

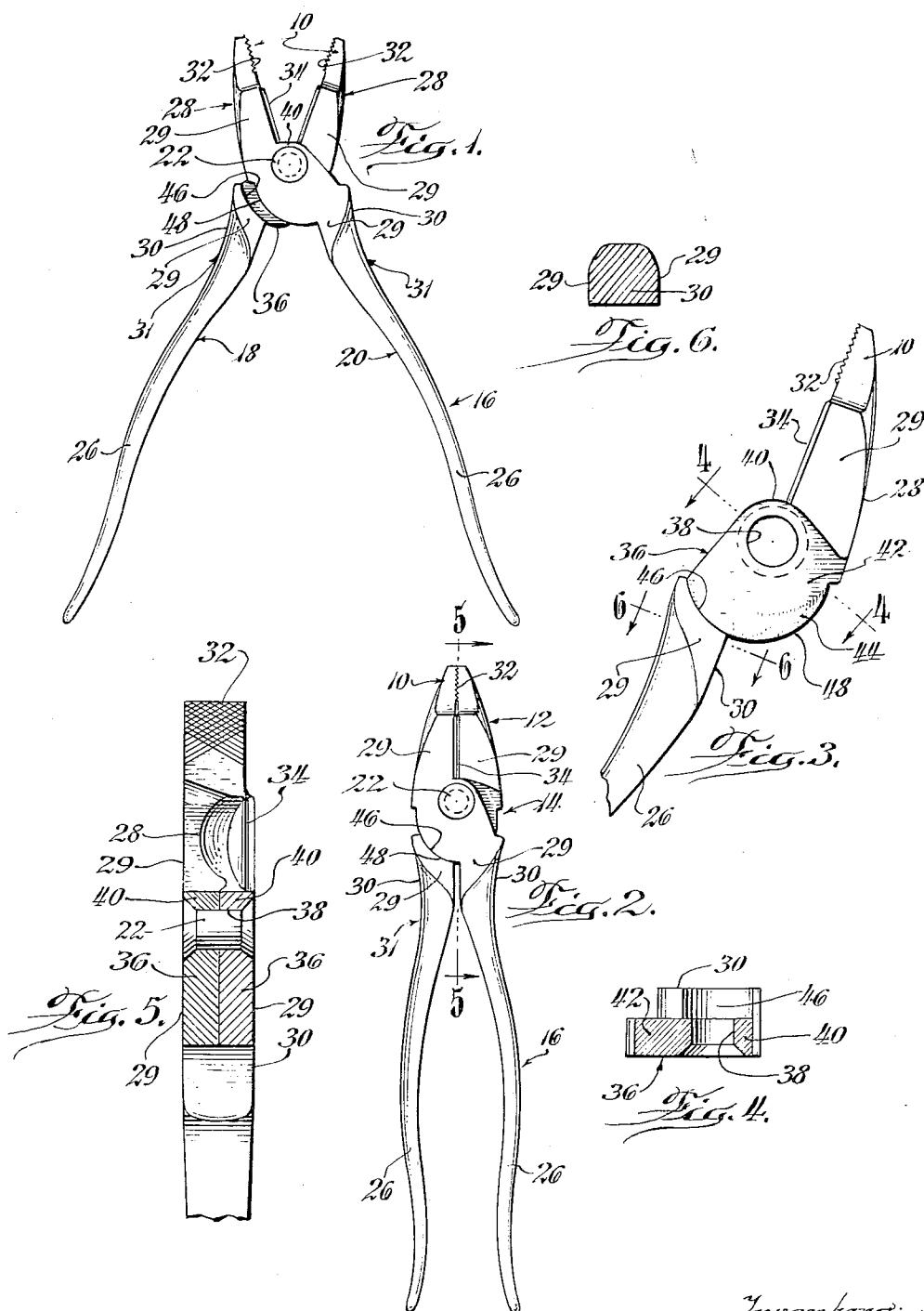
May 22, 1956

M. A. KLEIN, JR., ET AL

2,746,145

HIGH LEVERAGE SIDE CUTTING PLIERS

Filed Jan. 11, 1955



Inventors:
Mathias A. Klein Jr.
Walter F. Wendt

By Alfred H. Mueppel, Jr. and Gradolph J. Mueppel
Attorneys

1

2,746,145

HIGH LEVERAGE SIDE CUTTING PLIERS

Mathias A. Klein, Jr., Wilmette, and Walter F. Wendt, Chicago, Ill., assignors to Mathias Klein & Sons, Chicago, Ill., a corporation of Illinois

Application January 11, 1955, Serial No. 481,194

2 Claims. (Cl. 30—186)

The present invention relates to single hinged side cutting electrician's pliers of a very popular style designed along slim, symmetrical lines to provide a pleasing appearance highly valued by pole climbing linemen and others who use the tools constantly in their daily work.

