

[54] FOLDABLE IMPLEMENT AND METHOD OF MANUFACTURE THEREOF

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[51] Int. Cl. B26b 3/06
[58] Field of Search 30/152, 153, 154, 155, 30/161, 342, 344, 151, 156-160; 81/415; 156/73

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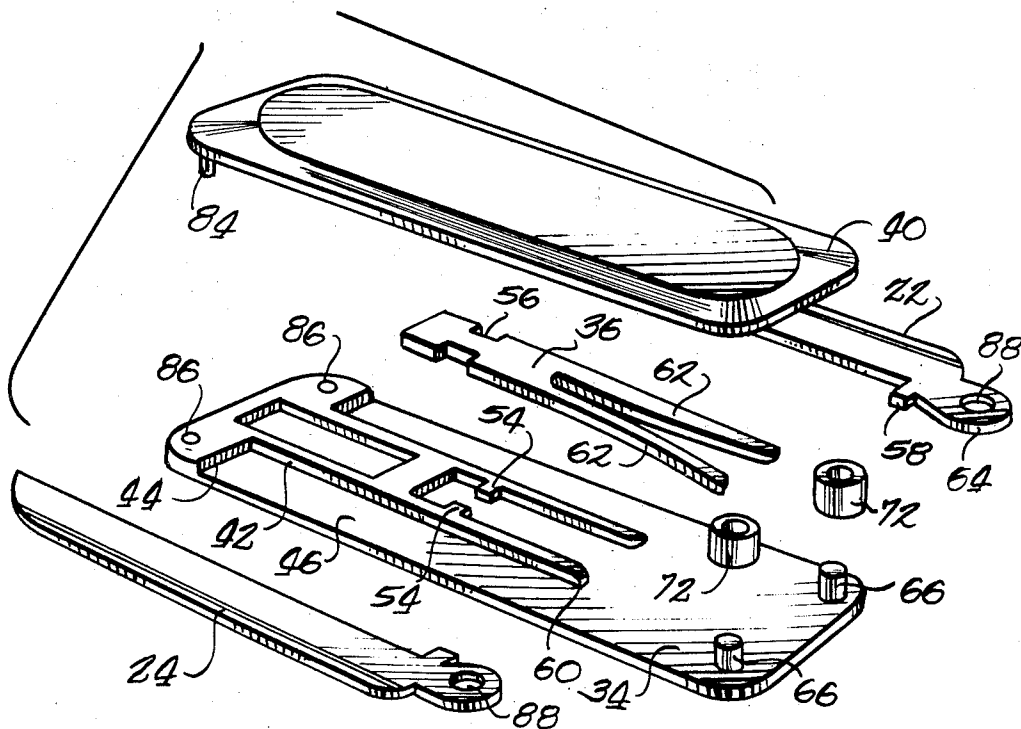
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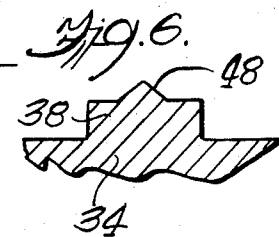
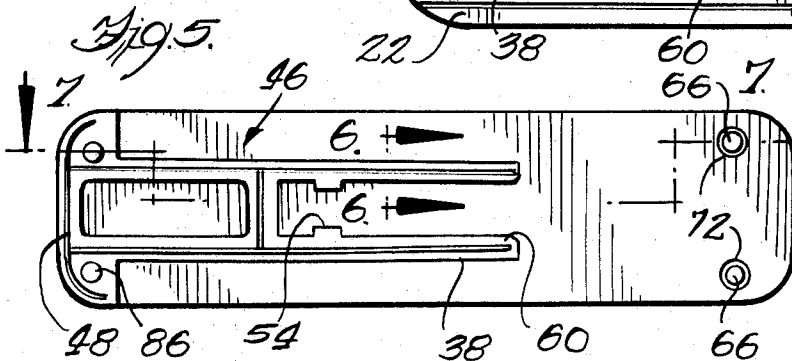
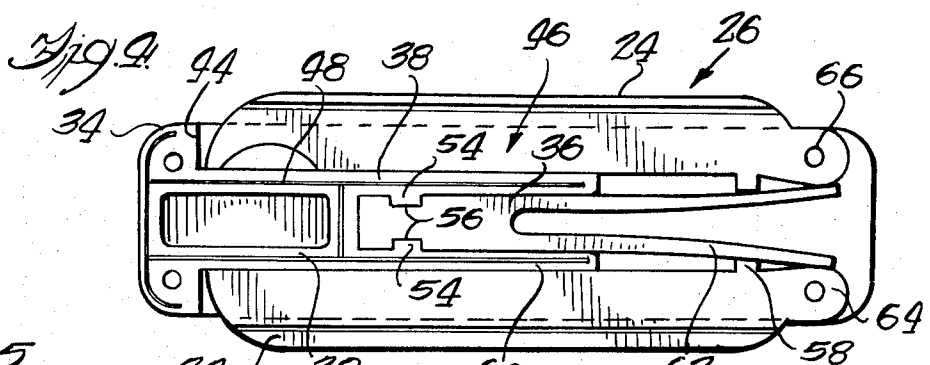
