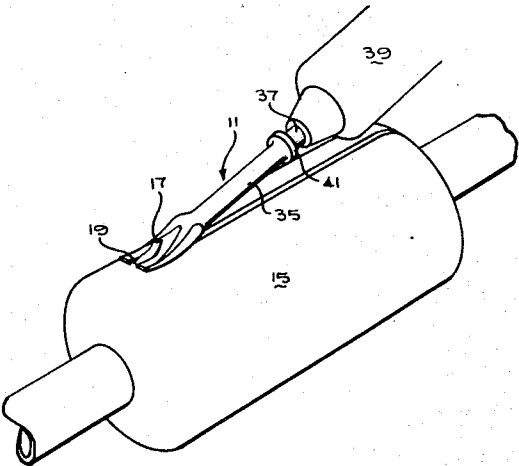


FIG. 1

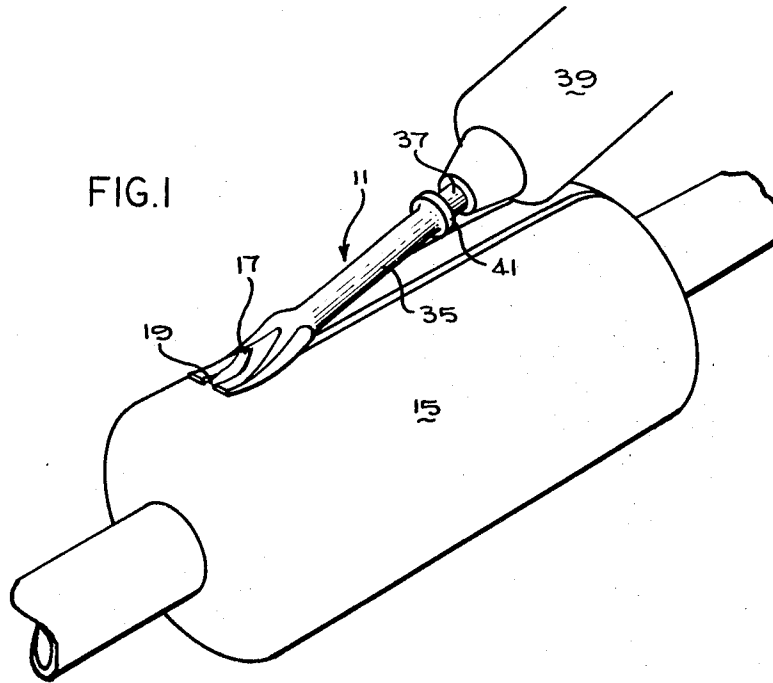


FIG. 2

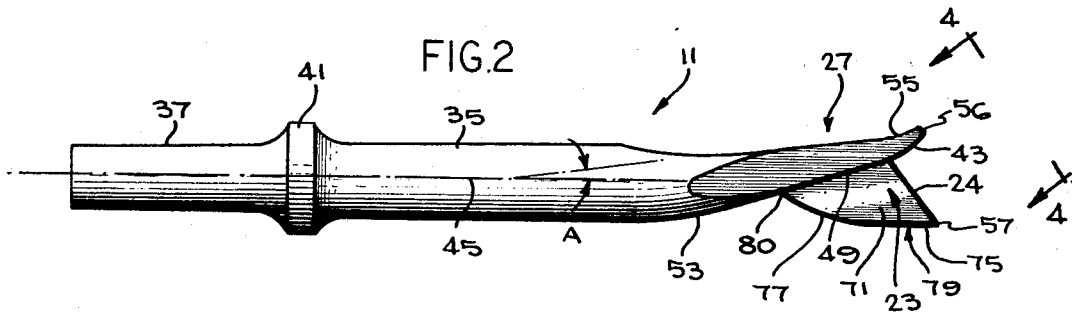


FIG. 3

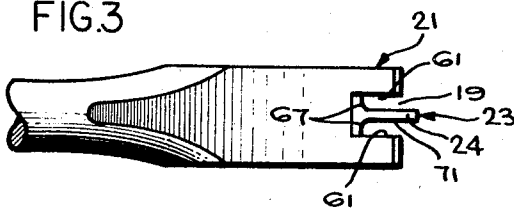


FIG. 4

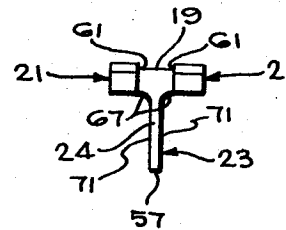
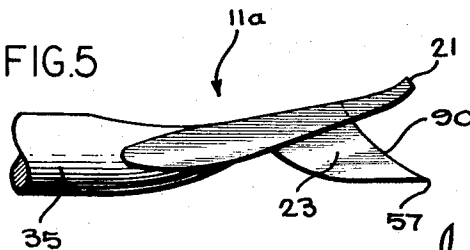