One object of the invention is to increase the wire cutting leverage of improved pliers of this style while at the same time preserving the strength and the slim, generally symmetrical appearance of conventional pliers affording far less wire cutting leverage for the same handle length.

Other objects and advantages will become apparent from the following description of the form of the invention illustrated in the drawings, in which:

Figure 1 is a side view showing the improved pliers in fully open position;

Fig. 2 is a side view showing the pliers in fully closed position;

Fig. 3 is a fragmentary side view of the jaw end of one of the two coacting levers of the pliers;

Fig. 4 is a fragmentary sectional view taken along the line 4—4 of Fig. 3;

Fig. 5 is a fragmentary sectional view taken along the line 5—5 of Fig. 2; and

Fig. 6 is a fragmentary view taken along the line 6—6 of Fig. 3.

In view of the close relationship of the structure of the improved pliers, which affords a greatly increased wire cutting leverage, to the appearance of the tool a description of the pliers may begin with structural features important to the achievement of a slim, symmetrical appearance essential to the overall merit of the tool.

Starting from the jaw end, the pliers as a whole (Fig. 2) terminate in a tapered pincer section 10. A wire cutting or shearing section 12 runs from the base of the pincer section to a hinge section 14 that connects with a handle section 16 continuing to the other extreme end of the tool.

Basically the pliers are formed by two generally straight lever members 18, 20 (Fig. 1) hinged together by a common pivot pin 22. The configurations of the two levers 18, 20 are so related to each other that the tool has an overall appearance, as viewed from either longitudinal side or edge, which is generally symmetrical about a central longitudinal plane.

Even though the two levers 18, 20 must cross one over the other in the hinge section 14 of the pliers, the levers for the sake of the appearance desired are made to appear coplanar throughout the length of both levers. The structure by which this effect of appearance is achieved and its relation to the provision for increased wire cutting leverage will be described presently in detail.

The handle section 16 of the tool is formed by two bowed handles 26 on the respective levers 18, 20; the pincer and wire shearing sections 10 and 12 are formed by two jaws 28 on the respective levers. The handles 26, jaws 28, and the hinge section 14 of the pliers (taken

2

as a whole) are all symmetrical about a common plane perpendicular to the hinge pin 22.

Opposite sides of each jaw 28, as viewed from a longitudinal edge of the tool, form flat parallel surfaces 29 flush with contiguous surface planes (represented by the same reference numbers) on the respective sides of the hinge section of the tool. Similarly, the base 30 of each handle 26 defines flat parallel faces on opposite sides which are flush with and form continuations of the same hinge section side surfaces 29. Thus, each side of the pliers presents to the viewer a substantially continuous flat surface 29 extending across the hinge section 14 and at least the adjacent portions of both jaws 28 and both handles 26. It will be noted that the bases 30 of both handles constitute mirror images of each other. Consequently, the junctures of both jaws and both handles with the hinge section of the tool are flush with both side surfaces 29, an essential factor in producing the desired symmetry in appearance.

To achieve a slender as well as a symmetrical appearance of the pliers, the end portions of the handles 26 adjacent the handle bases 30 are shaped to form, when the tool is in closed position a narrowed neck section 31 of substantially less width, Fig. 2, than the hinge section 14 of the tool.

As to the symmetry of the handle section of the tool, which is maintained even in the slender neck section 31, it will be observed that each handle 26 including its base portion 30 is located entirely to one side of a central longitudinal plane of the tool parallel to and passing through the axis of the hinge pin 22.

The outer end of each jaw 28 forms a pincer face 32 opposing a similar face on the other jaw. A wire shearing edge 34 formed along one side of each jaw in opposing relation to a similar edge on the other jaw extends toward the hinge pin 22 along a radial line from the axis of the pin.

A hinge segment 36 of each of the levers 18, 20 connecting the handle and jaw portions of the lever is abruptly recessed from one side to a medial plane perpendicular to the hinge pin 22 and shaped to substantially fill the recessed portion of a similar hinge segment of the other lever up to the bases of the jaw and handle sections of the latter. Thus, the hinge segments 36 of the two levers scissor together between the two parallel side surfaces 29 of the tool.

The hinge pin 22 extends through aligned apertures 38 in the hinge segments of both levers 18, 20.

The maximum wire cutting leverage of the pliers varies inversely for a given handle length of the tool with the distance between the axis of the hinge pin 22 and the adjacent ends of the shearing edges 34. This distance comprises both the radius of the hinge pin 22 and the thickness (measured radially from the axis of the pin) of the portion 40 of each hinge segment 36 between the hinge pin aperture 38 in the segment and the adjacent ends of the shearing edges 34.

The portion 40 of each lever hinge segment 36 must have sufficient strength to withstand the force to which it is subjected by the hinge pin 22 when maximum gripping force is applied to the handles 26. The minimum transverse sectional size of a hinge segment portion 40 capable of withstanding the load applied is a function of the degree to which it can be stressed, which in turn is determined by the degree of strain or "stretch" to which this critical structural element can be subjected without adversely affecting the mechanical capabilities of the tool, particularly the bending strength of the levers 18, 20.

Despite the structural provisions for creating a slim, symmetrical appearance of the pliers (considerations which impose drastic limitations on the shaping of its parts) the hinge segment 36 of each lever is so con-

structed that stretching under tension of the critical portion 40 of the hinge segment incident to the application of gripping force to the plier handles 26 does not necessarily allow bending of the lever. Consequently, the permissible strain on this portion 40 of the hinge section of each lever handle segment can be increased.

This increase in the effective strength of the hinge segment portion 40 is used to full advantage in maximizing the wire cutting leverage of the tool. As shown best in Fig. 3, the portion 40 of the lever segment 36 forms, in effect, an arcuate tension band (denoted by the same reference numeral 40) extending around the jaw side of the hinge pin aperture 38 from the base of the jaw 28 on the lever through a radial angle somewhat greater than the maximum angle through which the pliers can be opened, Fig. 1. The thickness of the tension band portion 40 of the hinge segment as measured along a radial line from the axis of the hinge pin aperture 38 is reduced to a small fraction, as shown, approximately one-fifth, of the overall width of the hinge section at the hinge pin as viewed in Fig. 3.

By reducing the radial thickness of the tension band portion 40 of each lever hinge section 36 and minimizing the diameter of the hinge pin 22 the distance between the axis of the hinge pin and the adjacent ends of the shearing edges 34 is reduced to approximately one-half that of conventional pliers of a similar size and style. The result is to double the maximum wire cutting leverage of the pliers.

Adequate bending strength is provided in each lever hinge segment 36 by a beam portion 42 of the hinge segment which extends around the side of the aperture 38 opposite from the band portion 40 to connect the adjacent bases of the handle and jaw portions of the lever. At the base of the attached jaw 28 the beam section 42 has a thickness (measured radially with respect to the aperture 38 and perpendicularly to the longitudinal center line of the tool) approaching that of the jaw. Starting near the base of the jaw 28 the beam section 42 has a progressively increasing thickness (measured radially with respect to the aperture 38) along its arcuate extent to the handle end of the hinge segment. The degree to which the thickness of the beam portion 42 increases radially in this manner is indicated by the shaded area 44 in Fig. 3.

The bending strength of the beam section 42 thus formed and the tensile strength of the radially thin band portion 40 of each lever hinge segment 36 provides a sturdy construction which is adequate for professional use, comparing favorably in strength and appearance with conventional pliers of comparable size and styling, which afford a far smaller wire cutting leverage to the user.

It will be noted that the width of each lever at the juncture of the handle base 30 and the hinge segment 36 (as viewed from one longitudinal edge of the tool) is abruptly narrowed to form a curving ledge 46, Figs. 3 and 4, shaped to conform to the extreme arcuate edge 48 of the progressively thickened beam portion 42 of the other lever hinge segment, Fig. 2. For this purpose the radial distance of the ledge 46 from the center of the aperture 38 is progressively increased toward the longitudinal central plane of the tool.

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

We claim:

1. High leverage side-cutting electrician pliers having

a slim symmetrical appearance and comprising, in combination, a pair of elongated generally straight levers disposed in scissoring relation to each other, two opposing end portions of said respective levers forming plier jaws shaped as mirror images of each other, the inner end of each jaw constituting a base therefor, both levers being otherwise substantially identical, the major portion of the length of each lever extending from the end thereof opposite from the jaw portion thereof forming a bowed handle including a base at the inner end thereof, the portion of each lever between the jaw and handle bases thereon forming a hinge segment sharply relieved from one side to a central longitudinal plane and shaped to cross in hinged relation a similar hinge segment of the other lever, said respective lever hinge segments defining a single pair of aligned hinge pin apertures therein having axes in a central longitudinal plane of the pliers, a hinge pin extending through both apertures, the levers being shaped and dimensioned to define on opposite sides of the pliers two plane parallel surfaces perpendicular to the axis of said hinge pin, each plane surface entirely covering the adjacent lever hinge segment and continuing a substantial distance along the bases of the handle portions of both levers, both of said plane surfaces continuing substantially without interruption from said respective hinge segments along opposite sides of both jaws to the outer ends thereof, each lever hinge segment having a depth along the axis of said hinge pin equal to substantially half the spacing between said planes, each lever hinge segment having an arcuate tension band portion bounding a sector of the jaw side of the hinge pin aperture therein and extending away from the jaw on the lever through a substantial radial angle with respect to the axis of the aperture, the thickness of said tension band portion of each hinge segment measured radially with respect to the axis of the hinge pin being substantially one-fifth of the overall thickness of the hinge segment measured through the axis of the hinge pin perpendicularly to both the hinge pin axis and the axis of elongation of the hinge segment, each of said jaws forming on one side thereof a straight elongated shearing edge opposing a similar edge on the other jaw and extending perpendicularly to the axis of said hinge pin into radial alignment relative to said axis with the radially outer edge of said thin tension band portion of the adjoined hinge segment, the portion of each lever hinge segment on the side of the aperture therein opposite the tension band portion thereof forming a beam extending between the adjoining jaw and handle bases, the end of each beam adjacent the adjoining jaw base extending substantially to the outer end of the jaw opposite the shearing edge thereon, the thickness of each hinge segment beam measured radially from the axis of the hinge pin progressively increasing toward the handle end of the beam, each handle base being shaped to conform to the outer extreme edge of the beam portion of the other lever when the pliers are in closed position, each handle including the base thereof being disposed entirely to one side of the central longitudinal plane of the pliers including the axis of said hinge pin, both handles including the bases thereof being symmetrical about a common longitudinal plane perpendicular to the axis of said hinge pin, and the ends of said handles adjacent the bases thereof being shaped to form upon closing a narrowed neck section of the pliers.

2. High leverage side-cutting electrician pliers having a slim symmetrical appearance and comprising, in combination, a pair of generally straight elongated levers disposed in scissoring relation to each other, two opposing end portions of said respective levers forming a pair of plier jaws shaped as mirror images of each other, the inner end of each jaw constituting a base therefor, the major portion of the length of each lever extending from the end thereof opposite the jaw thereon forming a bowed handle including a base on the inner end thereof, both

5

handles including the bases thereof being shaped as mirror images of each other symmetrical about a common plane containing the longitudinal center line of the pliers, the segment of each lever between the jaw and handle base portions thereof being sharply relieved from one side to a central longitudinal plane and shaped to hinge across a similar hinge segment of the other lever, said lever hinge segments defining a single pair of aligned hinge pins apertures therein having axes in a longitudinal central plane of the pliers, a hinge pin extending through both apertures, each lever hinge segment having an arcuate tension band portion bounding a sector of the jaw side of the hinge pin aperture therein and extending away from the adjacent jaw through a substantial radial angle with respect to the axis of the aperture, the thickness of said tension band portion of each hinge segment measured radially with respect to the axis of the hinge pin being only a minor fraction of the overall thickness of the segment measured through the axis of the hinge pin perpendicularly to both the hinge pin axis and the axis of elongation of the hinge segment, each of said jaws forming on one side thereof a straight elongated shearing edge opposing a similar edge on the other jaw and extending perpendicularly to the axis of said hinge pin into radial alinement relative to said axis with the radially outer

6

edge of said thin tension band portion of the adjacent lever hinge segment, the portion of each lever hinge segment on the side of the aperture therein opposite the tension band portion thereof forming a beam extending from the adjoining jaw base to the adjoining handle base, the end of the beam adjacent the attached jaw base extending substantially to the outer edge of the jaw opposite the shearing edge thereon, the thickness of each hinge segment beam portion measured radially from the axis of the hinge pin progressively increasing toward the handle end of the beam, each handle base being shaped to conform to the outer extreme edge of the beam segment of the other lever when the pliers are in closed position, and each handle including the base thereof being disposed entirely to one side of a central longitudinal plane of the pliers parallel to and including the axis of said hinge pin.

References Cited in the file of this patent

UNITED STATES PATENTS

928,335	Ryden	July 20, 1909
953,170	Kraeuter	Mar. 29, 1910
990,932	Walsh	May 2, 1911
1,022,489	Lyons	Apr. 9, 1912
2,431,970	Swartz	Dec. 2, 1947