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(54) **HANDLE ASSEMBLY FOR TOOL**

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(57) **ABSTRACT**

A handle assembly for a power tool **1** comprises a housing **2** defining a handle **4** and housing a motor for actuating an output member of the tool, such as a drill bit or jigsaw blade. The handle assembly comprises at least one flexible sheet **8** adapted to be mounted to a surface of the handle of the power tool and having a series of protrusions **10** adapted to be engaged by a hand of a user of the tool. The protrusions **10** retain one or more blister packs (not shown) containing at least one vibration damping gel material between the flexible sheet **8** and the surface of the handle **4**.

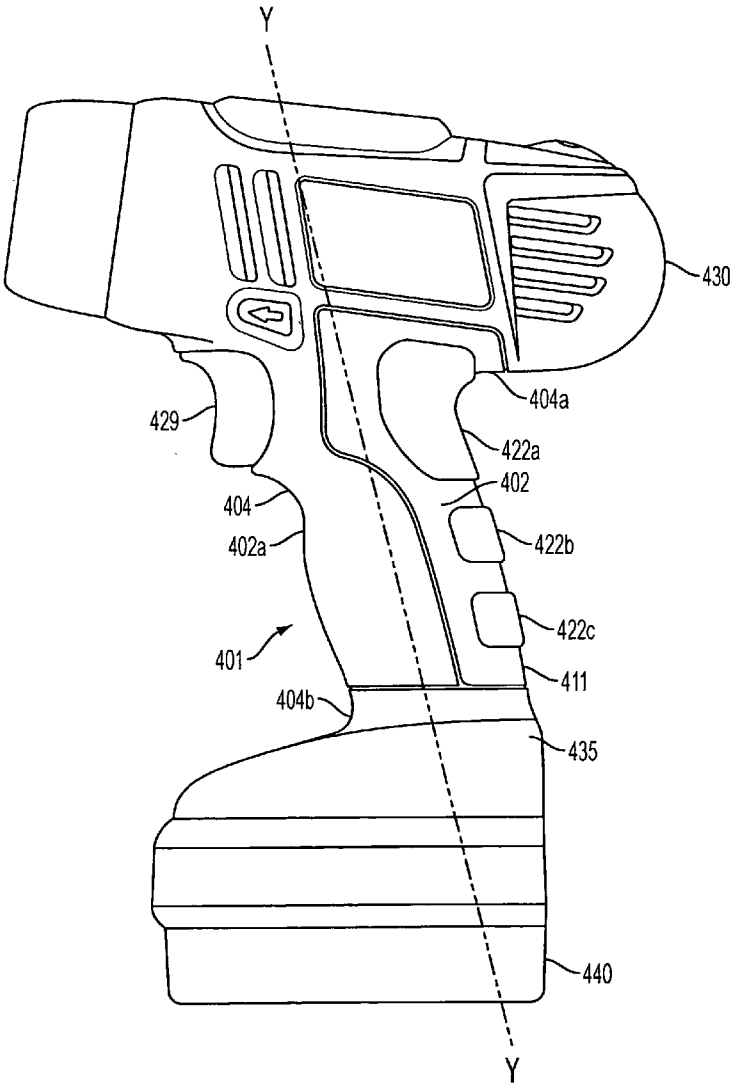
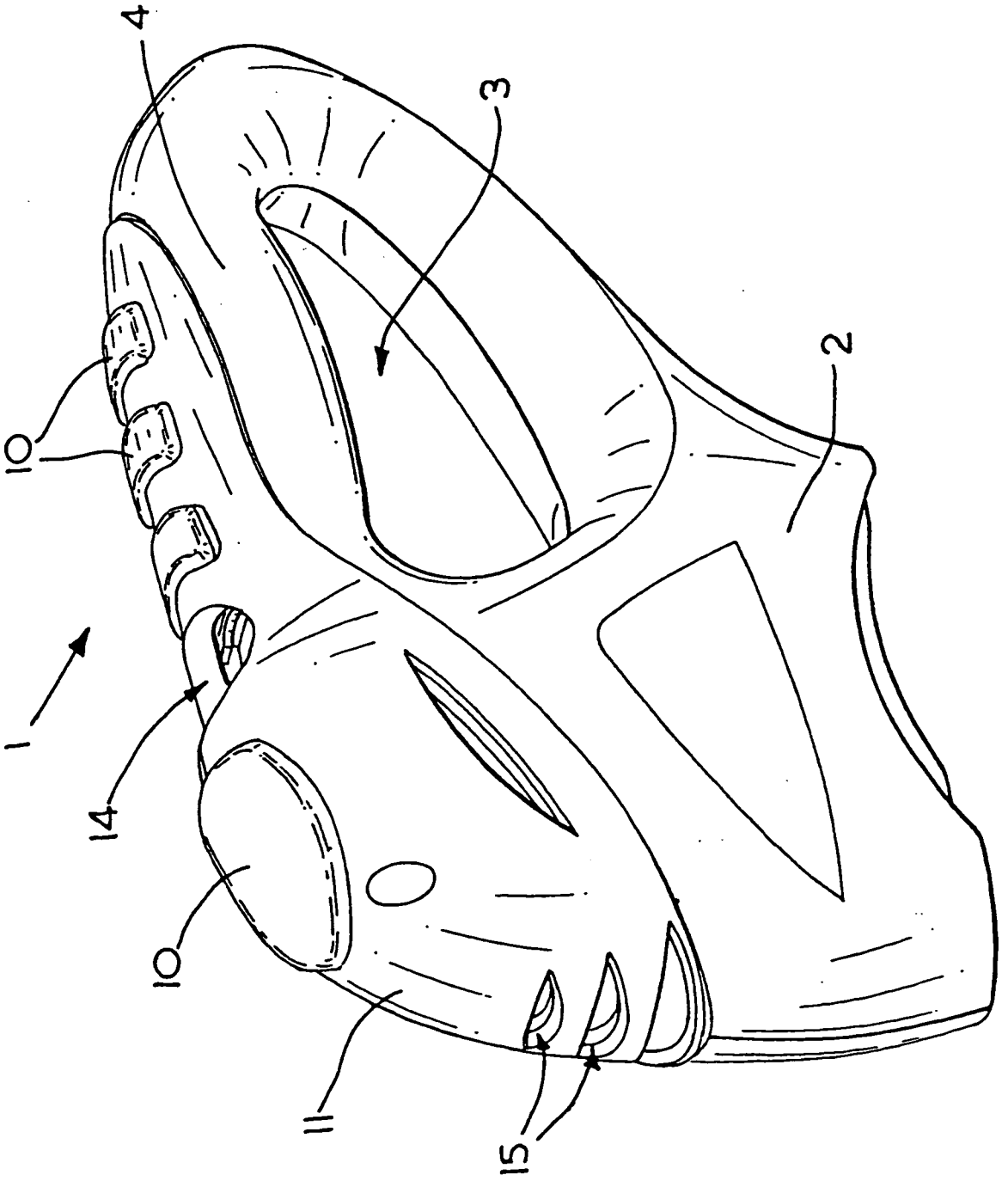


