United States Patent

Wondowski

[15] **3,638,516**

[45] **Feb. 1, 1972**

[54] TWEEZER WITH ADJUSTABLE PRECISION GRIP

[72] Inventor: **Raymond S. Wondowski,** 17 B Hampton Arms, Hightstown, N.J. 08540

[22] Filed: **Aug. 27, 1970**

[21] Appl. No.: **67,312**

[52] **U.S. Cl.** **81/43**

[51] **Int. Cl.** **B25b 9/02**

[58] **Field of Search** 81/43; 128/354; 294/99

[56] **References Cited**

UNITED STATES PATENTS

1,174,004 2/1916 Greenwald 81/43

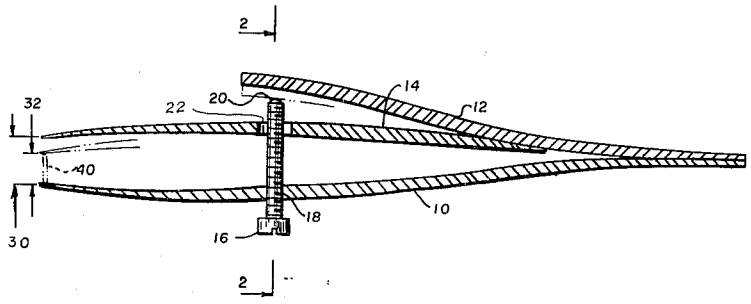
3,253,327 5/1966 McElligatt ..... 81/43 X

Primary Examiner—Theron E. Condon
Assistant Examiner—Roscoe V. Parker, Jr.
Attorney—Ralph R. Roberts

[57] **ABSTRACT**

There is disclosed a tweezer for gripping small fragile electronic parts and the like with a determined maximum gripping force. One of the jaw ends of the tweezer is the distal end of an intermediate leg member attached at and by its other end to a shortened leg member of the tweezer. The opposing jaw end is the distal end of the other leg member which also carries a stop screw disposed to engage the shortened leg member to adjustably limit the movement of the outer leg members and the jaw ends toward each other.