FIG. 5



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FIG.6

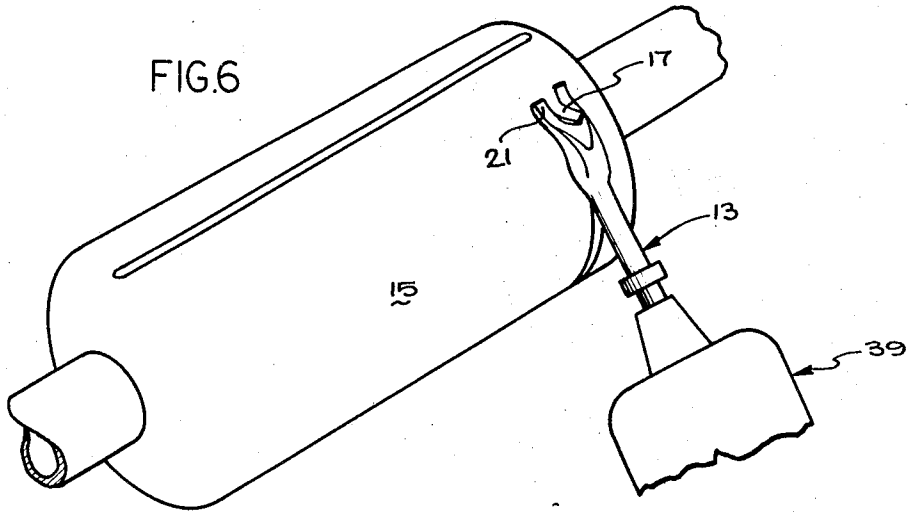


FIG.7

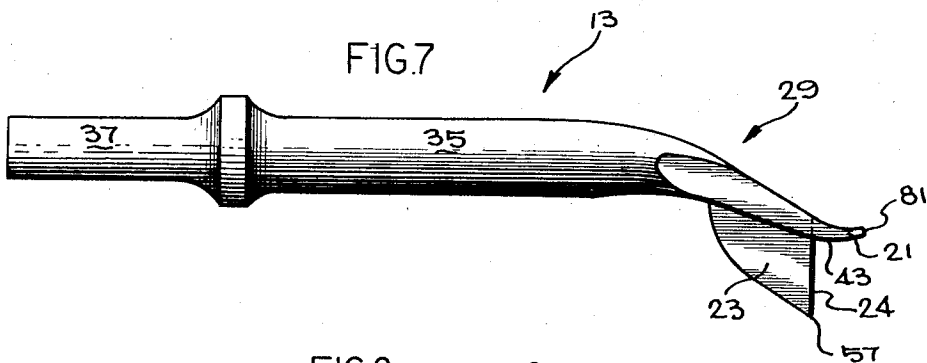


FIG.8

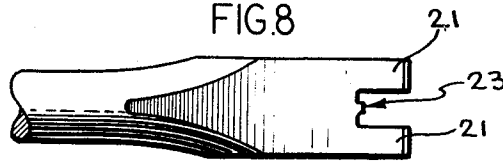


FIG.9

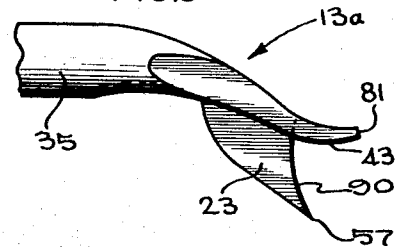
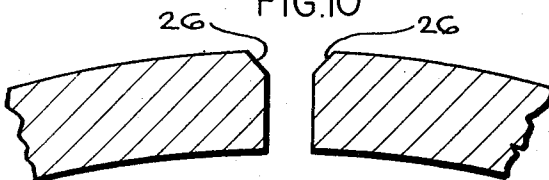


FIG.10



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LEAD SLEEVE CUTTING TOOL

This invention relates to ripper tools used with pneumatic hammers or the like and more particularly to a ripper tool capable of cutting soft ductile materials such as lead.

The ripper tools described herein are for cutting, among other things, telephone cable splice sleeves within which are wire splices between a large number of individual wires. The ripper tools are used to make one or more longitudinally extending cuts and one or more circumferentially extending cuts in the sleeve in order to provide an access opening or to remove the entire cylindrical portion of the sleeve between end caps at the ends of the sleeve. Such lead sleeves are relatively thick in cross section, for example, from one-sixteenth to five-sixteenths inch and the lead alloy material is difficult to rip in that it is a relatively inelastic, pliable material with a unique ductility. When being cut by a tooth on a ripper tool, the lead flows outwardly in a plastic flow and expands rather than shearing in the manner of steel sheets being ripped by a conventional ripper.

Lead splice sleeves of this general type often range up to 13 inches in diameter and may enclose as many as 2,700 wires. The cuts in the sleeve should be made without severing wires within the sleeve as the resplicing of severed wires is time consuming and expensive. Often, the splicing sleeve is located within a manhole and there is a very limited amount of space in which to manipulate the ripping tool. Additionally, in a manhole there is a possibility of a gas explosion, and hence it is preferred to drive the tool by a pneumatic hammer operated by compressed nitrogen or air rather than by means of an electrically driven device. Furthermore, the cost of labor renders it particularly important that the ripping tool perform a relatively fast cut but without the danger of severing a large number of interior wires in the splice.