FIG. 1



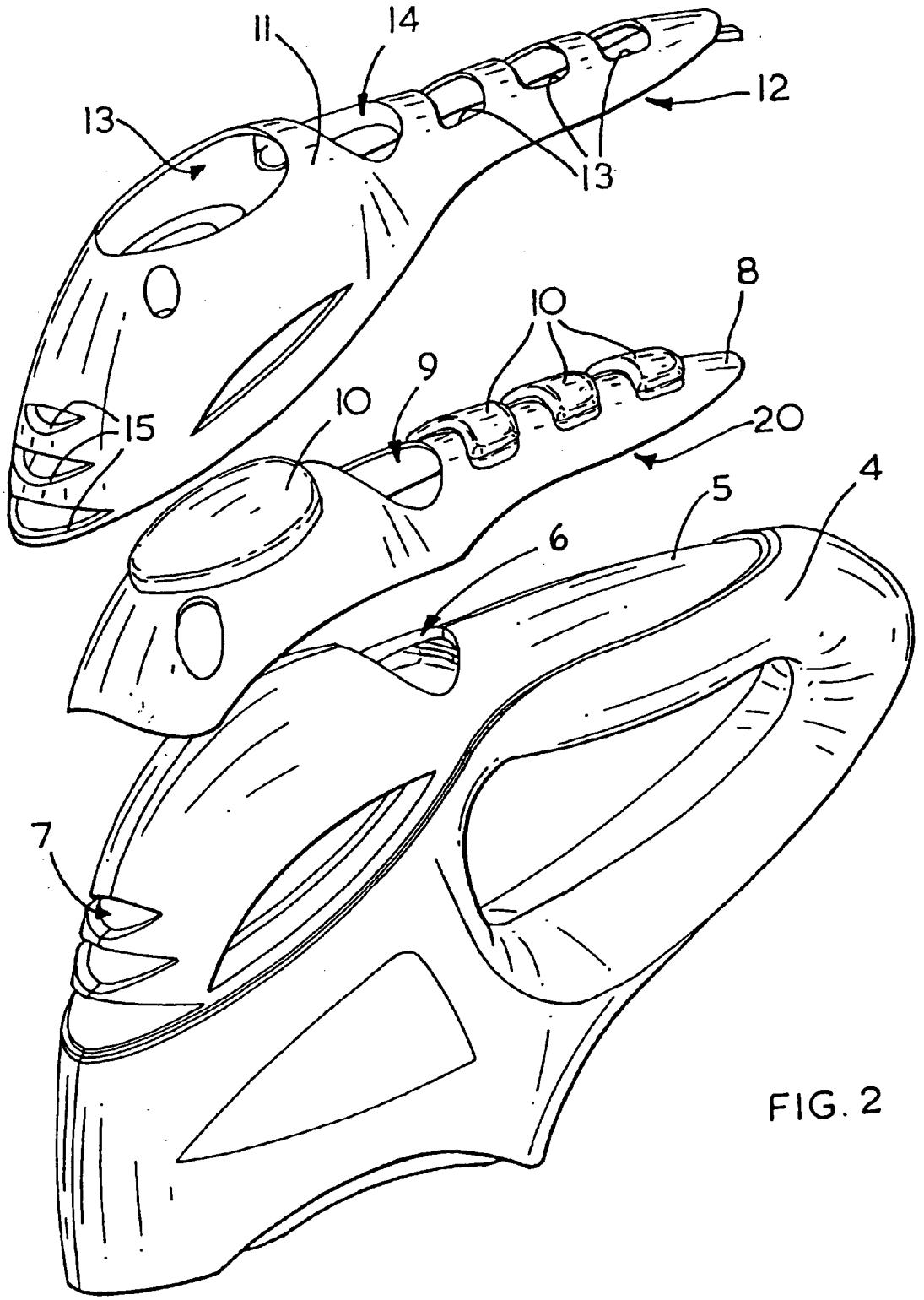


FIG. 2

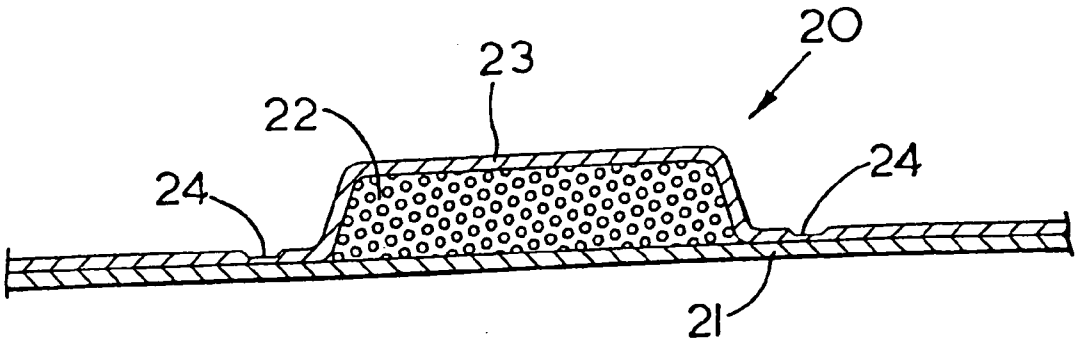


FIG. 3A

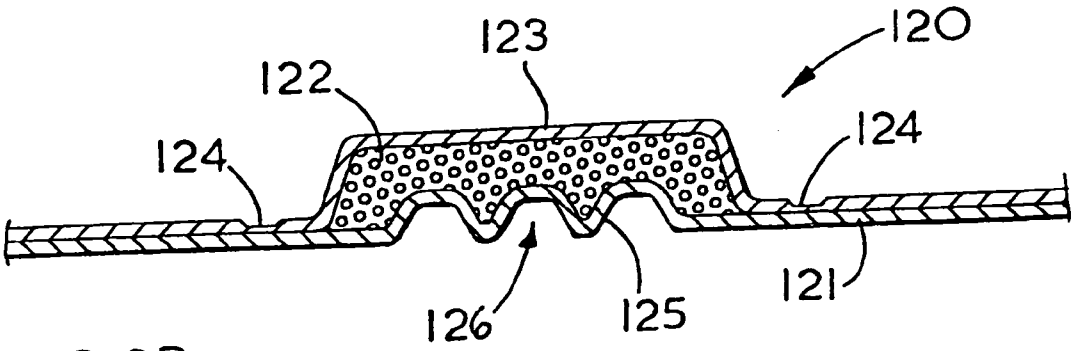


FIG. 3B

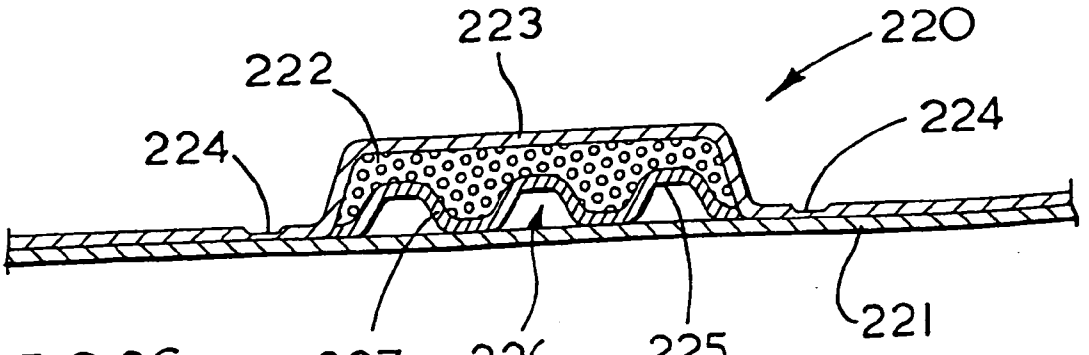


FIG. 3C