7 Claims, 3 Drawing Figures



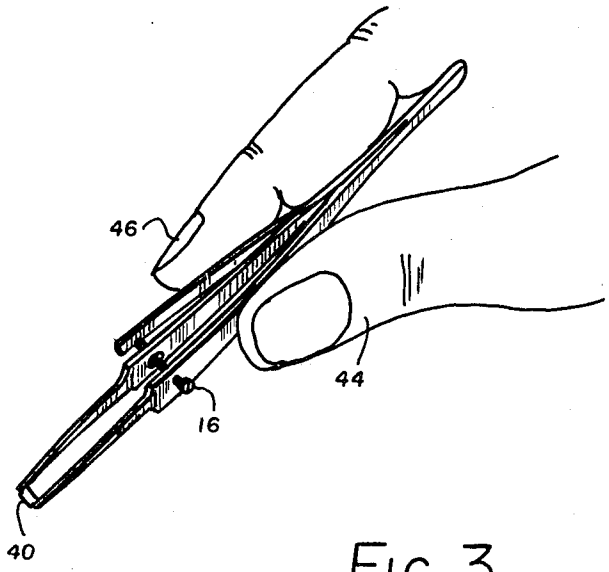


FIG. 3

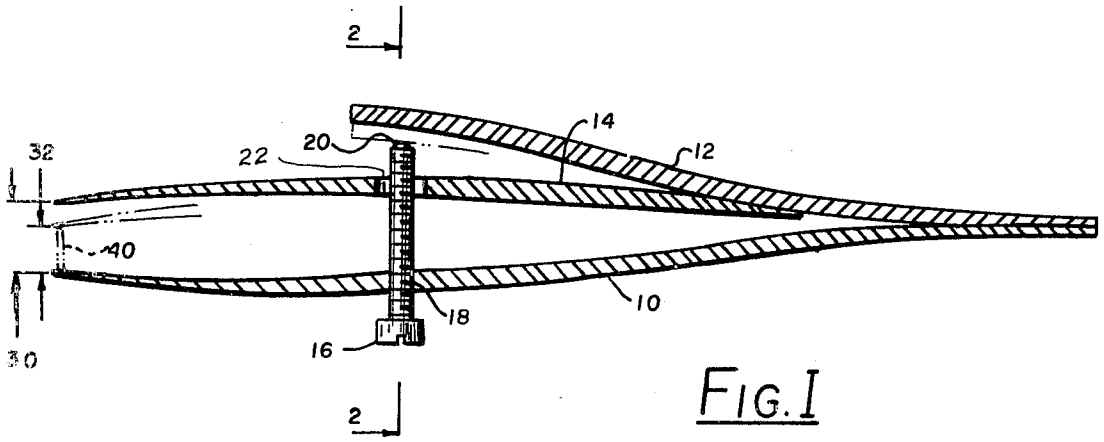


FIG. 1

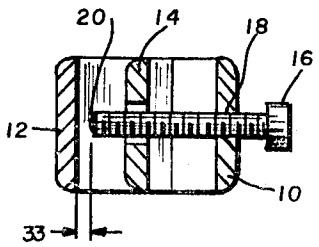


FIG. 2

INVENTOR.
RAYMOND S. WONDOWSKI
BY
Ralph R. Roberts
AGENT

TWEEZER WITH ADJUSTABLE PRECISION GRIP

BACKGROUND OF THE INVENTION

1. Field of the Invention

In reference to the classification of art as established in the U.S. Patent Office this invention pertains to the general class of "Tools," and more particularly to the subclass therein pertaining to "tweezers."

2. Description of the Prior Art

The gripping and placing of small parts by the use of tweezers is of course well known as tweezers economically provide the best means for and by which the operator may easily grasp and retain small pieces. In particular, where these parts are miniature sized components such as chips or bits as used in present day electronic systems, a tweezer-type implement is often the only manual supplement by which these components can be handled. Tweezers with stop screws to limit the minimum spacing between the jaw ends are well known and are illustrated in a few U.S. patents. However, insofar as is known, in those tweezers with a stop screw provision, the screw is mounted in one leg member and is disposed to engage the other leg member to limit the movement of the two members towards each other. In theory, this stop screw acts as a means to limit the minimum spacing between the jaw ends, the gripping force developed by these jaw ends should be consistent; however, when a small excess of pressure is applied to the leg members of these tweezers at positions other than directly over the screw stop the pressure results in a variation of the spacing between jaw ends causing the tips of the tweezers to be moved toward or away from the desired spacing for gripping the component. Where the item or component to be gripped is a small and fragile part this deviation of spacing may cause the part to be dropped when the jaw spacing is increased. When the jaw spacing is decreased the part in many cases is distorted or destroyed. In the present invention the gripping of the part or component is by means of the jaw end of one leg of the tweezer and the jaw end of an intermediate cantilever leg member of the tweezer. This intermediate leg is attached to and is moved toward and into the desired gripping position by means of an outer and shortened leg member which is limited in its inward movement by a stop screw. Variations of finger pressure applied to the two outer leg members produce substantially no change in the gripping results no matter what gripping pressure is applied to the two outer leg members.

SUMMARY OF THE INVENTION

This invention may be described at least in part by reference to its objects.

It is an object of this invention to provide, and it does provide, a tweezer having an adjustable precision grip wherein one of the tweezer legs for gripping a component is an intermediate leg attached in a cantilever manner at its inner end to an outer shortened leg member so that the deflection of the intermediate leg member is substantially constant through the normal gripping range of the tweezer.

It is a further object of this invention to provide, and it does provide, a tweezer having an adjustable stop disposed to establish a determined extent of movement of the gripping member ends toward one another. This tweezer has a first outer leg member attached at one end to a shortened outer leg member with these outer leg members movable toward one another. An intermediate tweezer member is carried in a cantilever fashion on the shortened leg member and is moved with this shortened member. The intermediate member has a distal end which is moved toward the first leg member to grip a workpiece therebetween with the movement of the first leg member and shortened leg member toward each other when the movement is terminated by said limitation established by the adjustable stop means.