With the present invention a cut in the sleeve may be made three times as fast as that using the conventional ripper chisel type of tool of the prior art. Additionally, the ripper tool of the present invention provides a cleaner cut and forms a bevel along the outer edges of the cut to serve as a groove for receiving solder when the opening formed by the cuts is closed by replacing the cut piece to fill the access opening in the sleeve. To these ends, the ripper tool is formed with a pair of spaced sleeve engaging toes defining a wide slot above a narrow ripper tooth with the expanding and flowing lead being driven upwardly through the slot as the ripper tooth is moved along the sleeve. The lead flowing in the slot has a wrinkled appearance and appears as a thick and heavy plastic flow as it moves outwardly through the slot.

Also, in the preferred embodiment of the invention the surfaces of the toes engaging the sleeve are curved to permit rocking of the tool relative to the sleeve to vary the depth to which the point of the tooth projects into the sleeve. By holding the pneumatic tool at the desired angle, depth of tooth penetration can be limited so that the danger of cutting any of the internal wires is minimized.

In accordance with the preferred embodiment of the invention, the ripper tool is formed with an inclined section at the end having the ripper tooth. To facilitate movement of the tool along the sleeve, the ripper section for making a longitudinal cut preferably projects upwardly and outwardly relative to a longitudinal axis through the body of the tool. To form circumferentially extending or peripheral cuts, it is preferred to provide another ripper tool in which the ripper section is pointed downwardly and forwardly to facilitate a curving or wrapping of the tool about the circumference of the sleeve during a circumferential cut.

