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Brown

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[54] **POWER HANDLE FOR PIVOTALLY INTERCONNECTED LEVER TOOLS**

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[51] **Int. Cl.** **B26b 17/00;** B25b 7/00

[58] **Field of Search** ..... 30/180, 209, 210, 228, 30/272 R; 81/301; 92/34, 37, 39, 91, 92; 72/410; 140/106

[56] **References Cited**

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[57] **ABSTRACT**

A power handle for pivotally interconnected lever tools, such as wire clippers, shears, pliers, snips and cutters, is composed of a portable case with an actuating arm mounted to one side. The arm when depressed actuates a plunger valve whereby a source of compressed gas is released into a pair of bellows each situated between one side of the case and one lever arm of the tool positioned within the case. The bellows fill with the compressed gas and force the lever arms toward each other about their pivot axis, counteracting the force of the torsion spring that normally biases the lever arms apart. Release of the arm closes the plunger valve and allows the rapid escape of the compressed gas trapped in the bellows, whereby the torsion spring reopens the lever arms of the tool.

8 Claims, 4 Drawing Figures

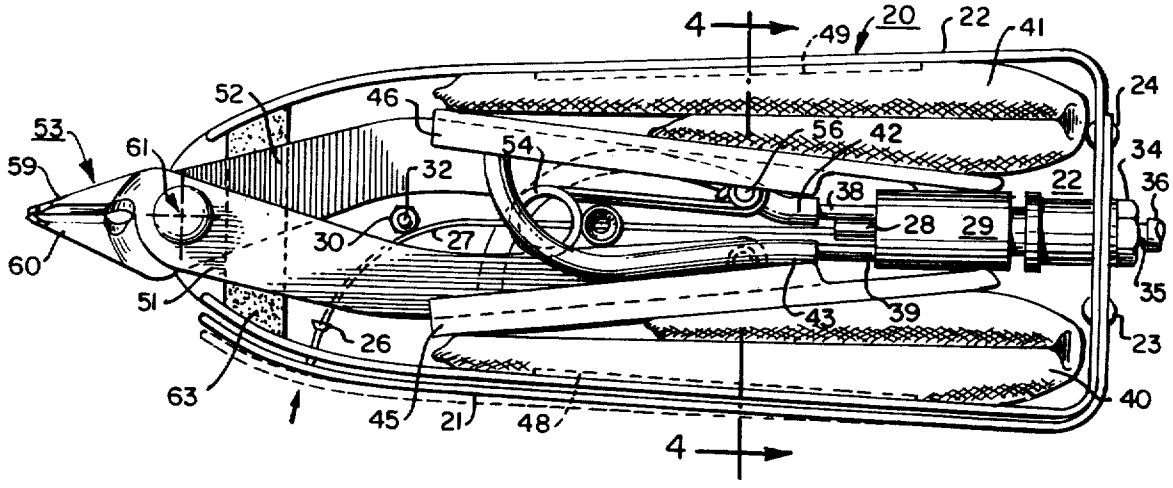


FIG. 1

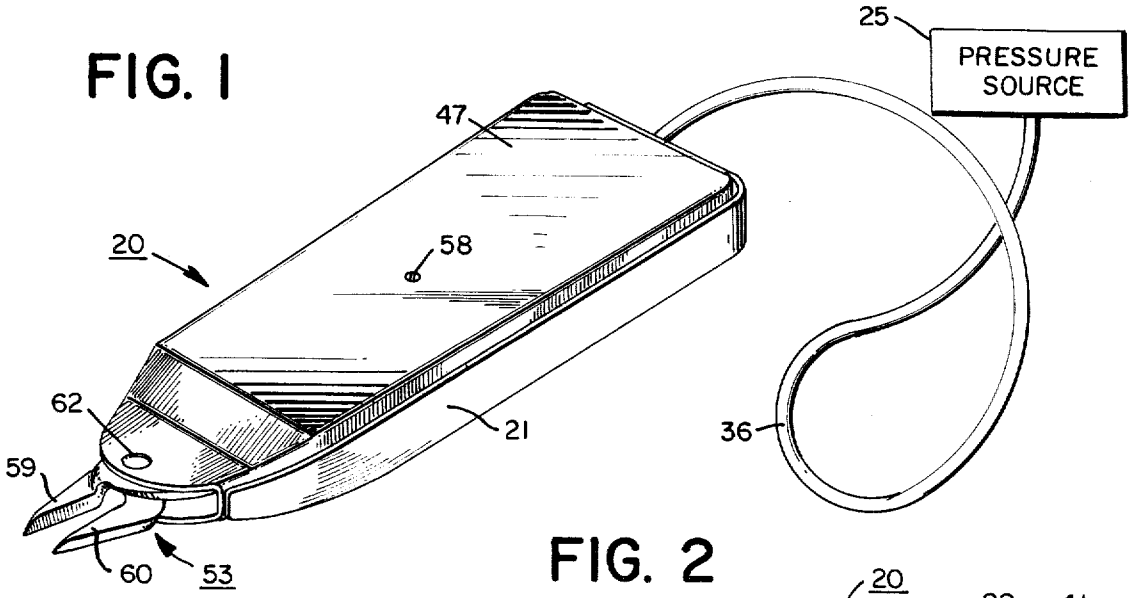


FIG. 2

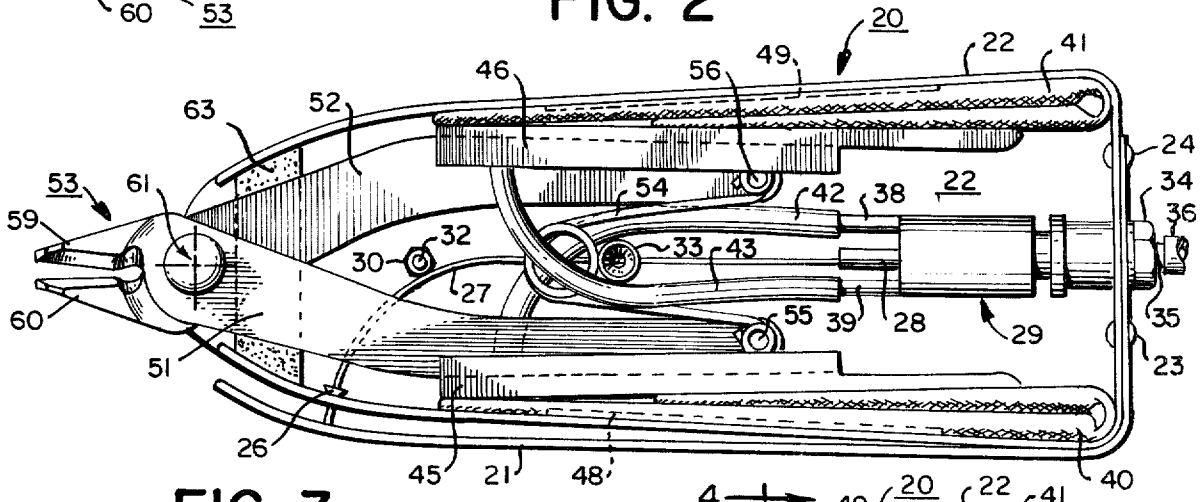


FIG. 3

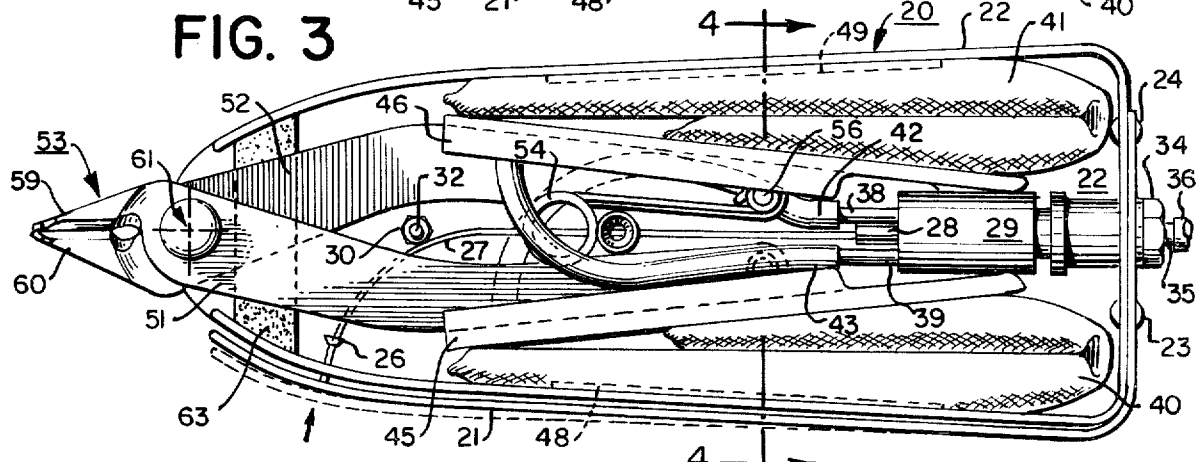
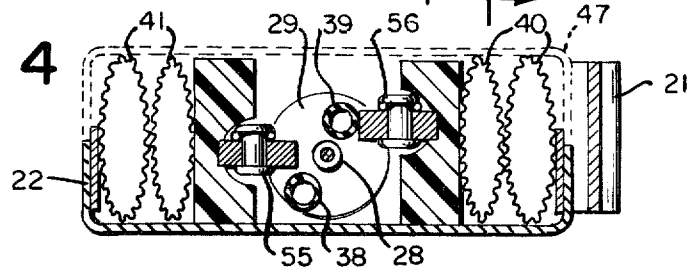