The tweezer of this invention is essentially a three-leaf assembly in which the bottom leaf is a leg member having its distal end or tip disposed to grasp one side of the workpiece to be held by the tweezer. The top or other outer leaf is attached to the bottom leg member at one end and is terminated at a point substantially short of the distal end of the bottom member. An intermediate leg member is attached to the terminated top member at a point near the attached end of the upper and lower members. This intermediate member is attached so as to be a cantilever member and provides a determined amount of deflection at its gripping end. The first leg member carries an adjusting screw which passes through an aperture formed in the intermediate leaf or leg member with the terminating end of the screw disposed to engage the underside of the upper terminated member to limit the motion of the two outer members toward each other. The terminated outer member carries the cantilevered intermediate leaf member in a determined spaced position. The adjusting screw provides a stop which permits a varied amount of pressure to be applied to the outer two members to bring the two outer members towards each other until terminated by the stop screw. When the two outer leg members reach the stop condition, the tip ends of the bottom leg member and intermediate member are at a determined spacing disposed to grasp a small object such as a chip or bit. The cantilever mounting of the intermediate leg permits it to grip the bit or chip with only a determined maximum amount of pressure.

INTENT OF THE DISCLOSURE

Although the following disclosure offered for public dissemination is detailed to insure adequacy and aid in understanding of the invention, this is not intended to prejudice that purpose of a patent which is to cover each new inventive concept therein no matter how it may later be disguised by variations in form or additions of further improvements. The claims at the end hereof are intended as the chief aid toward this purpose, as it is these that meet the requirement of pointing out the parts and improvements in which the inventive concept is found.

There has been chosen a specific embodiment of a tweezer with an adjustable precision grip and providing a preferred means for gripping small fragile components with a determined maximum pressure. This specific embodiment has been chosen for the purposes of illustration and description as shown in the accompanying drawings wherein:

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** represents a sectional side view showing the preferred arrangement of the components and leg members forming the adjustable tweezer of this invention;

FIG. **2** represents a sectional view taken on the line **2—2** of FIG. **1** and showing in particular the adjustable grip limiting means, and

FIG. **3** represents an isometric view showing the tweezer grasped in the hands of a user and with the jaw ends gripping a small electronic part without deforming or crushing the part.

In the following descriptions and in the claims various details will be identified by specific names for convenience; these names, however, are intended to be generic in their application. Corresponding reference characters refer to like members throughout the several figures of the drawing.

The drawing accompanying, and forming part of, this specification discloses certain details of construction for the purpose of explanation of the broader aspects of the invention, but it should be understood that structural details may be modified in various respects without departure from the concept and principles of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in particular to FIGS. **1** and **2** it is to be noted that the precision tweezer of this invention comprises a lower leg member **10** which has its left or distal jaw end tapered and shaped to provide a determined width and thickness which also provides a determined degree of resistance to deflection. At the right end of this lower leg member **10** it is joined to an

upper leg member 12 which may be joined by welding or may be an integrally formed member. The upper leg member 12 is substantially of the same configuration and thickness as the lower leg member; however it has no jaw end as it is terminated at a determined distance from the attached right end. On the inner or under surface of this upper member 12 there is attached in a cantilevered manner a third or intermediate leg member 14. This intermediate leg member is attached to leg member 12 near the right end of leg member 12 so as to be moved with member 12 when member 12 is squeezed toward leg member 10. During this movement the member 14 remains in a substantially fixed relation to leg member 12 as well as during the use of the tweezers. The leftward or distal end of intermediate leg member 14 is tapered and configured in the manner of the jaw end of leg member 10 and, as generally is provided in tweezers, is shown as having a thin end generally equal to that of the lower leg member.

The lower leg member 10 carries an adjusting screw 16 in a threaded aperture 18 formed in said lower leg member. This screw may be advanced or retarded in the threaded aperture in the lower member so as to project a determined distance above its inside surface. The upper end 20 of this screw 16 is rounded to provide a smooth engaging surface. This end may be the metal end of the screw, a hardened bit of metal and the like, or an attached plastic tip, as for example, by mounting a Teflon cap to the end of this screw. In its mounted condition the body of the screw projects through an aperture 22 formed in the intermediate leg member 14. Aperture 22 is sized so that screw 16 may freely move through the aperture without engaging or causing any unwanted movement of the member 14. As seen in FIG. 2 it is contemplated that the screw 16 is substantially centrally located in the lower leg member 10. In like manner it is also contemplated that the aperture 22 is leg member 14 be substantially centrally located so that when the rounded end 20 of the screw 16 engages the underside of the upper leg member 12 the screw 16 will tend to remain in a substantially normal condition to the undersurface of leg member 12.