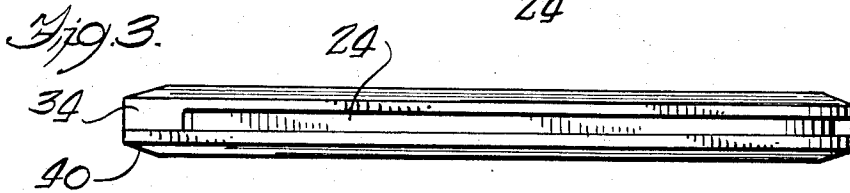
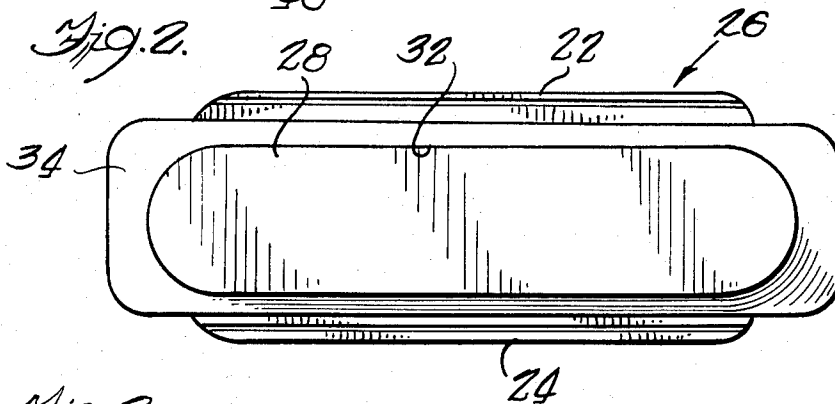
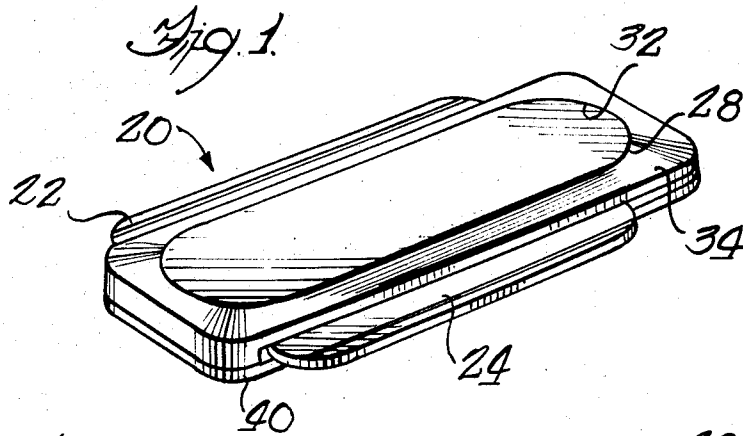
Primary Examiner—Al Lawrence Smith
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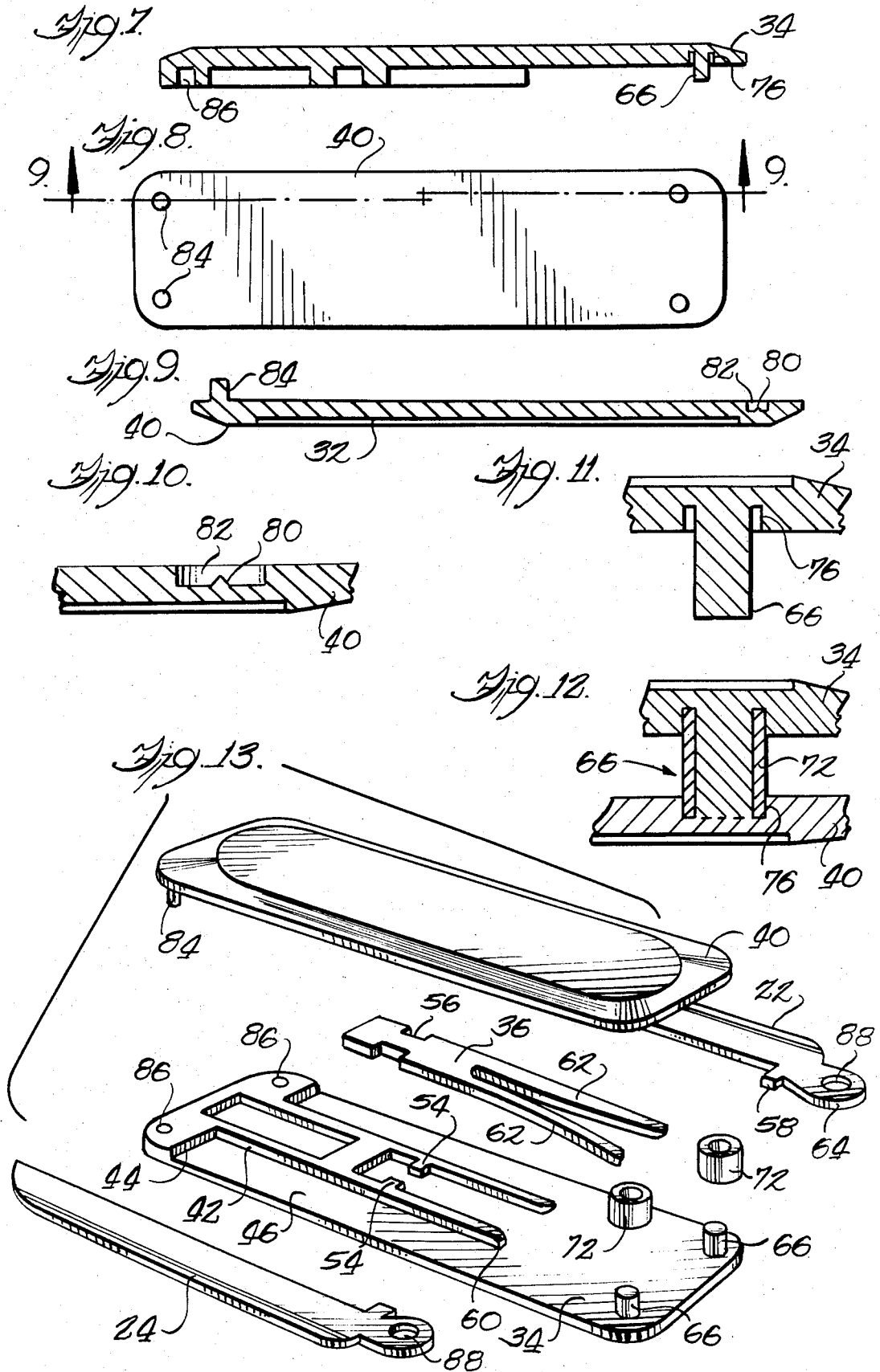
[57] ABSTRACT