Accordingly, an object of the invention is to provide an improved ripper tool of the foregoing kind for cutting difficult to cut metals such as lead.

Other objects and advantages of the invention will become apparent from the detailed description taken in connection with the accompanying drawings in which:

FIG. 1 is a perspective view of a ripper tool embodying the novel features of the invention and forming a longitudinal cut on a sleeve;

FIG. 2 is a side elevational view of the ripper tool of FIG. 1;

FIG. 3 is a fragmentary, plan view of the forward section of the ripper tool of FIG. 2;

FIG. 4 is a front view of the ripper tool of FIG. 2 taken substantially along the line 4—4 of FIG. 2.

FIG. 5 illustrates a further embodiment of the ripper tool of FIG. 1 having a curved leading wall on the depending tooth;

FIG. 6 illustrates another embodiment of the invention and a ripper tool usable for forming circumferential cuts on the sleeve;

FIG. 7 is a side elevational view of the ripper tool of FIG. 6;

FIG. 8 is a fragmentary, plan view of the tool of FIG. 7;

FIG. 9 illustrates another embodiment of the tool of FIGS. 6, 7 and 8 but formed with a curved leading wall on the tooth thereof; and

FIG. 10 illustrates in cross section a cut in the sleeve with outer beveled edges on the walls defining the cut.

As shown in the drawings for purposes of illustration, the invention is embodied, very generally, in a ripper tool 11 or 13 for forming a cut in a piece such as a sleeve 15 formed of a soft, flowable metal material such as, for example, a lead alloy hereinafter simply referred to as a lead. The lead from the cut forms a wide wrinkled chip 17 which is forced to flow upwardly from the sleeve through a wide slot 19 formed between a pair of toes 21 which slide along the sleeve surface. The preferred slot 19 is much wider than a narrow ripping tooth 23 which projects inwardly into the sleeve wall with its leading edge or wall 24 forcing the lead upwardly while the lead compresses and expands during its travel toward and through the slot 19 and outwardly above the ripping tool.

The ripper tool 11 is used primarily for the longitudinally extending cuts whereas the ripper tool 13 is used to make the cuts in a circumferential direction adjacent the ends of the sleeve. As will be explained in greater detail, the principle difference between the ripper tools 11 and 13 is the fact that they are formed with ripper sections 27 and 29, respectively of reverse inclinations. That is, the tool 11 is formed with a ripper section 27 having toes 21 projecting upwardly, as seen in FIG. 2, relative to the remaining body 35 of the tool whereas the tool 13 has a ripper section 29 with toes 21 projecting downwardly to wrap circumferentially about the sleeve 15, as illustrated in FIG. 6. Both of the tools 11 and 13 are used to make cuts in lead at relatively high speeds as compared to prior art ripping tools and both may be used to form bevel edges 26 along the outer edge of the cut 28, as best seen in FIG. 10 to form a solder receiving groove to facilitate retention of solder between a returned cut out portion 30 and the remainder of the sleeve.

Referring now in greater detail to the ripper tooth 11, which will now be described in detail. The ripper tooth 13 will not be described in such great detail as most of the elements thereof are identical in shape and function to that which are on the ripper tooth tool 11. Hence, a description of the ripper tool 13 hereinafter will make reference primarily to the portions thereof which are different in dimensions and to which different reference characters have been applied. The ripper tool 11 is formed with the elongated body 35 with a shank 37 at one end for attachment to a pneumatic hammer 39 or the like. The preferred tool is made of forged and heat treated steel with the elongated body 35 generally formed with a circular cross section and with the shank suitably machined to a predetermined diameter to fit into the pneumatic hammer which provides short reciprocating strokes to the ripper tool. For instance, the illustrated ripper tool may have an overall length of six inches and a body 35 which is one-half inch diameter. The shank 37 may be machined to a 0.400 inch diameter with a ¼ inch diameter collar 41.

