Sept. 15, 1959 M. A. KLEIN, JR 2,903,790

LONG NOSE FLUSH CUTTING PLIERS

Filed Sept. 29, 1958

Fig. 1.

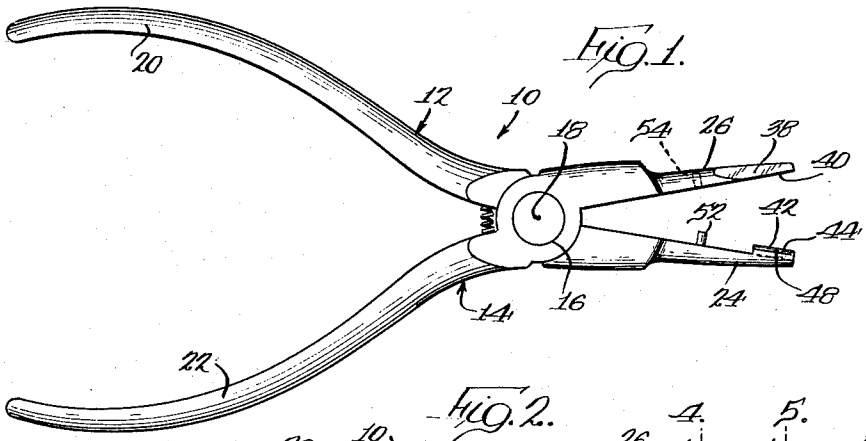


Fig. 2.

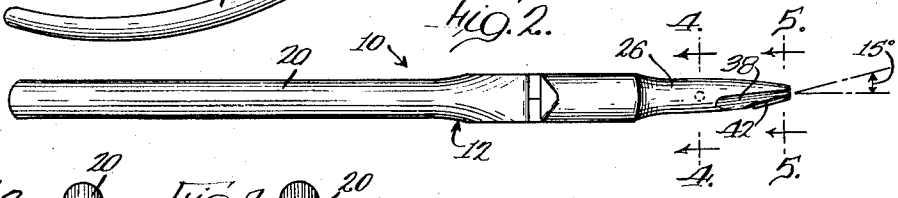


Fig. 3.

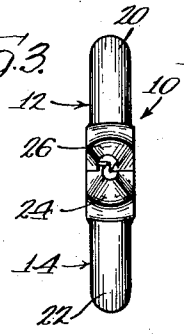


Fig. 4.

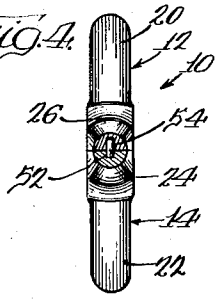


Fig. 5.

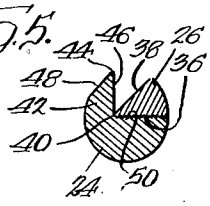


Fig. 6.

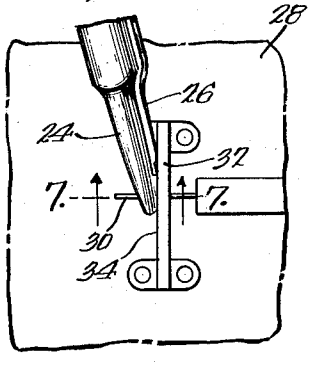


Fig. 7.

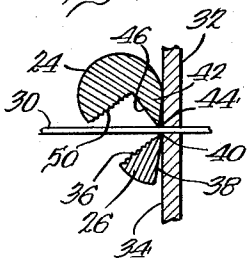
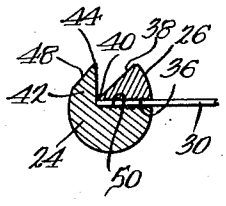


Fig. 8.



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LONG NOSE FLUSH CUTTING PLIERS

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Application September 29, 1958, Serial No. 764,095

4 Claims. (Cl. 30—134)

The present invention relates to novel long nose pliers which provide worthwhile advantages in the wiring of complex electronic circuitry and the like. In wiring television sets, for example, it is necessary to work through limited spaces to secure component leads and other small wires to interconnecting structure. The excess length of connected wiring is cut off and the cuttings removed so as not to cause electrical shorts.