A foldable implement in which one or more tools are pivotally supported in a body, the body assembly being formed into an integral unit from two spaced generally rectangular plastic plates sonically welded together. Preformed pins on one of the plates provide pivots for the tools. Operationally, these pivoted tools are held at open and close positions by unique spring means housed in the body assembly.

18 Claims, 13 Drawing Figures







FOLDABLE IMPLEMENT AND METHOD OF MANUFACTURE THEREOF

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to foldable implements and more particularly to a pocket tool assembly such as the common pocket knife, having a body which serves both as a housing for the tools and as a handle and pivotally mounted knife blades or similar pivotally mounted tools disposed in said body.

2. Description of Prior Art

Pocket knives and similar pocket tools have heretofore been fabricated by stacking a series of individual flat plates, partitions and springs together in a sandwich-fashion and clamping all the members together with rivets to form the body. That is, rivets pass through the entire assembly and have heads formed at the exposed faces. These rivets, while functional, usually protrude beyond the confines of the body assembly and after "upsetting" or "heading", the ends are frequently finished flush by grinding and polishing or covered with additional material, the assembly as well as each alternative for finishing being costly.

Furthermore, rivets which are left exposed have a propensity for wear on the ends, thereby causing possible loosening of the stacked assembly and unsightly appearance. This riveted assembly technique has also unduly restricted the choice of materials for the body assembly. Lightweight, relatively low strength materials could not be riveted satisfactorily or provide the required structural integrity.

In addition, the tool chambers and body frame assemblies of traditional pocket knives are formed from a multitude of pieces requiring much hand labor and expense to achieve proper alignment and appearance of the pieces and the finished product.

Finally, the spring mechanisms of known pocket knives have produced substantial loads on the body assembly, thereby necessitating costly, high strength materials for the body and care in mounting the springs.

Numerous pocket knives or pocket tools have been known, illustrations of which include:

A pocket knife shown in Schmachtenberg U.S. Pat. No. 449,499 employing the riveted-type assembly wherein the rivets and pins are covered by pouring molten metal over them after the main frame of the knife is riveted together; and

A pocket knife as shown in Swinden U.S. Pat. No. 2,977,678 with a sandwich-type frame wherein the so-called bolster units (outer decorative panels of handle) are held in position with respect to the knife frame subassembly by snapping the bolster units over headed pins on the frame subassembly and securing the bolsters with a keyhole slot arrangement.

The integration of components and the simplified structure of this invention produce a lightweight, foldable implement such as a pocket knife. The choice of body materials and overall configuration may vary over a range heretofore unknown in the art.

It is, therefore, an object of this invention to provide a foldable implement having a unitary body assembly with integral pivot pins which provide spacers for the body assembly, pivots for the foldable tools and a simple, yet secure, means of holding the assembled parts together.

In one of its aspects, it is an object of this invention to provide a tool such as a pocket knife with a spring mechanism which does not create excessive and unbalanced forces on the body assembly.

It is a further object of this invention to provide a tool such as a pocket knife which is easily aligned and fabricated without undue labor and expense.

Finally, it is an object of the invention to provide a unitary body assembly for an implement such as a pocket knife which provides an integral pivot pin, spacer and spring-retaining means.

SUMMARY OF THE INVENTION

In accordance with the invention, a foldable implement, such as a pocket knife, is provided having one or more tool means adapted for pivotal mounting and a unitary body assembly with integral pivot pins for the tool means. "Tool" or "tool means" in this specification broadly means any device which can advantageously be pivotally mounted in a body which serves both as a housing and a handle. This includes such "tools" as a knife blade, file, scissors, clipper, mirror, pick, awl, screwdriver, tamper, wire cutter, clamp, cork screw or any other devices usable in the described environment. Each tool means is mounted on the integral pivot pin of a first plate such that the tool means pivots about an axis generally normal to the first plate. A second plate is joined to the first plate such that the integral pivot pin provides a tool means pivot, a spacer for the plates and one means for holding the plates in assembled relation. The plates are joined together into a unitary assembly by sonic welding, gluing or an equivalent technique.

The tool means is held at predetermined positions, such as an open and closed position, by spring means housed in the body assembly and engaging each of the tool means near the respective pivot pins. Means are provided for retaining the spring in the body assembly. For example, in the described embodiment, an integral lug on the first plate engages a slot on the spring to retain the spring in the body assembly. The spring means may comprise a bifurcated spring having a fixed bight portion and a pair of free ends which tend to be substantially parallel when depressed by a pair of corresponding tool means. Such a spring tends to equalize or balance the loads on the spring so that a relatively small load as compared to the applied loads is felt by the body assembly to which the spring is secured.