To assist the operator in controlling the depth which the tooth 23 projects into the sleeve 15 and to prevent the digging in of the tooth as the toes 21 slide along the sleeve, it is preferred that the toes 21 be inclined to a longitudinal axis 45 through the body 35 of the ripper tool and be formed with curved or arcuate surfaces 43 on the underside of the toes 21.

The illustrated tool 11 is formed with upper flat walls 51 of the toes inclined upwardly at an angle A, e.g. of approximately

20° to the longitudinal axis 45 through the center of the tool body 35 as best seen in FIG. 2. The illustrated curved surfaces 43 are formed with a eleven-sixteenth inch radius and extend to and join relative flat surfaces 49 which are at an angle B, e.g. of 10°, to the upper flat surfaces 51. These flat undersurfaces 49 extend rearwardly to a common curved surface 53 which extends to and joins the circular surface of the body 35.

As best seen in FIG. 4, the upper surfaces of the toes adjacent the forward ends are formed with small curved surfaces 55 which, in this instance, are each formed with a one-half inch radius. The tips of the toes defined between the curved surfaces 43 and 55 are about one-sixteenth inch at end walls 56.

In use, the ripper tool 11 may be slid along the flat bottom surfaces 49 of the toes 21 whereby the tooth 23 may project inwardly to the maximum depth or when it is felt there is a danger of severing wires within the sleeve 15, the pneumatic hammer 39 and the body 35 of the tool may be pivoted upwardly to bring the curved surfaces 43 of the toes into contact with the sleeve thereby pivoting the pointed end 57 of the tooth 23 upwardly to lesser penetration depth, approximately the depth of the cross-sectional thickness of the lead sleeve.

The ripping tooth 23 for forming the cut is relatively thin in cross section compared to the width of the slot 19; e.g. the illustrated tooth 23 has a cross-sectional thickness of one-sixteenth inch as compared to a one-fourth inch width dimension for the slot 19. This is by way of example only and other dimensions may be employed for the various sizes and kinds of rippers although it is preferred that the ripper tooth width dimension be less than one half the width of the slot 19 as measured between opposite, vertically extending side walls 61 of the respective toes 21. Preferably, the slot 19 between the vertical inwardly facing side walls 61 of the teeth 21 extends rearwardly for only a relatively short distance as seen in FIG. 4. An upwardly and rearwardly inclined wall 63 defines the rear of the slot 19, as best seen in FIG. 4, and extends the full width of the slot between the vertical side walls 61 and slopes downwardly to the forward leading wall 24 for the tooth 23.

The beveled edges 26 of the cut 28 are formed by arcuate cutting edges 67 at the lower, forward edge of the inclined rear wall between the tooth 23 and the vertical side walls 61 of the teeth 21. As best seen in FIG. 4, the arcuate cutting edges 67 extend downwardly toward the tooth 23 and define a thickened cross-sectional portion between the tooth 23 and the tooth walls 61. In this instance, the arcuate cutting edges 67 are each formed with a three thirty-seconds inch radius. The arcuate cutting edges 67 thus project downwardly below the undersides of toes 21 to cut into the lead and project outwardly from the tooth 23 to cut the beveled edges 26 as best seen in FIG. 10. The lead cut to form the bevel edges 26 is forced upwardly and backwardly through the slot 19 and along the rear wall 63 of the slot 19.