FIG. 4



POWER HANDLE FOR PIVOTALLY INTERCONNECTED LEVER TOOLS

BACKGROUND OF THE INVENTION

The present invention relates to a power handle for pivotal scissors-action tools, and particularly small hand-holdable tools, whose operation requires a pair of lever arms to pivot about an axis. Many of these tools, such as wire-cutters, wire-crimpers and pliers, are used in manufacturing operations where employees are required to use these tools hundreds and sometimes thousands of times per day. Such repetitive use can easily cause hand and arm fatigue, drastically reducing productivity and morale of these employees.

The present power handle invention relieves the user of such tools from physically squeezing the lever arms of the tools by employing the use of bellows that fill with compressed gas to perform the same function, the actuation of which the user controls by means of a spring arm conveniently attached to the case of the power handle.

Since the power handle would be added weight for the user to lift, it has been designed to be lightweight. Furthermore, since safety regulations prohibit the use of hand tools operating on high pressure gas, the present invention operates on low pressure gas, in the range of from 15 to 40 pounds per square inch.

The use of low pressure gas clearly distinguishes the present invention from the prior art. U.S. Pat. No. 3,269,223 entitled "Fluid Operated Hand Tool" is typical of this prior art, wherein a pneumatic piston forces a pair of rollers against a pair of and pivotal jaws. High pressure gas is required to operate the device since the force area of the piston is relatively small. The present invention however is able to use low pressure gas since the bellows used have a large effective surface area in contact with plastic bands that make physical contact with the lever arms of the tool within the power handle, thereby generating relatively high forces urging the lever arms toward each other.

SUMMARY OF THE INVENTION

The power handles of this invention perform the automatic closure of small tool lever arms by means of a pair of inflatable bellows or bladders placed within the power handle, flanking the proximal lever arms of a pivotal scissors-type tool. Each bellows is placed between one side wall of the power handle housing and one longitudinal band which is grooved to embrace the outer edge of one lever arm of the tool placed within the device of the invention. The bellows are folded upon themselves at a point near the back wall of the housing thereby enabling the bellows to maintain contact with the rearward portion of said longitudinal bands when the bellows are inflated. The inflated bellows thus displace toward each other the lever arms of the tool about their pivot axis, causing the jaws of said tool to approach or make contact with each other to produce the desired clipping, shearing, cutting, crimping or clamping action.

The bellows are filled with compressed gas from an external source by the opening of a plunger valve actuated by means of a pusher wire connected to a spring arm member outside said housing but adjacent thereto and at one side thereof. The lever arms of the tool are normally biased apart by means of a torsion spring placed therebetween and attached to each of said arms.

The moving parts of the invention are protected from the entrance of foreign matter by means of a covered housing and two blocks of low density polymer foam, and thus the power handle is completely closed except for a frontal opening to allow the tool's jaws to protrude therefrom.

Therefore, it is a principal object of this invention to provide a hand-holdable power handle device that operates with low pressure gas for the power closing and opening of pivotally connected lever arm tools.

Another object of this invention is to provide a power handle that is lightweight and easy to operate.

An additional object of this invention is to provide a power handle that is human engineered to fit a person's hand with comfort while having a slim profile that allows its use in close quarters.

A further object of this invention is to provide a power handle that is of simple construction with a minimum number of parts and which does not require close tolerances of its member parts.

An additional object of this invention is to provide a power handle with a low unit cost.