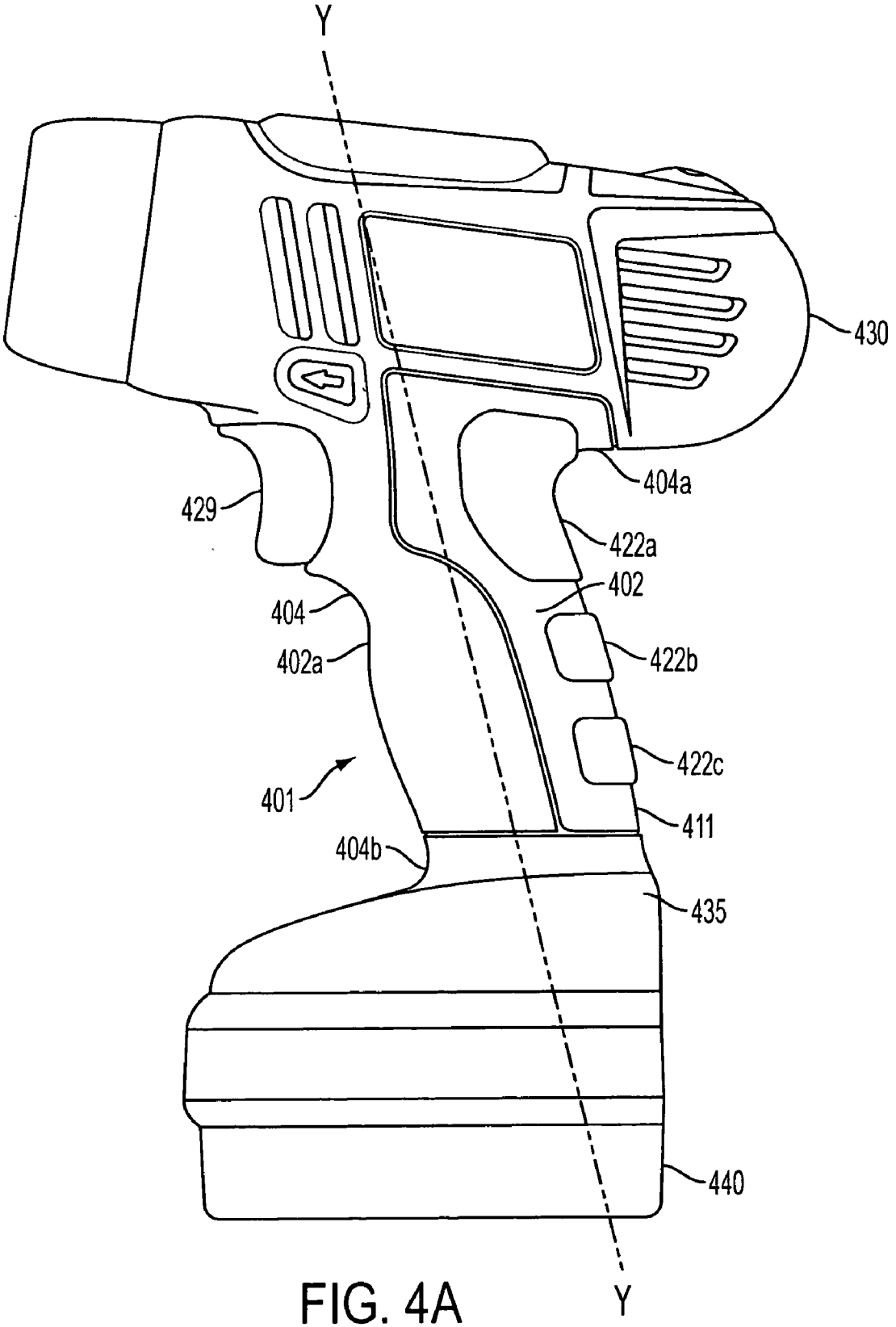

Y
430
404a
429
422a
402
404
422b
402a
422c
401
411
404b
435
440
Y

FIG. 4A

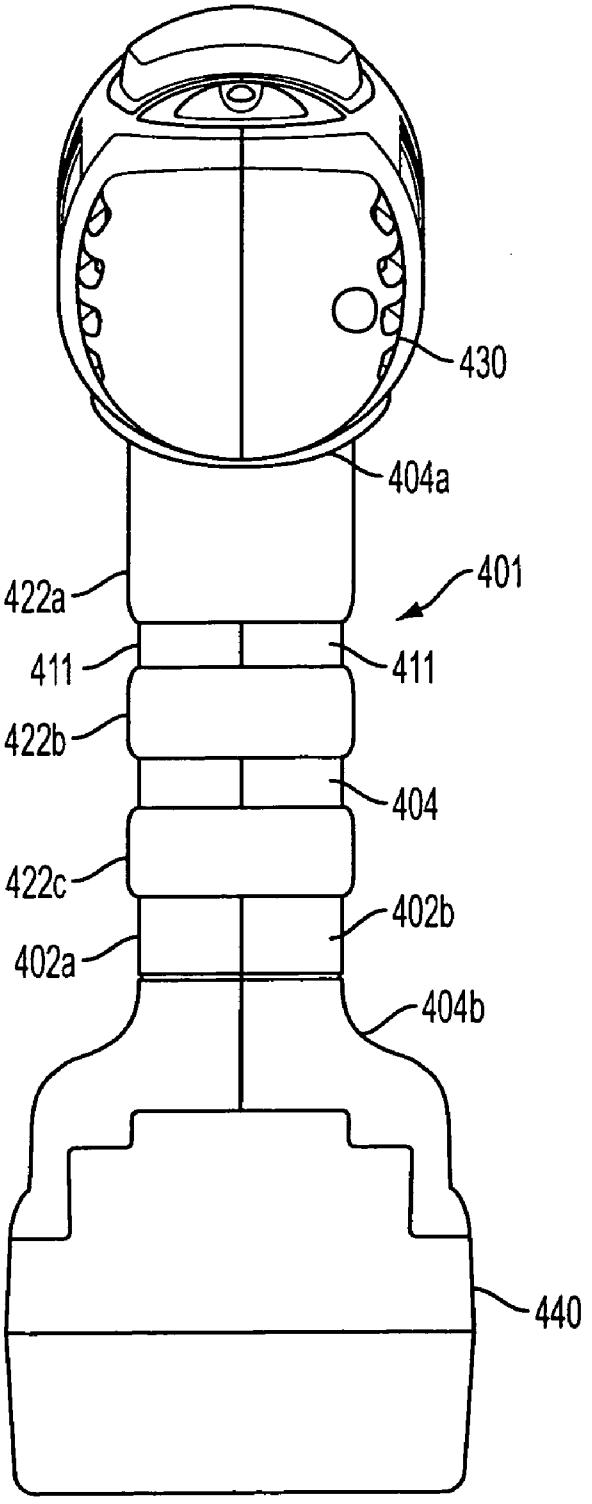


FIG. 4B

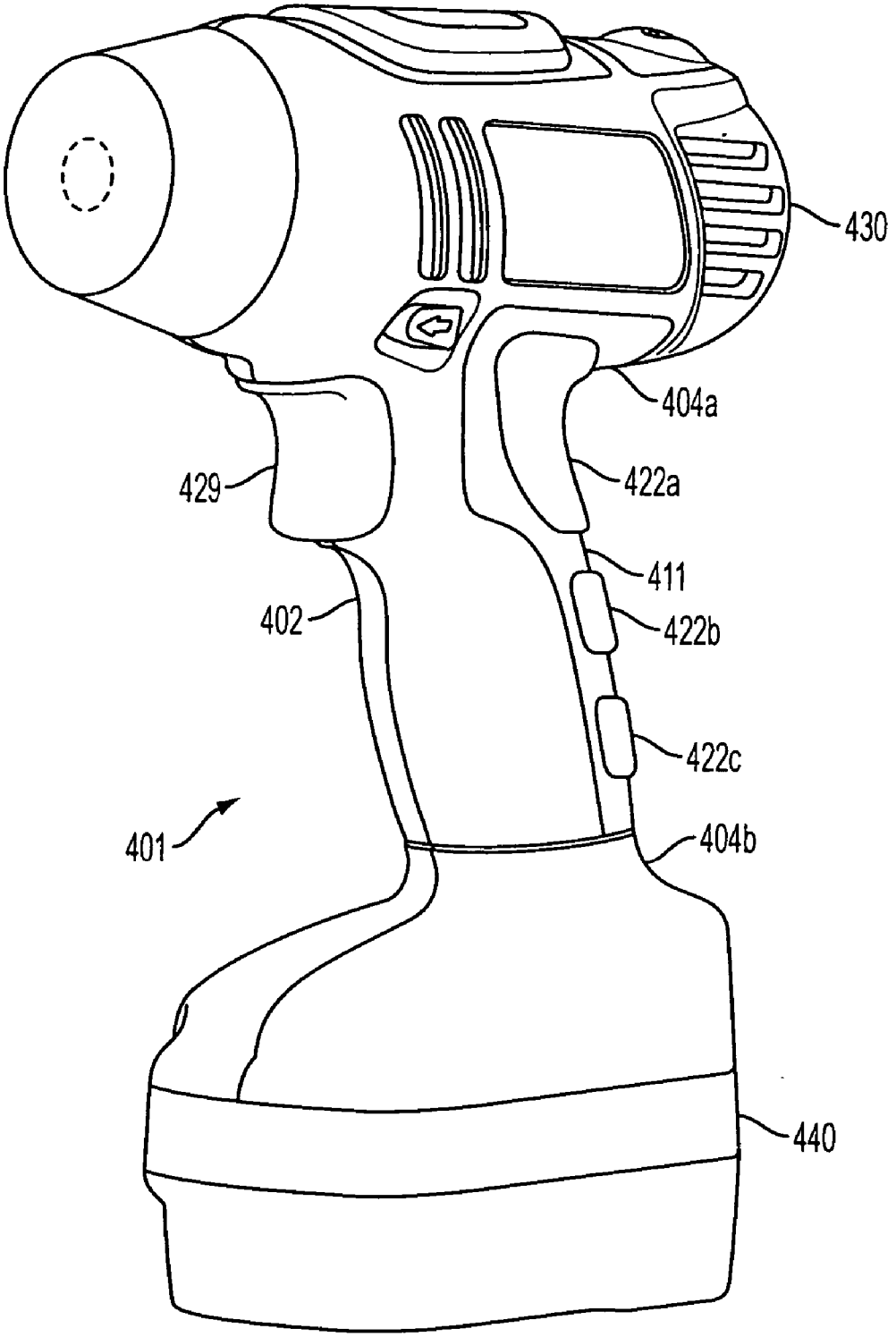


