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A. L. BETTON

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TWEEZERS

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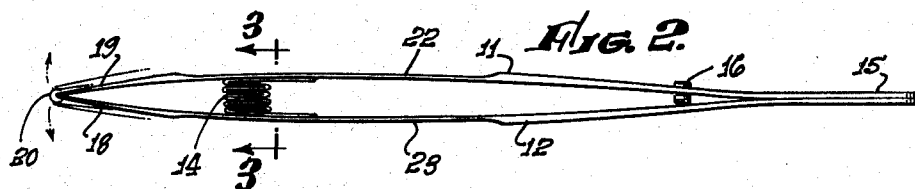
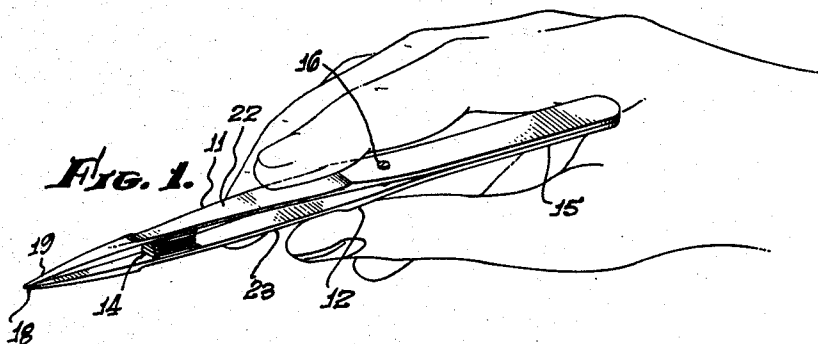
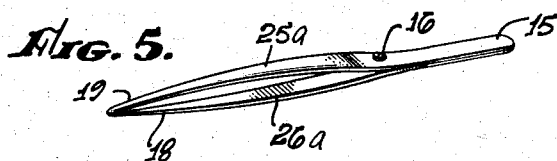
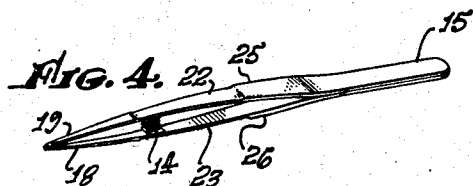
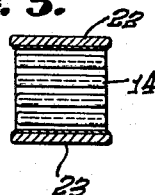


Fig. 3.



ARNOLD L. BETTON,
INVENTOR.

By *Spensley and Hahn*

ATTORNEYS

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TWEEZERS

Arnold L. Betton, 2851 Cochran St.,
Los Angeles 16, Calif.

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8 Claims. (Cl. 81-43)

This invention relates to tweezers and more particularly to a tool of this type which has a reverse action.

Tweezers having a reverse action are typically complicated mechanisms, expensive of manufacture and unsuited for the handling of small articles such as tiny jewels and crystals, this in part because a continual gripping force must be expended by the operator. Another shortcoming typical of prior art tweezers, either conventional action or reverse action, is their tendency to exhibit lateral play between the gripping jaws. That is to say, very often the jaws do not come together in alignment in the gripping position.

Most of the prior art tweezers possessing reverse action characteristics use a cross over leaf spring or the like. Two patents disclosing such prior art devices are U.S. Patent No. 1,795,256 entitled, "Soldering Pliers" by F. M. Johnson, issued March 3, 1931, and U.S. Patent No. 1,915,154 entitled, "Tool" by A. DeSchebcko, issued June 30, 1933.

These tweezers, typically because of their inherent design, cannot be used for fine watchmaking. They further are not suitable for use in the electronics industry such as the semiconductor field. In the latter industry it is often necessary to lift and transport very fine components such as fine wires and crystals of germanium or silicon, whose greatest dimension does not exceed .030 inch. No more than the slightest amount of play in the tips of the ends of the tweezers, i.e., of the very gripping surfaces can be tolerated, else the objects being handled may very well be damaged or even be inadvertently released from the jaws of the tweezers.

Another difficulty attendant with prior art tweezers is the lack of an adjustment mechanism. This is necessary due to the fact that, after continued use, play may develop between the jaws of the tweezers.

The present invention overcomes the above disadvantages and other difficulties encountered in prior art reverse action tweezers.

According to the basic concept of the present invention there is provided a tweezer of standard design whose arms are considerably thinner over a portion thereof to impart a spring like resiliency thereto over a distance between the ends of the arms. Further, there is provided an accordionlike flat spring joined to the inner surfaces of each arm at a point near the open gripping jaws of the tweezers.

In another embodiment of the present invention, a set screw is provided near the closed end of the tweezers which screw fits into a threaded hole within one arm of the tweezers to permit the set screw to controllably force apart the two arms.