An integral partition extending from the first plate may be included such that the plates, when joined together, are held in a predetermined spaced relationship. Such an integral partition and spacing of the plates provides a tool cavity for the tool means in the body assembly. When the plates are secured together by a preferred technique of sonic welding, an integral energy director bead along the top of the integral partition helps to fuse the plates together. These beads are small protuberant lines of material which become fused to the mating second plate under sonic welding. Integral energy director protuberant points at the bottom of sockets on the second plate which receive the pivot pins serve essentially the same purpose. Sonic welding fuses the points to the distal ends of the integral pivot pin to form a unitary pivot mechanism.

Bearing means positioned about the pivot pin provide a bearing surface for the tool means. Preferably, a sleeve bearing is pressed over the pivot pin and re-

tained in a groove at the base of the pivot pin providing a bearing which adds strength and wear-resistance to the pivot.

Additional integral pins on the second plate, which do not function as pivots, help to guide and align the plates during assembly. These integral pins fit into corresponding sockets on the first plate during the joining operation to hold the plates fixed relative to one another and the pins are also secured in the sockets by fusion or the like.

Thus, the invention eliminates unsightly rivets which are subject to wear and loosening. It also eliminates the multitude of pieces and subassemblies heretofore used in the sandwich-type riveted pocket knife. The body assembly of this invention supplies both the structural and appearance requirements of a pocket implement without the need for numerous and costly assembly steps and finishing operations.

Alignment problems during assembly of known pocket knives are substantially reduced in practicing the instant invention. The cooperating plates may be accurately preformed by injection molding and include integral projections which provide guidance and alignment during assembly. Preformed raised surfaces and recesses on the plates also provide partitions for tool cavities, spacers for the plates, spring retainers, sockets for alignment, and structural rigidity to the unitary assembly. By practicing the method of manufacture taught herein, substantial economies can be realized while producing an improved product.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an entire pocket implement incorporating the invention;

FIG. 2 is a top view of the embodiment of FIG. 1;

FIG. 3 is an elevation view thereof;

FIG. 4 is a top view of the pocket implement of FIG. 1 with the upper plate removed;

FIG. 5 is a plan view of the first plate of the implement of FIG. 1;

FIG. 6 is a fragmentary sectional view along section line 6—6 of FIG. 5 depicting an energy director bead to facilitate sonic welding;

FIG. 7 is a vertical sectional view of the first plate along section line 7—7 of FIG. 5;

FIG. 8 is a view depicting the internal surface of the second plate of the implement of FIG. 1;

FIG. 9 is a vertical sectional view of the second plate along section line 9—9 of FIG. 8 depicting a socket, an integral pivot pin and a surface indentation for receiving a decorative side strip;

FIG. 10 is an enlarged detail view of the right hand portion of FIG. 9 showing a protuberance for sonic welding in the pin socket;

FIG. 11 is an enlarged detail view of the first plate shown in FIG. 7 showing an integral pivot pin and bearing retainer groove;

FIG. 12 is an enlarged detail view of the pivot assembly depicting a sleeve bearing around the integral pivot pin and occupying the accompanying retainer groove; and

FIG. 13 is an exploded view of the entire pocket implement of FIG. 1.

While the invention will be described in connection with a preferred embodiment, it will be understood that it is not intended to limit the invention to that embodiment. On the contrary, it is intended to cover all alter-

natives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1, 2 and 3, a completed pocket implement assembly 20 is shown with the tools, in this instance a stainless steel knife blade 22 and nail file 24 in the closed position. The flat oblong panel 28 shown on the outer face of the assembly 20 is a decorative strip fitted into a shallow indentation 32 (see FIG. 9) of the first plate 34. This optional strip 28 may serve to present promotional material, additional ornamentation, desired texturing, or the like.

Referring to FIG. 4, the relationships of the tools 22 and 24 and a spring means 36 to each other and to the first plate 34 are shown. The first plate 34 has integral partitions 38 in the general style of a bifurcated "T". These partitions 38 help to hold the first plate 34 and a second plate 40 in a predetermined spaced relationship and define bottom 42 and end wall 44 of the tool cavity 46 formed after the first and second plates 34 and 40 are fused together. In the preferred embodiment, the plates 34 and 40 are fused together in final assembly by sonic welding.