FIG. 4C

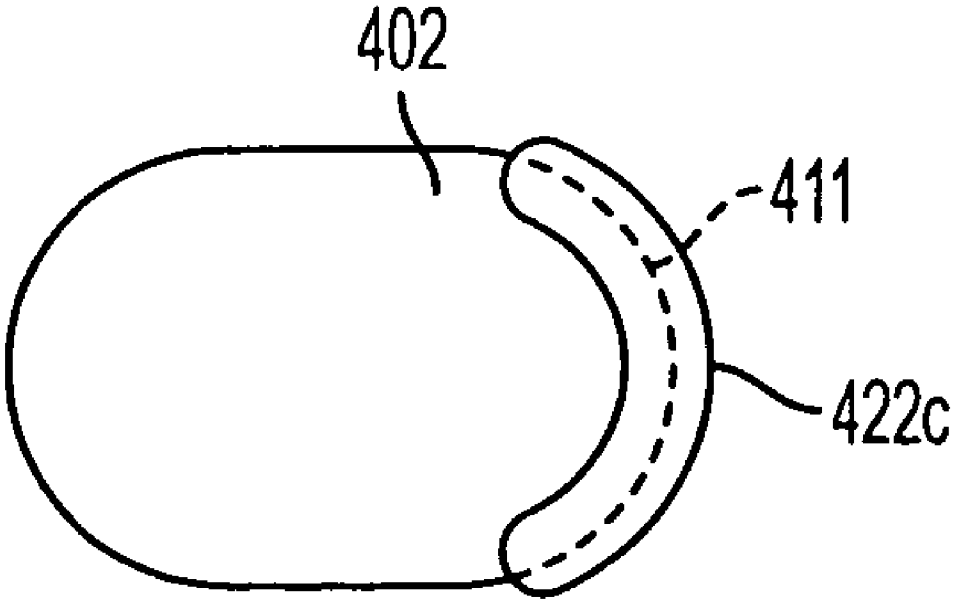


FIG. 4D

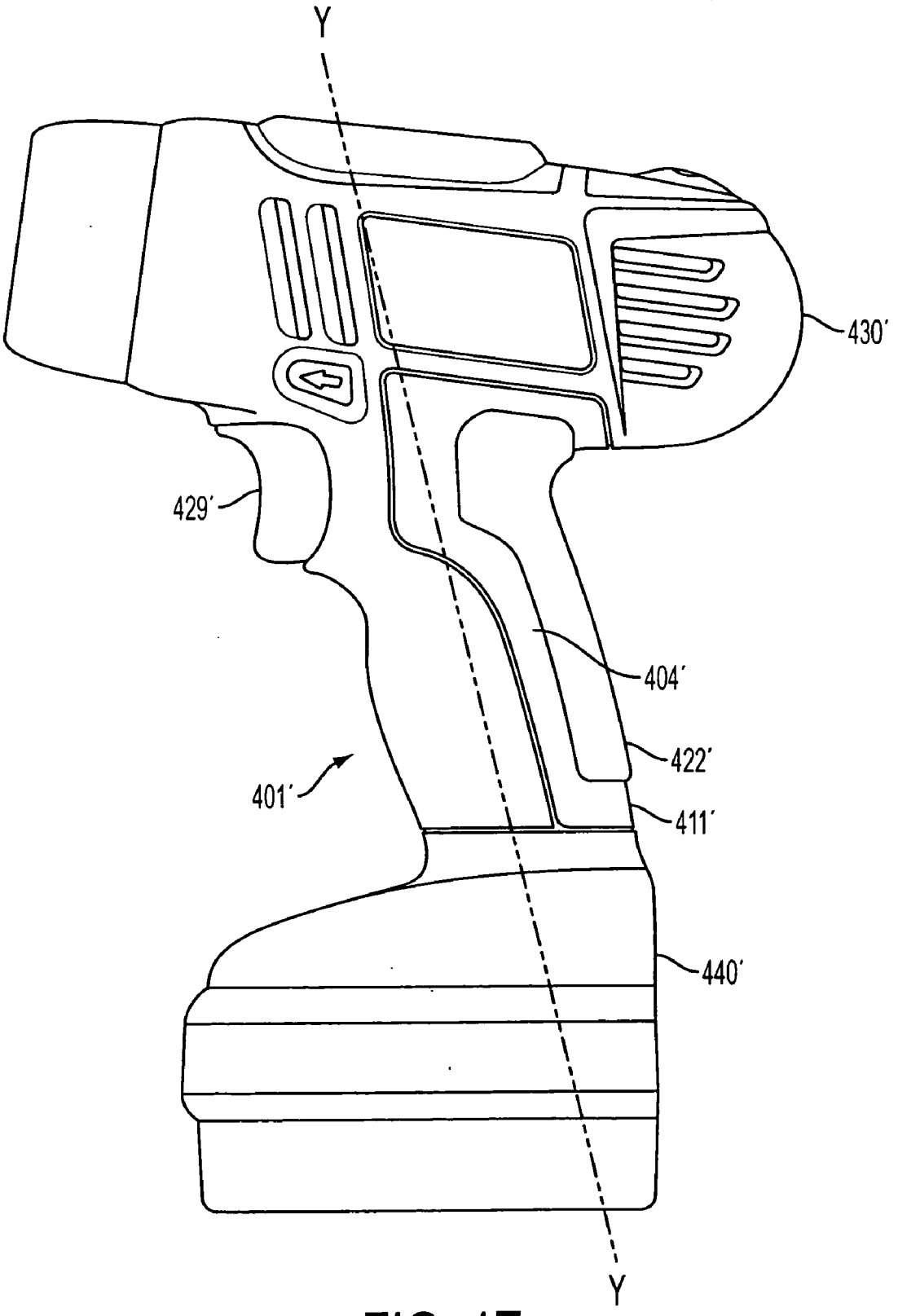


FIG. 4E

HANDLE ASSEMBLY FOR TOOL

FIELD OF THE INVENTION

[0001] The present invention relates to handle assemblies for tools, and relates particularly, but not exclusively, to handle assemblies having combined friction gripping and vibration damping properties, for power tools in which an output shaft is driven by a motor.

BACKGROUND OF THE INVENTION

[0002] Known power tools, such as power drills in which a drill bit is rotated by an output shaft which is in turn rotated by means of an electric motor, generate significant amounts of vibration, which can under certain circumstances limit the length of time during which the tool can be used continuously. In addition, the housing of such tools is generally made from a durable plastics material on which it can be difficult for a user of the tool to maintain a grip when the tool is in use for a sustained period.

[0003] U.S. Pat. No. 6,308,378 discloses a gripping arrangement for a handle of a power tool in which the sides of the handle are provided with frictional gripping zones, each side of the handle including a plurality of alternating gripping zones of a softer material and a harder material. The softer material used is generally a thermoplastic elastomer or rubber material, and the harder material is generally the same material as that from which the tool housing is formed.

[0004] This known arrangement suffers from the drawback that because the softer material performs the dual functions of providing a friction grip and vibration damping, the choice of material constitutes a compromise in that although it will have acceptable friction reducing and vibration damping properties, the performance of the handle is limited because a material having optimum frictional properties will generally have unacceptable vibration damping properties, and vice versa.

[0005] WO02/38341 discloses a grip handle for a hand-held machine tool in which a hand grip is separated from the remainder of the housing by a vibration damping element consisting of an inflatable annular air filled cushion. An additional handle is provided which has a tubular grip element surrounding a further annular air cushion.

[0006] This known arrangement suffers from the drawback that the vibration damping properties of air can only be varied by adjusting the air pressure within a chamber containing the air, and even then, the range of vibration damping properties achievable is limited. Furthermore, it is difficult, and therefore expensive, to manufacture a sealed chamber containing air having a predetermined pressure.

[0007] Preferred embodiments of the present invention seek to overcome the above disadvantages of the prior art.

BRIEF SUMMARY OF THE INVENTION

[0008] According to an aspect of the present invention, there is provided a gripping portion for a power tool having a housing and a motor within said housing for actuating an output member of the tool, the gripping portion adapted to be engaged by a hand of a user of the tool and comprising:

[0009] at least one blister pack comprising respective first and second flexible sheets defining at least one gel-containing chamber therebetween, wherein the or each said gel-containing chamber contains a vibration damping gel material and said first and second sheets are sealed to each other at the periphery of the or each said gel containing chamber; and

[0010] at least one clamping member for clamping at least one said blister pack to said housing and having at least one aperture therethrough such that at least one said gel-containing chamber protrudes in use through a respective said aperture and substantially none of said vibration damping gel is located in use between a said clamping member and the housing.

[0011] By providing at least one flexible member and at least one chamber containing at least one vibration damping gel material between the engaging portion and the surface of the handle in use, this provides the advantage of enabling the material of the flexible member to be chosen to have the optimum frictional properties to enable a user to maintain a grip on the tool, and the vibration damping gel material at the same time to have the optimum vibration damping properties. In particular, it is possible to provide gel materials having a wide range of vibration damping properties compared with air. This also provides the advantage of simplifying construction of the assembly, which in turn reduces the cost of manufacture of the assembly, as well as providing the advantage of further reducing the cost of manufacture of the assembly by providing one or more components which perform more than one function.

[0012] At least one said blister pack may be foldable.

[0013] This provides the advantage of enabling the blister pack to conform to the shape of the tool handle.

[0014] At least one said blister pack may be perforated between at least one pair of adjacent chambers.

[0015] This provides the advantage of facilitating folding of the blister pack.

[0016] At least one said blister pack may further comprise locating means for enabling the blister pack to be mounted to a support.

[0017] Said locating means may comprise at least one aperture through said blister pack at a respective location remote from the or each said chamber.

[0018] The assembly may further comprise support means adapted to be located on a side of at least one said blister pack remote from the corresponding said engaging portion.

[0019] At least one said chamber containing the or each said gel material may be at least partially transparent in use.

[0020] This provides the advantage of enabling visible indicia, such as decorative features or trade marks, or electrical indicators, for example indicating that the tool of which the assembly forms part is actuated, to be seen while the tool is in use.

[0021] The assembly may further comprise at least one visible indicium located in at least one said chamber.

[0022] At least one said visible indicium may be electrically operated in use.

[0023] This provides the advantage of enabling said indicium to provide an indication of an operating condition of a power tool, such as whether the tool is actuated.

[0024] At least one said indicium may be at least one light emitting diode.

[0025] The assembly may further comprise at least one electrical switch for actuating the tool.

[0026] This provides the advantage of simplifying assembly of the tool, which in turn further reduces the cost of manufacture of the tool.

[0027] According to another aspect of the present invention, there is provided a tool comprising:

[0028] a housing;

[0029] a motor within the housing adapted to actuate an output member of the tool; and

[0030] a gripping portion as defined above.

[0031] Said gripping portion may have an outer surface including at least one material of higher coefficient of friction than the material of the housing of the tool.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] Preferred embodiments of the invention will now be described, by way of example only and not in any limitative sense, with reference to the accompanying drawings, in which:

[0033] **FIG. 1** is a perspective view of part of a housing of a power tool of a first embodiment of the present invention;

[0034] **FIG. 2** is an exploded perspective view of the housing of the embodiment of **FIG. 1**;

[0035] **FIGS. 3A** to **3**C show side cross-sectional views of three alternative forms of gel blister pack for use in the embodiment of **FIGS. 1 and 2**;

[0036] **FIG. 4A** is a side view of a handle assembly of a power tool of a second embodiment of the present invention;

[0037] **FIG. 4B** is a rear view of the handle assembly of **FIG. 4A**;

[0038] **FIG. 4C** is a perspective view of the handle assembly of **FIG. 4AFIG. 4D** is a partial cross-sectional view showing the relation between the gel piece and the handle for the power tool shown in FIGS. **4**A-C.

[0039] **FIG. 4E** is a side view showing an alternative embodiment of the power tool shown in **FIG. 4A**.

DETAILED DESCRIPTION OF THE INVENTION

[0040] Referring to **FIGS. 1 and 2**, a power tool **1** such as a drill or jigsaw comprises a housing **2** defining an aperture **3** bounded on one side thereof by a handle **4**, the housing **2** containing a motor (not shown) for actuating an output member such as a drill bit or jigsaw blade (not shown).