With the tweezer of this invention in its "at rest" or ungripped condition the opening between the jaw ends of the member 10 and 14 is indicated as dimension 30 and is contemplated as being greater than the dimension necessary to grip the component or workpiece. Screw 16 is rotated in threaded aperture 18 in lower leg member 10 so that when the leg members 10 and 12 are gripped and urged toward one another the round end 20 of the screw is brought into engagement with the undersurface of member 12. In this condition the jaw ends are at the adjusted selected minimum distance 32. The difference in the distance from open condition 30 to gripping condition 32 of the jaws 10 and 14 is proportionate to the distance 33 which is established by the adjustment of screw 16. The desired gripping distance 32 is usually established by bringing the jaw ends of leg members 10 and 14 toward each other until the rounded end 20 is in engagement with the undersurface of leg member 12. Screw 16 is then rotated so that the leg member 12 and attached intermediate member 14 are brought closer or farther from member 10 until the desired distance 32 is achieved and established.

USE AND OPERATION

As seen in FIG. 3 a small electronic component such as a bit 40, or the like, is gripped by the distal or jaw ends 10 and 14. This bit 40 is often of a very fragile construction and as it is gripped between by the jaw ends of members 10 and 14 is maintained in a gripped condition without crushing by the limit established by positioning the stop end 20 of the screw 16 at a determined distance 33 from leg member 12. This requires that the deflection of the distal ends 10 and 14 be at a very minimum amount so as to limit the applied pressure to the bit 40. The leg member 14 and the lower leg member 10 have both a certain amount of residual bias to overcome as they are deflected. During the gripping of the component 40 the jaws are prevented from moving any further than the limit established by the screw 16 as its rounded end 20 engages member 12. In practice, this gripping distance 32 at the ends of leg members 10 and 14 is usually three- or four-thousandths of an inch less than the dimension of the piece to be grasped. In particular, the size of bits to be grasped and manipulated may be in the neighborhood of fifty to seventy-five thousandths of an inch in width and have a thickness of only a few thousandths of an inch which makes it necessary that the gripping force applied to the bit 40 be a determined amount. These pieces are often quite expensive and it is essential that not only are the pieces not damaged but also that the pieces are not inadvertently dropped due to a variation in the gripping pressure applied by the thumb and finger 44 and 46 of the operator as he grasps and manipulates the tweezers.

The cantilever mounting of the intermediate leg member permits this leg to deflect rather easily when and as upper leg member 12 is moved toward the lower leg member 10. In grasping the tweezer the operator usually will grip the members 10 and 12 as in FIG 3. Whether the fingers are over or are close to the screw 16 the intermediate leg member 14 is moved in a consistent manner and is subject to no deflection from gripping by the operator. Leg member 10 by virtue of the projection of screw 16 usually is gripped between the screw and the joined right end as seen in FIG. 1. In this manner, when the tweezer is gripped to cause a bit 40 to be grasped in and by the jaw ends of members 10 and 12 the established distance 32 is only slightly less than the size of the bit portion to be grasped and the pressure developed by the three or four-thousandths interference grip is quite minimal because of the cantilever mounting of leg member 14. By attaching leg member 14 to leg member 12 at a point near the joined juncture of leg members 10 and 12 any gripping variations which might cause leg member 12 to be bent a few thousandths of an inch from its constructed form are lost when translated to the position of the intermediate leg member 14. Where the tweezers to be used are for very fragile workpieces, it has been found highly satisfactory to make the leg member 10 rather rugged and stiff and to make leg member 14 much thinner and easily deflected. By using such a method of construction the tweezer can be made to accommodate parts of extreme fragility and lightness and the tips of the jaws can be sized to accommodate quite miniature components.

Tweezers of this invention and having the above-identified construction, of course, will be made in several sizes and with the leg member 14 of various degrees of rigidity so that the component or bit 40 to be grasped will have a determined resistance to the deflection of the leg member 14 of a few thousandths of an inch. For example, a deflection of five-thousandths of an inch of the leg member 14 may exert only a small fraction of a gram pressure. For larger parts having greater size variations in the same size component, the deflection variation may be ten-thousandths of an inch and the exerted force may be as much as a few grams.