The tooth 23 which performs the cutting operation has a relatively narrow cross section but is made with sufficient strength so that the same will not break while penetrating the usual cross-sectional thickness for the sleeves. The height (or depth) of the tooth may vary, e.g. from one-sixteenth to one-half inch, as measured from the flat undersides 49 of the toes 21 to the lower point 57 of the tooth. The illustrated tooth is formed with flat, parallel side walls 71 which are in planes parallel to one another and which planes are spaced from and parallel to the side walls 61 of the toes. In the illustrated ripper tooth there is a three thirty-seconds inch spacing between each of the tooth side walls 71 and its adjacent facing side wall 61 of a toe 21. In the illustrated ripper tool 11, the leading tooth wall 24 is inclined at an angle of 39° to the vertical. From the lower tooth point 57, the tooth has a bottom wall 79 extending upwardly and rearwardly from the tooth point and including a short flat portion 75 and a rearward curved por-

tion 77, the latter extending upwardly to join at 80 the lower straight wall 53 on the underside of the toes. In this instance, the length of the tooth from the leading wall 24 to the intersection 80 is about three-fourths of an inch.

Referring now to the ripper tool 13 for making a peripheral cut, the toes 21 project downwardly and also project slightly forward of the tooth point 57 to end walls 81 at the tips of the toes 21. In contrast, the longitudinal cut ripper tool 11 has its tooth point 57 projecting forwardly of the toe end walls 56. Specifically, the toe end walls 81 of the tool 13 project approximately five-sixteenths of an inch forwardly of the tooth point 57 whereas for the tool 11 the tooth point 57 projects about seven sixty-fourths of an inch forwardly to the end walls 56 of the toes 21.

In the illustrated peripheral cut, ripper tool 13, the ripping section 29 is disposed at an angle A of about 20° and with angle B between the flat surfaces 51 and 53 being 10°. In most other respects, the curves and dimensions for the tooth are the same as heretofore described for the longitudinal cut, ripper tool 11.

In a further embodiment of the invention illustrated in FIG. 5, the leading wall 24 of the tooth 23 of a longitudinal cut, ripper tool 11a is changed from the straight planar surface to a concave surface 90 which forms a hook-like leading portion for the tooth thereby providing a more gradually upward path along which the lead may flow. In other respects, the ripper tool 11a is the same as the ripper tool 11. In a similar manner, a peripheral cut, ripper tool 13a is illustrated in FIG. 9 with a concave surface 90 on its leading wall 24 to form a hook-like tooth.

What is claimed is:

1. A ripper tool for ripping a sleeve formed of lead comprising an elongated body having a longitudinal axis, a shank at one end of said body for connection to a reciprocating hammer, a ripper section on the other end of said body extending outwardly and forwardly relative to said axis, a pair of toes at the forward end of the ripper section, a pointed tooth located centrally between said toes and extending outwardly and forwardly from and between said toes to engage and perforate the sleeve, an upper wall on said tooth, an inner side wall on each of said toes spaced from each other and located above said tooth and defining therebetween a slot through which lead may flow, said tooth having a top wall, curved bottom wall and a pair of vertical side walls extending between said bottom wall to said top wall, each of said tooth side walls being spaced inwardly from its facing inner tooth wall, said slot being at least as twice as wide as said cross-sectional thickness of said tooth to accommodate lead flowing outwardly through said slot.

2. A ripper tool in accordance with claim 1 in which curved surfaces are formed on said toes for engaging said sleeve and for facilitating rocking of the tool body relative to the sleeve to change the depth of penetration of the tooth as said curved surfaces slide along said sleeve.

3. A ripper tool in accordance with claim 1 in which arcuate cutting edges are formed on walls extending between said tooth and said internal side walls of said toes for cutting bevels on the outer edges of the cut being formed in the sleeve.

4. A ripper tool in accordance with claim 1 in which a forward, leading wall on said ripping tooth is formed with a concave surface for guiding the flow of lead from the cut.

5. A ripper tool in accordance with claim 1 in which said ripper section projects upwardly and forwardly from said body and said tool is used to make a longitudinally extending cut.

6. A ripper tool in accordance with claim 1 in which said ripper section projects downwardly and forwardly from said body and said tool is used to make a circumferentially extending cut.

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