It is therefore an object of the present invention to pro-

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vide a tweezer having an improved reverse action mechanism.

It is a further object of the present invention to provide a reverse action tweezers whose gripping jaws are inherently free from play.

It is still a further object of the present invention to provide a reverse action tweezer which is ideally suited for the manipulation and holding of small components.

Another object of the present invention is to provide a reverse action tweezer possessing simplicity of design rendering it relatively uncstly of manufacture.

Still another object of the present invention is to provide an improved type of reverse action tweezers which may be adopted from a conventional tweezer.

Yet another object of the present invention is to provide a reverse action tweezer with a controlled gripping force adjustment.

The novel features which are believed to be characteristic of the present invention both as to its organization and method of operation, together with further objects and advantages thereof, will be better understood from the following description considered in connection with the accompanying drawing in which two embodiments of the present invention are illustrated by way of example only, and are not intended as a definition of the limits of the invention.

In the drawing:

Figure 1 is a perspective view of the presently preferred embodiment of the tweezers of this invention;

Figure 2 is a top plan view of the tweezers of Figure 1;

Figure 3 is an exploded sectional view taken along line 3-3 of Figure 2;

Figure 4 is a view in perspective of an alternate embodiment of the tweezers of the present invention; and

Figure 5 is a view in perspective showing how the set screw of the tweezers in Figures 1 and 2 may be employed in conventional tweezers.

Referring now to the drawing there is shown in Figure 1 the presently preferred embodiment of the reverse action tweezers of the present invention as it might be gripped by the hand of an operator during use. The tweezer consists of two resilient arms, 11 and 12 which are connected at the rear as at 15. As in the case of ordinary tweezers the arms 11 and 12 diverge from the closed end 15 when it is in the unloaded position. However, herein, in order to impart the reverse action, i.e., have tweezer jaws 18 and 19 closed when no pressure is applied to the arms, an accordionlike spring 14 is affixed between the inner faces of the arms 11 and 12. Further, at regions 22 and 23 as shown in Figure 2, the arms 11 and 12 are of decreased thickness in order to increase the resiliency thereof. Regions 22 and 23 preferably, but not necessarily, commence at a point substantially midway between jaws 18 and 19 and the closed or connected end 15 of the tweezers. Making regions 22 and 23 approximately one third of the overall length of the entire tweezers has been found most satisfactory by the inventor although this is not a necessary design limitation.

Thus, it will readily appear that with a relatively small gripping force being applied to regions 22 and 23 of arms 11 and 12, that the jaws 18 and 19 will be forced open with the spring 14 acting as a fulcrum. In Figure 2 there is shown in phantom lines, the action of the tweezers upon being squeezed at 22 and 23 to open jaws 18 and 19 to permit gripping of component 20.

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Accordionlike spring 14 should preferably be made of cold rolled steel in order to render it impervious to acids and the like, but any other resilient metal will suffice. Further, spring 14 may be attached to arms 11 and 12 by welding, soldering or the like. The number of folds, the thickness of the sheet, its positioning relative to jaws 18 and 19 and the particular material of spring 14 will of course depend upon the use contemplated for the tweezers. Generally speaking, the closer that spring 14 is placed to jaws 18 and 19 the looser will be the grip of the jaws and the greater will be their opening when portions 22 and 23 are squeezed. And of course the closer that spring 14 is located towards end 15 the wider will jaws 18 and 19 be opened. Further, rigid alignment of jaws 18 and 19 is assured by spring 14 as the jaws cannot then move in a plane parallel with the flat part of the tweezer arms. These parameters will easily be resolved by one skilled in the art.

It should further be noted that the exact position, the length and the thickness of portions 22 and 23 will also have an appreciable effect upon the magnitude of the gripping force exerted upon the jaws 18 and 19. With thinner portions 22 and 23 there will be less tension upon jaws 18 and 19, and the closer portions 22 and 23 are toward the rear 15 of the tweezers, the less tension will be exerted upon jaws 18 and 19. Again these parameters, depending upon the size of the tweezers and the materials used, can easily be determined by one skilled in the art.

Finally set screw 16 is provided at the rear of the tweezers to permit of controllable adjustment in the force exerted at the gripping jaws 18 and 19. It has been found that screw 16 should be placed from $\frac{3}{8}$ " to $\frac{5}{8}$ " from the opening of end 15, the point of opening being designated as 30. As screw 16 is tightened there is a tendency for the jaws 18 and 19 to be drawn more closely together while a loosening of the screw will have an opposite effect. This adjustment feature is particularly advantageous when components of varying sizes are to be handled. It is also of advantage to take up any play between the jaws which will typically result after prolonged use of the tweezers. Set screw 16 is merely screwed into a threaded hole in one arm, herein 11, which hole is located near the closed end 15 so that it will bear on the opposite arm, herein 12.

From the drawing of the tweezers as presented in Figures 1 and 2 it is apparent that a conventional tweezers can be easily be adapted to the design of that of this invention. That is thinned portions 22 and 23 may be produced by grinding away of the metal or the like to produce the thinning required. Accordionlike spring 14 can easily be inserted between the inside surfaces of arms 11 and 12. Finally, adjustment set screw 16 can then be provided for by drilling and tapping a hole in arm 11.

In Figure 4 there is shown an embodiment of the present invention without the set screw improvement of the Figure 1 and Figure 2 device. Herein the arms are also designated 22 and 23.

Finally, in Figure 5 there is shown an illustration of how the set screw 16 may be used in a conventional type tweezer to permit of greater range of grip opening and to compensate for play in much the same manner as discussed hereinabove with respect to the reverse action tweezer of Figures 1 and 2. Unlike the Figure 4 embodiment, there are no thinned portions in arms herein designated 25a and 26a.

There has thus been described a new and improved reverse action tweezer which incorporates simplicity of design and which inherently has little or no play between its gripping jaws.

What is claimed as new is:

1. A reverse action tweezer comprising: a pair of resilient arms connected at one end and terminating in gripping jaws at the other end, each of said arms having

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a first predetermined thickness from said connected end to a first point approximately midway between said connected end and said other end, each of said arms having a second and lesser thickness commencing from said first point and terminating at a second point, said second point being located intermediate said first point and said gripping jaws, and an accordionlike spring connected between the inner surfaces of said arms in the vicinity of said second point.

2. A reverse action tweezer comprising: a pair of substantially parallel resilient arms connected at one end and terminating in gripping jaws at the other end, said arms being of a predetermined thickness; a region of reduced thickness in said arms, said region extending from a first point on said arms and terminating at a second point proximate the rear of said jaws, said two points being separated by a distance approximately one-third the length of said arms; and a spring secured between the inner surfaces of said arms in the vicinity of said second point.

3. A reverse action tweezer comprising: a pair of resilient arms connected at one end and terminating in gripping jaws at the other end, each of said arms having a first predetermined thickness from said connected end to a first point approximately midway between said connected end and said other end, each of said arms having a second and lesser thickness commencing from said first point and terminating at a second point, said second point being located intermediate said first point and said gripping jaws; a spring connected between the inner surfaces of said arms in the vicinity of said second point; and adjustment means located between said first point and said connected end to control the gripping force between said gripping jaws.

4. A reverse action tweezer comprising: a pair of resilient arms connected at one end and terminating in gripping jaws at the other end, each of said arms having a first predetermined thickness from said connected end to a first point, each of said arms having a second and lesser thickness commencing from said first point and terminating at a second point, said second point being located intermediate said first point and said gripping jaws; and a spring connected between the inner surfaces of said arms in the vicinity of said second point.

5. A reverse action tweezer comprising: a pair of resilient arms connected at one end and terminating in gripping jaws at the other end, each of said arms having a first predetermined thickness from said connected end to a first point approximately midway between said connected end and said other end, each of said arms having a second and lesser thickness commencing from said first point and terminating at a second point, said second point being located intermediate said first point and gripping jaws; an accordionlike spring connected between the inner surfaces of said arms in the vicinity of said second point; and adjustment means located between said first point and said connected ends to control the gripping force between said gripping jaws.

6. A reverse action tweezer comprising: a pair of substantially parallel resilient arms connected at one end and terminating in gripping jaws at the other end, said arms being of a predetermined thickness; a region of reduced thickness in said arms, said region extending from a first point on said arms and terminating at a second point proximate the rear of said jaws; and a spring secured between the inner surfaces of said arms in the vicinity of said second point.

7. A reverse action tweezer comprising: a pair of resilient arm members, each having a jaw at one end shaped to facilitate gripping relatively small articles, said arms being permanently connected at the other end; each of said arms having a relatively thin portion intermediate the ends thereof; and a spring fastened to said thin portions and between said arms at a point proximate the jaw end of said thin portion.

8. A reverse action tweezer comprising: a pair of resilient arm members connected together at one end, each having a jaw at one end shaped to facilitate gripping relatively small articles, each of said arms having a relatively thin portion intermediate the ends thereof; an accordionlike spring fastened to and between said arms at a point proximate the jaw end of said thin portion to maintain said arms in alignment; and a set screw located at a point adjacent the connected ends of said arm mem-

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bers to control the gripping force between said gripping jaws.

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