CONCLUSION

The tweezer of this invention as provided with an adjustable precision grip as shown and above described provides a tweezer whose leg members are precisely limited in their gripping displacement. The cantilever mounted intermediate leg member provides a jaw which may be moved a few thousandths of an inch with a very light gripping pressure. Variations in gripping pressure by the operator of the leg members 10 and 12 do not affect the gripping pressure on the bit 40 as long as the upper leg 12 is held against the stop screw 16. The gripping pressure on the workpiece is made greater or less as the deflection of leg 14 is increased or decreased by the adjustment of the end 20 of screw 16. The rigidity of that short leg portion of member 12 which extends from the attaching point of leg member 14 to leg member 12 to the juncture joint of leg member 12 to member 10 insures that variations in gripping methods by the operator do not affect the resulting gripping of the workpiece.

Terms such as "left," "right," "up," "down," "bottom," "top," "front," "back," "in," "out" and the like are applicable to the embodiment shown and described in conjunction with the drawing. These terms are merely for the purposes of description and do not necessarily apply to the position in which the tweezers with adjustable precision grip may be constructed or used.

The conception of the tweezer as above shown and described and its many applications is not limited to the specific embodiment shown but departures therefrom may be made within the scope of the accompanying claims and protection is sought to the broadest extent the prior art allows.

What is claimed is:

1. A tweezer with an adjustable pressure grip adapted for grasping workpieces such as small fragile parts of like size, for example, electrical components, the grasping being with a predetermined gripping force, said tweezer including: (a) a lower leg member having one end tapered and shaped so as to provide a jaw end of determined width and thickness; (b) an upper leg member joined to the other end of the lower leg member and of similar configuration, said upper leg member being of a shortened length and being terminated substantially short of a mating jaw end; (c) an intermediate leg member attached to the inner surface of the upper leg member and at a point near the joining juncture of the lower and upper leg member, the attached intermediate leg member being a cantilevered member having its free distal end shaped and positioned so as to cooperate with the jaw end of the lower leg member to grip a workpiece between and by the jaw ends, the deflection of the jaw end of the intermediate leg member of a few thousandths of an inch from the mounted condition being occasioned with the exertion of a low force, and (d) means for adjustably limiting the movement of the outer leg members toward each other, the outer leg members consisting of the lower and upper leg members, said limiting movement permitting a workpiece of a predetermined size to be gripped by the jaw ends of the lower and intermediate leg members with the set determined gripping force when and after the outer leg members are moved to the adjusted limit under the influence of a finger gripping force which may have a wide variation in applied force.

2. A tweezer having an adjustable pressure grip as in claim 1 in which the means for adjustably limiting the movement of the outer leg members toward each other is a screw carried in a threaded hole in one of the outer leg members, the screw disposed to be rotated to a desired position so as to engage the other leg member when the tweezer is in gripped condition so as to establish the desired minimum spaced condition of the jaw ends.

3. A tweezer having an adjustable pressure grip as in claim 2 in which the adjusting screw is carried in the lower leg member at a position intermediate the ends of said lower leg member, the screw freely passing through an aperture provided in the intermediate leg member, the aperture configured and sized so that relative movement of the outer legs toward and away from each other may occur without engagement of the screw and the intermediate leg member.

4. A tweezer having an adjustable pressure grip as in claim 3 in which the adjusting screw is disposed substantially midway of the length of the lower leg, said screw having a rounded inner end disposed to smoothly engage the undersurface of the upper leg member as the screw is rotatably adjusted.

5. A tweezer having an adjustable pressure grip as in claim 4 in which the rounded end of the screw is a tip portion of plastic such as nylon, Teflon and the like.

6. A tweezer having an adjustable pressure grip as in claim 4 in which the rounded end of the screw is a tip portion of hardened material such as heat treated steel, carbide and the like.

7. A tweezer having an adjustable pressure grip as in claim 1 in which the intermediate leg member is of a lesser thickness than the lower leg member so that the intermediate leg member may be easily deflected by a light force.

* * * * *