A further object of this invention is to provide a power handle that is easy to repair with low cost replacement parts and which allows easy removability of the tool placed within it.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

THE DRAWINGS

FIG. **1** is a top perspective view of a power handle with a tool placed therein;

FIG. **2** is a top plan view of the same power handle with its top cover removed, its bellows deflated, showing a tool positioned therein with its jaws apart;

FIG. **3** is the same view as FIG. **2** with the bellows inflated, showing the tool with its jaws juxtaposed;

FIG. **4** is a front elevational cross-sectional view of the same power handle including the housing cover thereto taken along line **4—4** of FIG. **3.**

DETAILED DESCRIPTION

In FIGS. **2** and **3** the construction of the power handle **20** can best be seen. An external actuator is formed as a spring arm **21** of L-shaped configuration, with its shorter portion mounted to the rear end of a generally rectangular housing **22** by means of rivets **23** and **24.** The longer member of the spring arm **21** is slightly concave in longitudinal configuration so as to extend in close proximity with one slightly convex sidewall of housing **22.** In addition, spring arm **21** is preferably constructed from a material with elastic resiliency; e.g., spring steel, so that it will return to its unbiased position shown in FIG. **2** after being depressed by extremely light manual actuating pressure toward said sidewall, as shown in FIG. **3.**

Attached to the forward inner side of spring arm **21** is a hollow pin **26.** Said pin **26** passes through an aperture in the adjacent sidewall of housing **22.** One end of a spring wire **27** fits into the hollow portion of pin **26,** and the other end of wire **27** terminates in a depression in a plunger **28,** forming the actuator of a plunger valve **29.** The longitudinal path which spring wire **27** traverses when it is moved by arm **21** is constrained by a notched polymer nut **30,** itself mounted to housing **22** by machine screw **32,** and by a longitudinal bore in a

mounting post 33 through both of which wire 27 passes.

As best seen in FIG. 3, when spring arm 21 is depressed by the operator's slight squeezing action of the device, spring wire 27 pushes plunger 28 in a longitudinal path toward the back wall of housing 22. This movement of plunger 28 actuates a valve 29, attached to spring arm 21 and the back wall of housing 22 by a nut 34 having an integral tube extension 35. Actuation of valve 29 allows the passage of compressed gas from a pressure source 25 through flexible tubing 36 attached to the tube extension 35 to exit ports 38 and 39 of the plunger valve 29. Said exit ports are respectively connected to a pair of bellows or bladders 40 and 41 by flexible tube portions 42 and 43; said tube portions respectively passing through apertures in lower arm support members 45 and 46.

Inflatable bellows 40 and 41 are preferably composed of a polymer coated fabric which will flex and bend freely, allowing the inflatable bellows to expand and contract with little wear. As best seen in FIGS. 2 and 3, said bellows are preferably folded over on themselves for approximately two thirds of their length, the folds occurring at a point where said bellows are closest to the back walls of housing 22 and housing cover 47. Bellows 40 and 41 thus lie in a generally longitudinal direction and respectively rest between lever arm support members 45 and 46 and one sidewall of housing 22, a housing cover 47 and housing cover support strips 48 and 49 (FIG. 4).

The outermost edges of lever arms 51 and 52 of the pivotally interconnected lever tool 53 rest in longitudinal notches of lever arm support members 45 and 46 respectively. As seen in FIG. 2, a torsion spring 54, connected to lever arms 51 and 52 by rivets 55 and 56 respectively, biases said lever arm apart when plunger 28 is in its longitudinally extended position.

As is best seen in FIGS. 3 and 4, when bellows 40 and 41 fill with compressed gas, said bellows exert a force against lever arm support members 45 and 46 respectively, thus causing said support members to be displaced toward each other. Said displacement is halted just before said members respectively make contact with plunger valve 29. The displacement of said support arms causes lever arms 51 and 52 to be similarly displaced about their pivot axis, causing the jaws 59 and 60 of lever tool 53 to close.

It should be noted that since bellows 40 and 41 are of the same configuration and receive the compressed gas from the same source, the force they exert against the respective support members 45 and 46 must be approximately equal; thereby causing the highly desirable result that said pivotal displacement of lever arms 51 and 52 is approximately equal at all times. Consequently, the closing of lever tool jaws 59 and 60 is accomplished without any lateral displacement of pivot axis 61. Therefore, there is no need to mount either lever arm of said tool to the housing 22 of the present invention.

The prior art however, as evidenced by U.S. Pat. No. 3,269,223, relies on wedging, camming action, and would require one lever arm of the tool to be fixed to the housing of the power handle. This mounting necessarily involves the use of additional hardware and assembly labor as well as reducing the ease of interchanging tools that exists in the present invention.

When spring arm 21 is released, it springs back to its normal position shown in FIG. 2, and spring wire 27 longitudinally releases plunger 28, said plunger thus closing valve 29 and thus preventing compressed gas from entering tube connections 42 and 43 while allowing the escape to atmosphere of any compressed gas in bellows 40 and 41 through said valve 29.