The matter of cutting off and removing the ends of connected wires in the assembly of electronic circuitry has been an inherently tedious and time consuming element in the manufacture of electronic gear, which becomes increasingly significant as the electrical components are packed closer together in electronic assemblies designed to operate at higher frequencies. Moreover, the operating characteristics and functional problems associated with high frequency operation place a premium on eliminating excess or unused wire from such apparatus. These functional characteristics and the extremely compact construction of high frequency electronic circuitry also increase the need to provide positive assurance that all cuttings are removed.

One object of the invention is to provide, for wiring high frequency electronic assemblies and the like, novel long nose pliers which can be used with extraordinary ease and efficiency to reach through small openings and cut off a remote wire flush with the side of a terminal or other body to which the wire is connected or from which it protrudes, the construction of the pliers providing for an automatic and absolutely reliable gripping in the tool of the severed wire clipping or cutting as an incident to the wire cutting action of the pliers, thus providing positive assurance that the cutting is removed with the tool.

Another object is to provide improved pliers as set forth in the previous object which maintains a high, flush cutting efficiency over a long service life of the tool.

Other objects and advantages of the invention will be evident from the following description of the exemplary form shown in the accompanying drawings, in which:

Fig. 1 is a side view of the improved pliers in open position;

Fig. 2 is a longitudinal edge view of the pliers in closed position;

Fig. 3 is an end view of the tool taken with reference to the right end of Fig. 2;

Fig. 4 is a transverse sectional view of the plier jaws taken along the line 4—4 of Fig. 2;

Fig. 5 is a cross-sectional view on an enlarged scale taken along the line 5—5 of Fig. 2;

Fig. 6 is a fragmentary perspective view illustrating use of the tool in cutting a wire off flush with a flat body through which it protrudes;

Fig. 7 is a sectional view on an enlarged scale taken along the line 7—7 of Fig. 6; and

Fig. 8 is a sectional view similar to Fig. 5 but showing a clipping held between the plier jaws.

As shown in the drawings, the improved pliers 10 forming the preferred embodiment of the invention comprises a pair of crossing levers 12, 14 (Fig. 1) pivoted together by a medial hinge pin 16 for mutual swinging movement about a common hinge axis, indicated by the dot 18. The respective levers 12, 14 are shaped to form a pair of opposed bow handles 20, 22 extending generally in one direction from the hinge pin 16 and urged apart by a compression spring 23 at the base of the handles.

The ends of the levers 12, 14 opposite from the handles 20, 22 are shaped to form a pair of thin, long nose jaws 24, 26 opposing each other as shown.

The long, thin jaws 24, 26 are well adapted for working through cramped spaces in a typical electronic assembly 28 to reach, with the tips of the jaws, a wire 30 deep in the assembly, which is illustrated only diagrammatically in Fig. 6.

By virtue of a construction to be described presently in detail, the improved pliers 10 can be worked with great ease and efficiency deep within an electronic assembly to cut off a projecting wire flush with a surface alongside the tool from which the wire protrudes. Such use of the tool may be visualized with reference to Fig. 6. Ordinarily the excess length of a wire 30 connected to an electrical juncture element, such as a lug 32, will project beyond the element. If the connection is soldered, the wire projects beyond the solder.

As previously mentioned, it is highly desirable in the construction of electronic assemblies, particularly those designed to operate at high frequencies, that the excess length of wires be cut off flush with adjacent structure. The environment is illustrated in Fig. 6 in which the wire 30 projects to the left beyond the flat side surface 34 of the lug 32 through which the wire extends and to which it may be joined by soldering. Ordinarily it is not difficult in the construction of electronic assemblies to engage a typical surface 34 from which a wire 30 projects by one side of the forward ends of the plier jaws, as shown in Fig. 6.

The projecting end of the wire 30 is cut off and automatically grasped for removal from the electrical assembly 28 by the action of shearing structure on the projecting ends of the jaws 24, 26. This structure comprises a straight shearing edge 40 formed on one side of the forward end of the jaw 26 at the intersection of a flat anvil surface 36 and a straight relief surface 38.

The flat anvil surface 36 is parallel to the hinge axis 18 of the tool. The relief surface 38 is formed by relieving, as by grinding, the side of the jaw 26 generally opposite from the anvil surface 36. For a purpose to be described presently in greater detail, the flat relief surface 38 is oriented to intersect the anvil at an acute and very sharp angle. In the preferred construction shown, the angle between the relief surface 38 and the anvil surface 36 is approximately forty-five degrees.