Sonic welding of plates 34 and 40 is enhanced by integral energy director beads 48 located along the top of the partitions 38 shown in detail in FIG. 6. These bead lines 48 generally represent lines of initial fusion of the first and second plates 34 and 40 when the two plates are pressed together and welded sonically. Preferably, the plates 34 and 40 are preformed by injection molding. A durable sonically weldable plastic is preferred for the plates; however, other durable materials may be used. From present experience, it appears that a polycarbonate resin, such as LEXAN of the General Electric Company is a preferred material. However, an acetal resin such as DELRIN of E. I. DuPont-DeNemours and Company and CELCON of Celanese Corporation are also appropriate. An acrylonitrile-butadiene-styrene such as CYCOLAC of Marbon Chemical Company is also appropriate. The plates may also be glued together or otherwise secured together to form an integral assembly.

As shown in FIG. 4, the heat treated tool steel spring 36 and spring-retaining portions of partition 38 are shown. The preferred spring-retaining means comprises a pair of small keys 54 on the partition 38 fitted into corresponding recesses 56 on the rear portion of the spring 36 and additional rear restraint on the spring 36 is achieved by the close fitting partition sides 60. The free ends 62 of the spring 36 form a portion of the tool cavities 46 and ultimately resiliently rest against a cam portion of the tools 22 and 24 near the pivotal end. The forces between the free ends 62 of the spring 36 and the cam portion 64 of the tools 22 and 24 are such that the moments of force at pivot pins 66 tend to hold the tools in the closed position 26 (inside the tool cavity 46 as shown in FIG. 4) or in the open position (not shown) as desired by the user. The manner of shaping the cam portions 64 to accomplish this operation is well known. Stops 58 maintain tools 22 and 24 in a generally aesthetic parallel position when the tools are closed.

In the preferred embodiment, the pivot pins 66 are formed on, and normal to the first plate 34. FIG. 11

shows an integral pivot pin 66 in detail in relationship to the first plate 34. A small annular recess 76 is formed at the base of pivot pin 66. A sleeve bearing 72 (FIG. 12) is pressed over the pin 66 before the tool 22 and 24 and plates 34 and 40 are assembled. The sleeve bearing 72 is positioned in the bearing retainer groove 76 of the first plate 34 and the fusion of the second plate 40 onto pivot pin 66 effectively defines a second annular recess 78 in the second plate 40 after sonic welding.

FIG. 10 depicts an energy director protuberant point 80 inside the socket 82 of the second plate 40. This point 80 is fused to the integral pivot pin 66 of the first plate 34 by sonic welding when the plates 34 and 40 are pressed together to form a unitary assembly. The sleeve bearing 72 serves two primary purposes. First, it provides a choice of wear-resistance materials for the pivot pins 66; second, it supplies additional strength to the pivot mechanism. The added strength derives, in part, from extending the bearing 72 into the plates 34 and 40 which provides additional shear strength and better stress distribution in the pivot pin 66 and the overall body assembly.

The somewhat larger diameter integral pins 84 on the second plate 40 are shown best in FIG. 9 and fit into corresponding sockets 86 on the first plate 34 (FIG. 7) during assembly. These pins 84 help to guide, align and space the first and second plates during assembly.

FIG. 13 is an exploded view of the components of the implement 20. The spring 36 is positioned on the first plate 34 with the spring recesses 56 located in the integral keys 54. Sleeve bearings 72 are pressed on the integral pins 66 of the first plate 34 and into recesses 76 and the apertures 88 of the respective tools 22 and 24 are positioned on the bearing 72. Finally, the second plate 40 is mated with the first plate 34 guided by the integral pins 84 and sockets 86 and the plates are joined by sonic welding along the energy director beads 48 (not shown in FIG. 13) and at the points 80 of the second plate 40.

Thus, in accordance with the invention, a pocket implement and a method of manufacture are provided that fully satisfy the objects and advantages set forth above. While the invention has been described in conjunction with a preferred embodiment, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to embrace all such alternatives, modifications and variations as fall within the spirit and scope of the appended claims.