As seen in FIGS. 1 and 4, housing cover 47, guided by internal housing cover support strips 48 and 49, fits together with housing 22 and is secured thereto by machine screw 58 and mounting post 33 FIG. 3). Both of these housings may have the same configuration and therefore may be produced from the same stamping die.

Two blocks of low density flexible polymer foam material 63 are sandwiched between the housing parts and the jaws 59 and 60 to block entry of clipped wires into the housing. Said housing cover and foam prevent foreign material from entering the inner mechanism of the invention while yielding a compact easy-to-hold device. Each housing part 22 and 47 is provided with a convex dimple 62 near the jaws 59 and 60. These dimples embrace and capture the exposed ends of cutter pivot 61 when the housing is closed, positioning the cutter in the housing, but they do not interfere with the opening of the housing for lever tool 53 replacement.

Thus the present invention allows a person to use a pivotally interconnected lever tool; e.g., a wire clipper, wire crimper or the like, over long periods of time with a minimum of manual effort. The present invention performs the closing and opening of the tool's jaws by means of a simple compressed gas actuated bellows and opposing torsion spring assembly. The invention is light in weight, easy to hold and easy to operate. In addition, it uses a low pressure source of compressed gas whereby such gas is connected to the invention by a small diameter, lightweight flexible tubing.

It should be noted that the present invention would also perform its desirable objectives if the pressure source 25 employed a pressurized fluid instead of a pressurized gas. With such a source the escape of fluid from the bellows 40 and 41 would necessarily be directed to a fluid reservoir so as to prevent the fluid from flowing onto the user or his surroundings.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above article without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described the invention, what is claimed is:

1. A compressed gas operated power handle for use with tools having pivotally interconnected lever arms with forward extending distal jaw portions and proximal actuating portions comprising:

A. A pair of opposing sidewalls rigidly spaced apart;

B. A pair of inflatable bellows, each positioned between one of said sidewalls and the proximal portion of one lever arm of said tool;

C. A transversely expandable member attached to and between said lever arms; and

D. A manually operated inflation valve alternatively connecting said bellows to atmosphere when said valve is not actuated and connecting said bellows for inflation to a source of compressed gas when said valve is actuated, whereby the lever arms of said tool are pivotally juxtaposed when said bellows inflate and are pivotally separated when said bellows deflate.

2. A fluid operated power handle for use with tools having pivotally interconnected lever arms with forward extending distal jaw portions and proximal actuating portions comprising:

A. A pair of opposing sidewalls rigidly spaced apart;

B. A pair of inflatable bladders, each positioned between one of said sidewalls and the proximal portion of one lever arm of said tool;

C. A transversely expandable member attached to and between said lever arms; and

D. A manually operated inflation valve alternatively connecting said bladders to a fluid reservoir when said valve is not actuated and connecting said bladders for inflation to a source of pressurized fluid when said valve is actuated, whereby the lever arms of said tool are pivotally juxtaposed when said bladders inflate and are pivotally separated when said bladders deflate.

3. A compressed gas operated power handle for use with tools having pivotally interconnected lever arms as defined in claim **1**, further comprising a pair of lever arm support members each incorporating a groove dimensioned to embrace one of said tool's lever arms, each said support member being interposed between one of said arms and one of said bellows.

4. A compressed gas operated power handle for use with tools having pivotally interconnected lever arms as defined in claim **1**, wherein each of said bellows is folded upon itself in a U-shaped configuration tending to straighten and unfold upon inflation thereof.

5. A compressed gas operated power handle for use with tools having pivotally interconnected lever arms as defined in claim **1**, wherein said transversely expandable member attached between said lever arms is a resilient means for maintaining said lever arms apart when said bellows are deflated.

6. A compressed gas operated power handle for use with tools having pivotally interconnected lever arms as defined in claim **1**, wherein said opposed sidewalls are a section of a housing enclosing said bellows, said transversely expandable member, said valve and the said proximal portions of said tool's lever arms.

7. A compressed gas operated power handle for use with tools having pivotally interconnected lever arms as defined in claim **4**, wherein the bellows have their region of greatest inflated displacement substantially spaced away from the tool's pivot axis whereby maximum leverage at the distal jaws is obtained.

8. A compressed gas operated power handle for use with tools having pivotally interconnected lever arms as defined in claim **6**, further comprising a spring arm attached to said housing and extending substantially parallel to one side thereof and depressible relative thereto; and a spring wire having one end attached to said spring arm and its other end engaged with said valve whereby depression of said spring arm operates said valve.

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