Moreover, the straight shearing edge 40 formed at the juncture of the relief surface 38 with the anvil surface 36 is turned at a small angle with respect to the longitudinal center line of the jaw 26. In the preferred construction illustrated, this angle is approximately fifteen degrees, as indicated in Fig. 2. As will presently appear, the position of the shearing edge 40 on its jaw 26 maximizes the efficiency with which wires in electronic assemblies can be reached and cut off flush with surrounding surfaces.

The pliers 10 cut wire by a shearing action produced by the coaction of the shearing edge 40 with a shearing knife 42 formed on the opposing jaw 24 to shear slidably past and overlap the shearing edge 40 upon closing the pliers, Figs. 2 and 5. A shearing edge 44 is formed on the knife 42 at the intersection of a knife shearing surface 46 and a knife relief surface 48. The shearing surface 46 is perpendicular to the anvil surface 36 and

parallel and immediately contiguous to the shearing edge **40** upon closure of the jaws **24, 26.**

The knife relief surface **48** is a flat oriented to intersect the shearing surface **46** at a very acute angle, which preferably is less than forty-five degrees. Thus, the relief surface **48** extending from the knife shearing edge **44** and the relief surface **38** extending from the shearing edge **40** would define, if extended to intersect each other, an outside angle larger than one hundred and eighty degrees. The significance of this in achieving a flush cutting action will be further developed presently.

It is noteworthy that the shearing knife **42** projects from one longitudinal side of a clamping surface **50** on the jaw **24**, which opposes the anvil surface **36** so as to fit flat against the latter upon closing of the pliers. Both the clamping surface **50** and the anvil surface **36** are knurled as indicated in Fig. 8.

The significance of the previously described orientation of the two relief surfaces **38, 48** extending from the respective shearing edges **40, 44** is illustrated in Fig. 7 taken in conjunction with Fig. 6. The relief on the jaw **26** which extends down to the surface **38**, together with relief on the knife **42** which extends down to the surface **48** as described, enable the user of the tool to place both shearing edges **40, 44** against a flat surface **34** (Fig. 6) to engage opposite sides of a wire **30** as it emerges from the surrounding surface **34.**

This capability of the tool to engage both shearing edges **40, 44** with opposite sides of a wire where the wire first emerges from a surrounding surface, even though the surface may be flat or slightly concave, enables the user to shear off the wire flush with the surface. As previously intimated, easy engagement of the shearing edges **40, 40** with surfaces surrounding wires to be cut off in electronic assemblies is facilitated by the slight inclination of the shearing edge **40**, and also the shearing edge **44**, relative to longitudinal center lines of the plier jaws.

Removal of the wire sheared off by the tool is assured by the action of the jaws **24, 26**, which are stressed during the wire shearing action, in snapping the knurled clamping surface **50** and the knurled anvil surface **36** against opposite sides of a wire clipping the instant it is sheared off. Thus gripped between these surfaces, as shown in Fig. 8, the clipping is removed with the tool.

In the construction of the preferred tool **10** illustrated, a sturdy pin **52** is set in the jaw **24** a substantial distance inward of its extreme end and projects toward the opposing jaw **26** (Fig. 1) to fit into a coacting opening **54** in the opposing jaw as the tool is closed, Fig. 4. Thus the side surface of the pin **52** abuts slidably against the side surface of the opening **54** to preclude any lateral bending of the jaws **24, 26** upon closing, which would displace the shearing edge **46** laterally away from the shearing edge **40.**

While I have shown a preferred embodiment of my invention, it will be apparent that variations and modifications thereof may be made without departing from the underlying principles and scope of the invention. I therefore desire, by the following claims, to include all such variations and modifications by which substantially the results of my invention may be obtained through the use of substantially the same or equivalent means.

I claim:

1. For use in cutting off a remote wire flush with a surrounding surface and removing the wire cutting, long nose pliers comprising, in combination, a pair of crossing levers medially hinged together for swinging movement about a common axis, said levers defining two opposed handles extending in one direction from said hinge axis and two opposed long nose jaws extending in another direction from said hinge axis, the projecting end of one jaw defining a flat anvil surface thereon parallel to said hinge axis and facing the other jaw, a straight

shearing edge formed on one side of one jaw immediately adjacent said anvil surface, the side of said one jaw generally opposite from said anvil surface being relieved to define a relief surface extending to said shearing edge at an angle with respect to said anvil surface materially less than 90°, a clamping surface formed on the projecting end of the other jaw parallel to said hinge axis and opposing said anvil surface, a shearing knife formed on said projecting end of said other jaw and projecting toward said one jaw, said shearing knife defining a shearing surface perpendicular to and projecting from said clamping surface and oriented to slide past said shearing edge in contiguous parallel relation thereto upon movement of said jaws together, and the projecting edge of said shearing knife being relieved at the side generally opposite from said shearing surface to define a knife relief surface extending to said shearing surface at an acute sharp angle with respect to the latter.

2. For use in wiring electronic circuitry and the like, long nose flush cutting pliers comprising, in combination, a pair of crossing levers medially hinged together for swinging movement about a common hinge axis, said levers defining two opposed handles extending in one direction from said hinge axis and two opposed long nose jaws extending in another direction from said axis, the extreme projecting end of one jaw defining a flat anvil surface facing the other jaw, the extreme projecting end of said other jaw defining a flat clamping surface oriented to abut flat against said anvil surface upon swinging of said jaws together, said extreme projecting end of said one jaw being relieved along one side to define a relief surface extending to a straight shearing edge formed at one side of said anvil surface at a slight angle with respect to a plane perpendicular to said hinge axis, a shearing knife on said projecting end of said other jaw, said knife projecting toward said one jaw from one longitudinal side of said clamping surface and having a shearing knife edge defined by a shear surface oriented to slide past said first mentioned shearing edge in contiguous parallel engagement therewith upon closure of the jaws and a relief surface on the knife edge intersecting said shear surface at an acute angle, and said relief surface on said one jaw being inclined at a substantial angle away from the plane of said shear surface.

3. Long nose flush cutting pliers comprising, in combination, a pair of crossing levers medially hinged together for swinging movement about a common hinge axis, said levers defining two opposed handles extending in one direction from said hinge axis and two opposed long nose jaws extending generally in the opposite direction from said axis, the extreme projecting end of one jaw defining a flat anvil surface parallel to said hinge axis and facing the other jaw, said one jaw defining a shearing edge along one side of said anvil surface, the extreme projecting end of said other jaw defining a flat clamping surface parallel to said hinge axis and opposing said anvil surface, a shearing knife on said projecting end of said other jaw projecting toward said one jaw to shear past said shearing edge thereon upon swinging of said jaws together, said shearing knife defining thereon a shear surface perpendicular to said clamping surface and oriented to slide past said shearing edge in parallel relation thereto upon swinging of the jaws together, the side of said one jaw generally opposite from said anvil surface being relieved to define a generally flat relief surface extending to said shearing edge at an acute angle with respect to said anvil surface, the side of the projecting edge of said shearing knife generally opposite from said shearing surface being relieved to define a generally flat knife relief surface extending to said shearing surface at an acute angle with respect thereto, said first mentioned relief surface and said knife relief surface being oriented so that the respective planes thereof intersect each other at an angle at least equal

to a straight angle, and a reenforcing element projecting from a medial longitudinal portion of a first one of said jaws toward a second one of said jaws and slidably overlapping a surface on the latter upon swinging of said jaws toward each other to reenforce the jaws against bending such as would create space between said shearing edge and said knife shearing surface upon closure of the jaws.

4. Long nose flush cutting pliers comprising, in combination, a pair of crossing levers medially hinged together for swinging movement about a common hinge axis, said levers defining two opposed handles extending in one direction from said hinge axis and two opposed long nose jaws extending in another direction from said axis, the projecting end of one jaw defining a flat anvil surface parallel to said hinge axis and facing the other jaw, one side of said one jaw defining a straight shearing edge forming one edge of said anvil surface, the projecting end of said other jaw defining a flat clamping surface parallel to said hinge axis and opposing said

anvil surface, a shearing knife on said projecting end of said other jaw projecting toward said one jaw to shear past said shearing edge upon swinging of said jaws together, said shearing knife defining thereon a shear surface perpendicular to said clamping surface and oriented to slide past said shearing edge in parallel relation thereto upon swinging of the jaws together, the side of said one jaw generally opposite from said anvil surface being relieved to define a generally flat relief surface extending to said shearing edge at an acute angle with respect to said anvil surface, the side of the projecting edge of said shearing knife generally opposite from said shearing surface being relieved to define a knife relief surface extending to said shearing surface at an acute angle with respect thereto, and said first mentioned relief surface and said knife relief surface being oriented so that the respective planes thereof intersect each other at an angle which is at least approximately equal to a straight angle.

No references cited.