[0041] The housing **2** is formed from a generally durable plastics material, as will be familiar to persons skilled in the art, and has a recessed portion **5** on a generally smooth upper surface of the handle **4**, the recessed portion **5** being provided with a recess **6** containing an actuating switch (not shown) for turning the tool **1** on and off. The housing **2** is provided with ventilation apertures **7** at one end of the recessed portion **5** to allow cooling of the interior of the housing **2**.

[0042] A flexible sheet **8**, of thermoplastic elastomeric material, such as a thin layer of polyurethane, having a coefficient of friction higher than that of the material from which the housing **2** is made, is formed by means of a suitable method such as moulding. The sheet **8** has a periphery shaped to fit inside the periphery of recessed portion **5** to cover all of the recessed portion **5** except that part in which the ventilation apertures **7** are provided, and the flexible sheet **8** is provided with a through-aperture **9** to allow access to the actuating switch in recess **6**. The flexible sheet **8** is also provided with a series of protrusions **10**, each of which defines a chamber between the sheet **8** and the upper surface of the handle **4** of the housing **2** when the sheet **8** is placed in position on the upper surface of the recessed portion **5**. Each of the chambers underneath the protrusions **10** accommodates a vibration damping gel contained in a blister pack **20** (**FIGS. 3A** to **3**C). Alternatively, the flexible sheet **8** may be bonded to a backing sheet (not shown) to define the chambers containing the vibration damping gel.

[0043] A cover plate **11** of durable plastics material, such as the material from which the housing **2** is constructed, has an internal surface **12** corresponding generally to the external (i.e. upper) surface of the flexible sheet **8**. The cover plate **11** is provided with a series of first apertures **13** for allowing the protrusions **10** of the sheet **8** to protrude therethrough when the plate **11** is mounted to the handle **4** to secure the flexible sheet **8** in place, a second aperture **14** co-operating with the aperture **9** to allow access to the actuating switch in recess **6**, and a series of third apertures **15** cooperating with the ventilation apertures **7** in the housing **2**.

[0044] Referring now to **FIG. 3A**, a gel blister pack **20** for use in the embodiment of **FIGS. 1 and 2** is formed from a thin, flexible backing piece **21** of thermoplastic polyurethane film on which one or more pieces **22** of a vibration damping gel formed from a semi-solid silicone rubber or polyurethane material are provided. The pieces **22** of gel may be translucent and/or semi transparent and/or coloured, for reasons which will be explained in greater detail below. The backing layer **21** with the pieces **22** of gel are then covered by a generally transparent layer **23** of thin, thermoplastic polyurethane film, which is pulled down tightly over the gel pieces **22** by means of a combination of heat and pressure, and then secured to the backing piece **21** at the periphery **24** of each gel piece **22** to form discrete chambers encapsulating each gel piece by suitable welding techniques, such as heat staking and/or ultrasonic vibration, which will be familiar to persons skilled in the art. Alternatively, the gel material **22** can be poured or injected into a pre-formed transparent sheet **23** and then covered by backing piece **21** and welded. The upper surface of the backing piece **21** may be printed with decorative or trade mark information which is visible through the transparent layer **23** and gel **22**.

[0045] Referring to **FIG. 3B**, in which parts common to the embodiment of **FIG. 3A** are denoted by like reference numerals but increased by **100** and will therefore not be described in greater detail herein, the backing piece **121** of the blister pack **120** is provided with a series of raised portions **125** which may be decorative matter and/or trade marks or raised lettering. The raised portions **125** define recesses **126**, which may accommodate light emitting diodes which can be illuminated to provide a visual indication of an

operating parameter of the tool incorporating the blister pack **120**, for example to indicate whether the tool is switched on.

[**0046**] In the arrangement of **FIG. 3C**, in which parts common to the embodiment of **FIG. 3B** are denoted by like reference numerals but increased by **100**, the raised portions **225** defining recesses **226** may be formed by a separate layer **227**, which is encapsulated along with gel material **222** by transparent sheet **223** and backing piece **221**.

[**0047**] The operation of the handle **4** of the tool **1** of FIGS. **1** to **3** will now be described.

[**0048**] When a user's hand (not shown) grips the tool **1** when in use, the user's hand comes into contact with the cover plate **11** and the protrusions **10** beneath which one or more blister packs **20**, **120**, **220** containing vibration damping gel are located. As a result, vibrations generated by the motor in the tool housing **2** are damped by the vibration damping gel underneath protrusions **10**, and the user's grip on the tool is maintained by contact between the user's hand and the high friction material of the flexible sheet **8**. It can therefore be seen that by suitable choice of material of the flexible sheet **8**, the frictional properties of the sheet **8** can be optimized, while the vibration damping properties of the gel-filled blister packs **20**, **120**, **220** are generally superior to the vibration damping properties of known high friction materials or air filled cushions used in conventional handle assemblies.

[**0049**] Referring to **FIGS. 4A** to 4D, handle **404** of power tool **401** of a second embodiment of the invention, for example, a drill, is defined by two halves **402**A, **402**B of housing **402**. Drill **401** includes an upper motor housing **430** disposed above handle **404**. Housing **430** may extend along or at a small angle to the horizontal direction, while handle **404** may extend along or at a small angle to the vertical direction. As shown, both housing **430** and handle **404** are slightly angled to the horizontal and vertical directions when the drill rests on a horizontal surface. The lower surface of motor housing **430** transitions into handle **404** at fillet **404***a*. At its lower end handle **404** transitions into battery receiving portion **435** at a second fillet **404***b*. Battery **440** is slidably received in the receiving portion. Although the drill shown is a cordless drill receiving a removable battery which when inserted in the receiving portion forms the lower end of the drill, the invention could also be directed to a corded drill as well in which there is not a substantial part of the drill housing which is removable.

[**0050**] Three gel pieces **422***a-c* protrude from the rear of handle **404** and extend through cover plate **411**, which may be formed in one or two pieces. Both gel pieces **422***a-c* and cover plate **411** may have the same structure as the cover plate and gel pieces described with respect to the embodiment of **FIGS. 1-3**. Gel pieces **422***a-c* encompass the rear of handle **404** and extend partially around both sides of handle **404** and preferably terminate rearwardly of the center axis Y-Y of handle **404**, which extends at a slight angle to the vertical. Preferably, upper gel piece **422***a* is positioned relatively high on handle **404**, encompassing upper fillet **404***a*, opposite depressible trigger **429** which is disposed through the front of handle **404**. Upper gel piece **422***a* extends downwardly for substantially the same distance as trigger **429** to provide the maximum cushioning benefit when the user actuates trigger **429**.

[**0051**] In a preferred embodiment, the overall gripping region of the tool extends generally from upper fillet **404***a* towards lower fillet **404***b* in a range of 80-100 mm as measured in the vertical direction. Preferably lower gel piece **422***c* terminates above and adjacent lower fillet **404***b*. Upper gel piece **422***a* may extend in the vertical direction of handle **404** for 36 mm. At its maximum, upper gel piece **422***a* extends along each side of handle **404** in the direction which is transverse to the centerline Y-Y to a location which is 11 mm rearward of centerline Y-Y. The distance in the vertical direction between upper gel piece **422***a* and middle gel piece **422***b* may be 8 mm. The dimension of the middle and lower gel pieces **422***b* and **422***c* in the vertical direction may be 15 mm, and each may extend along each side of handle **404** in the direction which is transverse to the centerline Y-Y to a location which is 13 mm rearward of the centerline Y-Y. The distance in the vertical direction between middle gel piece **422***b* and lower gel piece **422***c* may be 7 mm. The distance in the vertical direction between lower gel piece **422***c* and lower fillet **404***b* may be 15 mm. The thickness of gel pieces **422***a-c* may be between 5-10 mm.

[**0052**] Cover plate **411** may be formed as one saddle-shaped piece which extends about the rear and partially along each side of handle **404**. Alternatively cover plate **411** may be formed as two pieces, with one piece disposed on each handle half. As measured in the vertical direction, cover plate **411** may extend from a location which is 6 mm above upper gel piece **422***a* to a location which is 8 mm below lower gel piece **422***c*. The openings in cover plate **411** have dimensions corresponding to those of gel pieces **422***a-c*. As shown, at an upper location cover plate **411** may extend forwardly of centerline Y-Y for 12 mm at its maximum. At a location which is about 32 mm below the upper edge of cover plate **411**, cover plate **411** narrows such that it only extends to a location which is 4 mm to the rear of centerline Y-Y. As shown in **FIG. 4D**, gel piece **422***c* may project outwardly from cover plate **411** by 3 mm. Gel pieces **422***a* and **422***b* also project outwardly from cover plate **411** by 3 mm.

[**0053**] **FIG. 4E** shows an alternative to the embodiment shown in **FIGS. 4A-4D**. In **FIG. 4E**, only a single gel piece **422'** is disposed on handle **404'**. Gel piece **422'** may have a saddle shape and wrap around the rear of handle **404'**, and extend forwardly on both side of handle **404'**, terminating to the rear of centerline Y-Y. Alternatively, two gel pieces **422'** which jointly form a saddle shape and wrap around the rear of handle **404'** may be used. With respect to the portion of handle **404**, **404'** covered by the gel piece(s), the overall dimensions of gel piece **422'** are similar to those of the three gel pieces **422***a-c* of FIGS. 4A-C. However, in the present embodiment, gel piece **422'** also occupies the regions of handle **404'** between each of gel pieces. **422***a-c*. Similarly, the overall dimensions of cover plate **411'** is similar to the overall dimensions of cover plate **411**.

[**0054**] It will be appreciated skilled in the art that the above embodiments have been described by way of example only, and not in any limitative sense, and that various alterations and modifications are possible without departure from the scope of the invention as defined by the appended claims.

1. A drill comprising:

a motor housing;

a handle extending downwardly from said motor housing, said handle having a front surface, a rear surface and side surfaces, said handle comprising a gripping portion;

a chamber enclosing a gel material disposed on said handle, said chamber disposed about the rear surface of said handle and extending forwardly along both said side surfaces, said chamber extending outwardly from said gripping portion.

2. The drill recited in claim 1 further comprising a trigger switch extending through said front surface, said chamber disposed on said handle at a location opposite said trigger switch.

3. The drill recited in claim 1, an upper transition defined between said motor housing and said handle, said chamber disposed so as to encompass said transition.

4. The drill recited in claim 3, said drill comprising a lower housing structure disposed below said handle, a lower transition defined between said handle and said lower housing structure, said chamber terminating at a location adjacent said lower transition.

5. The drill recited in claim 4, said lower housing structure comprising a battery receiving housing.

6. The drill recited in claim 1, said handle having a longitudinal center axis, said chamber extending along said side surfaces so as to terminate rearwardly of said center axis.

7. The drill recited in claim 6 further comprising a trigger switch extending through said front surface, said chamber disposed on said handle at a location opposite said trigger switch.

8. The drill recited in claim 7, an upper transition defined between said motor housing and said handle, said chamber disposed so as to encompass said transition.

9. The drill recited in claim 6, an upper transition defined between said motor housing and said handle, said chamber disposed so as to encompass said transition.

10. A drill comprising:

a motor housing;

a handle extending downwardly from said motor housing, said handle having a front surface, a rear surface and side surfaces;

a lower housing structure disposed below said handle;

an upper transition defined between said motor housing and said handle;

a lower transition defined between said handle and said lower housing structure; and

first and second chambers enclosing a gel material disposed on said handle, said chambers disposed about the rear surface of said handle and extending forwardly along both said side surfaces, said chambers displaced from each other in the longitudinal dimension of the handle and jointly covering a portion of the rear surface of the handle defined between the upper transition and the lower transition.

11. The drill recited in claim 10, the portion comprising a majority of the rear surface of the handle defined between the upper transition and the lower transition.

12. The drill recited in claim 11 further comprising a third chamber enclosing a gel material disposed on said handle, said first, second and third chambers displaced from each other in the longitudinal dimension of the handle and jointly covering a majority of the rear surface of the handle defined between the upper transition and the lower transition.

13. The drill recited in claim 11, one of said chambers disposed so as to encompass said upper transition.

14. The drill recited in claim 13, said lower housing structure comprising a battery receiving housing.

15. The drill recited in claim 10, further comprising a cover plate made of a material which is relatively hard as compared to said chambers, said cover plate disposed on said handle and including an aperture through which said chambers protrude.

16. A drill comprising:

a motor housing;

a handle extending downwardly from said motor housing, said handle having a front surface, a rear surface and side surfaces;

a chamber enclosing a gel material disposed on said handle, said chamber disposed about the rear surface of said handle and extending forwardly along both said side surfaces;

and a cover plate made of a material which is relatively hard as compared to said chamber, said cover plate disposed on said handle and including an aperture through which said chamber protrudes.

* * * * *