What is claimed is:

1. A pocket implement comprising:

a first plate having an integral pivot pin generally normal to said first plate and having a free end surface;

a second plate having an inner surface facing said first plate and in abutment with said free end surface;

tool means pivotally mounted adjacent one end thereof on a pivot pin; and

a fusion joint connecting said inner surface to said free end surface of the pivot pin of said first plate to form a unitary body assembly such that the integral pivot pin functions as a tool means pivot secured to said plates at both ends and as a plate spacer.

2. A pocket implement as recited in claim 1 including:

spring means having a fixed portion rigidly held within a cavity defined between the first and second plates in the body assembly and a yieldable portion engaging the tool means near the pivot pin to hold the tool at a plurality of predetermined pivotal positions.

3. A pocket implement as recited in claim 1 including:

cylindrical bearing means positioned about the pivot pin of the pivotally mounted tool means, said tool means being pivotally mounted thereon.

4. A pocket implement as recited in claim 1 including:

a partition normal to and integral with one of said plates and engaging the other plate such that the first and second plates are held in a predetermined spaced relationship when joined together in a unitary body assembly.

5. A pocket implement as recited in claim 2 including:

means integrally formed with one of said plates and defining a shaped cavity for retaining the spring means in the body assembly.

6. A pocket implement as recited in claim 4 including:

an integral energy director bead along the top of the integral partition to provide for sonic welding of the plates.

7. A pocket implement as recited in claim 3 including:

a bearing retainer groove at the base of the pivot pin to retain the bearing.

8. A pocket implement as recited in claim 5 wherein the spring-retaining means comprises:

a key integral on said one plate; and

a slot on the spring means to receive the key whereby the spring means is retained in the body assembly.

9. A pocket implement as recited in claim 1 wherein:

said plates are formed of thermoplastic material, said joining means comprises sonically welded portions of the first and second plates forming a unitary body assembly.

10. A pocket implement as recited in claim 2 including two separately pivotal tool means having generally parallel pivotal axes, and two pivot pins extending from said plates, the spring means comprising:

a spring having a bight portion and a pair of free ends each engaging one of said tool means adjacent its pivot axis, said free ends tending to be generally parallel when depressed by the corresponding tool means whereby the loads on the spring are directed inwardly and are compensatory whereby a relatively small force is exerted on the body assembly in which the spring is secured.

11. A pocket implement as recited in claim 9 including:

a socket in the second plate to accept the integral pivot pin of the first plate; and
an integral energy director protuberance in the bottom of the socket to enhance sonic welding of the integral pivot pin to the second plate.

12. A pocket implement as recited in claim 11 including cylindrical bearing means surrounding said pivot pin and extending into said socket.

13. A pocket implement as recited in claim 1 further comprising:

an integral pin on the second plate; and
a corresponding socket on the first plate such that the plates are guided and aligned when joined together.

14. A pocket implement as recited in claim 3 including bearing retaining grooves at the base of the pivot pin formed in each of said plates to retain the bearing means, said bearing means extending into said grooves.

15. A method of manufacturing a foldable pocket implement which includes a body assembly having two plates which define a tool cavity, pivot pin means, and a pivotally mounted apertured tool means in said tool cavity comprising the steps of:

integrally molding said pivot pin means and one of said plates from a thermoplastic material,
assembling the apertured portion of said tool means on said pin means,
molding the other plate of a thermoplastic material,

assembling said other plate over said one plate with its internal surface in abutting engagement with the end surface of said pin means to retain said tool means on said pin means and within the cavity defined between said plates,
and fusing said other plate to said end surface of said pin.

16. The method of claim 15 including the step of clamping one portion of a resilient means between said plates with a free portion thereof in resilient engagement with said tool means.

17. The method of claim 16 wherein a cavity is formed in said other plate to receive the end of said pin, and including the step of applying sonic energy thereto to fuse said pin in said cavity.

18. The method of claim 17 wherein partition portions are formed on one of said plates to define said cavity and partially surround said resilient means, including the steps of forming protuberant portions in said cavity and on said partition portions, and applying sonic energy thereto to fuse said partition to the other of said plates and to fuse said pin in said cavity.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,832,775 Dated September 3, 1974

Inventor(s) ALWIN J. STAHEL II and TERRY N. NELSON

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 3, line 37, "top view" should be --bottom view--

Col. 3, line 38, "upper plate" should be --lower plate--

Signed and sealed this 7th day of January 1975.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents